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A SURVEY OF FAMILY PHYSICIANS' KNOWLEDGE AND BELIEFS ABOUT THE PREVENTION OF TUBERCULOSIS

by

MAUREEN T. CAREW, M.D.

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the School of Graduate Studies and Research
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University of Ottawa

Maureen T. Carew, M.D.

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ABSTRACT

Background:

An important aspect of the prevention and possible elimination of tuberculosis (TB) in Canada relates to the screening practices of primary care physicians. Physicians' behavior is in turn dependent upon their knowledge and beliefs, their personal skills and the environment in which they practice. There is good evidence that screening for TB is under-utilized by physicians in Canada and other industrialized countries. This thesis was conducted to determine:

1. family physicians' knowledge and beliefs about the prevention of tuberculosis,
2. their awareness and use of TB screening guidelines circulated by the Ottawa-Carleton Health Department
3. the perceived barriers to screening and,
4. to identify factors associated with primary care physicians knowledge and beliefs about the prevention of tuberculosis.

Methods:

A random sample of 302 family physicians in Ottawa-Carleton was selected for this descriptive survey which was conducted by telephone between January, 1995 and April, 1995. The questionnaire was developed using the PRECEDE/PROCEED Health Planning and Education framework and following extensive consultation with both family physicians and experts in the field of tuberculosis. The main outcome variables were:

1. knowledge calculated as a mean percent score
2. beliefs (including self-efficacy beliefs) about screening for TB and,
3. perceived barriers to screening.

Predictor variables included gender, year of graduation, certification, practice setting, whether a physician lived in a developing country, whether a physician practiced medicine in a developing country and the percentage of persons from developing countries in physicians' practices.

Results:

For the 242 eligible subjects, 178 interviews were completed yielding a response rate of 74%. Physicians had a moderate level of knowledge about the prevention of tuberculosis which varied according to the specific components of screening. For overall knowledge the mean score for the sample was 71% (95% Confidence Interval (CI) 68%, 73%). The mean knowledge scores and 95% CIs for the specific components of screening were:

1. 89% (87%, 91%) for administering the Mantoux test,
2. 79% (75%, 84%) for interpreting the test,
3. 71% (68%, 74%) for knowledge about the effect of Bacille Calmette-Geurin (BCG) vaccine on screening and
4. 53% (50%, 57%) for recognizing when to prescribe preventive therapy with isoniazid (INH).

In both bi-variate and multi-variate analyses, the main predictors of knowledge were "year of graduation" and "the percentage of persons from developing countries in physicians' practices". Younger physicians and practitioners with a higher proportion of clients from developing countries were more knowledgeable about screening for tuberculosis. Only 13% of the total variability in physicians' knowledge however, was explained by the regression model containing these two explanatory variables.

Physicians' self-efficacy beliefs also varied according to specific aspects of screening. Most felt very confident or confident about the following screening steps: recognizing who to screen (85%), administering the Mantoux test (98%) and interpreting the test (84%). Self-confidence about prescribing INH and managing INH therapy was low with only 46% and 65% respectively, of physicians feeling very confident or confident about these steps. A high percentage of physicians believed in the importance of screening (100%), the efficacy of the Mantoux test (99%), the efficacy of INH (88%) and in the safety of INH (90%). Only 48% of the sample believed that patient compliance with INH therapy was good. With respect to barriers to screening, 60% of physicians felt that reimbursement for TB screening was inadequate, 30% cited language/cultural problems with clients, 90% felt that more continuing medical education (CME) programs were needed and 65% were in favor of a central TB screening clinic. Awareness of tuberculosis prevention and treatment guidelines circulated by the Ottawa-Carleton Health Department was low (63%).

Conclusion:

This survey identified deficiencies in physicians' knowledge and self-confidence for important aspects of tuberculosis prevention. The findings signify the need to increase physicians' knowledge about TB prevention through wider dissemination of clinical practice guidelines and continuing medical education programs. Educational initiatives must provide physicians with both the knowledge and the skills that are necessary to perform screening. The determinants of physicians' knowledge, beliefs and preventive practices are still largely unknown and deserve further attention if we hope to make health promotion and disease prevention a priority in primary care.

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CHAPTER 1 INTRODUCTION

The Canadian Task Force on the Periodic Health Exam, (CTFPHE) was created to examine the use of the periodic health exam in promoting health and preventing disease and provides up-to-date practice guidelines to Canadian physicians for a wide variety of preventive activities.[1] The Task Force recommends tuberculosis screening for high risk groups including persons from TB endemic countries, Aboriginal peoples, persons infected with HIV and for individuals with certain chronic diseases. The Tuberculosis Standards Committee of the Canadian Thoracic Society also sets national guidelines for the prevention and treatment of TB and recommends screening for the same high risk groups.[2] It is unknown however, whether physicians are aware of or to what extent they implement these guidelines in everyday clinical practice.

In 1992, the Ottawa-Carleton Health Department implemented mandatory screening for tuberculosis at school entry for children from countries where TB was endemic. An evaluation of this programme suggested that many physicians do not follow or are unaware of tuberculosis screening and treatment recommendations.[3] Between November 1992 and June 1993, 887 students from high-risk areas were identified and 86 (9.8%) had a significant Mantoux test. After contacting the parents of 48 of these students, 21 (44%) had discussed treatment using isoniazid (INH) with their family doctor and 19 of the 48 students (40%) were prescribed INH. Only 12 of the 48 students (25%) took this medication for at least 6 months. Therefore, less than half of the students surveyed were offered INH chemoprophylaxis and only one fourth of those offered treatment, completed therapy.

Another survey conducted in Toronto, yielded similar results.[4] Of 720 high-risk elementary and secondary students who underwent screening for TB, 162 (23%) had a significant Mantoux test, 142 (88%) saw a physician and 2 cases of active tuberculosis were identified. For the remaining 140 students who saw a physician, only 62 (44%) were prescribed INH. The U.S. Centre for Disease Control and Prevention (CDC) also reported low rates of preventive therapy with less than 60% of infected contacts of active cases receiving INH chemoprophylaxis.[5]

The limited use of preventive therapy for tuberculosis appears to be a widespread problem in North America and may relate to physicians' general lack of awareness and knowledge about screening for this disease. The dissemination of clinical practice guidelines alone however, without providing incentives or removing disincentives has been shown to be ineffective in changing physicians' practice patterns.[6,7,8,9] In order for physicians to implement TB prevention activities in their practices, circulation of tuberculosis screening guidelines should be accompanied by the removal of barriers and provision of incentives to perform screening.

This study was undertaken to describe physicians' knowledge and beliefs about the prevention of tuberculosis and to explore the determinants of their knowledge and beliefs. It also provides an assessment of possible barriers to screening such as inadequate reimbursement and language/cultural problems as well as incentives, such as the presence of clinical practice guidelines, CME programs and a central screening clinic. The findings will be used to direct future CME programs and development of the undergraduate medical curriculum. By improving physicians' knowledge and skills about TB screening and by removing

modifiable barriers, it is anticipated that a greater number of infected persons will be treated thereby reducing the pool of inactive tuberculosis in Ottawa-Carleton.

CHAPTER 2 TUBERCULOSIS

2.1 Epidemiology

There has been renewed interest worldwide in tuberculosis, a disease once considered to be an affliction of past generations. The World Health organization estimated in 1990 that there were over 7.5 million cases of tuberculosis (TB) and 2.5 million TB deaths worldwide.[10] Although this disease is both treatable and preventable, it is still a major cause of morbidity and mortality in developing countries and has yet to be eliminated from industrialized countries. In the United States (US) outbreaks continue to occur especially in large urban areas affecting mainly the homeless, the poor and persons infected with HIV.[11]

The incidence of tuberculosis in Canada steadily declined between the early 1960's until the mid-1980's. Since 1987, the rate has been stable with approximately 2000 cases per year yielding an incidence of 7 per 100,000.[12]
In 1993, 53% of cases occurred in the foreign-born, 25% in non-Aboriginal, Canadian-born persons, 18% in Aboriginal peoples and the birthplace was unknown for 4% of cases. While the incidence of TB in non-Aboriginal, Canadian born persons has declined over the past two decades, the incidence in Aboriginal populations has not changed and in the foreign-born, rates have increased slightly.[12]

Until 1983 the incidence of tuberculosis in Ontario was declining but since then, TB rates have been fairly stable.[13] Between 1989 and 1992, the incidence rate was approximately 7.7 per 100,000 with 75% of cases occurring in the foreign born, 22% in Canadian-born and 3% in Aboriginal populations. The majority of

cases in the foreign-born occurred in persons originating from countries where TB is endemic such as Vietnam, the Philippines, China, India and Somalia. The number of persons immigrating to Ontario from endemic areas has increased steadily over the past two decades. It is not surprising then, that the proportion of TB cases in the foreign-born has almost doubled over the past 25 years.

In Ottawa-Carleton, between 1988 and 1993, the number of cases of tuberculosis per year more than tripled from 24 to 86. In 1993, 70% of the cases occurred in persons from developing countries with the countries of origin being mainly Somalia, Vietnam and Haiti. The epidemiological pattern also changed with primary pulmonary infectious TB becoming more common than the reactivated type and affecting a younger population.[14]

2.2 Infection and Transmission

Tuberculosis is caused by infection with *Mycobacterium tuberculosis* and is transmitted from person to person through inhalation of respiratory droplets containing the mycobacterium. There are two possibilities following initial infection:[2]

(1) Active infection - the mycobacterium enters the body and spreads to the lungs. The infected person becomes symptomatic and can transmit the infection to others through coughing

(2) Inactive or Latent infection - the mycobacterium enters the body but lies dormant. The infected person remains asymptomatic and cannot transmit the mycobacterium to others. The dormant mycobacterium however, may become re-activated at some point in the future to cause "active" disease. Persons with "inactive" infection have an estimated 10% lifetime risk of developing "active"

tuberculosis and the risk is greatest within the first 2 to 3 years after the initial infection.[13] Active TB may be prevented by using chemoprophylaxis with INH.

Although immigrants and refugees must have a complete physical examination and chest x-ray to rule out active tuberculosis, they are not required to undergo screening for inactive infection.[15] A number will therefore go on to develop active disease, which could have been prevented with screening and preventive therapy. The risk of developing active TB in immigrant populations from TB endemic countries is highest within the first 5 years of arriving in Canada and without INH-chemoprophylaxis, this risk continues for life.[13]

To reduce the pool of inactive tuberculosis, persons with inactive infection must first be identified through screening, be offered preventive therapy and be compliant with therapy. Therefore, for a preventive program to be successful both physicians and patients must be compliant with the screening protocol.

2.3 Screening

The purpose of tuberculosis screening is twofold: (1) to identify persons who have active TB and (2) to identify persons with latent or inactive infection who may benefit from chemoprophylaxis. The Tuberculosis Standards Committee of the Canadian Thoracic Society and the Canadian Task Force on the Periodic Health Exam recommend TB screening (using the Mantoux or tuberculin test) for the following persons:[1,2]

- Close contacts of persons with known or suspected active TB
- Persons with a history of active TB or chest x-ray suggestive of past TB who have not received adequate therapy

- Persons infected with HIV.
- Foreign-born persons from countries where the prevalence of TB is high
- The poor especially the urban homeless
- Alcoholics and intravenous drug users
- Staff and residents of long-term care institutions
- Persons with high-risk medical conditions such as chronic renal failure, diabetes mellitus, immunosuppresive therapy and silicosis
- Those at risk of occupational exposure such as health care workers.
- Persons employed in settings where they may infect infants, children, adolescents or the immune compromised.

Once the Mantoux test has been performed, the results must be interpreted. The characteristics of the individual, the amount of induration in millimetres (mm) and the possible causes for a false-positive or false-negative test must be considered when determining significance of the Mantoux test (Table 1).

Table 1 Interpretation of the Mantoux Test*

Mantoux Test Reaction (mm induration)	Setting in which reaction is significant
0-4	HIV infection and the expected risk of TB is high (e.g. from a country where TB is endemic, household contact of an active case, abnormal chest x-ray)
5-9	HIV infection regardless of AIDS status Contact of active contagious case Abnormal chest x-ray with fibro-nodular disease.
> or = 10	All others

*Adapted with permission from the 1996 Canadian Tuberculosis Standards[2]

Until recently, the effect of the vaccine against tuberculosis (Bacille Calmette-Geurin or BCG) on tuberculin reactivity was unknown and BCG vaccine was felt to be a major cause of false-positive tuberculin reactions. A number of persons in Canada including individuals from developing countries (and some European countries), Aboriginal peoples and persons living in Quebec and Newfoundland until 1980, received this vaccine to protect against tuberculosis. A study conducted in Montreal in 1992, revealed that significant tuberculin reactions in persons from TB endemic countries who received BCG vaccine, were indicative of infection with TB rather than hypersensitivity to BCG.[16] Subsequently, the Tuberculosis Standards Committee recommended that a history of BCG vaccination after infancy be ignored as a cause of significant Mantoux reactions in all high risk groups.[2] The committee also stated that in Canada, sensitivity to non-tuberculous mycobacterium can be ignored as a cause of tuberculin reactions of 10 mm or more. It is unknown whether or not these new recommendations have been disseminated or adopted in the medical community. Findings from the two Ontario school screening surveys indicated that physicians continue to attribute significant tuberculin reactions in high-risk individuals to BCG vaccine.[3,4]

All persons with significant Mantoux tests should be considered infected with tuberculosis and should be immediately assessed for active disease with a physical examination and chest x-ray. Once active disease has been excluded, the need for preventive therapy with isoniazid should be determined.

2.4 Chemoprophylaxis

The Canadian Tuberculosis Standards Committee recommends 6 to 12 months of INH at a dose of 300 mg per day. [17] Indications for INH preventive therapy vary depending on the risk of developing active tuberculosis and the risk of side effects. At the time this survey was conducted, INH was recommended for all persons under the age of 35 with a significant Mantoux test. Persons over the age of 35 with additional risk factors such as HIV infection, recent conversion or incompletely treated TB were also candidates for chemoprophylaxis.

The most serious reaction associated with INH is hepatitis. The risk of hepatitis is age dependent and is 0% for persons under the age of 20, 0.3% for those aged 20 to 34, 1.2% for persons aged 35 to 49 and is 2.3 % for persons aged 50 to 64 years.[18] Most cases of INH-induced hepatitis have occurred in individuals with previous liver problems or who were managed inappropriately. Hepatitis associated with INH is reversible when this medication is discontinued and deaths due to toxicity are extremely rare.

Estimates of the efficacy of INH chemoprophylaxis vary according to patient compliance. In one study, with 100% compliance and a 6 to 9 month treatment regimen, protection was estimated to be about 90%.[12] Effectiveness trials (taking compliance into account) have shown an overall protective estimate of approximately 68% with 6 months of therapy.[19,20] Although INH is generally considered a safe drug when prescribed properly, studies suggest that physicians are reluctant to administer this medication because of concerns about untoward side effects.[3,4]

2.5 Summary

The prevention and possible elimination of tuberculosis in Canada is dependent upon the screening practices of primary care physicians. Physicians' behavior is in turn influenced by their knowledge and awareness of practice guidelines, their personal skills and the environment in which they practice. Previous surveys indicate that physicians' limited use of INH preventive therapy may be partly attributable to misconceptions about the effect of BCG on tuberculin reactivity and risks associated with INH therapy.[3,4]

CHAPTER 3 LITERATURE REVIEW ON PHYSICIANS' KNOWLEDGE AND BELIEFS

3.1 Literature Review Methods

Published studies were identified by conducting a MEDLINE search of the period January, 1976 to May, 1996. The database was searched using the National Library of Medicine's Medical Subject Headings (MeSH) "tuberculosis" (which was limited to the more specific term of "tuberculosis prevention") and "physician survey". Another search was conducted using the MeSH heading "tuberculosis (prevention)" and the text word "survey". No articles were retrieved using the above search methods.

Experts in the field of tuberculosis were contacted and were unaware of any ongoing or unpublished physician surveys on the prevention of tuberculosis. One expert conducted focus group interviews with a variety of physicians practicing in a large urban Ontario City to determine the feasibility of conducting a national survey about TB prevention.[21] Members of the focus groups indicated that without monetary incentive, participation rates would be low so that the survey was eventually aborted.

Although little is known about the prevention of TB, many studies have been conducted regarding physicians' knowledge, beliefs and behavior about the prevention of cancer, especially breast cancer. Therefore, to assist in the development of this study the investigator conducted a literature search of physicians' preventive practices, beliefs and knowledge about breast cancer. A MEDLINE search was carried out for the period January 1980 to October 1994 using the MeSH headings "breast neoplasm", "screening" and "physicians". The

reference list of pertinent articles were also reviewed to identify other published studies.

3.2 Theoretical Framework/Literature Review

The PRECEDE/PROCEED framework for planning health education and health promotion programs was used as the theoretical framework for this study. [22] This framework was developed by Green and Kreuter in the early 1980's and originally consisted of only the PRECEDE component which stood for the "*p*redisposing, *r*einforcing and *e*nabling constructs in *e*ducational *d*iagnosis and *e*valuation." To accommodate a broader mandate of health promotion, the framework was revised in 1991 to include the PROCEED component which incorporated "*p*olicy, *r*egulatory and *o*rganizational constructs in *e*ducational and *e*nvironmental *d*evelopment". PRECEDE is therefore the diagnostic (needs assessment) phase, while PROCEED is the developmental stage where implementation and evaluation of a program begin. The PRECEED/PROCEDE framework is robust in that it has been used in a wide variety of situations from planning health programs at both regional and federal levels to curriculum development and training for health care professionals.[23,24,25] The "Educational and Organization" phase of the PRECEDE component has been especially useful in studying the preventive practices of physicians where three main categories of behavioral influence are considered: predisposing, enabling and reinforcing factors. [26,27,28] Our study focused on these three factors in order to anticipate the determinants of physicians' behavior when screening for TB. Information from this "diagnostic phase" can then be used by health departments and health educators in the PROCEED component of the framework, to

implement, plan and evaluate educational initiatives for physicians about the prevention of tuberculosis.

3.2.1 Predisposing factors:

Predisposing factors were defined by Green and Kreuter as "the antecedents to behavior that provide rationale or motivation for the behavior and include knowledge, beliefs, values, confidence and attitudes". A belief was defined as "a conviction that a phenomenon is true or real".[22]

The preventive practices of physicians with respect to cancer screening have been studied more extensively than for tuberculosis.[27,28,29,30,31] A major limitation of many of the cancer prevention surveys was that they did not use a theoretical framework to anticipate the determinants of physicians' behavior and hence guide the development of the study questionnaire. Two studies conducted by Battista et al however, used the PRECEDE/PROCEED framework to examine factors influencing adult cancer prevention in primary medical practice for four anatomical sites: breast, colo-rectal, cervix and lung.[27,28] The first study was conducted in Quebec on a sample of 430 family physicians employed in a variety of settings (e.g. salary, fee-for-service, sessional family medicine centres).[27] The second survey involved 552 fee-for-service physicians, with primary care practices in two provinces: Quebec and New Brunswick.[28] In both studies, different patterns emerged for each cancer type but the main predictors of behavior were knowledge, participation in continuing medical education (CME) activities, mode of reimbursement, female gender and belief in the effectiveness of the screening intervention. The potential for selection and non-response bias in both surveys was minimal since physicians were randomly selected and the

response rate was extremely high at 95%. The data was partially validated by comparing responses for colon cancer screening with actual provincial billing data. This process revealed that physicians overestimated their practice behaviors by approximately 10%. Whether this overestimation affected the determinants of physicians' behavior could not be determined.

A U.S. survey of 576 primary care physicians conducted by Weinberger et al also found that physicians who were more knowledgeable about breast cancer screening and who believed in mammography were more likely to recommend this procedure to their patients.[29] Interpretation of this study however, was limited due to the low response rate (45%) and the lack of validation of the survey instrument.

Based on these studies, knowledge and participation in CME programs appeared to be important predictors of screening for various types of cancer. Although knowledge alone does not necessarily lead to behavior change, a minimum level of knowledge must exist before a behavior can be adopted, continued or rejected. With respect to TB, physicians must be aware of who is at risk, how to perform and interpret the Mantoux test and when to prescribe INH before effective prevention can take place.

The Toronto school screening survey indicated that physicians from countries where TB was endemic were more likely to prescribe INH chemoprophylaxis.[4] Past experiences with tuberculosis may have enhanced their knowledge and skill sets and may have predisposed these physicians to adopt TB prevention activities. It is conceivable as well, that physicians' with greater numbers of persons from TB endemic countries in their practices may have better knowledge

and skills about screening for TB, although this factor was not measured in the Toronto study. Whether a physician lived or practiced medicine in a developing country and the number of persons from developing countries in a physicians' practice were therefore considered important determinants of screening behavior for TB and were included as explanatory variables in our survey.

Physicians' beliefs in the importance of screening, the effectiveness of interventions and in patient compliance have also been shown to affect their behavior.[27, 28, 32] In Battista's studies, physicians' beliefs in the effectiveness of the mammography and chest x-ray were important predictors of screening for cancers of the breast and lung, respectively.[27,28] Concerns about risks associated with screening interventions for carcinoma of the breast and colon however, were cited as barriers to screening. Similar results were obtained in a U.S. survey conducted by Cummings et al, regarding the use of mammography for the prevention of breast cancer in women over the age of 50.[30] Only 8% of the 509 physicians participating in the survey recommended mammography for women in this age group. The main reasons for not recommending mammography were: concerns about safety, cost to the patient and low positive predictive value for this test. These findings may be unreliable however, since the study instrument was not validated and the response rate was low (60%). For tuberculosis prevention, it is possible that beliefs in the efficacy of the Mantoux test and in INH chemoprophylaxis may affect whether or not physicians advise these interventions to their patients.

It is also possible that physicians' beliefs in self-efficacy (or self-confidence) and beliefs in patient compliance play an important role in predisposing physicians to either adopt or reject screening for TB. Physicians' confidence in their ability to

perform interventions and expectations about patient compliance were found to be important predictors of behavior for smoking cessation counseling.[33,34,35,36] Although self-efficacy beliefs were not assessed in the cancer prevention surveys, Battista did examine the effect of perceived patient compliance on the cancer control activities of family practitioners.[27,28] A relationship between physicians' expectations about patients compliance and cancer screening was not found.

A number of other factors were identified in the literature as possible predictors of physicians' screening behavior and included age, gender, practice setting (urban vs rural) and practice volume.[27,28,30] Battista found that female physicians had higher detection scores for breast, cervical and colo-rectal cancer than their male counterparts and that younger physicians were more likely to promote cervical cancer screening. Higher screening rates were also found for physicians with urban based practices and higher practice volumes.[27,28]

A survey of physicians' breast cancer detection practices conducted by the National cancer Institute (NIH) had similar findings.[31] Approximately 42% of physicians in the study reported screening for breast cancer using mammography and physicians who were younger or who were female were more likely to advise this intervention to their patients. Within specialty types, gynecologists performed more breast cancer screening than internists or family doctors. Although the survey questionnaire was partially validated, the response rate was low at 63% so that the results should be interpreted with caution. The survey conducted by Weinberger did not find an association between breast cancer screening and physicians' gender, age, race or practice volume.[29]

3.2.2 Enabling Factors

Despite the presence of predisposing factors, physicians may still fail to take appropriate preventive action because they lack the necessary incentives, resources or other enabling factors to do so. Green and Kreuter defined enabling factors as "the antecedents to behavior that allow a motivation to be realized" and can either encourage or discourage a particular behavior.[22] Barriers to the adoption of preventive practices of physicians have been described in the literature and include: lack of time, inadequate reimbursement, lack of CME courses and unclear recommendations.[22,32] All of these factors were cited as impediments to screening in the cancer prevention studies presented above.[27,28,29,30] Battista et al found that mode of reimbursement was associated with screening for all cancer sites and that salaried physicians were more likely to adopt preventive behavior than were fee-for-service physicians. [27,28]

The screening process for tuberculosis requires multiple steps, may be time consuming and may not be adequately reimbursed under a fee-for-service system. Communication problems with clients from foreign countries are common in primary care and further complicate the screening process for physicians. Alternatively, the presence of a central screening clinic may encourage physicians to provide TB preventive services or refer clients with significant Mantoux tests. The dissemination of TB screening guidelines may both predispose and enable physicians to perform screening by increasing their awareness of the problem and by providing a resource for future reference. It is recognized that the dissemination of guidelines alone, without considering the potential enabling, predisposing and reinforcing factors may have little effect on physicians' practices. Lomas et al found that dissemination of a consensus statement recommending a decrease in the use of cesarean sections enhanced

physicians' awareness of the guidelines but had no effect on actual behavior.[6] The investigators concluded that clinical practice guidelines should not be developed and circulated in isolation from other initiatives to modify physicians' behavior.

In this survey time to perform screening, reimbursement, dissemination of guidelines, language and communication and the presence of a centralized screening clinic were considered as the main factors that may enable family practitioners (either positively or negatively) to screen for tuberculosis.

3.2.3 Reinforcing Factors

Reinforcing factors are considered "factors subsequent to a behavior that provide the continuing reward or incentive for the behavior and contribute to its persistence or repetition".[22] Previous studies have shown that visible results, support from colleagues and feedback from patients may reinforce physicians' behavior.[37,38] Since the results of preventive practices are less visible than other interventions, prevention can be more difficult to reinforce than other clinical activities. In this survey, reimbursement and past experiences with patient compliance were also considered as factors that could positively or negatively reinforce tuberculosis prevention activities.

3.3 Summary

Based on the PRECEDE/PROCEED framework[22] and literature review, the following factors were assessed in this survey:

- physicians' knowledge about screening for TB,
- physicians' beliefs in the effectiveness of screening and treatment interventions,
- physicians' beliefs in patient compliance,
- self-efficacy beliefs,
- physicians' perceptions about barriers to screening (time, reimbursement, language/communication difficulties, lack of CME, lack of guidelines, lack of central TB clinic).
- demographic factors such as:
    - gender
    - year of graduation
    - whether a physician lived or practiced medicine in a developing country, the percentage of persons from developing countries in physicians' practices.

CHAPTER 4 OBJECTIVES

The objectives of this study are:

1. to determine primary care physicians' knowledge and beliefs about screening for tuberculosis;

2. to determine primary care physicians' awareness and use of tuberculosis treatment and screening guidelines circulated by the Ottawa-Carleton Health Department;

3. to determine perceived barriers to screening for tuberculosis; and

4. to identify factors associated with primary care physicians' knowledge and beliefs about the prevention of tuberculosis.

CHAPTER 5 METHODS

5.1 Study Design

The most appropriate and feasible design to assess physicians' current state of knowledge and beliefs about the prevention of tuberculosis was a descriptive survey. A review of charts from family practitioners' offices would provide information about physicians' behavior but would add little to our understanding of their knowledge and beliefs about TB screening. More importantly, a chart review would be less practical due to increased cost and a potential low rate of participation.

Three data collection options were considered for this survey; mail, telephone or personal interview. The telephone format was chosen in order to achieve the highest possible response rate in the most cost-effective and expedient manner. Due to limited funds, physicians could not be offered payment for participating in the survey. Without monetary incentives, the response rate was expected to be the highest with a telephone survey because all interviews were conducted by the principal investigator who was also a physician. The telephone format was advantageous in comparison to the other data collection methods as physicians and their office staff may be more cooperative and more likely to participate if contacted by another physician. A previous telephone survey of physicians regarding their smoking cessation counseling activities, conducted by a physician at the Ottawa-Carleton Health Department achieved a response rate of 88%.[39]

Although physicians could be contacted directly using a personal interview as well, this format would cost more and the survey would take much longer to complete. Another disadvantage of this format was that physicians who felt insecure about their knowledge or screening practices may find a personal interview more intimidating than a telephone interview and may be more likely to refuse to participate. As well, with the face-to-face format physicians may feel more pressured to provide "socially acceptable" responses possibly introducing "social desirability" bias to the study.

The main reason for choosing the telephone format over a mail-out survey was to enhance the response rate as outlined previously and some other advantages of a telephone survey include:

1. Expediency of data collection
2. Minimization of item non-response
3. Ability to probe for reasons for non-response
4. Sequencing of questions and answers could be controlled
5. Less opportunity for physicians to prepare for the interview or consult references.

5.2 Sample Size

Hulley and Cummings provide tables for determining the sample size for a descriptive study with either a continuous or dichotomous dependent variable.[40] The main outcome variable for this survey was physicians' knowledge about the prevention of TB which was calculated as a percent score (as outlined in section 5.5). For a descriptive study with a continuous outcome variable, the sample size

can be determined easily from a table, if the standard deviation for this variable is known. If the standard deviation is not known, Hulley and Cummings suggest converting the continuous variable to categorical. The sample size for the survey can then be determined.

In our survey, a standard deviation for physicians' knowledge about TB prevention could not be determined from the literature therefore knowledge was converted into a dichotomous variable. During the development of the questionnaire, experts in the field of TB prevention indicated that a percent score of 75% or above would be considered an acceptable level of knowledge for family physicians about the prevention of TB. The expected proportion of physicians with a knowledge score greater than or equal to 75% (P) was estimated to be 0.50.

For this value of P, a two-tailed significance level of $\alpha = 0.05$ and a desired confidence interval width of 0.15, the required sample size was 171. A confidence interval of 15% was considered acceptable since this survey provided a preliminary estimate of physicians' knowledge about tuberculosis screening. With an estimated 60% response rate and taking into account non-contacts, the final sample size for the study was 302.

5.3 Study Population

5.3.1 Sampling Strategy

Using Epi-Info 6,[41]a random sample of 302 physicians were chosen from a sampling frame (see section 5.3.3) containing the names, addresses and

telephone numbers of 665 family physicians in the Ottawa area. The sampling frame was listed in alphabetical order and numbered from 1 to 665, with the first entry selected as number one. A list of random numbers was created using the "randomization with replacement" procedure. Replacement was used to ensure that each of the 665 physicians had the same chance of being included in the final sample. Numbers chosen more than once using this procedure were replaced as follows: (1) the entry appearing immediately before (one above) the originally selected number on the sampling frame was selected.
(2) if the entry "before" (one above) had been previously selected then the entry appearing immediately after (one below) the originally selected subject was chosen.

5.3.2 Inclusion/Exclusion Criteria

All family physicians in the Ottawa-Carleton were considered eligible for this survey. Only family physicians were chosen because in Canada, primary care physicians are the first health professionals to assess persons at risk of developing tuberculosis and therefore have the first opportunity to offer screening and preventive therapy. Pediatricians also provide primary care but were not included due to limited resources. A separate study could be conducted in the future to compare preventive practices among medical specialties.

The sample was limited to the Ottawa-Carleton area since educational interventions initiated by the Health Department would be directed towards physicians practicing in this region. As well, the epidemiology of tuberculosis, distribution of high-risk groups and characteristics of physicians may vary from one region to another.

For the purposes of this study, all physicians practicing family medicine were considered "family physicians" regardless of their practice setting or type of certification. The following physicians were considered ineligible for inclusion in the survey :

1. Family physicians with practices restricted to a non-clinical area of medicine where they would never have the opportunity to screen for tuberculosis such as psychotherapy, family therapy, addiction counseling and hypnosis.
2. Specialists (not including family physicians with emergency CCFP (ER) training)
3. Residents or post-graduate fellows
4. Retired family physicians and physicians not in active practice
5. Family physicians with practices outside Ottawa-Carleton

Locum physicians were substituted for subjects who were away during the period when interviews were being conducted.

5.3.3 Sampling Frame

The following data sources were consulted to develop the sampling frame for this study: the Ottawa-Carleton Health Department Physician Database, the 1994 Canadian Medical Directory (CMD)[42], the 1994 Ontario Medical Association (OMA) physician list and the 1994 Ottawa-Hull telephone directory.

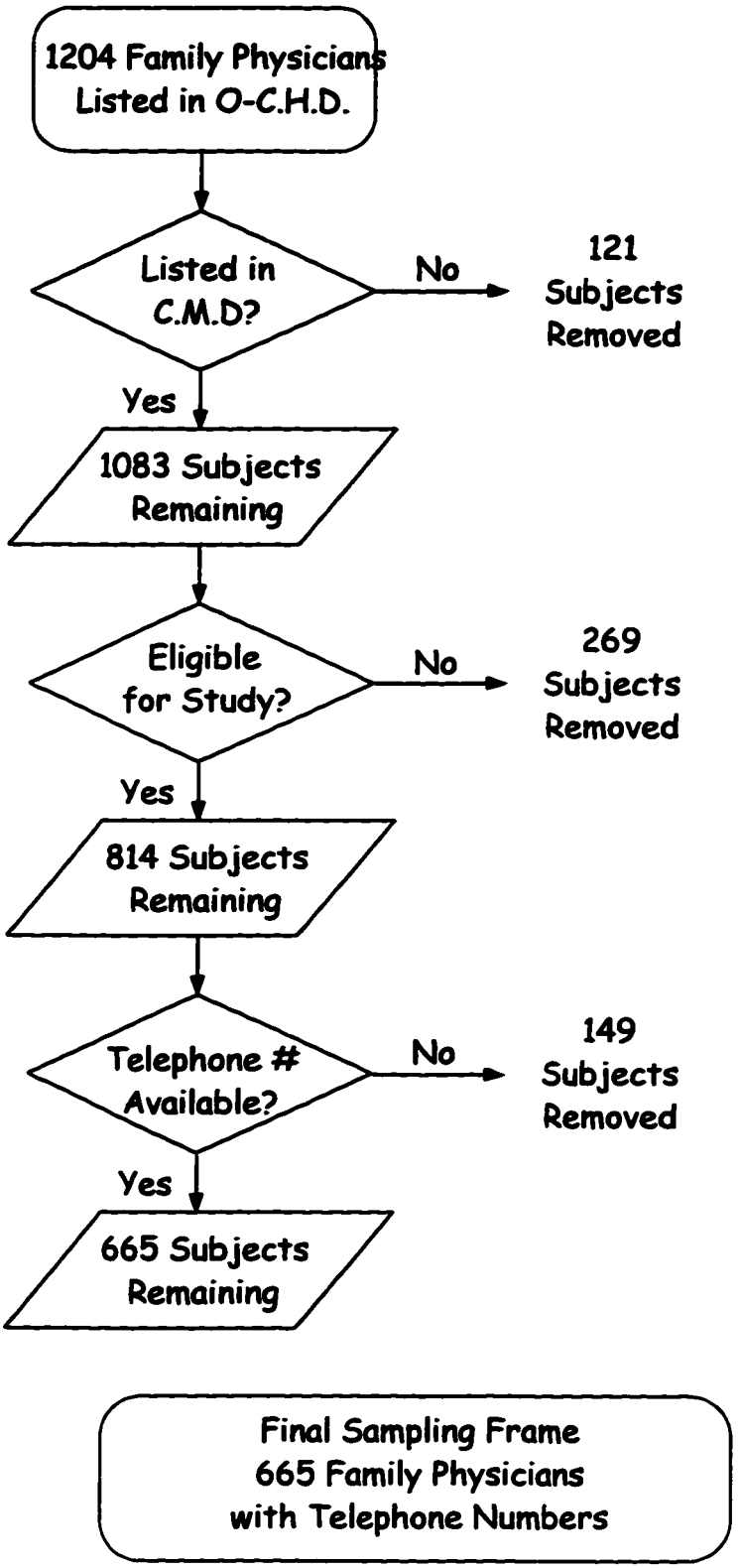
The Ottawa-Carleton Health Department maintains a list of the names, addresses, telephone numbers and specialty types of physicians practicing in the region. This list originated from the College of Physicians and Surgeons of

Ontario (CPSO) who keep a database containing demographic information on all licensed physicians in the province. The College sends data on new entries to the Health Department every two to four weeks. Physicians are not required to submit telephone numbers to the College so that the data-set with respect to this variable is incomplete. The OMA also maintains a list of its members and at the time of this survey, all physicians in Ontario were required to become members. The OMA database however, does not contain telephone numbers for all members.

The Canadian Medical Association (CMA) in association with Southam Communications annually publishes the Canadian Medical Directory (CMD) which compiles demographic data on Canadian physicians. To obtain this information, the CMD conducts two mail-out surveys each year and consults with a variety of accredited sources including the Canadian Medical Association, provincial Medical Associations, the Royal College of Physicians and Surgeons of Canada and The Canadian College of Family Physicians. In 1994, telephone numbers were not available for approximately 15% of physicians listed in the CMD. According to Southam Communications, most of these missing numbers belonged to younger, more mobile physicians who may be reluctant to provide their home numbers.[43] The CMA also estimated that approximately 15% of entries on their mailing list do not have listed telephone numbers.[44]

In October 1994, the Health Department database contained 1204 physicians who were categorized as family practitioners. This database however had not been revised to remove physicians who had moved, changed specialties or retired. Therefore, the first step in compiling a more accurate list was to compare the Health Department database with the CMD (refer to flowchart, page 27).

Sampling Frame Flow Chart



There were 121 subjects without telephone numbers on the original Health Department list that could not be located at all in the CMD and were removed from the database. Another 269 subjects were found to be ineligible based on pre-specified exclusion criteria and were also removed.

Therefore, the revised list contained 814 entries for which telephone numbers were not available for 149 (18%). Demographic information on sex and year of graduation was extracted from the CMD on a sample of 30 of these 149 physicians (Table 2). Twelve (40%) of these physicians were female and over 73% (22) graduated after 1990.

Table 2 Characteristics of Physicians Without Telephone Numbers Listed in the CMD

Variable	No. (%)
Sex	
Male	18 (60)
Female	12 (40)
Year of Graduation	
1992	8 (27)
1991	10 (30)
1990	3 (10)
1989	3 (10)
1986	1 (3)
1985	1 (3)
1982	1 (3)
1979	1 (3)
1971	1 (3)
After 1990	22 (73%)

CMD, the 1994 Canadian Medical Directory

A mailing list of 645 family physicians practicing in Ottawa-Carleton was obtained on request from the OMA and telephone numbers were missing for 72 (11%) of

the entries. None of the 149 missing numbers from the revised study list could be located on either the OMA list or in the local telephone directory.

To determine the completeness of the sampling frame, a random sample of names of 30 family physicians from the yellow pages of the 1994 Ottawa-Hull telephone directory were compared to the revised list and all names from the phone book were located on the list. Similarly, a sample of 30 names selected randomly from the OMA list were all accounted for on the revised list.

After extensive comparisons with other data sources, the final sampling frame consisted of the names, addresses and telephone numbers of 665 family physicians. This final list was considered as complete as was possible, given the limitations of databases that were available to the investigator. All of the credible physician databases were incomplete with respect to information on telephone numbers. However, most of the target population for this study should have been included in the sampling frame since family practitioners usually ensure that their telephone numbers are readily available to the general public through phone directories or professional associations. Although the sampling frame for a mail-out survey may have been more complete, the response rate with a mail-out was expected to be lower therefore the telephone format was chosen. If an association is found between year of graduation and the main outcome variable knowledge, then exclusion of physicians without telephone numbers (who may be younger) may lead to either an underestimation or overestimation of physicians' knowledge. This will be acknowledged in the discussion section.

5.4 Survey Instrument

5.4.1 Questionnaire Development

The following steps were followed in developing the study questionnaire:

1. Conceptualization of factors affecting physician behavior through reviewing the literature and using the PRECEDE/PROCEED theoretical framework.[22]
2. Key informant interviews
3. First draft of the questionnaire
4. Review of first draft by experts in the field of tuberculosis and public health
5. Revised questionnaire (second draft)
6. Pre-test of second draft
7. Pre-test of third draft
8. Final questionnaire

5.4.1.1 Theoretical Framework

Using the three categories of behavioral influence (predisposing, enabling and reinforcing factors) described in the PRECEDE/PROCEED[22] framework, the following were identified as possible determinants of the physicians' preventive practices:

(I) *Predisposing factors* - physicians' knowledge and beliefs (including self-efficacy beliefs), about TB prevention.

(II) *Enabling factors* (positive or negative) - time, reimbursement, language/communication, continuing medical education programs, presence of a central screening clinic and availability of clinical practice guidelines.

(III) *Reinforcing* - physicians' past experiences with INH chemoprophylaxis and problems with patient compliance.

For each item listed above, the following emerged as variables to be included in the questionnaire:

I. ***Based on Predisposing Factors***:

A. Knowledge

- Who to screen (high risk groups)
- Administration of the Mantoux test
- Interpretation of the Mantoux test
- Interpretation of the Mantoux test for persons who received BCG vaccine
- Indications for prescribing INH

B. Beliefs

- Belief in the importance of screening for tuberculosis
- Belief in the efficacy of the Mantoux test
- Belief in the efficacy of INH
- Belief in the safety of INH chemoprophylaxis (for persons below age 35 and for those above age 35)
- Beliefs about patient compliance with INH chemoprophylaxis.

C. Self-efficacy Beliefs:

- Knowing who to screen
- Administering the Mantoux test
- Interpreting the Mantoux test
- Prescribing INH chemoprophylaxis

- Managing persons who are taking INH

II. ***Based on Enabling Factors***

Factors which promote (enable) or prevent screening behavior:

- Time
- Reimbursement
- Language, communication with clients
- Continuing medical education programs
- Central TB screening clinic
- Clinical practice guidelines

III. ***Reinforcing Factors***

- Past experiences with INH chemoprophylaxis and patient compliance.

IV. ***Demographic Factors***

Other factors identified in the literature review as possible determinants of physician behavior included:

- age or year of graduation
- gender
- practice setting
- whether a physician had lived in a developing country
- whether a physician had practiced medicine in a developing country.

The cancer prevention surveys did not assess whether certification was related to behavior. Physicians who completed training in Family Medicine and who were certified with the Canadian College of Family Physicians (CCFP) may have received more training about disease prevention and may be more predisposed

to adopt screening. Certification therefore, was included as a possible determinant of family practitioners' knowledge. We also expected that physicians with greater numbers of persons from developing countries in their practices may have a higher level of knowledge about TB prevention so that this variable was also considered in our study.

A detailed description of the study variables is given in Appendix A.

5.4.1.2 Key Informant Interviews

Six key informant interviews were conducted in October, 1994 by the principal investigator to gain insight into family physicians' perceptions about their role in TB prevention and problems they may be experiencing in this respect. The participants were all family physicians known to the investigator, who were practicing family medicine in the Ottawa area. Interviews were conducted by telephone and consisted of twenty-one open-ended and three closed-ended questions derived from the theoretical framework and literature review.

The key informant interviews were invaluable in confirming suspected as well as new factors that may be influencing physicians' preventive practices. A number of common themes emerged:

- The perceived role of family physicians in the prevention of TB was to perform the Mantoux test, interpret the test, initiate treatment when necessary and manage INH therapy for uncomplicated cases.
- Knowing who to screen was a problem. Should moderate risk groups such as English as a Second Language (ESL) teachers, welfare housing occupants and community health professionals undergo screening for TB?

- Interpretation of the Mantoux test for persons who received BCG vaccine was a problem.
- Many physicians were unsure of which countries have a high prevalence of tuberculosis.
- Indications for performing the two-step Mantoux test and interpretation of this test were unclear.
- Patient compliance in returning for reading of the Mantoux test was variable and often poor.
- Many participants felt there was a lack of consensus among experts in the field (infectious disease, respirologists and public health physicians) about TB screening and management guidelines.
- INH chemoprophylaxis was felt to be efficacious in preventing active TB but was not always prescribed due to concerns about adverse reactions and patient non-compliance.
- Patients with a significant Mantoux test but a negative chest x-ray may not considered infected and therefore may not receive appropriate preventive therapy.
- Directly observed therapy for INH chemoprophylaxis was not commonly used in the community.
- One informant felt that screening for tuberculosis was time consuming
- All participants felt that family physicians' needed more education about the prevention of tuberculosis.
- Language and communication problems occurred commonly with clients from foreign countries, complicated the screening process and prevented physicians from prescribing INH.
- All informants were aware of the Health Department TB screening guidelines and found them to be useful

- All informants were in favor of a central screening clinic.

5.4.1.3 Expert Review

A questionnaire was drafted based on findings from the key informant interviews as well as concepts developed through the theoretical framework and literature review. Questions were organized according to the study objectives. Knowledge questions were formulated using the 1994 Ottawa-Carleton Health Department "Tuberculosis Screening Recommendations and Notes" which were circulated to all family physicians on the Health Department roster. These notes were in turn based on National Standards, the 1994 Canadian Tuberculosis Standards produced by the Canadian Lung Association.[17]

Six experts in the field of tuberculosis (2 adult infectious disease specialists, 1 pediatric infectious disease specialist and 3 public health physicians) were asked to review the questionnaire to determine whether the study objectives were adequately assessed and to provide correct answers for each knowledge question. They were encouraged to give comments about the clarity and structure of the questions, the format of the questionnaire and what percentage knowledge scores they would consider as low, medium and high.

Responses to knowledge questions were consistent among the experts and formed the "gold standard" or correct set of answers for the survey. The following suggestions were made regarding the addition or deletion and wording of questions:

1. to add a knowledge question about screening for an infant who was in contact with a case of active TB

2. to add a knowledge question about whether physicians patients are able interpret their own Mantoux tests
3. for questions regarding interpretation of the Mantoux test, the term "significant" should always be accompanied by the amount of induration of the skin in millimetres.
4. to delete a question regarding the screening a homeless person presenting to a physician's office, since this was an uncommon occurrence.
5. to delete a question regarding the duration of INH chemoprophylaxis since recommendations in this area were inconsistent.

The questionnaire was revised according to the above recommendations.

Four experts commented on cut-points for levels of knowledge. Three felt that a score below 60% was low, 60% to 75% was medium and greater than 75% was high. One expert considered a score less than 75% as low, 75% to 85% medium and more than 85% as high. Physicians' must possess a very high level of knowledge about TB screening before preventive behavior can even be contemplated. For this reason, the investigator also considered a score of 85% as the minimum acceptable score for overall knowledge.

5.4.1.4 Pre-test

The revised questionnaire was pre-tested on a sample of 6 physicians (3 family physicians and 3 Community Medicine residents) to assess the clarity of the questions and instructions and to measure the duration of the interview. Some minor revisions in wording were suggested and one question regarding Ontario

Health Insurance Plan (OHIP) billing codes for TB screening was deleted since responses were highly variable. Respondents were still asked whether reimbursement for TB screening was considered adequate (question 45). Another question regarding the side affects associated with INH was reorganized into two separate questions regarding the perceived safety of INH for persons younger than age 35 (question 40) and for persons older than age 35 (question 41). The questionnaire was tested again on a smaller sample of 3 physicians (2 family doctors and 1 community medicine resident), took approximately 15 minutes to complete, did not require any further changes and became the final questionnaire for the survey (Appendix B).

5.4.2 Organization and Content

The study questionnaire consisted of 55 questions with 60 items in total. Common subject areas were grouped together (as outlined below) and were introduced with a brief narrative outlining the nature of the questions and giving instructions for answering.

Organization of the Questionnaire

Subject		Question Number
1.	Eligibility status	1 and 2
2.	Demographic information	3 to 10
3.	Knowledge	
	• who to screen	11 to 17
	• administering the Mantoux test	18, 19, 24 and 25
	• BCG issues and screening	20, 21 and 22
	• Interpretation of the Mantoux test	26 to 31
4.	INH chemoprophylaxis	23, 32 to 36
5.	Beliefs	
	• importance of screening	37
	• efficacy of Mantoux test	38
	• efficacy of INH	39
	• safety of INH	40 and 41
	• patient compliance	42 and 43
6.	Barriers	
	• time	44
	• reimbursement	45
	• language/cultural factors	46
	• continuing medical education	47
	• need for central clinic	50
7.	Awareness of guidelines	48 and 49
8.	Physicians' self-efficacy beliefs	51 to 55

Question format

Almost all questions were closed-ended except for those regarding the use of Health Department guidelines and the need for a central screening clinic. Qualitative information was also obtained upon completion of the interview when participants were asked to provide comments about the survey or discuss their experiences with TB screening.

Knowledge questions were presented either as (1) case scenarios with the response options of yes, no or don't know or (2) factual statements with true/false response options. By using written cases, aspects of screening could be tested without providing clues for the response within the question themselves. Screening concepts that required investigation of physicians' decision making and clinical competence (recognizing who to screen, interpreting the Mantoux test and determining which persons should receive INH) were examined using case simulations. For example, to test knowledge about the interpreting the Mantoux test, physicians were presented with scenarios giving information about an individual's risk factors, BCG vaccine status and the amount of induration of the Mantoux test (in millimetres). Physicians were then asked to indicate whether the Mantoux test was significant or not significant. This complex concept would be difficult to test with a true/false format. Knowledge about the more factual areas of screening however, such as administration of the Mantoux test and risk of hepatitis associated with INH were assessed using the true/false format.

Case scenarios or case simulations have been used in a variety of surveys to determine physicians' behavior or knowledge for a particular clinical question. A criticism of these scenarios is that physicians may respond differently in case

simulations than in real life and that written cases lack visual clues that exist with real-life patient interactions.[45,46,47] These issues were less crucial to our survey since behavior was not measured.

Questions regarding physicians' beliefs about screening were assessed using a five point Likert scale since it was anticipated that beliefs may vary in degree or intensity. Response choices to statements about screening were: 1-strongly disagree, 2-slightly disagree, 3-slightly agree, 4-strongly agree, 5-no opinion. The category "no opinion" was placed as the last option to encourage respondents to respond in one of the former four categories.

The remaining questions concerning barriers to screening and physicians' awareness of guidelines had categorical responses of yes, no or don't know. Physicians who were not in favor of a central screening clinic were asked to give a reason for their response and physicians who did not use circulated Health Department guidelines were also asked to state why this was so.

Given the technical nature of the survey, some questions were complex and lengthy but the syntax of questions was kept as short (less than 25 words) and simple as possible. The line of questioning was guided by providing respondents with narrative transition statements so that the ensuing questions could be anticipated.

Telephone surveys can be subject to recency bias in that subjects may be more likely to remember and answer affirmatively to the latter part of a question. To minimize this problem the number of response options were limited to less than or equal to five and respondents were encouraged to write down response

choices especially for questions involving a scale. Questions were repeated or summarized whenever requested by a respondent or deemed necessary by the interviewer and those that were consistently misinterpreted or that seemed unclear were dropped from the survey.

5.4.3 Administration

The survey was conducted according to the Dillman "Total Design Method" for telephone surveys and using two resources from the Canadian Public Health Association (CPHA) on questionnaire design.[48,49,50]

Prior to conducting the survey, each subject was sent a cover letter identifying the investigator, outlining the purpose of the study and providing subjects the opportunity to make an appointment for an interview, refuse to participate or have questions answered (Appendix C). Letters were mailed in batches of 50 approximately 2 to 3 weeks before the first telephone contact. Interviews were conducted between January 10, 1995 and April 15,1995.

The interviewer either spoke directly with the physician or an office employee (the receptionist or nurse) or contacted an answering machine. If an answering machine or message centre was reached, the interviewer would call back at a different time or on another day of the week. A message was left on the office machine or message centre only if the physician or an office employee could not be reached in person after three attempts. For subjects with both office and home telephone numbers, again, a message was left on the home machine only if the physician could not be contacted at the office after three attempts.

When personal contact was finally established, the interviewer introduced herself as a physician from the Ottawa-Carleton Health Department who wished to speak to the selected physician about the prevention of tuberculosis. If available, the physician came to the phone and indicated whether or not he/she would participate in the survey. If unavailable, the receptionist was asked to inquire about the physician's willingness to participate in the study and to call the interviewer back with a response. Subjects who did not call back were contacted until a response was finally obtained. Physicians who refused to participate were ask to state a reason for their refusal.

A telephone log was kept documenting the number and dates of attempted contacts, the date of a completed interview or refusal and the reason for refusal. The subject was labeled a "non-contact" if he or she could not be reached after seven attempts. To determine if the "non-contacts" had moved or retired the CMD and the OMA lists were consulted.

5.4.3 Reliability and Validity

Reliability

Prior to beginning the study, the investigator practiced administering the survey (by telephone) with colleagues and during the pre-testing phase. The interviewing process was standardized to reduce the potential for bias and interviews were conducted using uniform wording of questions and a consistent tone of voice. The questionnaire was written in a form resembling common speech and the interviewer read directly from this material. Respondents were asked to withhold questions or comments until the end of the survey so that informal discussion took place only after the questionnaire was completed. The

use of only one interviewer enhanced the reliability of the survey. Repeated measurements to determine test-retest consistency were not performed since it would be difficult to interview physicians more than once.

Internal consistency was partially addressed by checking concordance between questions measuring similar concepts as outlined below:

- screening persons with HIV infection for TB (question 13) as well as those with AIDS (question 14)
- interpretation of the Mantoux test for persons with HIV infection (question 26) and those with AIDS (question 27)
- Prescribing INH for a 4 year old with a significant Mantoux test who had not received BCG vaccine (question 35) and for the same child when BCG vaccine had been given (question 36)

To measure agreement above and beyond chance Cohen's Kappa[51] (K) (unweighted) was calculated using the following formula:

$K = p_o - p_c / 1 - p_c$

where p_o = the observed proportion of agreement and

p_c = the chance expected proportion of agreement.

According to Landis and Koch, a kappa of < 0.40 indicates poor agreement, 0.41 to 0.60 moderate agreement, 0.61 to 0.80 substantial agreement and greater than 0.80 is near perfect agreement.[52]

Cronbach's alpha does not correct for chance agreement but is often used to assess the internal consistency of a number of questions or items measuring one construct.[53] Cronbach's alpha was therefore calculated using SPSS to determine

the consistency among items measuring physicians' knowledge and also their self-efficacy beliefs. For a new instrument, Nunnally claims that an alpha of greater than 0.70 indicates good consistency among items.[54]

Validity

The accuracy of the questionnaire was based on face validity according to the judgment of experts in the field of TB. All experts felt that the questionnaire development process made intuitive sense, was a reasonable approach accomplishing the study objectives and that the study instrument accurately measured physicians' knowledge and beliefs about TB prevention.

5.5 Data Handling and Analysis

Responses from completed questionnaires were entered into an SPSS[55] (Statistical Package for the Social Sciences) data-set by a research assistant from the Ottawa-Carleton Health Department. Checks for missing data and extreme values were incorporated in to the data entry process. A separate data-set for non-respondents was created after extracting demographic information about these physicians from the 1994 CMD.

The coding scheme for knowledge questions was revised so that the data-set contained only "correct" responses for each participant. For each of the 19 knowledge questions, correct responses were assigned a value of "1" and incorrect or unknown responses were given the value "0". Each participant was assigned an overall knowledge score based on the proportion of correct responses to these 19 questions. This score was converted to a percent score by multiplying the proportion by 100%. A mean percent score with 95% confidence intervals was then calculated for the sample.

Knowledge questions were categorized according to the following components of screening: (1) administration of the Mantoux test (TESTSCOR) (2) interpretation

of the Mantoux test (READSCOR) (3) BCG and screening (BCGSCOR) and (4) prescription of INH (INHSCOR). Each participant was assigned a percent score based on the proportion of correct responses for each of the above categories. Mean percent scores for the sample with 95% confidence intervals were then calculated for all knowledge categories.

The data set was analyzed using SPSS for Windows version 6.0[55]. The response rate was calculated and characteristics of the respondents were compared to that of the non-respondents. Frequencies for each question were analyzed and described. Mean percent knowledge scores, standard deviations and 95% confidence intervals for each knowledge variable were calculated.

Bi-variate Analysis

Knowledge

Scatterplots were produced to examine the relationship between knowledge and the independent variables "year of graduation" and "percentage of persons from developing countries in a physician's practice". Using the Bi-variate Correlation procedure, Pearson correlation coefficients were produced to determine the strength of each of these associations. The t-test for independent samples was used to determine whether knowledge was associated with the nominal independent variables sex, practiced in a developing country or lived in a developing country. The relationship between knowledge and independent variables with more than 2 categories (practice setting and certification) was explored using One-way Analysis of Variance (ANOVA).

Beliefs

Non-parametric statistical methods were used to examine associations between physicians' beliefs about screening and the demographic variables. For non-parametric procedures, continuous independent variables (year of graduation and percent practice from developing countries) were converted into categorical variables as described in the "Results" section 6.3.3.

The Mann-Whitney U test was used to investigate the relationship between physicians' beliefs about screening (including self-efficacy beliefs) and each of the following independent variables: sex, ever practiced in a developing country, ever lived in a developing country, year of graduation and percent persons from developing countries in physicians' practices. For independent variables with more than two categories (practice setting and certification), the Kruskall-Wallis procedure was performed to assess the significance of the Chi-Square test statistic.

Barriers

The relationships between each of the proposed barriers to screening (time, reimbursement, language difficulties, lack of central clinic, CME) and each of the demographic variables (sex, year of graduation, percent persons from developing countries in practice, practice setting, certification, ever lived in developing country, ever practiced in developing country) were examined using cross-tabulations tables and the Pearson Chi-Square statistic. For cells with an expected frequency of less than 5, Fischer's exact test was computed.

Gender Effects

To eyeball for gender differences beyond associations that were found to be significant statistically, descriptive statistics for all variables (demographic, knowledge, beliefs, barriers and awareness of guidelines) were examined according to gender.

Multivariate Analysis

Stepwise multiple linear regression was used to determine which independent variables best predicted physicians' knowledge about screening. Explanatory variables were selected either because they were felt to have an important relationship with knowledge or were statistically associated with knowledge in the bi-variate analyses. The probability of F-to-enter-in (PIN) was set at 0.05 so that only variables with a probability associated with the F statistic of less than 0.05 were entered in the regression equation. The probability of F-to-remove-out (POUT) was set at 0.10. Variables with POUT greater than 0.10 were removed from the equation.

First order interaction terms were considered using stepwise multiple linear regression and confounding was tested by examining the regression coefficients for each independent variable in the regression model, when one variable was removed. Finally, violation of regression assumptions was checked by examining regression residual scatterplots.

CHAPTER 6 RESULTS

6.1 Response Rate

Of the 302 physicians randomly selected, 58 were deemed to be ineligible, based upon the pre-specified exclusion criteria (table 3 below). For physicians who could not be contacted directly, information regarding eligibility was extracted from the Canadian Medical Directory and the OMA list. An additional two physicians could not be reached and were absent from both the CMD and OMA lists so that their eligibility status was unknown. For the remaining 242 eligible subjects, 178 interviews were completed yielding a response rate of 74%.

Table 3 Reasons for Exclusion

Reason	Number
Moved outside Ottawa-Carleton	12
Retired	6
Specialist*	11
Practice limited**	16
Resident	7
Dentist	3
Leave of Absence	1
Maternity Leave with no Replacement	1
Nurse Practitioner	1
Total	58

* Specialist in Internal Medicine, Rheumatology, Radiology, Ophthalmology, Psychiatry, Community, Medicine, Lab Medicine.

** Practice limited to psychotherapy, addiction counseling, palliative care, oncology, emergency medicine.

6.2 Demographic Characteristics

Demographic characteristics of the respondents and non-respondents are presented in Table 4.

Table 4 Characteristics of the Respondents and Non-Respondents		
	Respondents No. (%), N=178	**Non-respondents No. (%), N = 64***
Sex		
Male	103 (58)	40 (63)
Female	75 (42)	24 (37)
Certification		
LMCC	81 (45)	24 (45)
CCFP	92 (52)	27 (51)
CCFP(EM)	5 (3)	2 (4)
missing	0	11 (17)
Practice Setting		
GP/Solo or group	138 (78)	41(87)
CHC	11 (6)	2 (4)
Walkin Clinic	18 (10)	3 (6)
University FMC	6 (3)	1 (4)
Other	5 (3)	--
Missing	0	17 (26)
Year graduation		
Median Year	1980	1980
Graduated <=1980	95 (54)	33 (55)
Graduated <=1984	123 (69)	43 (71)
Graduated >1984	55 (30)	17 (28)
Graduated 1985-1989	36 (20)	16 (26)
Graduated 1990-1993	19 (11)	1 (2)
Ever Practiced in Developing Country	25 (14)	Unavailable
Ever Lived in Developing Country	41 (23)	Unavailable
Percent Persons From Developing Countries in Physicians' Practices		Unavailable
Median	5.0%	
Cutpoints		
> 5%	71 (40)	
>10%	44 (25)	
>15%	31 (17)	
>20%	24 (14)	
>25%	20 (11)	
>30%	13 (7)	

*For the variables certification, practice setting and year of graduation information was missing for 11 (17%), 17 (26%) and 4 (6%) of the non-respondents, respectively. Therefore, valid percentages are reported. Data for the variables: ever practiced in a developing country, ever lived in a developing country and the percent of persons from a developing country could not be obtained for physicians who refused to participate.

6.2.1 Respondents

The sample of respondents contained a higher percentage of males than females (58% vs 42%). The median year of graduation was 1980 and ranged from 1952 to 1993. Almost 70% of the study subjects graduated before 1985. Most physicians (154, 87%) graduated from a Canadian medical school (data not shown). Fourteen (8%) completed their medical education in a developing country and the remaining 10 (5%) attended school in either Great Britain or the United States.

For the variable practice setting, 138 (78%) physicians worked in private practices, 11 (6%) in Community Health Centres, 18 (10%) in walk-in clinics, 6 (3%) practiced in a University based setting and 5 (3%) were in other practice settings (Health Maintenance Organizations or combined office/emergency practice). With respect to certification, 97 (55%) were members of the Canadian College of Family Physicians (CCFP).

Of the 41 (23% of the sample) physicians who had lived in a developing country, 25 (60% of them) had also practiced medicine in a developing country. The median for the estimated percentage of persons from developing countries in physicians' practices was 5%. Forty-four (25%) physicians reported that more than 10% of their practice consisted of persons from developing countries and 13 (7%) had more than 30% of their patients originating from developing countries.

The effect of item non-response was extremely small with a total of four missing responses (one for question 16, one for question 30, one for question 49 and one for question 55).

6.2.2 Non-respondents

The most common reason for not participating in the survey was "lack of time". For the 64 physicians who refused to participate, information on sex and year of graduation was obtained from the Canadian Medical Directory. Data on certification was not available for 11 (17%) of the non-respondents. For the variables practice setting and year of graduation, information could not be obtained for 17 (26%) and 4 (6%), respectively. Therefore, valid percentages were reported for these three variables.

The non-respondent group had a higher percentage of males compared to the study population (63% vs 58%) (Table 4). The median year of graduation was similar for respondents and non-respondents (1980). The distribution of year of graduation was similar for the two groups until the year 1984. In comparison to the refusal group, the study population had a higher percentage of physicians who graduated during the 1990s (11% vs 2%) but a lower percentage who graduated between 1985 and 1989 (20% vs 26%). This difference in year of graduation however, was not statistically significant ($p>0.05$) with 31% (95% CI 24%, 38%) of respondents and 28% (95% CI 17%, 42%) of non-respondents graduating after 1984. The percentage of physicians who were members of the Canadian College of Family Physicians (CCFP) was the same for the two groups (55%).

6.3 Knowledge

6.3.1 Frequencies

Who to screen

Response frequencies for questions pertaining to knowledge are presented in Table 5.

Table 5: Response Frequencies to Knowledge Questions

#	Knowledge Category	Yes No. (%)	No No. (%)	Don't Know No. (%)	Missing No. (%)
	Who to Screen				
11	3 year old from developing country	171 (96)*	6 (3)	1 (1)	0
12	30 year old from developing country	172 (97)*	5 (2)	1 (1)	0
13	HIV positive, not anergic	156 (87)*	8 (5)	14 (8)	0
14	AIDS, not anergic	148 (83)*	10 (6)	20 (11)	0
15	Aboriginal	165 (93)*	9 (5)	4 (2)	0
16	Nurse, long-term care facility	167 (93)*	9 (5)	1 (1)	1 (1)
17	Chronic disease - diabetes	29 (16)*	145 (82)	4 (2)	0
	Administering the Mantoux Test				
18	Measure according to erythema	18 (10)	158 (89)*	2 (1)	0
19	Timing for reading test	176 (99)*	2 (1)	0 (0)	0
24	Measure according to induration	175 (98)*	2 (1)	1 (1)	0
25	Allowing patient to read test	26 (15)	127 (71)*	25 (14)	0
	BCG and Screening				
20	No need to screen if had BCG	12 (7)	154 (86)*	12 (7)	0
21	Screening contraindicated if had BCG	17 (10)	149 (83)*	12 (7)	0
22	Significant Mantoux, high risk significant test due to BCG	115 (65)	54 (30)*	9 (5)	0
	Interpreting the Mantoux Test				
26	Mantoux significant, HIV	75 (42)*	30 (17)	73 (41)	0
27	Mantoux significant, AIDS	106 (60)*	8 (4)	64 (36)	0
28	Baby contact, Mantoux significant	95 (53)*	13 (7)	70 (40)	0
29	20 yr. old, 15 mm, no BCG?significant	174 (98)*	4 (2)	0 (0)	0
30	3 yr. old, 13 mm, no BCG ? significant	167 (94)*	2 (1)	8 (4)	1 (1)
31	nurse, 5 mm ? significant	142 (80)	36 (20)*	0	0
	INH and Screening				
23	Risk of hepatitis with INH <1% for age <35	108 (61)*	11 (6)	59 (33)	0
32	INH 60 yr. old, no risk, significant test	36 (20)	86 (48)*	56 (32)	0
33	INH 20 yr old, high risk, sig.test, -BCG	158 (89)*	3 (2)	17 (9)	0
34	INH 20 yr old, high risk, sig.test, +BCG	87 (49)*	15 (8)	76 (43)	0
35	INH 4 yr old, high risk, sig. Test, -BCG	93 (52)*	2 (1)	83 (47)	0
36	INH 4 yr old, high risk, sig. Test, +BCG	38 (21)*	18 (10)	122 (69)	0

*Indicates the correct response

Physicians participating in this survey were quite knowledgeable about who to screen for tuberculosis. More than 90% correctly identified the need to screen persons from TB endemic countries (questions 11 and 12), Aboriginal persons from high risk areas (question 15) and health care workers (question 16). A slightly lower percentage recognized that persons with HIV infection or AIDS should have a Mantoux test (87% and 83%, respectively). Only 16% of physicians were aware that persons with chronic diseases such as diabetes should have a Mantoux test.

The correct response of questions 11 to 17 was "yes" leading to concern that respondents may guess the answer and respond affirmatively regardless of their true state of their knowledge. However, the fact that 83% of the sample answered "no" to question 17 does not support this conclusion.

Administration of the Mantoux test

Physicians also possessed a high level of knowledge about administering the Mantoux test. Almost 90% of physicians were aware that the Mantoux test should not be interpreted according to the amount of erythema (question 18). Question 19, regarding time between administration and reading the Mantoux test was answered correctly by 99% of the sample. Ninety-eight percent answered correctly that the test should be interpreted according to the amount of induration (question 24). A relatively low percentage of physicians however (71%), were aware that the Mantoux test should be read by a health professional and not by patients themselves (question 25).

BCG and Screening

Eighty-six percent of physicians knew that persons who received BCG vaccine were still eligible for screening (question 20) and 83% knew that previous vaccination with BCG vaccine was not a contraindication to receiving the Mantoux test (question 21). Only 30% of the sample were aware that significant tuberculin reactions in high-risk persons who received BCG vaccine, indicated infection with TB rather than a hypersensitivity to BCG (question 22).

Interpretation of the Mantoux Test

Responses to questions concerning interpretation of the Mantoux test were more variable. Ninety-eight percent interpreted the test correctly for the scenario involving an adult from a developing country (questions 29) and 94% correctly interpreted the test for a child from a developing country (question 30). However, only 53% correctly interpreted the Mantoux test as significant for the infant who was a contact of an active case of tuberculosis (question 28). The level of knowledge regarding interpretation of tests for persons with HIV infection and AIDS was also low with only 42% and 60% respectively, responding correctly to questions 26 and 27.

Prescription of INH

Knowledge about chemoprophylaxis with INH was low, especially for scenarios involving children or persons of any age who received BCG vaccine. Although 88% of the sample correctly responded that they would give INH to an adult with a significant test who had not received BCG (question 33), when a history of BCG was added (question 34), only 49% correctly stated that INH was still indicated.

For the scenario involving a child from a developing country who did not receive BCG (question 35), 52% answered correctly that they would prescribe INH. The percentage of correct responses dropped even further when the same child received BCG at birth (question 36), with only 21% of physicians correctly stating that they would still prescribe INH. Forty-eight percent of physicians were aware that INH was not indicated for a healthy 60 year old female with no risk factors for TB and a significant Mantoux test (question 32).

Only 61% of physicians were aware that the risk of INH-associated hepatitis for persons under the age of 35 was less than 1% (question 23).

6.3.2 Knowledge Scores

Mean knowledge scores were calculated for overall knowledge about TB prevention (KNOSCOR) and for each of the following screening components: (1) administering the Mantoux test (TESTSCOR), (2) interpreting the Mantoux test (READSCOR) (3) prescribing INH (INHSCOR) and (4) the effect of BCG vaccine on screening (BCGSCOR).

For each respondent, an overall knowledge percent score (KNOSCOR) was calculated based on the proportion of correct responses for the 19 questions pertaining to knowledge (questions 18 to 36). Mean percent scores were also calculated for each knowledge sub-category (INHSCOR, READSCOR, TESTSCOR and BCGSCOR) by dividing the number of correct responses by the total number of questions in that category and then multiplying by 100%. The sample mean percent scores and 95% confidence intervals for total knowledge

(KNOSCOR) and each sub-category (INHSCOR, READSCOR, BCGSCOR and TESTSCOR) are presented in Table 6 and Figure 1.

Physicians' knowledge about who to screen for tuberculosis tested in question 11-17, was uniformly high. These questions did not contribute to the overall variation in knowledge and therefore were not included in calculating the "total knowledge" score. There was sufficient variation in responses to questions in the other screening categories (questions 18 to 36) however, to include these questions in calculating the "overall knowledge" percent score. Exclusion of questions 11 to 17 had little effect on the overall knowledge score. When they were included in the calculation, the mean score was 73.40% (95% CI 71.48, 75.32) and when excluded the mean score was 70.63% (95% CI, 68.38%, 72.89%) (Table 6).

Table 6 Knowledge Percent Scores

Variable	Mean Score** %	Standard Deviation	95% Confidence Interval
KNOSCOR	70.63	15.31	68.38, 72.89
INHSCOR	53.37	25.82	49.57, 57.17
READSCOR	71.07	20.07	68.13, 74.01
BCGSCOR	79.03	30.64	74.52, 83.54
TESTSCOR	89.61	14.22	87.51, 91.70

KNOSCOR = percent score for all knowledge questions (19 questions in total)
INHSCOR = percent score for questions about INH prescription (6 questions)
READSCOR = percent score for questions about interpreting the Mantoux test (6 questions)
BCGSCOR = percent score for questions about BCG and screening (3 questions)
TESTSCOR = percent score for questions about administering the Mantoux test (4 questions)
*Percent scores were calculated for total knowledge and for each of the above knowledge categories by multiplying the proportion of correct responses by 100%
**Mean of percent scores for the sample

Overall knowledge (KNOSCOR) was normally distributed (Figure 1) with a minimum score of 31.50% and maximum of 100%. For the knowledge sub-categories, the mean score was highest for TESTSCOR at 89.61% (95% CI

87.51%, 91.70%), followed by BCGSCOR at 79.03% (95% CI 74.52%, 83.54%), READSCOR at 71.07% (95% CI 68.13%, 74.01%) and INHSCOR at 53.37% (95% CI 49.57%, 57.17%).

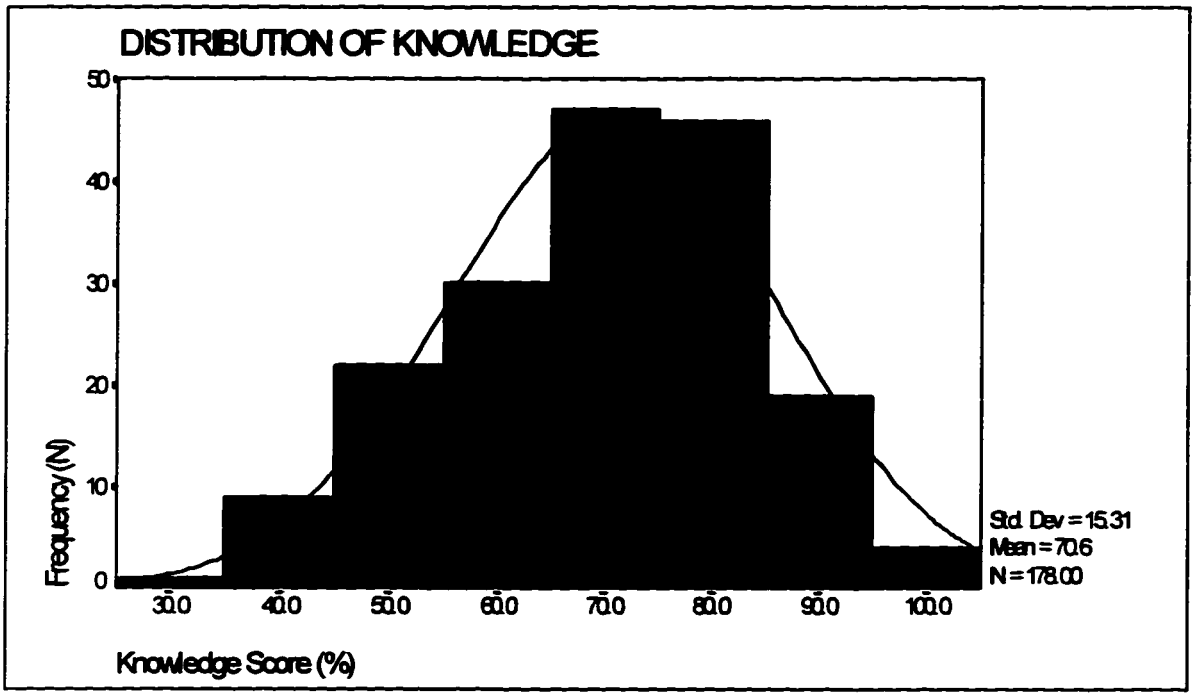


Figure 1 : Distribution of Knowledge

6.3.3 Variables Associated with Knowledge

Using correlation analysis, a significant positive association (α=0.05) was found between overall knowledge score and year of graduation (R= 0.326, p=.000). All knowledge sub-categories were associated with year of graduation with the following correlation coefficients: TESTSCOR R=0.239, READSCOR R=0.179, BCGSCOR R=0.387, INHSCOR R=0.156. The correlation coefficients and p-values for each of the knowledge variables are presented in Table 7.

Table 7: Correlation Between Knowledge and Year of Graduation

Variable	R	P
Total knowledge (KNOSCOR)	0.326	0.000
Administering the Mantoux test (TESTSCOR)	0.239	0.001
Interpreting the Mantoux test (READSCOR)	0.179	0.017
BCG and screening (BCGSCOR)	0.387	0.000
Prescribing INH (INHSCOR)	0.156	0.037

R: the Correlation Coefficient

A scatterplot of knowledge by year of graduation revealed a distribution of data points as shown in Figure 2 below.

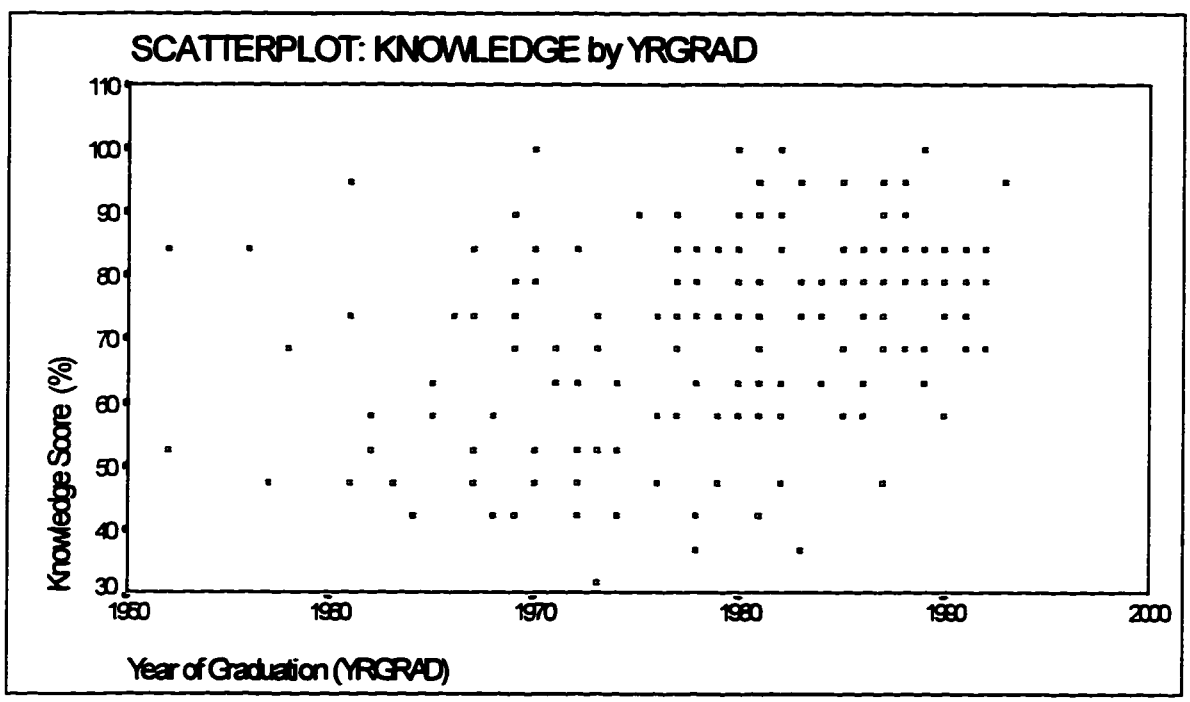


Figure 2 : Scatterplot - Knowledge by YRGRAD

ANOVA was used to explore the association between knowledge and year of graduation further. The sample was divided according to year of graduation to yield quartiles of approximately equal sample size: (1) 1952-1971, (2) 1971-1979, (3) 1980-1985 and (4) 1986 to 1993. Mean total knowledge scores for

each group were compared and were found to be different (F=8.01, p=0.000) (Tables 8 and 9).

Table 8: Knowledge Percent Score by Year of Graduation

Year of Graduation Group	Mean Score %	Standard Deviation	95% Confidence Interval
1 1952-1971	64.37	15.94	59.20, 69.54
2 1972-1979	65.90	14.75	61.52, 70.28
3 1980-1985	74.16	15.96	69.31, 79.02
4 1986-1993	76.90	11.20	73.69, 80.13

Mean of percent scores for the sample

Table 9: One Way ANOVA for Knowledge by Year of Graduation

Source	Degrees of Freedom	Sum of Squares	Mean Square	F ratio	F prob (p)
Between group	3	5034.03	1678	8.01	0.000
Within groups	174	36,445.16	209.45		
Total	177	41,479.19			

The Bonferroni multiple range test showed that group 1 was different from groups 3 and 4 and group 2 was different from group 3 and 4. Groups 1 and 2 were then combined to give the new category "year of graduation less than or equal to 1979" and groups 3 and 4, "year of graduation after 1979". Knowledge was therefore analyzed according to the median year of graduation, which was 1980 (Table 10 and Figure 3).

Table 10: Association Between Knowledge and Year of Graduation Before 1980 vs After 1980

Knowledge Variable	Year of Graduation	Mean Score* %	Standard deviation	95% C.I.	p value
KNOSCOR	<=1979	65.20	15.24	62.96, 67.44	0.004
	>=1980	75.61	13.65	73.60, 77.62	
TESTSCOR	<=1979	87.05	15.72	84.74, 89.36	0.023
	>=1980	91.94	12.32	90.13, 93.75	
READSCOR	<=1979	66.07	20.00	63.13, 69.01	0.001
	>=1980	75.63	19.12	72.82, 78.44	
BCGSCOR	<=1979	69.02	36.65	63.64, 74.4	0.000
	>=1980	88.17	20.05	85.22, 91.12	
INHSCOR	<=1979	47.84	24.90	44.18, 51.50	0.006
	>=1980	58.42	25.72	54.64, 62.20	

KNOSCOR = percent score for all knowledge questions (19 questions in total)
INHSCOR = percent score for questions about INH prescription (6 questions)
READSCOR = percent score for questions about interpreting the Mantoux test (5 questions)
BCGSCOR = percent score for questions about BCG and screening (3 questions)
TESTSCOR = percent score for questions about administering the Mantoux test (4 questions)
*Percent scores were calculated for total knowledge and for each of the above knowledge categories by multiplying the proportion of correct responses by 100%
Mean of percent scores for the sample

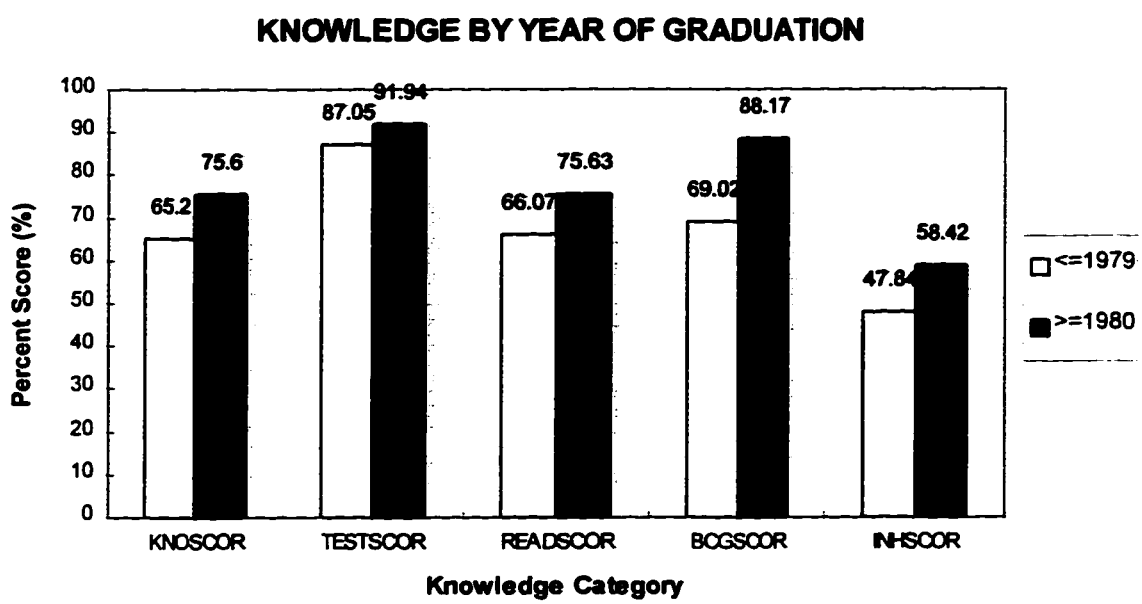


Figure 3 : Knowledge by year of Graduation

For all knowledge variables, physicians who graduated in the year 1980 or after that year had significantly higher mean scores than those who graduated before 1980 ($p<0.05$). Overall knowledge about the prevention of TB (KNOSCOR) was low for physicians graduating before 1980 (mean score 65.20%, 95% CI 62.96, 67.44). Physicians who graduated after 1980 however had a much higher score of 75.61% (95% CI 73.60, 77.62). Looking at the components of screening, the greatest discrepancy in knowledge was found for BCGSCOR with a difference of almost 20 points between the two groups (88.17% vs 69.02%). It is important to note that since participants were slightly younger than population from which they were sampled, this survey may have overestimated physicians' true state of knowledge.

Total knowledge was also associated with the percentage of persons from developing countries in physicians' practices (IMMIG) ($R = 0.226$ $p=.000$). For the sub-categories of knowledge, only INHSCOR was significantly associated with this variable ($R = 0.225$, $p=0.001$). Since most physicians had less than 20% of persons in their practices coming from developing countries, the scatterplot of "knowledge" vs "percentage of persons from developing countries in physicians' practices" showed a cluster of data points randomly distributed below the 20% level (Figure 4). Because a logical cut-point for IMMIG could not be determined from the scatterplot and due to small numbers in categories beyond the 5% level, this variable was analyzed by dichotomising about the sample median of 5%.

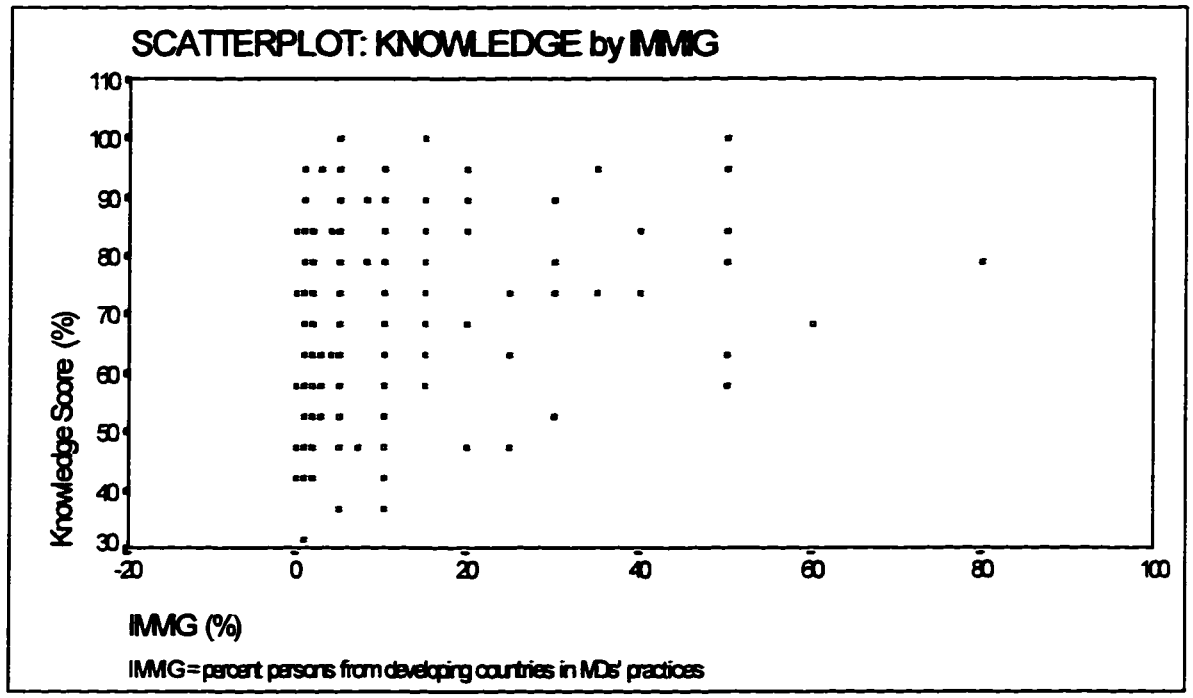


Figure 4 : Scatterplot - Knowledge by Immig

Table 11 shows the relationship between overall knowledge and the percentage of persons from developing countries in physicians' practices according to the sample median of 5%. Physicians with more than 5% of their clients originating from developing countries had an overall knowledge score (KNOSCOR) of 73.91% (95% CI 71.70%, 76.12%) which was significantly higher (p=0.020) than physicians who had less than 5% immigrants in their practice (KNOSCOR 68.47% with 95% CI 65.60%, 71.34%). They were also more knowledgeable about prescribing INH (p=0.001) with a mean score (INHSCOR) of 58.45% (95% CI 55.49%, 64.41%) compared to 50% (95% CI 46.26%, 53.74%) for physicians with less than 5% of their practices containing immigrants from developing countries.

Table 11: Association Between Knowledge and Percentage of Immigrants in Physicians' Practices (IMMIG): <=5% vs. >5%

Knowledge Variable	IMMIG %	Mean Score* %	Standard deviation	95% C.I.	p value
KNOSCOR	<=5	68.40	15.15	65.60, 71.34	0.020
	>5	73.91	15.05	71.70, 76.12	
TESTSCOR	<=5	88.79	15.06	85.94, 91.64	0.150
	>5	90.85	12.84	87.86, 93.84	
READSCOR	<=5	68.07	20.36	64.21, 71.93	0.127
	>5	75.59	18.86	71.20, 79.98	
BCGSCOR	<=5	79.12	28.78	74.89, 83.35	0.958
	>5	78.87	33.44	73.96, 83.78	
INHSCOR	<=5	50.00	25.49	46.26, 53.74	0.032
	>5	58.45	25.64	55.49, 64.41	

KNOSCOR = percent score for all knowledge questions (18 questions in total)
INHSCOR = percent score for questions about INH prescription (6 questions)
READSCOR = percent score for questions about interpreting the Mantoux test (6 questions)
BCGSCOR = percent score for questions about BCG and screening (3 questions)
TESTSCOR = percent score for questions about administering the Mantoux test (4 questions)
*Mean of percent scores for the sample. Percent scores were calculated for total knowledge and for each of the above knowledge categories by multiplying the proportion of correct responses by 100%.

A correlation was also found between the variables YRGRAD and IMMIG (R=0.216, p=0.004). The scatterplot of IMMIG by YRGRAD in Figure 5 shows that most physicians had less than 20% of their practice consisting of immigrants from developing countries. The higher percentages of immigrants in physicians practices were found more frequently among physicians who graduated after 1980.

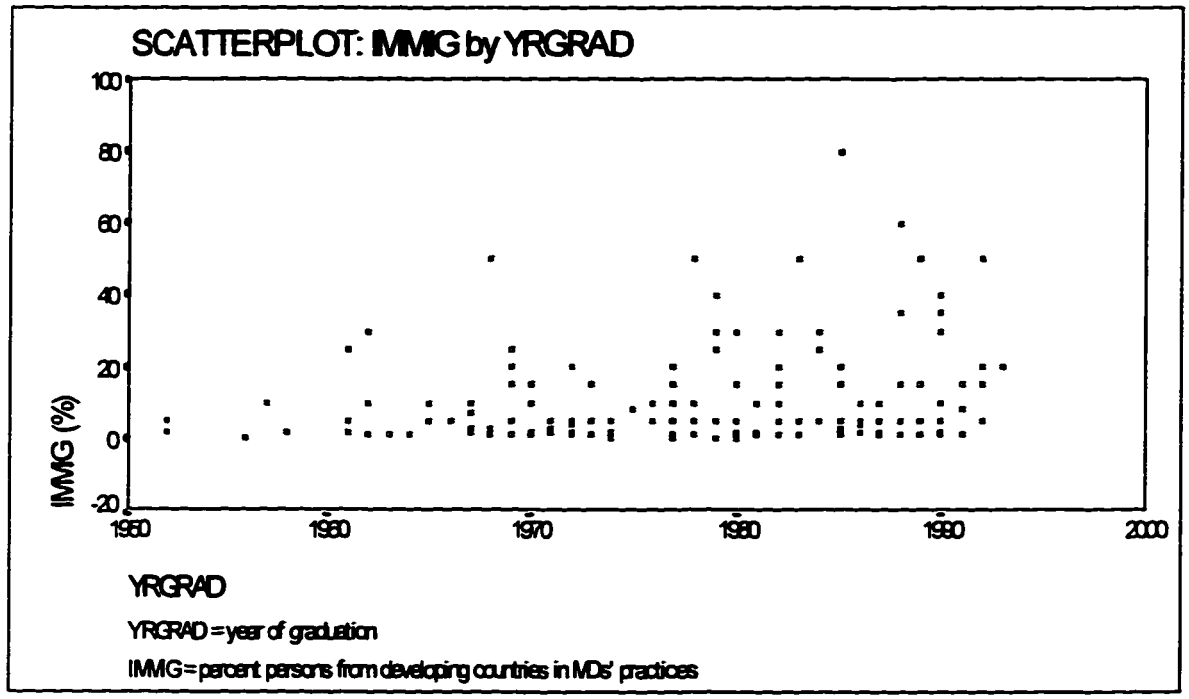


Figure 5 : Scatterplot - IMMIG by YRGRAD

6.4 Beliefs

6.4.1 Frequencies

Screening Beliefs (Table 12)

All of the participants believed that screening for tuberculosis was an important step in controlling this disease and 99% percent believed (74% strongly, 25% slightly) that the Mantoux test was an effective screening method. Regarding INH chemoprophylaxis, 86% believed that INH was efficacious in preventing TB (58% strongly and 28% slightly). For the 8% of physicians who had "no opinion" on this matter, many indicated that the opportunity to use INH rarely arose in their practices. Therefore they could not comment on the efficacy of this medication.

Table 12: Beliefs About Screening					
Belief	**Strongly Disagree No. (%)**	**Slightly Disagree No. (%)**	**Slightly Agree No. (%)**	**Strongly Agree No. (%)**	**No opinion No. (%)**
Belief in the importance of screening for TB	0 (0)	0 (0)	0 (0)	178 (100)	0 (0)
Belief in the efficacy of the Mantoux test in screening	0 (0)	2 (1)	45 (25)	131 (74)	0 (0)
Belief in the efficacy of INH for chemoprophylaxis	7 (4)	4 (2)	49 (28)	103 (58)	15 (8)
Belief in the safety of INH below age 35	0 (0)	(0) 0	15 (8)	160 (90)	3 (2)
Belief in the safety of INH above age 35	6 (3)	9 (5)	51 (29)	112 (63)	0 (0)
Belief that patient compliance is >80%	21 (12)	64 (36)	38 (21)	26 (15)	29 (16)
Belief that would not prescribe INH if suspect low compliance	80 (45)	38 (21)	36 (20)	21 (12)	3 (2)

Most physicians (98%) felt that INH was safe for persons under the age of 35 and 90% strongly believed this. For persons older than 35, 92% of physicians still believed that INH could be prescribed safely however only, 63% strongly agreed with this statement.

Physicians' beliefs about patient compliance with INH therapy varied considerably with 48% feeling that compliance was low (12% strongly and 36% slightly), 36% believing that compliance was acceptable (15% strongly and 21% slightly) and 16% had no opinion. Again, many of the participants with "no opinion" commented that they rarely prescribed this medication.

Self-efficacy Beliefs (Table 13, Figure 6)

Physicians were asked about their level of self-confidence for all screening steps. Twenty-four percent felt very confident and 61% confident, about recognizing who to screen. Most participants (98%) were either very confident or confident about performing the Mantoux test (64% very confident and 34% confident). With respect to interpreting the Mantoux test, only 26% felt very confident and 58% confident about this screening step.

The level of confidence in knowing when to prescribe INH was generally low with only 7% feeling very confident and 39% confident about this step. Therefore, 54% of physicians were not confident or had a low level of confidence about administering INH chemoprophylaxis. Fourteen percent of physicians felt very confident and 51% confident, in their ability to manage patients who were taking INH.

Table 13 Physicians' Self-Efficacy Beliefs About Screening for Tuberculosis

Self-efficacy Belief	Very Confident No. (%)	Confident No. (%)	Somewhat Confident No. (%)	Not Confident No. (%)
Recognizing who to screen	43 (24)	109 (61)	24 (14)	2 (1)
Administering the Mantoux test	114 (64)	60 (34)	3 (2)	1 (0)
Interpreting the Mantoux test	46 (26)	103 (58)	28 (16)	1 (0)
Prescribing INH	12 (7)	69 (39)	79 (44)	18 (10)
Management of INH chemoprophylaxis	26 (14)	90 (51)	42 (24)	20 (11)

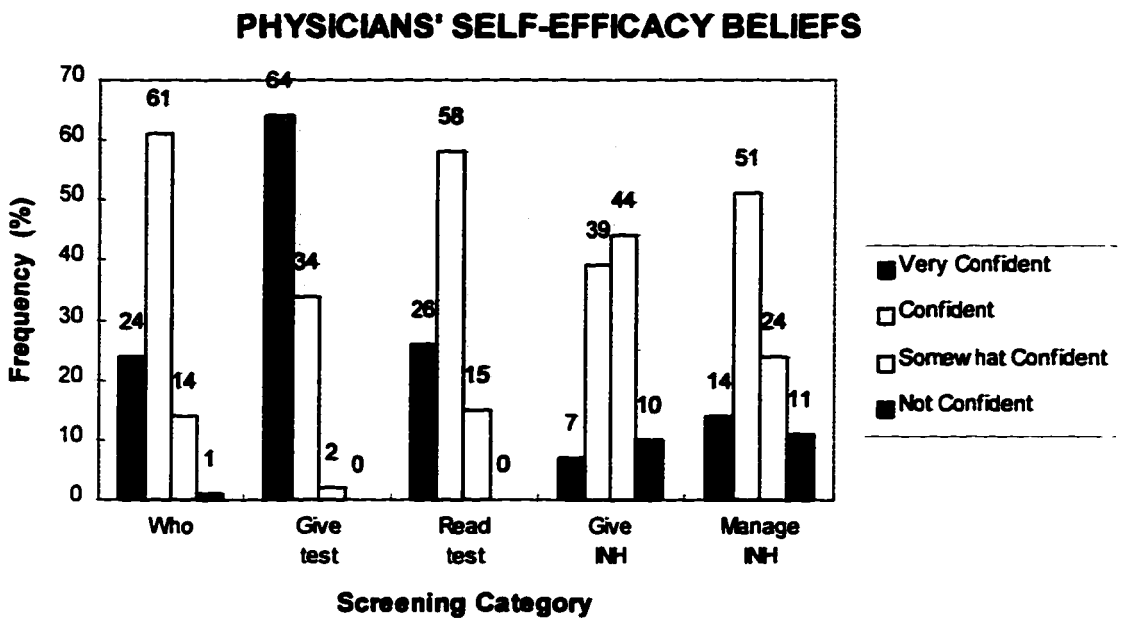


Figure 6 : Physicians' Self-Efficacy Beliefs

6.4.2 Variables Associated with Beliefs

Screening Beliefs

Belief in the efficacy of the Mantoux test was significantly associated (p=0.031) with the percentage of persons from developing countries in physicians' practices (Table 14). Physicians with practices having more than 5% of patients from developing countries were less likely (65% vs 80%) to strongly agree and more likely to slightly agree (34% vs 19%) that the Mantoux test was effective compared to those with less than 5% immigrants (p=0.031). The overall percentage of physicians "agreeing" that this test was effective was similar for the two groups (99% and 99%) so that the clinical significance of this association may be small.

Table 14: Belief in Efficacy of Mantoux Test and Percent Persons from Developing Countries in Physicians' Practices				
% Persons from Developing Country (N) p=0.031	Strongly Agree N, (%)	Slightly Agree N, (%)	Either Strongly or Slightly Agree N, (%)	Slightly Disagree
<= 5% (107)	85 (80)	21 (19)	107 (99)	1 (1)
>5% (71)	46 (65)	24 (34)	70 (99)	1 (1)

Belief in the safety of INH for persons older than 35 years was associated with whether physicians had lived in developing country (p=0.025) (Table 15). Participants who had lived in a developing country were less likely to either strongly or slightly agree that INH could prescribed safely compared to those who had never lived in a developing country (85% vs 93%). Again, the clinical significance of this finding may be limited.

Table 15: Belief in Safety INH over 35 Years and Ever Lived in a developing Country					
Ever Lived in a Developing Country (No) p=0.025	Strongly Agree No, (%)	Slightly Agree No, (%)	Either Strongly or Slightly Agree No, (%)	Slightly Disagree No, (%)	Strongly Disagree No, (%)
Yes (41)	20 (49)	15 (36)	35 (85)	4 (10)	2 (5)
No (137)	92 (67)	36 (26)	128 (93)	5 (4)	4 (3)

Self-efficacy Beliefs

Confidence in reading the Mantoux test was significantly associated (p=0.001) with gender (Table 16). Thirty-two percent of male physicians felt very confident and 8% somewhat confident about interpreting a Mantoux test. For females 17% felt very confident and 27% somewhat confident about this procedure.

Table 16: Self-Efficacy Beliefs About Screening for Tuberculosis by Gender

Self-efficacy Belief (No)	Very Confident No. (%)	Confident No. (%)	Somewhat Confident No. (%)	Not Confident, No. (%)
Recognizing who to screen				
Male (103)	24 (23)	65 (63)	12 (12)	2 (2)
Female (75)	19 (25)	44 (59)	12 (16)	0 (0)
Administering the Mantoux test				
Male (103)	67 (65)	33 (33)	2 (2)	0 (0)
Female (75)	47 (63)	26 (35)	1 (1)	1 (1)
Interpreting the Mantoux test p=0.001				
Male (103)	33 (32)	61 (59)	8 (8)	1 (1)
Female (75)	13 (17)	42 (56)	20 (27)	0 (0)
Prescribing INH* p=0.017				
Male (103)	10 (10)	45 (44)	38 (37)	10 (9)
Female (75)	2 (3)	24 (32)	41 (54)	8 (11)
Management of INH p=0.041				
Male (103)	21 (20)	50 (49)	23 (22)	9 (9)
Female (75)	5 (7)	40 (54)	19 (25)	11 (14)

Statistically significant for $\alpha = 0.05$

The relationship between confidence in reading the Mantoux test and practice setting was just outside the level of significance (p=0.06) and the trends are presented in Table 17. It was difficult to compare sub-groups, because of small numbers in the CHC, walk-in clinic and university affiliated practice categories.

Table 17: Association Between Practice Setting and Confidence in Reading Mantoux Test

Practice Setting, No p=0.06	Very Confident No. (%)	Confident No. (%)	Somewhat Confident No. (%)	Not Confident No. (%)
Solo/ Group Family Practice, 138	34 (24)	80 (58)	23 (17)	1 (1)
Community Health Centre, 11	2 (18)	8 (73)	1 (9)	0 (0)
Walkin Clinic, 18	5 (28)	10 (56)	3 (16)	0 (0)
University Family Medicine, 6	5 (83)	1 (17)	0 (0)	0 (0)
Other (GP + emergency), 5	4 (80)	1 (20)	0 (0)	0 (0)

Confidence in recognizing who to screen was significantly associated with practice setting (p=0.023). Interpretation of the data in Table 18 is limited again due to small numbers but it appeared that physicians working in CHCs were slightly more confident about TB screening than those working in fee-for-service settings.

Table 18: Association Between Practice Setting and Confidence in Recognizing Who to Screen

Practice Setting, No	Very Confident No. (%)	Confident No. (%)	Somewhat Confident No. (%)	Not Confident No. (%)
Solo/ Group Family Practice, 138	32 (23)	86 (62)	18 (13)	2 (1.4)
Community Health Centre, 11	4 (36)	6 (54)	1(10)	0 (0)
Walkin Clinic, 18	1 (6)	13 (72)	4 (22)	0 (0)
University Family Medicine, 6	2 (33)	3 (50)	1 (17)	0 (0)
Other (GP + emergency), 5	4 (80)	1 (20)	0 (0)	0 (0)

Level of confidence in prescribing INH (Table 19) was associated with three variables: gender (p=0.017), the percentage of persons from developing countries in physicians' practices (above or below 5%, p=0.032) and with a history of practicing medicine in a developing country (p=0.033).

Table 19: Associations for Confidence in Prescribing INH

Variable (No)	Very Confident No. (%)	Confident No. (%)	Somewhat Confident, No. (%)	Not Confident No. (%)
Gender, p=0.017				
Males (103)	10 (10)	45 (44)	38 (37)	9 (9)
Females (75)	2 (3)	24 (32)	41 (54)	8 (11)
Percent Practice p=0.032 from developing country				
<=5% (107)	5 (4)	38 (36)	50 (47)	14 (13)
> 5% (71)	7 (10)	31 (44)	29 (41)	4 (5)
Practiced in developing country p=0.033				
Yes (25)	3 (12)	13 (52)	8 (32)	1 (4)
No (153)	9 (6)	57 (37)	70 (46)	17 (11)

Males were more likely to feel either very confident or confident about prescribing INH than were females (54% vs 35%). Similarly a higher percentage of females admitted to feeling only "somewhat confident" (54% vs 37%) and "not confident" (11% vs 9%) about this screening step. Physicians' with practices having more than 5% of their clients from developing countries were more likely to feel very confident or confident (54% vs 40%) about prescribing INH. As well, physicians who had practiced in a developing country were more likely to feel either very confident or confident (64% vs 43%) about administering INH than their counterparts. The association between confidence in prescribing INH and living in a developing country was just above the acceptable level of significance for α =0.05 (p=0.06). It appeared that physicians who had lived in a developing country were also more confident about prescribing INH than those who had not (58% vs 41%) (data not shown).

Gender was also associated with physicians' confidence in managing persons who were taking INH preventive therapy (p=0.041) (Table 16). Males were more likely to feel very confident than were females (20% vs 7%) and a higher percentage of females were not confident (14% vs 9%) about monitoring INH chemoprophylaxis.

6.5 Barriers to screening

6.5.1 Frequencies

Response frequencies to questions about potential barriers to screening are presented in Table 20 and Figure 7. Only 14% of participants felt that screening for TB was time consuming however, 60% felt they were not adequately reimbursed for their efforts. Twenty physicians who were employed on a salary

basis, could not comment on the adequacy of OHIP reimbursement for TB screening procedures and were therefore excluded from the analysis for this barrier only. The number of salaried physicians according to practice setting was: Group practice (5), CHC (9), walk-in (6), family medicine (2) and other (2). This meant that some physicians in private practices or walk-in clinics had some form of salaried remuneration while certain physicians in CHC's, university centres and emergency departments also billed OHIP.

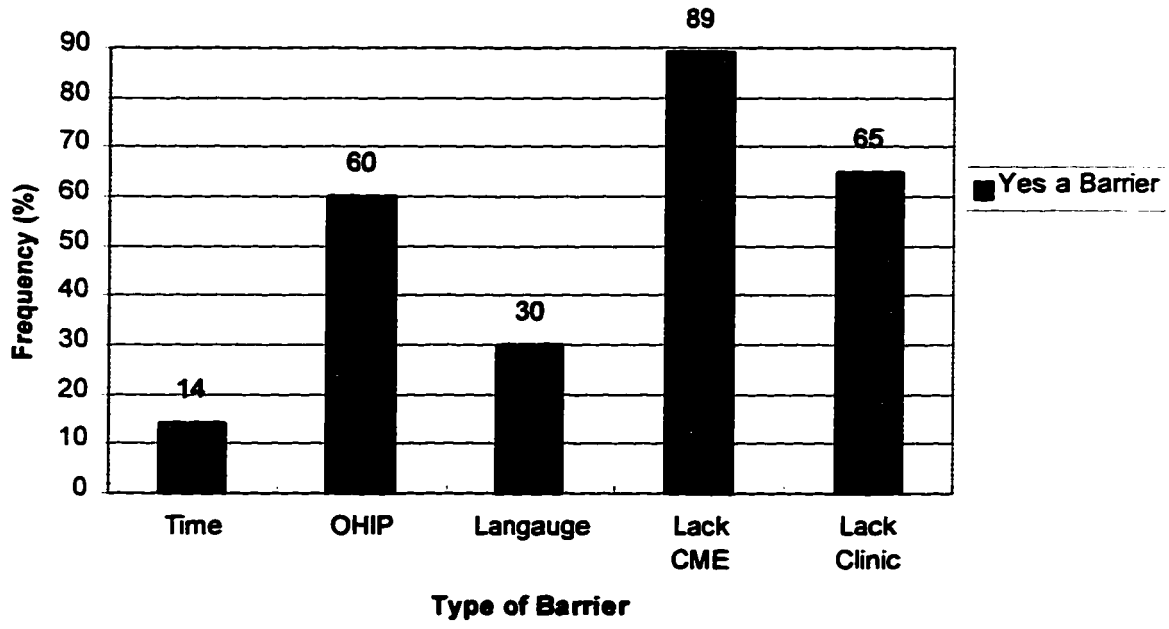


Figure 7 : Barriers to Screening for Tuberculosis

Table 20: Barriers to Screening for Tuberculosis			
Barrier	**Yes, a barrier No. (%)**	**Not a barrier No. (%)**	**Don't Know No. (%)**
Lack of Time	25 (14)	151 (85)	2 (1)
Inadequate Reimbursement*	95 (60)	58 (37)	5 (3)
Language/ Cultural Factors (Communication problems)	53 (30)	123 (69)	2 (1)
Lack of CME	158 (89)	12 (7)	8 (4)
Lack of Centralized screening clinic	115 (65)	54 (30)	9 (5)
*Reimbursement by OHIP was considered for fee-for-service physicians only. The 20 physicians on salary were excluded from this analysis so that for this variable only, the sample size was 158.			

Differences in language were cited as a problem when screening for TB by 30% of physicians. Almost 90% of the sample felt that CME programs should be increased and 65% were in favor of a central screening clinic. Responses obtained from 53 of the 54 physicians who were not in favor of a central screening clinic are presented in Table 21 below.

Table 21: Reasons Against Central TB Screening Clinic	
Reason	N (%)
Will lead to fragmented care	22 (42)
TB screening is the family doctor's responsibility	16 (30)
Patients will not be compliant, won't go	9 (17)
Not cost-effective	6 (11)

6.5.2 Variables Associated with Barriers

For the analysis of barriers to screening and the variable practice setting, certain cells in the 4 by 2 contingency tables were found to have expected frequencies of less than five. Therefore, for this analysis only, practice setting was converted into two categories: fee-for service (combining group/solo and walk-in clinic categories) and salary (combining CHC and university-based categories). Perceptions about CME as a barrier to screening were associated with two

variables: (1) gender (p=0.006) and (2) whether or not a physician had practiced in a developing country (p=0.026) (Tables 22 and 23).

Table 22: Barriers to Screening for Tuberculosis by Gender

Barrier		Yes a barrier No. (%)	Not a barrier No. (%)	Don't Know No. (%)
Lack of Time	Male	16 (16)	85 (82)	2 (2)
	Female	9 (12)	66 (88)	0 (0)
Inadequate Reimbursement*	Male	37 (41)	53 (58)	1 (1)
	Female	21 (31)	42 (63)	4 (46)
Language/ Cultural Factors				
	Male	25 (24)	77 (75)	1 (1)
	Female	28 (37)	46 (61)	1 (1)
Lack of CME**	Male	92 (89)	10 (10)	1 (1)
	Female	66 (88)	2 (3)	7 (9)
Lack of Screening Clinic				
	Male	75 (73)	28 (27)	0 (0)
	Female	49 (65)	26 (35)	0 (0)

*Reimbursement by OHIP only considered for fee-for-service physicians. The 20 physicians on salary were excluded from this analysis so that for this variable only, the sample size was 158; significant for α=0.05, p=0.003.
**Significant for α=0.05, p=0.006.

Table 23: Associations Between Independent Variables and Barriers to Screening

Barrier Type	Associated Variable (No)	Yes-Barrier No. (%)	No-Barrier No. (%)	Don't Know No. (%)
Lack of CME, p=0.026	Practiced in Developing country			
	Yes (25)	18 (72)	4 (16)	3 (12)
	No (153)	140 (92)	8 (5)	5 (3)
Language/Communication Problems, p=0.002	Year of Graduation			
	Before 1980 (85)	15 (18)	69 (81)	1 (1)
	After 1980 (93)	38 (41)	54 (58)	1 (1)
Language/Communication Problems, p=0.003	% Practice From Developing Countries			
	<=5% (107)	24 (22)	83 (78)	0 (0)
	> 5% (71)	29 (41)	40 (56)	2 (3)
Language/Communication Problems, p=0.005	Practice Setting*			
	Fee-for-Service (156)	42 (27)	114 (73)	0
	Salary (17)	11 (63)	6 (37)	0

* Practice setting has 2 categories: fee-for-service vs salary for this analysis, due to small numbers in certain practice categories.

Female physicians were more likely to be unsure if more CME programs were needed (9% females vs 1% males) (Table 23). Physicians who had practiced in a developing country were less inclined to think that physicians' needed more CME about the prevention of TB in comparison to those who had never practiced medicine in a developing country (72% vs 92%) (Table 23).

Statistically significant relationships were found between language/communication problems when screening and the variables "year of graduation" (p=0.002), "practice setting" (p=0.005) and "percentage of persons from developing countries in physicians' practices" (p=0.003) (Table 23). A higher percentage of physicians graduating after 1980 (41%) had language/communication problems with their clients than those graduating before 1980 (18%). As expected, physicians with more than 5% of persons in their practice coming from developing countries had more communication problems than their counterparts (41% vs 22%). For practice setting, salaried physicians were more likely to report difficulties communicating with their clients than fee-for-service physicians (63% vs 27%).

6.6 Awareness of guidelines

A large number of physicians 66 (37%) were unaware of the TB screening guidelines circulated by the Ottawa-Carleton Health Department (Table 24). Of the 112 physicians that were aware of the recommendations, 90 (80% of them) had used them. Reasons for not using the guidelines were provided by 15 of the 20 (75%) physicians who did not use them and included: consults with a specialist when questions arise (7), opportunity to use guidelines rarely arises (5), uses other resources (2) and lost the guidelines (1).

Table 24: Awareness of Tuberculosis Guidelines		
	Yes aware No. (%)	**Not aware No. (%)**
Awareness of Health Department TB Guidelines	112 (63)	66 (37)
Awareness of Other TB Guidelines	43 (24)	135 (76)

Forty-three participants (24%) used "other" resources including:

1. American Thoracic Society TB screening recommendations (5%)
2. Canadian Lung Association TB screening recommendations (19%)
3. Communication with Specialists (19%)
4. Journal articles (29%)
5. Textbooks (28%)

6.7 Effect of Gender

Since gender was found to be an important determinant of physicians self-efficacy beliefs, for descriptive purposes only, frequencies for all variables were examined according to gender .

6.7.1 *Demographics*

The demographic characteristics of the sample according to gender are presented in Table 25. A higher percentage of female physicians (67%) were CCFP certified than were males (46%) and more females worked in solo/group practices (81% females vs 75% males) and CHCs (8% females vs 5% females). The median year of graduation was 1982 for female physicians and 1977 for males. Therefore, female participants were younger than their male counterparts. As well, female physicians had a higher percentage of persons originating from

TB endemic countries in their practices for all cut-points of this variable. Although the same percentage of males and females had lived in a developing country (23%), a slightly higher percentage of male physicians had practiced medicine in a developing country (17% vs 12%).

Table 25 Demographic Characteristics by Gender

	Total N=178 No. (%)	Males, N=103 No. (%)	Females, N=75 No. (%)
Certification			
LMCC	80 (45)	55 (53)	25 (33)
CCFP	92 (52)	44 (43)	48 (64)
CCFP(EM)	5 (3)	3 (3)	2 (3)
other	1 (1)	1 (1)	0 (0)
Practice Setting			
GP/Solo or group	138 (78)	77 (75)	61 (81)
CHC	11 (6)	5 (5)	6 (8)
Walkin Clinic	18 (10)	13 (12)	5 (7)
University FMC	6 (3)	5 (5)	1 (1)
Other	5 (3)	3 (3)	2 (3)
Year graduation			
Median (year)	1980	1977	1982
Graduated <=1984	123 (69)	80 (78)	43 (57)
Graduated >1984	55 (31)	23 (22)	32 (43)
Graduated 1985-1989	36 (20)	16 (16)	20 (27)
Graduated 1990-1993	19 (11)	7 (7)	12 (16)
Practiced in a Developing Country	25 (14)	18 (17)	9 (12)
Lived in a Developing Country	41 (23)	24 (23)	17 (23)
Percent Persons from Developing Countries in Practice	11	9	12
Mean (%)	5	5	5
Median (%)			
Cutpoints	71 (40)	40 (39)	31 (41)
> 5%	44 (25)	22 (21)	22 (29)
>10%	31 (17)	15 (15)	16 (21)
>15%	24 (14)	11 (11)	13 (17)
>20%	20 (11)	9 (9)	11 (15)
>25%	13 (7)	5 (5)	8 (11)
>30%			

6.7.2 Knowledge

The mean "overall knowledge" scores for males and females were comparable (Table 26, Figure 8). Although a statistically significant association between sex and knowledge was not detected, mean scores for total knowledge (KNOSCOR) and the sub-categories (READSCOR, BCGSCOR, TESTSCOR) appeared to be slightly higher for female physicians.

Table 26 Knowledge Percent Scores by Gender

Variable	Mean Score %	Standard Deviation	95% Confidence Interval
KNOSCOR			
Males	69.90	15.83	66.84, 72.96
Females	71.64	14.60	68.34, 74.94
INHSCOR			
Males	53.72	26.09	48.68, 58.76
Females	52.90	25.612	47.09, 58.69
READSCOR			
Males	70.39	20.34	66.46, 74.32
Females	72.00	19.79	67.52, 76.48
BCGSCOR			
Males	77.67	32.80	71.34, 84.00
Females	80.90	27.50	74.67, 87.11
TESTSCOR			
Males	87.62	15.21	84.68, 90.56
Females	92.33	12.31	89.54, 95.12

KNOSCOR = percent score all knowledge questions (19 questions in total)
INHSCOR = percent score for questions about INH prescription (6 questions)
READSCOR = percent score for questions about interpreting the Mantoux test (6 questions)
BCGSCOR = percent score for questions about BCG and screening (3 questions)
TESTSCOR = percent score for questions about administering the Mantoux test (4 questions)
Percent scores were calculated for total knowledge and for each of the above knowledge categories by multiplying the proportion of correct responses by 100%
Mean of percent scores for the sample

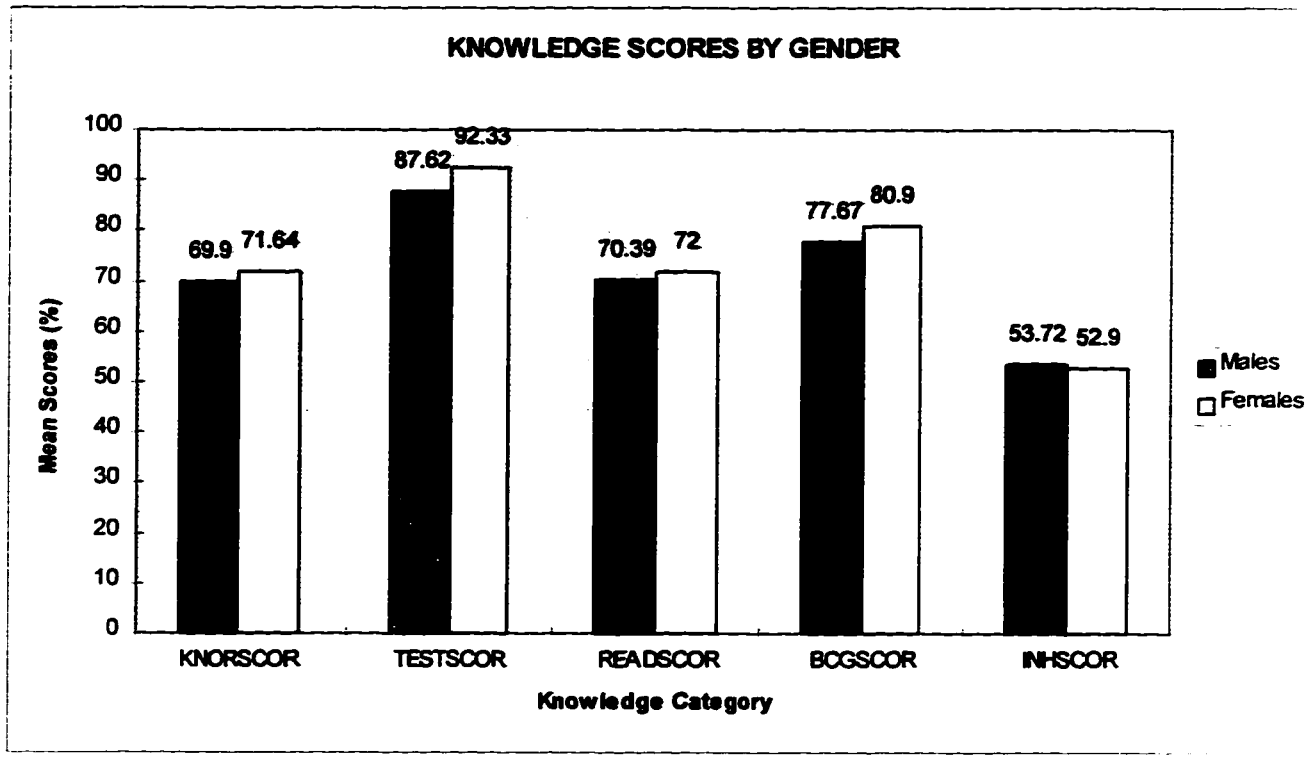


Figure 8 : Knowledge Scores by Gender

6.7.3 Beliefs

Men and women had similar beliefs about screening and preventive therapy for tuberculosis (Table 27). Self-efficacy beliefs however, differed according to gender (Table 16). Males were more confident about interpreting the Mantoux test (p=0.001), prescribing INH (p=0.017) and managing INH chemoprophylaxis (p=0.041). Females and males were equally confident about recognizing who to screen and about administering the Mantoux test. To control for the possible confounding effects of "year of graduation" and "whether a physician had practised in a developing country" on the relationship between gender and self-efficacy beliefs, stepwise multiple linear regression was performed. For this analysis, the items measuring self-efficacy were combined to form a score. The main predictor of physicians' self-confidence after controlling for the effects of year of graduation and lived in a developing country.

Table 27: Beliefs About Screening by Gender					
Belief	**Strongly Disagree No. (%)**	**Slightly Disagree No. (%)**	**Slightly Agree No. (%)**	**Strongly Agree No. (%)**	**No opinion No. (%)**
Belief in the importance of screening for TB					
Males	0 (0)	0 (0)	0 (0)	103 (100)	0 (0)
Females	0 (0)	0 (0)	0 (0)	75 (100)	0 (0)
Belief in the efficacy of the Mantoux test in screening					
Males (103)	0 (0)	0 (0)	28 (27)	75 (73)	0 (0)
Females (75)	0 (0)	2 (3)	17 (22)	56 (75)	0 (0)
Belief in the efficacy of INH for chemoprophylaxis					
Males (103)	5 (5)	4 (4)	29 (28)	57 (55)	8 (8)
Females (75)	2 (3)	0 (0)	20 (27)	46 (61)	7 (9)
Belief in the safety of INH below age 35					
Males (103)	0 (0)	0 (0)	8 (8)	93 (90)	2 (2)
Females (75)	0 (0)	0 (0)	7 (9)	67 (89)	1 (1)
Belief in the safety of INH above age 35					
Males (103)	2 (2)	4 (4)	29 (28)	68 (66)	0 (0)
Females (75)	4 (5)	5 (7)	22 (29)	44 (59)	0 (0)
Belief that patient compliance is >80%					
Males (103)	14 (14)	36 (35)	23 (22)	16 (15)	14 (14)
Females (75)	7 (9)	28 (37)	15 (20)	10 (13)	15 (20)
Belief that would not prescribe INH if suspect low compliance					
Males (103)	47 (46)	19 (18)	23 (22)	11(11)	3 (3)
Females (75)	33 (45)	19 (25)	13 (17)	10 (13)	0 (0)

6.7.4 Barriers

A higher percentage of male physicians felt that they were inadequately re-reimbursed (41% vs 31%) for tuberculosis screening (Table 22). Females tended to have more language/communication problems (37% vs 24%), were less in favor of a central screening clinic (65% vs 73%) and were less likely to consider screening for TB as time consuming.

6.7.5 Awareness of Guidelines

Awareness of Health Department or other TB screening guidelines did not differ according to gender (Table 28). Of the physicians that were aware of the Health Department guidelines, a higher percentage of females (87%) indicated that they used the guidelines than did males (78%).

Table 28: Awareness of Tuberculosis Guidelines by Gender

	Yes aware No. (%)		Not aware No. (%)	
	Males	Females	Males	Females
Awareness of Health Department TB Guidelines	64 (62)	48 (64)	39 (38)	27 (36)
Awareness of Other TB Guidelines	27 (26)	16 (21)	76 (74)	59 (79)

6.8 Quality of the Data

Cohen's Kappa

Reliability of the questionnaire was tested by checking concordance (using Kappa) between questions evaluating similar concepts and there was good evidence that the research instrument was reliable. Screening persons with HIV infection for tuberculosis and those with AIDS were examined in questions 13 and 14. The proportion of agreement beyond chance between these questions (or Kappa) was 0.462. Similarly, the proportion of agreement beyond chance between the questions regarding interpretation of the Mantoux test for persons with HIV infections (question 26) and AIDS (question 27) was 0.410. In question 35 physicians were asked if they would prescribe INH to a child from a developing country who had a significant Mantoux test. In question 36, the same scenario was proposed except the child had received BCG vaccine at birth. Even though a new factor had been added to the original concept, the concordance

between these two questions (beyond chance) was still good with a Kappa of 0.480. The above values of Kappa indicate moderate agreement.

Cronbach's Alpha

For the 19 items measuring physicians' knowledge, Cronbach's alpha was 0.674 and for self-efficacy items, Cronbach's alpha was 0.710 indicating an acceptable level of internal consistency for these two constructs.

Other

The fact that deficiencies in knowledge were accompanied by low levels of confidence for the same components of screening also lends support to the reliability of the questionnaire. Physicians' knowledge about who to screen and administering the Mantoux test was higher than their knowledge about interpreting the Mantoux test and prescribing INH. Similarly, physicians felt much more confident about recognizing groups to screen and performing the Mantoux test than they did about interpreting the test and administering INH. This trend would not be anticipated if physicians were responding randomly during the interview and brings to light an important point; that physicians' knowledge and self-efficacy beliefs are closely related and may need to coexist before preventive activities take place.

6.9 Multivariate Analysis

One of the goals of this survey was to assess but not quantify the relationship between the demographic variables and physicians' knowledge about screening for tuberculosis. Stepwise multiple linear regression was used to model knowledge as a function of explanatory variables selected either because they

were thought a priori to have an important relationship with knowledge or because they were found to have a statistically significant relationship with knowledge in the bi-variate analysis. The independent variables sex, certification, ever lived in a developing country, ever practiced in a developing country, practice setting, percent persons from developing countries in a practice and year of graduation were first entered in a stepwise fashion; then interaction terms were added also in a stepwise fashion. The purpose of multiple linear regression modeling was to assess the simultaneous effects of the above independent variables on knowledge and to adjust for the effect of potentially confounding variables.

With a probability of P-to-enter-in (PIN) set at 0.05 and probability of P-to-remove-out (POUT) at 0.10, only "year of graduation" (YRGRAD) and "percentage persons from developing countries in physicians' practices" (IMMIG) remained as explanatory variables with an R^2 0f 0.1319 and leading to the following regression equation: (Tables 29 and 30)

Regression Model 1:

Total Knowledge = -910 + 0.185 IMMIG + 0.494 YRGRAD + E.

Table 29: Variables in the Stepwise Multiple Linear Regression Equation

Variable	B	SE (B)	Beta	T	p
IMMIG*	0.185	0.082	0.163	2.264	0.025
YRGRAD**	0.494	0.123	0.291	4.035	0.000
Constant	-910.2	0242.5			0.000

*IMMIG = percent persons form developing countries in physicians practices
**YRGRAD = year of graduation
R^2 = 0.131 ($p<0.001$)

Table 30: Variables Not in the Stepwise Multiple Linear Regression Equation

Variable	Beta In	Partial B	T	p
1. Certification	0.031	0.032	0.426	0.67
2. Lived in a developing country	-0.019	-0.019	-.251	0.80
3. Practiced in a developing country	-0.006	-0.007	-.096	0.92
4. Practice setting	-1.87E-04	-0.0002	-.003	0.99
5. Sex	-0.556	-0.056	-.750	0.45

When YRGRAD was considered in the first step of the regression process, R^2 was 0.106 and when IMMIG was added to the model, R^2 increased slightly to 0.131. The correlation coefficient for YRGRAD was 0.326 and for IMMIG was 0.226 indicating a higher correlation between knowledge and YRGRAD than between knowledge and IMMIG. Tests for collinearity did not reveal collinearity between YRGRAD and IMMIG. To assess for interaction, the first-order interaction term "YRGRAD X IMMIG" was added to the above model. Using stepwise regression, an interaction between YRGRAD and IMMIG on knowledge was not found.

To assess for confounding, regression coefficients (B) for each of the independent variables were examined when one of the variables was removed from model 1. Removing IMMIG had no effect on the B for year of graduation. When year of graduation was removed from model 1, the B for IMMIG however, changed from 0.185 to 0.257. Since YRGRAD confounded the relationship between IMMIG and knowledge, YRGRAD was kept in the model. The final regression model therefore remained unchanged and included both YRGRAD and IMMIG as predictors of knowledge. This model however, explained only 13%

of the total variability of physicians' knowledge and within the model, most of the variability was determined by "year of graduation".

Violation of Regression Assumptions

Violation of assumptions for linear regression were tested by examining scatterplots of regression residuals. In Figure 10, the regression standardized predicted values were plotted against regression standardized residuals. The residuals were randomly distributed indicating that that the assumption of linearity was intact. The spread of residuals did not increase or decrease with the magnitude of the predicted values therefore, the homoscedasticity assumption was not violated. Analysis of residuals revealed a minor deviation from normality which was not considered serious enough to invalidate the regression results (Figure 10).

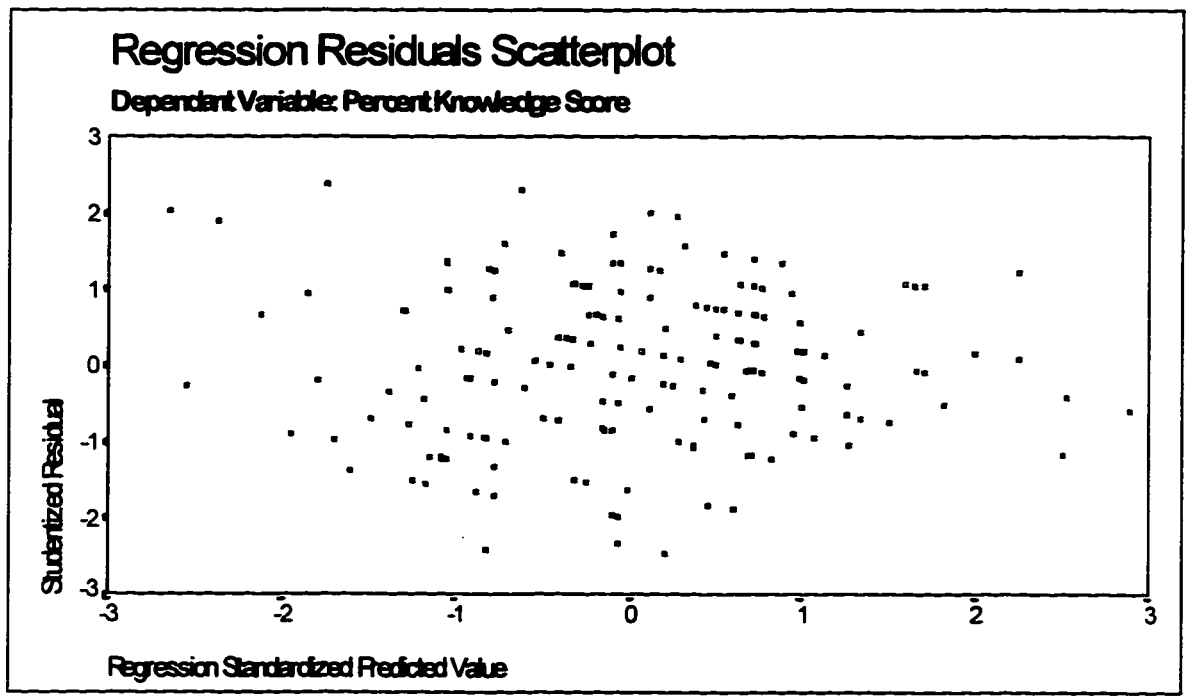


Figure 9: Regression Residuals Scatterplot

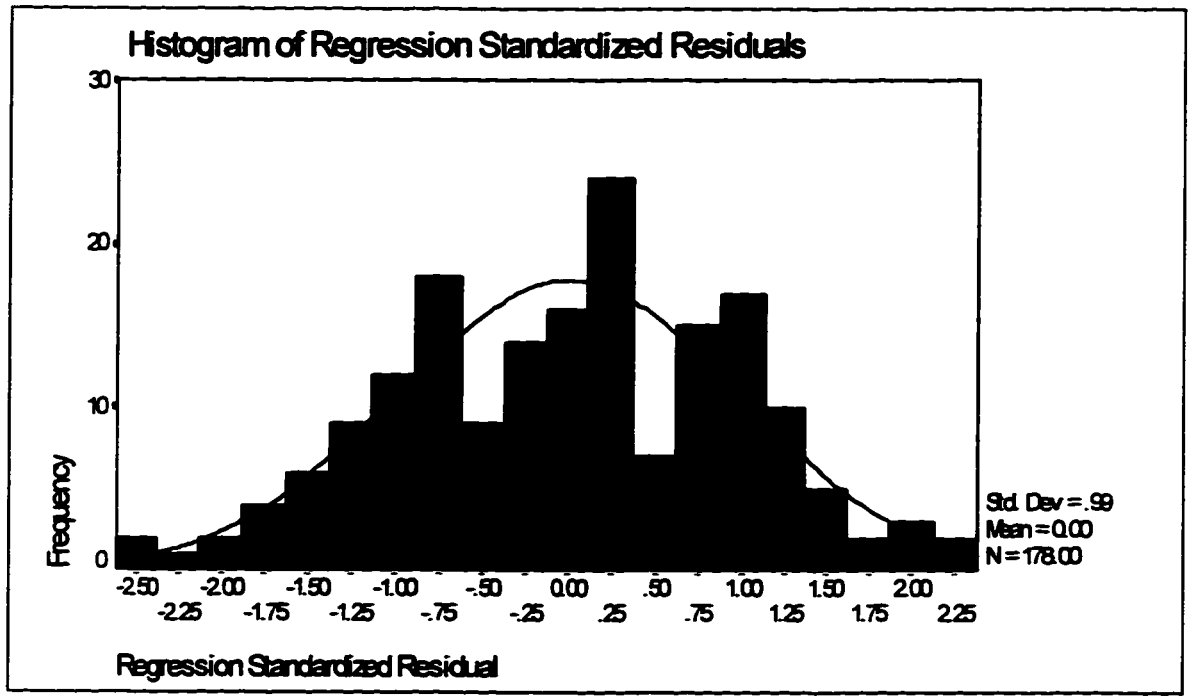


Figure 10: Histogram of Regression Standardized Residuals

CHAPTER 7 DISCUSSION

Physicians must first possess an appropriate level of knowledge and skills about the prevention of tuberculosis before screening interventions will be adopted in their practices. Deficiencies in knowledge however, for important aspects of TB prevention were identified in this survey and include: (1) interpretation the Mantoux test for persons who received BCG (2) recognizing the need to screen persons with chronic diseases (e.g. diabetes, renal failure and silicosis), (3) interpretation of the Mantoux test for persons infected with HIV, (4) interpretation of the Mantoux test for contacts of active TB cases and (5) administering INH chemoprophylaxis.

These gaps in knowledge may partially explain physicians' low use of preventive therapy found in the two Ontario school screening surveys.[3,4] In both of these studies, misconceptions about the impact of BCG vaccine on the tuberculin test were thought to affect whether or not physicians prescribed INH.[7,8] Our survey provides the first direct evidence that physicians have difficulty interpreting a Mantoux test for persons who received BCG, are more likely to attribute significant tuberculin reactions to BCG and have limited knowledge about indications for INH therapy. Since the majority of TB cases in Ottawa-Carleton and Canada occur in immigrants from developing countries where BCG is routinely administered, incorrect interpretation of tuberculin reactions for these persons along with physicians' reluctance to administer preventive therapy may have a negative impact on TB prevention efforts.

Improving physicians' awareness of screening guidelines for persons with chronic diseases may be another important consideration for the future. Although

the percentage of TB cases in persons with chronic diseases is presently low, the prevalence of chronic conditions such as diabetes and chronic renal failure are expected to increase as the elderly population expands. This signifies that physicians must become more vigilant about screening for tuberculosis in this particular risk group. The finding of limited knowledge about interpreting the Mantoux test for persons with HIV infection was not surprising given the low prevalence of HIV and AIDS in Ottawa-Carleton (with 338 cases of AIDS to date).[56] Similarly physicians' lack of knowledge regarding tuberculin reactivity for contacts of active cases probably relates to the fact that most contact tracing is performed by the local Health Department. If the incidence of HIV remains stable and contact tracing a responsibility of the Health Department, the impact of knowledge gaps for these risk-groups on overall TB prevention may be small.

The above deficiencies in knowledge suggest that (1) either TB prevention guidelines are not reaching primary care physicians or (2) that physicians receive the guidelines but (a) do not read them (b) cannot learn from them or (c) don't agree with them. Our study suggests the former since only 63% of physicians were aware of the Health Department TB screening recommendations. However, for those who were aware, 80% reported using these guidelines. Standards for the prevention and treatment of tuberculosis have recently been updated by the Canadian Tuberculosis Standards Committee[2] and these new guidelines can be purchased from the Canadian Lung Association but will not be circulated to primary care physicians. It will therefore be the responsibility of local health departments to ensure that a summary of the guidelines or a complete set of the new recommendations is made available to physicians practicing in their jurisdiction.

In this sample, "year of graduation" (YRGRAD) and "the percent of persons from developing countries in physicians' practices" (IMMIG) were the variables most strongly associated with physicians' knowledge about TB prevention. This finding compares favorably with other studies where the age of physicians was also found to be an important determinant of their practices.[27,28,31]

The variables "year of graduation" and the percentage of persons from developing countries in physicians' practices" were also correlated with one another but were not collinear. This finding was not unexpected since the practices of older physicians may have reached capacity whereas younger doctors may continue to accept new patients. Younger physicians may therefore have more knowledge about tuberculosis prevention since they have a higher percentage of immigrants from TB endemic countries in their practices and may be better informed about diseases affecting these clients.

Another explanation for the positive association between knowledge and year of graduation may be that younger physicians have received more recent information and training about the prevention of tuberculosis. Physicians who practiced during the 1960's and 1970's when the incidence of TB declined dramatically, may have lost some of their knowledge and skills about screening for tuberculosis and may be less aware of the re-emergence of this disease in certain populations.

Since this was a descriptive survey, the temporal sequence between explanatory and outcome variables cannot be confirmed. Although less likely, it is possible that physicians who are less knowledgeable about TB may selectively exclude clients from their practices with obvious risk factors for this disease. The opposite

however, seems more plausible; that physicians who see a greater percentage of persons at risk of developing TB become more knowledgeable about the prevention and treatment of this disease.

Although physicians' knowledge about certain aspects of TB prevention was low, it was encouraging to observe that most physicians in this study believed in the importance of screening, the efficacy of the Mantoux test and in the efficacy of INH. Skepticism about patient compliance with preventive regimens however may have hindered some physicians from prescribing INH. In comparison to Battista's studies, expectations of patient compliance were not found to be associated with cancer control activities. Perceived compliance however, was a major determinant of physicians' behavior however in the smoking cessation studies. The discrepancy in the above findings was not unexpected given that treatment of inactive tuberculosis involves a long-term (6 to 12 months) commitment and dedication from the affected client much like a smoking cessation intervention. Cancer screening however, usually involves a short-term intervention which is largely dependant on the initiative of the attending physician. [33,34,35,36]

Other potential barriers to screening including inadequate reimbursement for preventive services and language/communication problems with clients were identified in this survey. Physicians employed in settings where fee-for-service billing was the main type of funding (e.g. private practice and walk-in clinics) expressed dissatisfaction with remuneration for TB screening procedures. This concurs with findings from Battista's studies where inadequate reimbursement was also cited as a barrier to screening for certain types of cancer.[27,28] In Battista's Quebec study, salaried physicians were found to engage in more

preventive activities more often than fee-for-service physicians.[27] The present fee-for-service system of remuneration in Ontario and most of Canada, does not provide incentives to physicians to perform prevention activities. New methods of remuneration therefore, should be explored to motivate physicians toward screening for tuberculosis and other diseases.

A number of physicians in this survey identified communication problems for clients who spoke foreign languages. Health departments could assist these physicians by providing fact sheets available in a variety of languages about the prevention and treatment of tuberculosis. As well, physicians could be given a list of language interpreters in the community. Clients who speak languages that differ from that of their physician, should be encouraged bring family or friends who may assist in communication whenever they visit their physician. This may be difficult to implement in clinical practice from a practical standpoint and without more centralized screening with appropriate translation services, communication problems may be difficult to resolve.

Our survey suggested that physicians' confidence in their ability to perform screening interventions may have an important impact on their behavior. As observed with knowledge, physicians' self-efficacy beliefs varied according to specific components of screening. While confidence about recognizing who to screen, administering the Mantoux test and interpreting the test were high (when BCG vaccine was not administered), physicians were not confident about prescribing INH or managing persons taking this medication. Physicians' self-efficacy beliefs were not evaluated in the cancer prevention studies but were found to be a predictor of physicians' behavior in the smoking prevention and cessation surveys.[33,35] The combination of a low level of knowledge and lack of

confidence in prescribing INH, may explain the low use of INH preventive therapy by physicians found in the Ottawa-Carleton and other geographic areas.[3,4,5]

This lack of confidence may relate to physicians' limited knowledge about certain aspects of screening and the fact that most family practitioners do not see high-risk persons in their practices and are therefore unfamiliar with tuberculosis screening. This is supported by the finding that only one fourth of physicians in our study had more than 10% of persons in their practices coming from TB endemic countries. It was not surprising to find therefore that physicians working in CHCs (where the number of clients from developing countries is high) were more confident about screening than physicians employed in the walk-in clinic and private practice categories. This indicates the importance of practical experience to enhance physicians' self-confidence and predispose them towards screening.

An interesting finding of this survey was that self-efficacy beliefs varied according the gender of participants. Male physicians were more confident about interpreting the Mantoux test, prescribing INH and managing persons who were taking INH than were female physicians. This finding cannot be explained by discrepancies in training between the sexes since the knowledge scores of males and females were comparable. Previous research indicates that female medical graduates are generally more oriented towards screening than their male colleagues, especially for prevention of cervical and breast cancer.[27,28,29,30] Whether this lower level of self-confidence led to lower screening rates for female physicians remains unknown since behavior was not measured in this study.

Another demographic determinant of self-efficacy beliefs was whether a physician had lived in a developing country. In the Toronto school screening survey, physicians who lived in a developing country were more likely to prescribe INH.[4] Our study showed as well, that physicians who had lived in a developing country felt more confident about prescribing INH but were less likely to believe in the safety of INH for persons older than age 35. Reasons for this skepticism about INH safety are unknown. Perhaps the limited access to laboratory services, poor nutrition and numerous co-morbid diseases for patients in TB endemic countries, may have led to an increase in the incidence of adverse reactions to INH thereby increasing concern about this medication.

The main outcome variable in our survey was knowledge while other studies mainly examined physicians' behavior. In order to compare our findings to the literature, it was assumed that the determinants of physicians' knowledge, beliefs and practices were closely related. Support for this theory was seen in Battista's survey where physicians' knowledge and beliefs were predictors of screening activities for cancer of the breast, cervix and colon.[27,28] Battista demonstrated that physicians overestimated their practice behaviors by approximately 10%. We anticipated that physicians in Ottawa-Carleton like physicians in Battista's surveys, would also overestimate their screening practices for tuberculosis. Confirmation of actual behavior using the OHIP database was not feasible due to the multiplicity of billing codes for TB screening. Therefore, self-reported screening for tuberculosis was not measured in this survey.

A strength of this survey in comparison to most of the cancer prevention research, was the use of a theoretical framework and key informant interviews to anticipate factors influencing physicians preventive practices and to guide

development of the questionnaire. A limitation of our study was that despite the use of the above techniques, not all possible determinants of physicians' behavior could be identified. In fact, when the demographic variables were considered collectively using multiple regression, only 13% of knowledge variability was explained by the regression model. A similar result was found in Battista's surveys where regression models explained only 5% to 17% of the total variance in physicians' cancer screening behavior. This indicates that the determinants of physicians' behavior and knowledge are complex and that we still have much to learn about their preventive practices. What physicians do and how they learn may be related to a whole host of factors such as their value systems, their attitudes towards disease prevention and health promotion and personal experiences both within and external to the field of medicine.[57] Screening for tuberculosis is unique in that it involves groups with special needs such as immigrants from foreign countries, Aboriginal peoples and persons with HIV infection. Physicians' attitudes towards these special groups may play an important role in the clinical decision-making process. The exclusion of these factors from our questionnaire was recognized as a limitation of the survey. However, values, attitudes and personal experiences can be difficult to evaluate especially using a telephone format and expanding the questionnaire to include these variables with an increase in interviewing time, may have adversely affected the accuracy of physicians' responses.

Another limitation of the survey was that the sampling methodology may have introduced selection bias thereby influencing the study results. Despite extensive efforts telephone numbers could not be determined for 149 (18%) of the 814 physicians on the study list. It is possible that physicians without telephone numbers are younger with less settled practices than those with telephone

numbers. Since younger physicians were more knowledgeable about TB prevention, physicians true state of knowledge may have been underestimated in this survey. The response rate of 74% was comparable to or higher than rates found in other physician surveys.[29,31]

CHAPTER 8 CONCLUSION

Tuberculosis has the potential to be eliminated as a public health concern in Canada if equal emphasis is placed on detection and treatment of both active and inactive infections. Case management and contact tracing alone are insufficient for long-term control of this disease. Without screening, the pool of tuberculosis infection will increase and continue to threaten the health of Canadians (especially new Canadians) and will continue to consume valuable health care resources. As described by Osler over 70 years ago, "the seedbeds of tuberculosis are infected persons, particularly the small number of persons in whom the bacillus will eventually multiply".[58] In order to eliminate the "seedbeds" of tuberculosis, physicians must diligently implement screening for high-risk groups. In Canada, primary care physicians are the gate-keepers to the health care system, are the first to see persons at risk of developing tuberculosis and therefore, have the first opportunity to take preventive action. Before action can be taken however, these physicians must be knowledgeable about TB prevention and possess the necessary skills for screening.

This study clearly indicated that a large number of physicians in Ottawa-Carleton lack the appropriate knowledge and skills to perform screening for tuberculosis. Through implementation of the recommendations presented in Chapter 9, physicians' knowledge and skills may be enhanced and they will be better prepared to become integral players in tuberculosis control programs. Although behavior change may take time, it is hoped that early detection and treatment of tuberculosis will eventually become a common-place practice in primary medical care. In the meantime, researchers, clinicians, politicians and communities must continue to pursue other avenues of TB prevention including the development of

new immigration screening policies and the establishment of centralized tuberculosis screening and treatment centres.

Chapter 9 Recommendations for Future Action

Based on the findings of this survey, the following recommendations are made:

1. That continuing medical education (CME) programs in Ottawa-Carleton provide information on the epidemiology, transmission, treatment and prevention of TB with emphasis on the following aspects of prevention:
    - The correct process for administering and reading of the Mantoux test
    - The effect of BCG vaccine on reactivity of the Mantoux test
    - The indications for INH therapy
    - The risk of hepatitis associated with INH
    - The management of persons who are taking INH
    - Screening for tuberculosis for persons with HIV infection, AIDS and with chronic diseases such as diabetes, silicosis and renal failure.

2. That CME programs provide physicians with the skills necessary to perform TB screening, especially with respect to the interpretation and administration of the Mantoux test. Skills ideally would be demonstrated and practiced in small group sessions using patient models and clinical scenarios.

3. That the undergraduate medical curriculum be regularly reviewed to ensure that all medical students receive up-to-date information on the epidemiology, transmission, prevention and treatment of TB. Particular emphasis should be placed on the following aspects of TB prevention:
    - administration and interpretation of the Mantoux test
    - the effect of BCG vaccine on tuberculin reactivity
    - the risks associated with INH
    - the indications for INH therapy.

During clinical rotations, all students should have the opportunity to perform a Mantoux test, interpret the result and decide on the need for chemoprophylaxis with INH.

4. That experts in the field of tuberculosis (Respirologists, Infectious Disease Specialists, Public Health Physicians) collaborate to provide consistent and up-to-date information to all primary care physicians regarding the prevention of tuberculosis.

5. That up-to-date "Tuberculosis Treatment and Screening Clinical Practice Guidelines" be disseminated to all primary care physicians in Ottawa-Carleton.

6. That primary care physicians in Ottawa-Carleton receive an annual newsletter providing information about the epidemiology of TB, ongoing CME activities and places to obtain advice about TB prevention and treatment.

7. That the municipality of Ottawa-Carleton consider the development of a multi-disciplinary TB screening clinic to provide advice, screening and management services to clients of primary care physicians. These clinics ideally would be developed in conjunction with existing hospital and community clinics with satellite centres for persons residing out-side the urban core.

8. That similar surveys be conducted to determine the prevalence of physicians' knowledge and beliefs about TB prevention in other geographic areas and to further explore factors affecting their knowledge, beliefs and behavior.

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APPENDIX A

DESCRIPTION OF VARIABLES AND THEIR CODING SCHEME

Coding Scheme for Survey Variables

Variable Name	Question	Variable Labels and Values
SEX	1	Gender of respondent 1=male, 2=female, missing=9
CERT	4	Medical Certification 1=LMCC, 2=CCFP, 3=CCFP(EM), missing=9
PRACSET	5	Practice setting 1=Solo or group practice, 2=CHC, 3=Walkin, 4=University FMC, missing=9
PRACSET2	5	String - other
SCHOOL	7	String - Name of medical school attended
YRGRAD	6	Year of graduation, missing=9999
YRGRAD1	6	Year of graduation categorized as before or after 1980, missing =9999
LIVDEL	8	Ever lived in developing country 1=yes, 2=no, missing=9
LIVWHER	8a	String -which country
LIVTIME	8b	String - how long
PRACDEL	9	Ever practiced in developing country 1=yes, 2=no, missing=9
PRACWHER	9a	String -which country
IMMIG	10	Estimated percent of practice that came from developing countries in the past 5 years, missing 99
IMMIG1	10	Percent of practice from developing countries categorized as <or =5% or >5%, missing=99
SCR3YR	11	who to screen, 3 year old from developing country 1=yes, 2=no, 3=don't know, missing=9
SCR30YR	12	who to screen, 30 yr old from developing country 1=yes, 2=no, 3=don't know, missing=9
SCRHIV	13	who to screen, HIV positive, no AIDS 1=yes, 2=no, 3=don't know, missing=9
SCRAID	14	who to screen, AIDS, 1=yes, 2=no, 3=don't know, missing=9
SCRABOR	15	who to screen - aboriginal, 1=yes, 2=no, 3=don't know, missing=9
SCRRN	16	who to screen - nurse long-term care 1=yes, 2=no, 3=don't know, missing=9
SCRDIAB	17	who to screen - diabetes 1=yes, 2=n0, 3=don't know, missing=9
TESTRED	18	administration test, measure erythema 1=true 2=false don't know=3, missing=9
TESTTIME	19	administration of test -timing 1=true 2=false 3=don't know, mising=9
TESTIDUR	24	administration of test - measure induration 1=true, 2=false, 3=don't know, missing=9

TESTSELF	25	administration of test- self measurement 1=true, 2=false, 3=don't know, missing=9
BCGWHO1	20	no need to screen if had BCG 1=true, 2=false, 3=don't know
BCGWHO2	21	screening contraindicated if had BCG 1=true, 2=false, 3=don't know, missing=9
BCGTEST	22	BCG and +Mantoux due to BCG 1=true, 2=false, 3=don't know, missing=9
READHIV	26	interpret Mantoux positive, HIV (no AIDS) 1=yes, 2=no, 3=don't know, mising=9
READAID	27	interpret Mantoux positive, AIDS 1=yes, 2=no, 3=don't know,missing=9
READBABY	28	interpret Mantoux positive, baby contact 1=yes, 2=no, 3=don't know, missing=9
READ3YR	29	interpret 3 yr old positive, no BCG 1=yes, 2=no, 3=don't know, 9=missing
READ30YR	30	interpret 30 yr old positive, no BCG 1=yes, 2=no, 3=don't know 9=missing
READRN	31	interpret nurse negative, 1=yes, 2=no, 3 don't know, 9 missing
INHHEP	23	risk hepatitis with INH 1=true, 2=false, 3=don't know, mising=9
INH60	32	Prescribe INH 60 yr old 1=yes, 2=no, 3=don't know
INH20	33	Prescribe INH 20 yr old, no BCG 1=yes, 2=no, 3=don't know, missing=9
INH20BCG	34	Prescribe INH 20yr old, BCG^+ 1=yes, 2=no, 3=don't know, missing=9
INH4	35	Prescribe INH 4 yr old, no BCG 1=yes, 2=no, 3=don't know, missing=9
INH4BCG	36	Prescribe INH 4 yr old, BCG^+ 1=yes, 2=no, 3=don't know, missing=9
KNOSCOR	-	Overall knowledge score calculated as number of correct answers to 19 knowledge questions / total number of knowledge questions (19) * 100%
TESTSCOR	-	Composite Knowledge Percent Score for TEST variables
READSCOR	-	Composite Knowledge Percent Score for READ variables
BCGSCOR	-	Composite Knowledge Percent Score for BCG variables
INHSCOR	-	Composite Knowledge Percent Score for INH variables
BELSCR	37	Belief in importance screening 1-strongly disagree, 2-slightly disagree 3-slightly agree, 4-strongly agree, 5-no opinion 9=missing
BELTEST	38	Belief in efficacy of Mantoux test 1-strongly disagree, 2-slightly disagree 3-slightly agree, 4-strongly agree, 5-no opinion 9=missing
BELINH	39	Belief in efficacy of INH 1-strongly disagree, 2-slightly disagree 3-slightly agree, 4-strongly agree, 5-no opinion 9=missing
BELSAFE1	40	Belief in safety INH < age 35 years 1-strongly disagree, 2-slightly disagree 3-slightly agree, 4-strongly agree, 5-no opinion 9=missing
BELSAFE2	41	Belief in safety INH > 35 years 1-strongly disagree, 2-slightly disagree 3-slightly agree, 4-strongly agree, 5-no opinion 9=missing
BELCOMP1	42	Belief that patient compliance 80% 1-strongly disagree, 2-slightly disagree 3-slightly agree, 4-strongly agree, 5-no opinion 9=missing

BELCOMP2	43	Belief in prescribe INH when patient compliance is low 1-strongly disagree, 2-slightly disagree 3-slightly agree, 4-strongly agree, 5-no opinion 9-missing
BARTIME	44	Screening Barrier, lack of time 1=yes, 2=no, 3=don't know, 9=missing
BAROHIP	45	Screening Barrier, reimbursement adequate 1=yes, 2=no, 3=don't know, 9=missing
BAROHIP3	45	Screening barrier, reimbursement adequate with "not applicable" group removed 1=yes, 2=no, 9=missing
BARLANG	46	Screening Barrier Language/Communication 1=yes, 2=no, 3=don't know, 9=missing
BARCME	47	Screening Barrier need for more CME 1=yes, 2=no, 3=don't know, 9=missing
BARCLIN	50	Screening Barrier need for central clinic 1=yes, 2=no, 3=don't know, 9=missing
BARCLIN2	50a	String - why not in favor of central screening clinic
GUIDAWAR	48	Awareness of Health Department guidelines 1=yes, 2=no, 3=don't know, missing=9
GUIDUSE	48a	Use guidelines 1=yes, 2=no, 3=don't know, 9=missing
GUIDNO	48b	String -why not use guidelines
GUIDOTH	49	Use other TB screening guidelines 1=yes, 2=no, 3=don't know, 9=missing
GUIDOTH2	49a	String - names of other TB prevention sources
CONFWHO	51	Confidence in recognizing who to screen 1=very confident, 2=confident, 3=somewhat confident, 4=not confident
CONFGIVE	52	Confidence in giving the Mantoux test 1=very confident, 2=confident, 3=somewhat confident, 4=not confident
CONFREAD	53	Confidence in interpreting a Mantoux test 1=very confident, 2=confident, 3=somewhat confident, 4=not confident
CONFINHp	54	Confidence in prescribing INH 1=very confident, 2=confident, 3=somewhat confident, 4=not confident
CONFINHm	55	Confidence in managing persons taking INH 1=very confident, 2=confident, 3=somewhat confident, 4=not confident

APPENDIX B : Survey Questionnaire

RECORD OF CALLS FORM

ID# _____ Telephone number _____

Hello, my name is Dr. Maureen Carew. I'm calling from the Ottawa-Carleton Health Department. May I please speak to Dr.? _____

IF THE RECEPTIONIST ASKS FOR MORE INFORMATION, PLEASE STATE THE FOLLOWING:

The Health Department is conducting a survey to identify problems that family physicians may have when screening for tuberculosis. Dr._____ should have received a letter outlining the purpose of this survey within the past few weeks. The whole interview takes about 15 minutes. Is now a good time or would Dr. _____ like to make an appointment for an interview?

WHEN SPEAKING TO THE PHYSICIAN:

Hello Dr. _____, my name is Dr. Maureen Carew. I'm calling from the Ottawa-Carleton Health Department. I would like to ask you a few questions about screening for tuberculosis. Did you receive a letter about our survey?

IF YES, PROCEED WITH THE FOLLOWING:
The interview takes about 15 minutes to complete. Is now a good time or would you like me to call back at a more conveniant time?

IF NO, PROCEED WITH THE FOLLOWING:
The Ottawa-Carleton Health Department is conducting a survey of family physicians' knowledge and beliefs about screening for tuberculosis. We would also like to find out how the increasing incidence of TB in the Ottawa-Carleton area is affecting local physicians like yourself.

Your name was randomly picked from a list of all family physicians in Ottawa-Carleton and I hope that you can take about 15 minutes either now or at another time to answer a few questions. Your participation is entirely voluntary and aside from the interview itself, your identity will be completely confidential. Is now a good time or would you like me to call back at a more conveniant time?

EITHER PROCEED WITH INTERVIEW(PAGE 3) OR TURN TO CHART ON PAGE 2.

RECORD OF CALLS CHART

Calls	Date			Notes
	Hour	Day	Month	
1				
2				
3				
4				
5				
6				

Unable to contact after 6 tries _____ .

Refusal _____ Reason _____

_____

If the correct respondent could not be contacted for any reason other than a refusal, the reason should be indicated in the notes column of the first call.

TB SCREENING QUESTIONNAIRE

1. Sex

   1 male
   2 female

First I would like to ask you some questions about you and your practice:

2. To which of the following categories of medical practice do you belong?

   1. Family physician or general practitioner (either fulltime or part-time practice)
   2. Specialist
   3. Intern, Resident or Fellow
   4. Retired or no active clinical practice
   5. Other _____

3. Is your practice completely restricted to a particular area of medicine?

   1 yes
   2 no

   If yes, which area or areas? _____
   _____

(If the physician is **not** in category 1 or 2 in question 3 or if his/her practice is restricted to an area that would not include TB screening then say the following else continue with the interview).

In as much as we would like to know more about the knowledge and beliefs of all physicians with respect to TB prevention, this survey is limited to family physicians or general practitioners who are actively practicing general medicine. Therefore you do not need to complete this interview. Your participation is appreciated though and if you have any questions or concerns about screening for TB, I would be happy to discuss them with you.

4. Which of the following Canadian clinical certifications do you hold?

1 LMCC
2 LMCC + CCFP
3 LMCC + CCFP(EM)
4 Other _____

5. In which of the following settings do you perform most of your clinical activity?

1 Solo or group private practice
2 Community health centre
3 Walkin clinic
4 University affiliated Family Medicine Centre
5 other _____

6. What year did you graduate from medical school? _____

7. Which medical school did you attend?

Name of school: _____
Province, State or Country: _____

8. Have you ever lived in a developing country?

1 yes ----- **GO TO QUESTIONS 8(a) AND 8(b)**
2 no

8(a) Which country or countries? _____
_____

8(b) For how long? _____ months

9. Have you ever practiced medicine in a developing country?

1 yes ----- **GO TO QUESTION 9(a)**
2 no

9(a) Which country or countries?

_____

10. Approximately what percentage of patients that you see, came to Canada from developing countries within the past 5 years or so?

_____%

Now I would like to ask you about which persons you think should be screened for TB. For the following clinical scenarios, please indicate by stating yes, no or don't know whether or not you would consider performing a skin test for tuberculosis.

11. A 3 year old male from a country where the prevalence of TB is high, who has not had a TB skin test as part of his immigration medical examination or since arriving in Canada 1 year ago.

    1 yes
    2 no
    3 don't know

12. A 30 year old female from a country where the prevalence of TB is high, who has not had a TB skin test as part of her immigration medical examination or since arriving in Canada 1 year ago.

    1 yes
    2 no
    3 don't know

13. A 25 year old male who is HIV sero-positive but does not have AIDS (Assuming that he is able to mount an immune response).

    1 yes
    2 no
    3 don't know

14. A 25 year old male with AIDS, assuming that he is able to mount an immune response.

    1 yes
    2 no
    3 don't know

15. A 35 year old aboriginal female who lived on a reserve in Northern Manitoba before moving to Ottawa 1 year ago.

1 yes
2 no
3 don't know

16. A 30 year old nurse who is beginning employment at a long term care facility.

1 yes
2 no
3 don't know

17. A 25 year old male with insulin dependant diabetes who presents for a routine annual physical examination and cannot recall being tested for TB in the past.

1 yes
2 no
3 don't know

The next section deals with the administration of the Mantoux test, vaccination with BCG and prophylaxis with isoniazid or INH. Please indicate whether you think the following statements are true or false. If you are unsure of the correct answer, you may respond by saying you "don't know".

18. The result of the Mantoux skin test should be measured according to the amount of erythema or redness.

1 true
2 false
3 don't know

19. The result should be measured 48 to 72 hours after the Mantoux test is administered.

1 true
2 false
3 don't know

20. Persons who received BCG vaccine do not need to be screened for tuberculosis.

1 true
2 false
3 don't know

21. The Mantoux skin test is contraindicated for persons who received BCG vaccine.

1 true
2 false
3 don't know

22. For an adult who lived in an area where the prevalence of TB is high and received BCG vaccine at birth, a significant Mantoux skin test result of 15 mm of induration, more likely indicates a reaction to the BCG and not infection with TB.

1 true
2 false
3 don't know

23. The risk of INH-induced hepatitis in persons below the age of 35 is less than 1%.

1 true
2 false
3 don't know

24. The Mantoux skin test result should be recorded as millimetres of induration.

1 true
2 false
3 don't know

25. Patients themselves can interpret a Mantoux test correctly more than 60% of the time.

1 true
2 false
3 don't know

The next 8 questions are about interpreting the Mantoux test which can be a difficult task for even the most experienced physician. For the following scenarios, please indicate by stating yes, no or don't know whether or not you would interpret the Mantoux test as being significant or positive:

26. A 30 year old male who is HIV-seropositive but does not have AIDS, with 7 mm of induration.

    1 yes
    2 no
    3 don't know

27. A 30 year old male who has AIDS with 7 mm of induration.

    1 yes
    2 no
    3 don't know

28. A 12 month old male with 7 mm of induration, who has been in contact with a case of active pulmonary TB.

    1 yes
    2 no
    3 don't know

29. A 3 year old male immigrant from a country where the prevalence of TB is high, who did not receive BCG vaccine, with 13 mm of induration.

    1 yes
    2 no
    3 don't know

30. A 30 year old female who recently immigrated from a country where the prevalence of TB is high, with 20 mm of induration.

    1 yes
    2 no
    3 don't know

31. A healthy 18 year old female entering nursing school with no risk factors for HIV infection, who has 5 mm of induration.

1 yes
2 no
3 don't know

Knowing when to prescribe chemoprophylaxis with INH can also be confusing. For the following 5 scenarios, please indicate by stating yes, no or don't know whether or not you would prescribe INH.

32. A 60 year old healthy female with no risk factors for TB, a significant Mantoux test of 15 mm of induration, and a negative chest x-ray.

1 yes
2 no
3 don't know

33. A 20 year old male immigrated to Canada 1 year ago from a country where the prevalence of TB is high. He did not receive BCG vaccine, has a significant Mantoux test of 15 mm of induration and a negative chest x-ray.

1 yes
2 no
3 don't know

34. A 30 year old male immigrated to Canada 1 year ago from a country where the prevalence of TB is high. He received BCG vaccine at birth, has a significant Mantoux test of 15 mm of induration and a negative chest x-ray.

1 yes
2 no
3 don't know

35. A 4 year old female immigrated to Canada with her family 1 year ago from a country where the prevalence of TB is high. She did not receive BCG vaccine, has a significant Mantoux test of 15 mm of induration and a negative chest x-ray.

1 yes
2 no
3 don't know

36. A 4 year old female immigrated to Canada with her family 1 year ago from a country where the prevalence of TB is high. She received BCG vaccine at birth, has a significant Mantoux test of 15 mm of induration and a negative chest x-ray.

1 yes
2 no
3 don't know

Now I would like to ask you about your beliefs surrounding a number of TB screening issues. It may be helpful to write down the possible responses before I ask you these questions. The response choices are 1-strongly disagree, 2-slightly disagree, 3-slightly agree, 4-strongly agree or 5-no opinion. Please indicate how strongly you agree or disagree with the following statements:

	strongly disagree	slightly disagree	slightly agree	strongly agree	no opinion
37. Screening for tuberculosis in high risk groups is an important step controlling this disease.	1	2	3	4	5
38. The Mantoux skin test is an effective method of screening for TB.	1	2	3	4	5
39. For persons infected with tuberculosis who do not have active pulmonary disease, INH is effective in preventing the development of active TB in the future.	1	2	3	4	5
40. INH can be prescribed with reasonable safety in a person below the age of 35, if the person is monitored.	1	2	3	4	5
41. INH can be prescribed with reasonable safety in a person above the age of 35, if the person is monitored.	1	2	3	4	5

	strongly disagree	slightly disagree	slightly agree	strongly agree	no opinion
42. Persons who are prescribed INH usually take more than 80% of the doses.	1	2	3	4	5
43. If you suspect that a patient will be non-compliant with therapy, you may be less inclined to prescibe INH.	1	2	3	4	5

The TB screening process has 3 essential steps: (1) an initial assessment for risk factors and symptoms or signs of tuberculosis, (2) the administration of the Mantoux test and (3) the interpretation of this test. The next few questions are about factors that may act as barriers to this screening process. Please answer yes, no or don't know for the following:

44. Do you consider this screening process to be time consuming?

    1 yes
    2 no
    3 don't know

45. Do you think that screening for TB is adequately reimbursed by OHIP?

    1 yes
    2 no
    3 not applicable
    4 don't know

46. In your practice, do language problems interfere with screening?

    1 yes
    2 no
    3 don't know

47. Do you think that physicians need more continuing medical education about the prevention of TB?

1 yes
2 no
3 don't know

48. Are you aware of the document circulated by the Ottawa-Carleton Health Department called the "Tuberculosis Screening and Contact Management Recommendations and Notes"?

1 yes ----- **GO TO QUESTION 48(a)**
2 no

48(a) Do you use this document?

1 yes
2 no ----- **GO TO QUESTION 48(b)**

48(b) If no, why not? _____

_____

49. Do you use any other TB screening guidelines?

1 yes ----- **GO TO QUESTION 49(a)**
2 no
3 don't know

49(a) Which ones?

1 American Thoracic Society
2 Canadian Lung Association
3 CMAJ article - Essentials of TB control for the practising physician.
4 Personal communication with ID or Public Health specialists.
5 Other Journal Articles
6 Textbook
7 Other _____

50. The city of Toronto is developing a centralized TB clinic where experienced staff would administer the Mantoux test to persons at increased risk of infection, interpret the results and prescribe INH-chemoprophylaxis when indicated. Persons taking INH can then be followed at the clinic or by their referring family physician.

Would you be in favour of such a clinic in Ottawa-Carleton?

1 yes
2 no ----- **GO TO QUESTION 50(a)**
3 don't know

50(a) If no, why not? _____
_____

This final set of questions deals with your level of confidence in screening for TB and prescribing INH-chemoprophylaxis. It is possible that some physicians have had little opportunity to either screen for or treat this disease. For the following scenarios, please indicate your level of confidence as being either 1-very confident, 2-confident, 3-somewhat confident or 4-not confident.

	Very Confident	Confident	Somewhat Confident	Not Confident
51. Recognizing persons who should be screened for TB.	1	2	3	4
52. Administering the Mantoux skin test.	1	2	3	4
53. Deciding whether or not a Mantoux test result is significant.	1	2	3	4
54. Knowing when to prescribe INH.	1	2	3	4
55. Managing persons who are taking INH-chemoprophylaxis.	1	2	3	4

That brings us to the end of our interview and I would like to thank-you for participating in this survey. Would you like to receive a copy of the results when the study is completed?

1 yes
2 no

Would you like to receive a copy of the Health Department's "Tuberculosis Screening Guidelines"?

1 yes
2 no

If you have any questions, I would be happy to discuss them with you either now or at another time. (WRITE DOWN QUESTIONS BELOW)

APPENDIX C : Cover Letter to Physicians

December, 1994

Dr. ... (Address)

Dear Dr. ...

A resurgence of tuberculosis (TB) has occurred in Canada and the United States over the past decade. In the Ottawa area alone, the number of cases between 1988 to 1993 tripled from 24 to over 80. The identification of infected persons through screening and institution of appropriate chemoprophylaxis are crucial steps in controlling this disease.

The Ottawa-Carleton Health Department is conducting a brief telephone survey about family physicians' current knowledge and beliefs with respect to screening for TB. The study will assess the need for medical education programs, physician support services and will provide valuable information about the problems physicians face when screening for and treating this disease. Interviews be conducted between January, 1995 and April, 1995 and will take approximately 15 minutes to complete.

We would like to ask you to participate in this study which is entirely voluntary. Your name was picked through a computer generated random sample of all family physicians in Ottawa-Carleton. Your identity will only be known at the time of the interview but otherwise, is strictly confidential and will not appear on any reports or documents. Since we are interested in your present knowledge and beliefs, you do not need to consult any reference material before the interview. If you would like to make an appointment, are unable to participate or have any questions, please contact Dr. Maureen Carew at 742-4122, extension 3643.

The Health Department has prepared a document known as the "Tuberculosis Screening and Contact Management Recommendations and Notes" to aid physicians in screening for TB. If you would like a copy of these guidelines please notify Dr. Carew at the time of the interview.

Your assistance is greatly appreciated and will help to shape future medical educational programs as well as control programs for tuberculosis. We look forward to speaking with you soon.

Sincerely,

Maureen Carew MD

Paula Stewart MD, FRCP(C)
Associate Medical Officer of Health