A B S T R A C T

Current recommendations for tuberculosis control are to screen high risk populations and provide chemoprophylaxis for those infected. In Edmonton, Alberta, one strategy has been to identify and provide TB skin tests to newly arrived immigrant school age children from TB endemic areas. The difficulty has been in identifying these children in the school population. This article describes a process tried in 1993-94 to find a better approach and to determine the outcome of a concentrated effort at screening and follow-up of this population. Using this method, 1,146 students were TB skin tested using 5tu PPD: 15% showed significant reactions (10mm), 89% were offered chemoprophylaxis, and 68% of those offered (84% of those accepting) completed 9 months of chemoprophylaxis. The success of this process was dependent on the dedicated follow-up provided by the specialty public health clinic devoted to the prevention and treatment of tuberculosis.

A B R É G É

Pour lutter contre la tuberculose, on recommande à l'heure actuelle de dépister les populations présentant un risque élevé et de faire une chimioprophylaxie aux personnes infectées. À Edmonton, en Alberta, une stratégie consiste à identifier les enfants d'âge scolaire récemment immigrés de régions où la TB est endémique et à leur faire subir un test de sensibilité cutané à la tuberculine. La difficulté consiste à identifier ces enfants au sein de la population scolaire. Cet article décrit un processus tenté en 1993-1994 pour trouver une meilleure façon de faire et pour déterminer les résultats d'un effort concentré de dépistage et de suivi de cette population. En ayant recours à cette méthode, 1 146 élèves ont subi un test cutané à la tuberculine avec 5 unités de PPD : 15 % ont manifesté des réactions significatives (10 mm), 89 % se sont vus offrir une chimioprophylaxie, et chez ces derniers, 68 % (84 % de ceux qui l'ont acceptée) ont suivi une chimioprophylaxie pendant 9 mois. Le succès de cette méthode a reposé sur le suivi attentif assuré par la clinique de santé publique spécialisée dans la prévention et le traitement de la tuberculose.

A Tuberculosis Screening and Chemoprophylaxis Project in Children from a High Risk Population in Edmonton, Alberta

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Canada reports about 2,000 cases of active tuberculosis (TB) yearly, with about half of those occurring in the immigrant population. Due to the prevalence of TB in developing countries, immigrants from these areas are at high risk of having been infected and subsequently developing active TB.

Edmonton, Alberta received approximately 8,000 immigrants in 1990, the majority from the Asia/Pacific region. In 1992, the incidence of TB in Edmonton was 10.4 per 100,000 population. Forty-seven (72%) of the 65 active cases of TB in Edmonton were found in the immigrant population. Nearly half of those were recent arrivals, having landed in Edmonton within five years prior to diagnosis.

Tuberculin testing surveys in Alberta schools were discontinued in the mid-1980s when very low reactor rates were shown in school children. However, skin testing and Isoniazid (INH) prophylaxis continued to be offered to the high-risk population of foreign-born children, as recommended by the Advisory Committee for Elimination of Tuberculosis.^{1,2} Previous studies have shown the cost-effectiveness of providing INH prophylaxis to infected persons from high-risk populations as a means of preventing active cases of TB.³

Identifying students from high-risk countries and obtaining a good history with regard to previous tuberculin skin tests or BCG vaccination was a difficult task for public health nurses. This information

was not obtained by the school system so was not readily available. The process was further complicated by ineffective communication with families whose first language was not English. In 1993-94, a project was developed to determine a better approach for the identification and testing of foreign-born children who had recently arrived in Canada. While not designed as a research study, it was felt that the information gained from this project could provide the basis for an effective TB screening program in this population.

METHOD

The project began in September 1993 in both the School Boards in Edmonton. Two part-time public health nurses undertook to identify foreign-born children who were new to Edmonton schools within the previous two years. To avoid stigmatizing children from particular ethnic groups, it was decided to target all students who were foreign-born, regardless of country of birth.

Identifying the target population was a problem as the schools do not systematically collect information about country of origin or date of arrival in Canada. The eligibility criteria were subsequently adjusted to include foreign-born students who had not been tested for tuberculosis since their arrival in Canada.

Consent forms and TB fact sheets were translated and available in eight languages: English, Arabic, Chinese, Spanish, Punjabi, Vietnamese, Cambodian, and Polish. Initially the translated materials were mailed with a request that the children return the consent form to the school. When this process resulted in less than a 50% return rate, subsequent schools were

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asked to send the consent and fact sheets home with the students, to be returned to the teachers. The project nurses followed up with personal contact by phone to parents if no consent was returned, using interpreters as needed. This process improved the return rate for consents to 82%. Verbal consent by telephone was also accepted.

The project nurses provided tuberculin skin tests at school for students with consents. A 0.1 ml of 5tu Mantoux solution was administered intradermally on the left forearm. A reading of ≥ 10 mm induration at the injection site 48-72 hours following administration of the skin test was reported as a significant reaction.⁴ Although BCG history or scar was recorded, this was ignored in assessing skin-test reactions.⁵ Students with significant reactions were referred to the Edmonton Board of Health TB Clinic* for assessment and preventive therapy. It was important to reassure students that a significant reaction did not indicate they had active TB disease.

The TB Clinic is a specialty public health service staffed by public health nurse specialists who are responsible for the TB control program in Edmonton. The clinic provides outpatient treatment and contact follow-up for active cases, as well as assessment and chemoprophylaxis. Clients are each assigned to a nurse who assumes responsibility for that client's care and completion of treatment. One nurse provides outreach services in the community to clients in their homes or workplaces. Three physicians experienced in the diagnosis and treatment of tuberculosis provide consultation and assessment.

One nurse specialist at the TB Clinic was dedicated part time to the project. With the assistance of paid interpreters, she contacted the families of those students with significant TB skin test reactions and invited them to attend the clinic for assessment. A protocol for assessment of the child was developed by the physicians and nurses of the TB Clinic. The assessment included a health history, symptom check, physical exam, chest x-ray, and CBC and

AST. The nurse specialist was authorized to initiate Isoniazid (INH) prophylaxis as outlined in the protocol. If the nurse or family identified a concern, an appointment was arranged with a clinic physician.

Once the assessment was completed, INH prophylaxis was initiated at a dose of 10mg/kg to a maximum of 300mg daily. On subsequent visits, the child was seen by one of the TB clinic nurses who assumed responsibility for the completion of nine months of INH preventive therapy. The child was seen at two-month intervals in the clinic to determine compliance and check for side effects to the medication. Compliance was assessed using pill counts and verbal reports. To encourage adherence, a local business donated funds which were used to provide small rewards at clinic appointments. This was reported by the nurses to have a positive effect on adherence.

The cost of the project was determined by using actual costs incurred for salaries and travel expenses for the tuberculin skin testing component, and actual amounts billed for interpreter services at \$17.50 per phone interpretation and \$35.00 per in-person interpretation. The TB Clinic costs were based on a mean public health nursing salary of \$23.27/hr and clerical salary of \$13.50/hr.

RESULTS

In 1993, Edmonton's 271 elementary and junior high schools had a total population of about 86,200 students in two school systems, with an estimated 1,000 new immigrant students admitted every year. For this project, 36 schools were selected from the two school systems, with a total population of 15,361 students.

A total of 1,506 students aged 5-15 were listed as eligible for TB skin testing. Consents were obtained from 1,230 (82%) students and 1,146 students were skin tested. This represented 93% of those who had returned consents and 76% of those who had been identified as eligible. A reported 895 (78%) of those tested had arrived in Edmonton in the previous five years. Of those who were tested, 972 had no significant reaction (<10 mm of induration), 174 (15%) had significant reactions

(≥ 10 mm of induration) and were referred to the TB Clinic for assessment. Visible BCG scars were present in 705 (61.6%) of the total students tested, and 162 (93%) of those with significant reactions reported a history of BCG vaccination (Figure 1).

Of the 174 significant reactors, 10 (6%) students were not seen at the TB Clinic. The following reasons were given for not attending: the family was too busy to bring the child, they felt that it was not necessary since the child seemed well, they felt that the child was protected from TB due to BCG vaccination, or they had been told that a significant reaction to a TB test was to be expected from their country. Three students were not assessed as they had previously received preventive therapy but had not made this known at the time of testing.

The TB Clinic nurse assessed 164 students according to established protocols. No active cases were diagnosed, 1 student was referred to a specialist for a non-TB related issue, 3 had previously been treated for TB, 3 were not recommended preventive medication due to a very recent BCG vaccination which may have contributed to the significant mantoux reaction, and 3 moved and could not be located. Twenty-seven students were referred to a clinic physician for further assessment. No significant health concerns were identified by the physician.

Of the 174 significant reactors, 154 (89%) were offered preventive treatment with Isoniazid (INH); 124 (71%) accepted that recommendation. Of the 30 who refused, 27 did so because they were convinced that the medication was not necessary. Many had consulted their family physicians and been advised that a positive mantoux reaction was "normal" for them and not a cause for concern. Three students had moved and could not be located.

Of the 124 who started INH, 104 (84%) completed nine months of medication (Figure 2). This represents 60% of the students who were found to be significant reactors. No serious side effects or incidences of hepatotoxicity due to INH occurred in any of the participants.

It was estimated that 7.8 cases of active TB were prevented, based on a 10% lifetime risk³ of developing TB once infected,

* The Edmonton Board of Health was disestablished in 1995 to become part of Capital Health Authority, Community Care and Public Health.

TABLE I
Cost Breakdown of Tuberculosis Screening and Prophylaxis Project

Tuberculin skin testing (nursing, clerical, travel)	\$19,000.00
TB Clinic assessment	
154 hrs @ \$23.27 - nursing	\$3,583.58
38.5 hrs @ \$13.50 - clerical	\$519.75
27 x \$20.00 each - physician	\$540.00
CBC & AST	
154 @ \$9.50 each	\$1,463.00
Chest x-ray	
154 @ \$38.00 each	\$5,852.00
Interpreter services	\$717.00
INH prophylaxis follow-up for the 104 students completing 9 months of INH	
6 visits (1.5 hrs @ \$23.27/hr)	\$3,630.12
INH medication	
124 @ \$5.85/pt.	\$608.00
TOTAL COST	\$35,913.45

and a 75% estimate of effectiveness of chemoprophylaxis.⁶ The total cost of the project was \$35,913.45, or \$4,604.29 per single case of TB prevented (Table I).

DISCUSSION

The success of a TB screening program lies in the ability to provide chemoprophylaxis for those individuals who are infected. In this project, the TB nurse specialist case management role at a Public Health TB Clinic provided consistent follow-up, assessment, coordination, medication delivery, and monitoring for compliance and side effects. This resulted in high rates of INH recommendations (89%), acceptance (71%), and completion (84%). These rates are significantly higher than those reported elsewhere,^{3,7,8} and reflect the importance of a TB control system which has the ability to utilize staff with specialized knowledge and understanding of tuberculosis disease, treatment, and prevention. In areas where this does not exist, and family physicians or other health care providers would be expected to carry out this role, extensive collaboration may be needed to promote a better understanding and acceptance of TB prevention programs.

The cost-effectiveness of chemoprophylaxis for TB has been analyzed and reported by Fitzgerald and Gafni³ as well as others,^{7,8} using a variety of factors including direct costs of treatment of an active case of TB and indirect costs associated with secondary cases. In general it has been felt that chemoprophylaxis is cost-effective in high-risk groups, especially if the rate of acceptance and completion of INH is high. The relatively low cost of \$4,604.29 per case prevented in this project compares favourably with costs of active treatment reported by Yuan et al. of \$4,508.82 in Toronto, ON,⁸ and \$9,182.25 reported by Fitzgerald and Gafni.³

An important limiting factor in this project was the absence of a system to collect information about the country of origin and entry date of students to Canada, resulting in a labour-intensive and inaccurate method of identifying the high-risk group of students for screening. This individualized approach substantially increased

Figure 1. Tuberculosis testing in Alberta schools (1,146 students tested)

Figure 2. INH treatment recommended for 154 children

the cost of the project. If this information was collected and stored in an information base in the school system, and could be readily retrieved, the time saving could result in a lower cost screening program.

Screening of high-risk groups and prevention of TB by means of chemoprophylaxis is an important component of TB control, and is especially important for the age group under 20 years due to the combined advantage of a longer lifespan free from TB disease and the very low risk of side effects of INH medication. Addressing the issues which decrease the effectiveness of screening and prevention programs would improve results and consequently increase the cost-effectiveness of the program.

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- 1) La politique de santé publique et la gestion des risques : la surveillance doit permettre de déterminer les besoins de santé et les progrès dans la protection et la promotion de la santé.
- 2) La lutte immédiate contre la maladie : la vitesse d'intervention est d'une importance vitale dans la gestion des maladies infectieuses qui peuvent potentiellement faire courir des risques de maladie grave, voire de décès, à de nombreux Canadiens. La détection précoce des flambées de maladie infectieuse est indispensable pour déclencher rapidement l'application de mesures de lutte et peut répondre à des obligations légales spécifiques (par ex., la salubrité des aliments).
- 3) Le suivi et la prévision des problèmes de santé et de leurs déterminants pour tirer rapidement la sonnette d'alarme en cas de changements significatifs (par ex., le tabagisme des adolescents), et pour identifier les groupes à risque élevé (par ex., les groupes à risque pour le VIH/sida).

Les données de surveillance ont aussi des utilisations secondaires importantes, par exemple pour la formulation d'hypothèses, pour la recherche sur la population (par ex., sur les services de santé, sur l'évaluation des programmes) et pour donner au public une information de base sur les indicateurs de l'état de santé.

Les systèmes de surveillance de la santé au Canada présentent de grandes carences. Bien que nous disposions d'une bonne information sur la mortalité résultant d'un grand nombre de maladies et de blessures, nous n'avons que des données démographiques nationales sur l'incidence du cancer et sur celle du VIH/sida. Pour aussi incroyable que ce soit, nous n'avons que peu ou pas de données sur l'incidence de la plupart des maladies, notamment pour ce qui est des maladies coronariennes, des accidents cérébro-vasculaires, de la cirrhose, du diabète, des blessures et autres pathologies que l'on peut prévenir. Même dans le cas du cancer, nous manquons d'informations sur l'ampleur de la maladie à la pose du diagnostic, informations dont on a besoin pourtant pour évaluer l'impact

du dépistage du cancer et des programmes de traitement.

S'agissant des facteurs de risque et des déterminants de la santé, les systèmes de surveillance sont insuffisants ou inexistant pour la qualité de l'eau potable, la qualité de l'air, les comportements à risque (même s'il y a des évolutions dans ce domaine), l'état nutritionnel, la forme physique et l'accès aux services de prévention. L'absence d'informations démographiques sur l'incidence et l'exposition aux maladies signifie que nous disposons rarement d'informations relatives au fardeau de la morbidité attribuable à un facteur de risque donné, un indicateur pourtant très important pour évaluer les priorités en matière de santé publique. Nous n'avons pas encore accès facilement aux données concernant les facteurs de risque, l'incidence, la prévalence et la mortalité propres à une maladie donnée ventilées en fonction du revenu, du niveau de scolarité et d'autres grands déterminants de la santé. La surveillance exige que l'on s'engage à recueillir des données normalisées et comparables entre elles sur une longue durée; dans la pratique, même cette exigence fondamentale n'est pas satisfaite.

Alors que le Canada s'apprête à entrer dans le nouveau millénaire, il y a d'autres besoins de surveillance qui ne sont pas satisfaits, notamment des données complètes sur des populations cibles (par ex., les groupes à faible revenu, les enfants, les femmes, les Autochtones, les réfugiés/immigrants et les personnes âgées), sur les conséquences des catastrophes naturelles sur la santé, sur les variations climatiques extrêmes et autres effets potentiels du changement climatique mondial, sur les dangers associés aux produits de consommation et commerciaux (surveillance postcommercialisation) et sur la santé et la sécurité au travail.

L'Équipe fédérale-provinciale-territoriale de conception de l'intégration a constaté plusieurs carences s'agissant de maladies spécifiques, mais en est arrivée à la conclusion qu'il était beaucoup plus urgent de s'attaquer aux besoins communs à de nombreux systèmes de surveillance. Il s'agit notamment :

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