

# Failure of diagnosis as a factor in tuberculosis mortality

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In British Columbia between January 1970 and December 1974 active tuberculosis was diagnosed only after death in 69 cases; this was more frequent for miliary tuberculosis (31% of reported cases) than for advanced pulmonary tuberculosis (3% of cases). Although 28% of the patients were more than 75 years old, some were much younger, and 38% of the latter were alcoholics. More than 50% of the patients had been hospitalized before death, for a mean of 14.5 days; they were most frequently thought to have pneumonia or cancer at the time of death. Clearly, increased awareness of the continuing presence of tuberculosis in our society is needed.

En Colombie-Britannique entre janvier 1970 et décembre 1974 la tuberculose active a été diagnostiquée après le décès dans 69 cas; ceci est survenu plus fréquemment dans les cas de tuberculose miliaire (31% des cas signalés) que pour la tuberculose pulmonaire avancée (3% des cas). Bien que 28% des patients aient été âgés de plus de 75 ans, certains étaient beaucoup plus jeunes, et 38% de ces derniers étaient alcooliques. Plus de 50% des patients avaient été hospitalisés avant la mort, pour une moyenne de 14.5 jours; au moment du décès on croyait, dans la plupart des cas, qu'il s'agissait d'une pneumonie ou d'un cancer. Il y a nettement nécessité d'être davantage conscient de la présence persistante de la tuberculose dans notre société.

All deaths from tuberculosis are avoidable. In spite of this, among deaths due to infectious diseases in Canada in 1974 the number caused by tuberculosis was exceeded only by the number attributed to influenza.

Several factors contribute to the continuing deaths from tuberculosis. As tuberculosis has become less prevalent, failure of diagnosis has become an increasingly important con-

tributor to death from the disease.<sup>1</sup> Furthermore, tuberculosis is increasingly a disease of the elderly, in whom concomitant conditions render diagnosis more difficult.

In a report from New York City in 1964 Simpson and Lowell<sup>2</sup> emphasized the consequences to public health of this failure of diagnosis. Linell and Ostberg,<sup>3</sup> from a study of autopsies in Malmö, Sweden, drew attention in 1966 to the fact that the magnitude of the problem is better appreciated when the frequency of autopsy is high. The 1971 report of a collaborative study by the British Thoracic and Tuberculosis Association<sup>4</sup> noted that patient factors (such as advanced age, mental disorder and alcoholism) and medical care factors (such as inadequate investigation and misdiagnosis) contribute to the problem. The study described below was designed to determine the magnitude of the problem in British Columbia and to identify avoidable factors relating to it.

## Methods

The division of tuberculosis control, Ministry of Health, British Columbia, must be notified of all cases of active tuberculosis in the province. Tuberculosis diagnosed only after death comes to the attention of the division in one of two ways. In some instances diagnosis is made from analysis of bacteriologic specimens submitted to the provincial laboratory. But most such cases come to the attention of the division when tuberculosis is recorded on the death certificate as causing or contributing to death; the division is notified and information is collected to assess the site and type of disease and the mode of death.

We reviewed all notifications of active tuberculosis in British Columbia from 1967 through 1976 and identified all persons dying of or with tuberculosis, including those in whom the diagnosis was made only after death. In addition, we reviewed the case records of the 69 persons in whom the diagnosis was made only after death in 1970 through 1974;

the hospital records of the 36 who died in hospital were provided by the institutions for review.

Information was obtained in each case regarding age, sex, place of birth, site and type of disease, past medical history, chest roentgenograms, course in hospital, clinical diagnosis and cause of death.

## Results

Tuberculosis mortality progressively decreased over the 10 years studied (Fig. 1). During the decade 1967 through 1976 almost one half (47.4%) of the patients dying of tuberculosis were not suspected of having the disease; while the mortality due to tuberculosis undiagnosed before death decreased slightly over this period, the decrease was much less than that in the overall mortality, which indicates that an increasing proportion of deaths from tuberculosis were due to failure of diagnosis (Fig. 2). Most cases of tuberculosis detected after death were diagnosed at autopsy.

Variations were found between different demographic groups. For example, the proportion of cases of active tuberculosis diagnosed only after death was more than twice as high among registered Indians (3.5%) as among other Canadian-born persons (1.7%); for those born outside Canada the proportion was in between (2.1%).

The mortality of various types of tuberculosis is shown in Table I. The rates were particularly high for miliary tuberculosis (31%) and tuberculous meningitis (33%), and most persons dying of these two types did so before the diagnosis was made. The other deaths among persons with tuberculosis were due to advanced pulmonary, adrenal and pericardial disease, as well as massive hemoptysis.

Several factors related to the failure of diagnosis during life were identified from analysis of the 69 such cases from 1970 through 1974. Whereas in the entire group of 69 persons the male:female ratio was roughly 1.0, among the elderly in

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the group (those more than 75 years old) the ratio was much greater, an important trend since the frequency of tuberculosis also increases greatly with age. Of the 19 persons who were more than 75 years old 13 died of tuberculosis. Among the other 50 persons 19 were alcoholics, 3 were ingesting corticosteroid medication

and 3 had previously undergone gastrectomy.

Other details of the 69 cases were reviewed. The record of 1 person did not contain the items considered; of the remaining 68 persons 32 died outside hospital and in 7 of these a diagnosis of tuberculosis had been made previously. Most of those dying

of miliary tuberculosis, tuberculous meningitis or tuberculous pericarditis died in hospital. None of those dying of massive hemoptysis or tuberculous Addison's disease did so in hospital.

Of the 36 who died in hospital 14 were in a community hospital and 22 in a referral hospital; 7 were known to have had active tuberculosis in the past. Tuberculosis was recorded in the differential diagnosis in 2 of the 36 cases but was not included in the physician's report of death in any case prior to autopsy. Sputum smears and cultures were ordered in only seven cases and the results were reported as positive in all seven after the patient's death. In no case was antituberculous chemotherapy ordered by the physician in charge. The mean duration of hospitalization was 14.5 days (range 1 to 65 days) and was the same in the two types of hospital. The 17 dying of advanced pulmonary tuberculosis were in hospital a mean of 8.4 days, and the 13 dying of miliary tuberculosis were in hospital a mean of 11.9 days prior to death. The clinical diagnoses at the time of death were pneumonia in 13 (36%), cancer in 8 (22%), congestive heart failure in 3 and others in 12 (33%); the proportions were approximately the same for those dying of advanced pulmonary or miliary tuberculosis.

The presenting symptoms of the 30 persons dying in hospital with advanced pulmonary or miliary tuberculosis are shown in Table II. Of the 23 whose presenting symptoms were on record 16 had a productive cough and 15 had a fever. Chest roentgenograms were made before death in 25 cases and most showed abnormalities suggesting infiltration, usually bilaterally (10 cases) or unilaterally in the upper lobe (8 cases); pleural effusion was evident in 6 cases, without concomitant infiltration in 2.

Nineteen of the 69 persons with unsuspected tuberculosis at the time of death died of other causes, though active tuberculosis was a contributing factor; 5 had cirrhosis, 4 chronic renal failure, 4 cancer, 3 gastrointestinal hemorrhage and and 3 other conditions.

## Discussion

The annual decrease in the tuber-

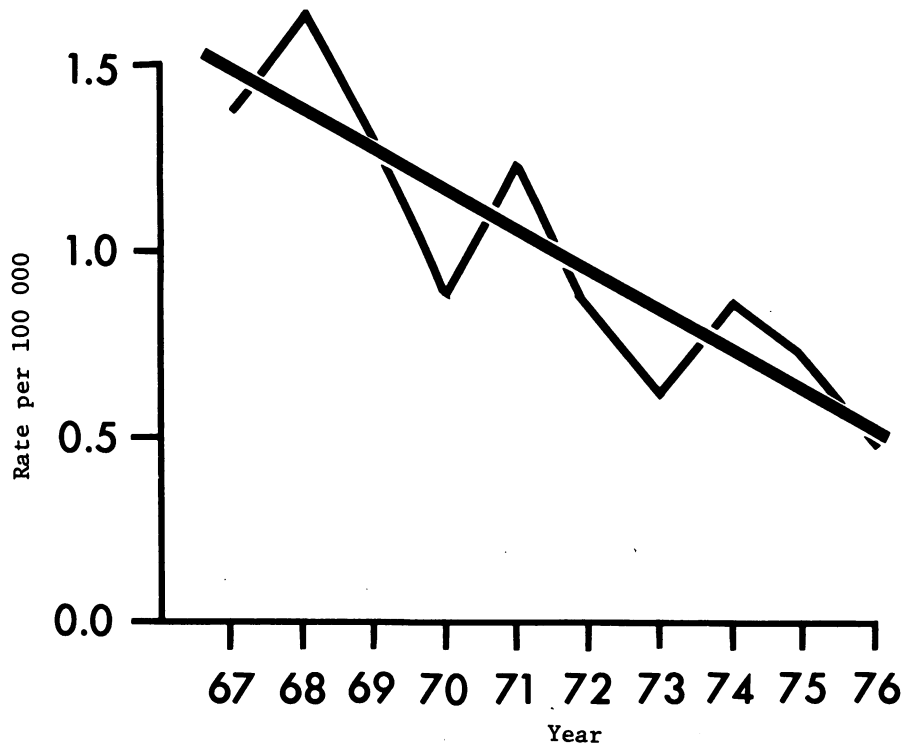


FIG. 1—Tuberculosis mortality, British Columbia, 1967 through 1976.

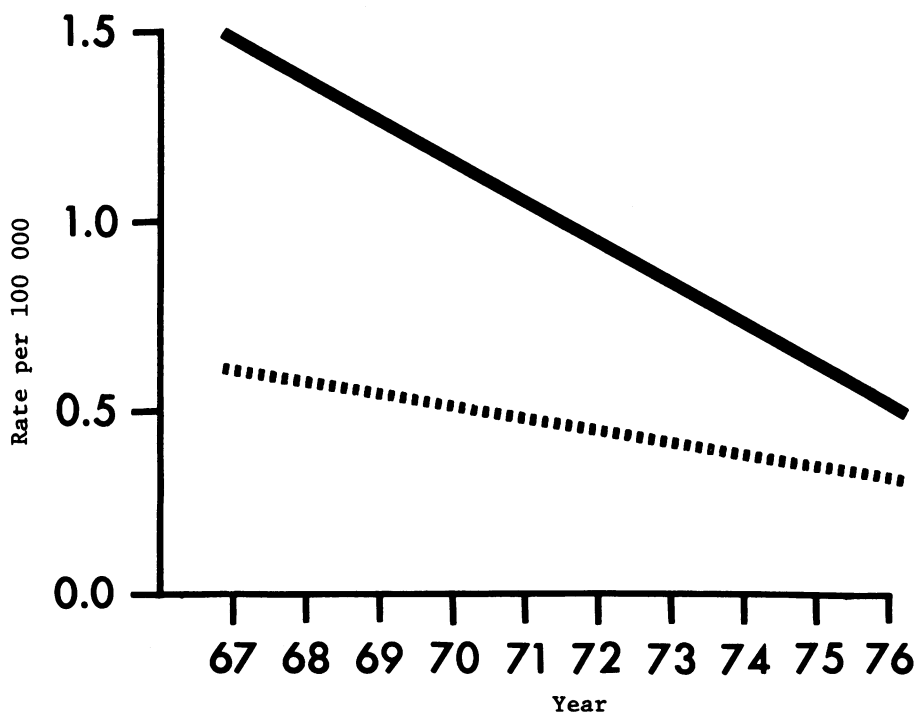


FIG. 2—Contribution of failure of antemortem diagnosis of tuberculosis to mortality, British Columbia, 1967 through 1976. Solid line represents total mortality and broken line mortality due to tuberculosis diagnosed only after death.

Table I—Mortality of various types of tuberculosis in British Columbia, 1970 through 1974

Type	No. of cases	No. of deaths due to tuberculosis	No. of postmortem diagnoses	
			Deaths due to tuberculosis	Deaths due to other causes
Advanced pulmonary*	904	65	27	10
Miliary†	48	24	15	0
Meningitis	3	1	1	0
Other	2042	9	7	9
Total	2997	99	50	19

\*Includes moderately advanced and far advanced pulmonary tuberculosis and silicotuberculosis.

†Includes pulmonary miliary and disseminated miliary tuberculosis.

culosis mortality in British Columbia parallels that of the incidence of tuberculosis (approximately 6% per year). The proportion of cases in which the diagnosis of tuberculosis is not made before death has not declined concomitantly, so the proportion of tuberculosis mortality due to failure of antemortem diagnosis has slowly risen. Since only one out of three persons who die in British Columbia come to autopsy the problem is of greater magnitude than our figures suggest; in fact, failure of antemortem diagnosis is the most important factor related to death from tuberculosis in our society at present.

The explanation for this failure is found in factors related to both the patient and medical care.<sup>4</sup>

Some studies have suggested that the problem is greatest in elderly single men.<sup>1,2</sup> Our study has reinforced the association of advanced age with failure of diagnosis prior to death, but in terms of case-fatality rates the risk of death from tuberculosis as a result of failure of diagnosis is equally great in the two sexes. The findings in the other studies may reflect the increased incidence of tuberculosis in older men.

Alcoholism was also identified as a problem, particularly in the younger patients. Although it is hard to obtain reliable statistics on the frequency of alcohol-related problems in persons with tuberculosis (or in the general population) the importance of these problems is evident from the frequency with which cirrhosis was noted at autopsy.

The higher mortality in registered Indians cannot be explained simply by the increased incidence in this group. It may be related to the lifestyle and innate susceptibility of Indians or to the adequacy and relevance of medical care.

It is apparent from the frequency and duration of hospitalization of the 69 persons in whom an antemortem diagnosis of tuberculosis was not made that deficient medical care was an important factor in their death. Specific problems were the failure to consider tuberculosis in a person with unresponsive pneumonia, particularly an elderly person, and the readiness to accept a diagnosis of advanced malignant disease in the absence of histologic confirmation. Furthermore, for those dying in hospital, indications of the possibility of tuberculosis being present were available to the physician before the patient's death. For example, in approximately 20% of this group a diagnosis of tuberculosis had been made previously. Of those whose presenting symptoms were on record about 65% had a productive cough and 70% a fever. More than 80% underwent chest roentgenography prior to death, and changes compatible with the diagnosis of tuberculosis were noted in most; indeed, almost a third had infiltration restricted to an upper lobe.

The importance of a high index of suspicion in the prevention of

death from miliary tuberculosis and the high mortality in the elderly associated with delay in diagnosis have previously been emphasized.<sup>5</sup> Petersdorf and Beeson<sup>6</sup> drew attention to the frequency of tuberculosis as the cause of fever of unknown origin. In addition, Haas and colleagues<sup>7</sup> pointed out how often the diagnosis of tuberculous meningitis is delayed or not made and how this affects the outcome.

In conclusion, the failure to diagnose tuberculosis prior to the patient's death is presently the leading contributor to tuberculosis mortality in this country. To maintain the decline in mortality observed over the past century it will be necessary to improve medical care provided to the elderly, the alcoholic and the registered Indian, and to foster an increased awareness of the continuing presence of tuberculosis in the community.

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Table II—Presenting symptoms of persons hospitalized prior to death with undiagnosed advanced pulmonary or miliary tuberculosis

Symptoms	Type of tuberculosis; no. of persons	
	Advanced pulmonary	Miliary
Weakness and weight loss only	1	2
Fever only	2	2
Productive cough only	4	1
Fever and productive cough	6	5
Unknown	4	3
Total	17	13