Childhood Tuberculosis With Reference to the American Indian

HELEN M. WALLACE, M.D., M.P.H.

GREAT PROGRESS has been made in reducing deaths from tuberculosis in the United States over the past decades, but the greater challenge of eradication remains. From 1900 to 1960 the tuberculosis death rate declined from 194.1 to 6.1 per 100,000 persons (*1*). Striking decreases in the rate occurred during the early years of the 20th century and in the years 1946–55 following discovery of the chemotherapeutic and antibiotic compounds isoniazid and streptomycin.

For many decades the rate of deaths due to tuberculosis has been higher among the nonwhite than in the white population. In 1960 among white infants, children, and youth, mortality rates from tuberculosis were low; for the comparable nonwhite age groups mortality rates were significantly higher (table 1). The ratio of deaths of nonwhite to white persons from tuberculosis in 1960 was 2.8 to 1.

Morbidity Among Indians

The reported incidence of tuberculosis among American Indians in 1962 was 263.4 per 100,000 population compared with 37 for the entire U.S. population—or approximately seven times that of the non-Indian population (*2*). This was a decline from 284.8 in 1961 and 292.3 in 1960. Nearly 80 percent, or 647 of the total of 844 cases reported in 1962, were classified as active or probably active cases. During the 1950's there had been a reduction of 54 percent in the reported incidence of tuberculosis among Indians.

In 1964 a total of 578 new active cases of tuberculosis were reported among the Indians (*3*). This was a reduction of 3 percent from 1963, but the rate of incidence was still seven times that of the United States as a whole. Of the total cases reported in 1964, nearly 38 percent were in persons less than 20 years old (table 2).

Since 1956 fewer patients with tuberculosis have been hospitalized and their hospital stays have been shorter. In 1965 the tuberculosis patient census constituted about 17 percent of the total census for all types of patients. This was a decrease of 76 percent in census from the peak in 1956 (*3*). The ambulatory chemotherapy program contributed to a marked decline in hospitalization, and the use of drugs also helped to reduce the length of stay of patients requiring hospitalization.

Mortality Among Indians

The highest tuberculosis death rate in the United States has been among American Indians. During 1961–63, it was 11 times that for the total population in 1962 (table 3).

In 1964 tuberculosis ranked ninth among the causes of death of Indians, while among the total U.S. population it was no longer among the first 10 causes (*3*).

The high rate of death caused by tuberculosis among Indians and the high risk of illness from tuberculosis encountered by many Indian children strongly suggest a grave need to prevent further spread of tuberculosis in Indian communities. Any tuberculosis program for In-

Dr. Wallace is professor and chairman, Division of Maternal and Child Health, University of California School of Public Health, Berkeley. *This paper is based on material presented at a medical staff meeting, at the Public Health Service Indian Hospital, Gallup, N. Mex., December 16, 1965.*

dian children should be an integral part of the health services for their entire families. Furthermore, the general health needs of Indian children should be given high priority.

Suggested Program for Children

The specifics in a program for Indian children include (*a*) casefinding and data collection, (*b*) followup of the child and his contacts, (*c*) diagnosis and treatment, (*d*) prevention, and (*e*) evaluation of data.

Casefinding. Tuberculosis morbidity is three to five times higher among children who react positively to the tuberculin test than among those who do not. This susceptivity applies to immediate complications and to later breakdown into endogenous pulmonary disease. The probability of developing progressive disease and extrapulmonary complications within a year is high for children 4 years old or younger, and this risk is multiplied many times for reactors under 1 year of age.

Tuberculin testing of children should be part of the general plan for supervising their health. It can be included routinely in a well-child conference; school health, day care, or hospital clinic programs; or the procedures followed by a private physician.

In areas with high incidence of tuberculosis, testing should be done at 6 months of age, annually until 1 year after admission to school, at ages 9 and 12, and again annually through high school. All hospitalized children should be tuberculin tested, and all children attending a hospital clinic should be skin tested yearly. If the reaction to the tuberculin test is positive, the child should receive a standard diagnostic X-ray. Extent of followup is determined by clinical findings (length and extent of infection, presence or absence of calcification, or discovery of any pulmonary disease), the child's association with persons having active tuberculosis, and his age.

If a child has tuberculosis, it is imperative to identify and control the source of infection. This should include a tuberculin test for members of his family, or household, and his close associates. Positive tests of contacts should be followed by a diagnostic chest X-ray. Persons at special risk should be re-examined periodically, and prophylactic chemotherapy should be given to those for whom it is considered appropriate. Persons with the disease should be treated.

Tuberculin testing should be routine for adults in close contact with children. Mothers

Table 1. Death rates [1] from tuberculosis, by age groups, race, and sex, United States, 1960

Age group (years)	White		Nonwhite	
	Male	Female	Male	Female
Under 1	0.4	0.5	3.3	3.6
1–4	.3	.4	2.1	1.6
5–14	.1	.1	.3	.5
15–24	.2	.2	2.0	3.9

[1] Rates are per 100,000 persons.

SOURCE: Reference 1.

Table 2. Reported cases of tuberculosis among American Indians,[1] by age groups, 1964

Age group (years)	New active cases	Total cases
Under 1	10	11
1–4	61	70
5–9	60	67
10–14	42	51
15–19	43	51
20 and over	361	440
Unknown	1	1
Total	578	691

[1] Excludes Alaska natives.

SOURCE: Reference 3, p. 41.

Table 3. Age-specific death rates from tuberculosis

Age group (years)	Indian		All races
	1961–63	1953–55	1962
Under 5	6.5	63.4	0.8
5–14	2.8	10.5	.5
15–19	5.1	30.0	.2
20–24	9.0	19.8	.5
All ages	56.6	25.3	5.1

SOURCE: Reference 3, p. 20.

should be given a tuberculin test during pregnancy and another at 3 months postpartum. School employees, personnel of day care centers, nursery schools, summer camps, children's institutions, and baby sitters should be tested annually. If the results of the tests are negative, persons working with preschool and primary grade school children should be tested annually. If the results of their tuberculin tests are positive, people working with children of any age should have a chest X-ray immediately and each year thereafter.

The tuberculin test. The kind of tuberculin test to be used merits some discussion.

1. The Mantoux test permits administration of accurately measured amounts of tuberculin. The materials and equipment are readily available, and the reactions can be read and recorded quantitatively. However, skillful administration of the Mantoux test is required for best results, techniques associated with its use are cumbersome, and there are psychological objections to use of a hypodermic needle (*4*).

2. The multiple-puncture test can be administered by persons with minimal technical skill. Concentrated tuberculin punched into the skin is essentially a strong dose, a factor which minimizes the number of false negative results. The materials for this test are stable at room temperature. Disadvantages include the fact that the tuberculins are not well standardized, the dose of antigen retained in the skin is unknown, and an excess of false positive reactions is produced by concentrated tuberculin. Quantitative measurements of reactions can be only approximate guides to degrees of sensitivity in view of the variables affecting the dose (*4*).

The following recommendations have been made (*4*).

1. For screening and diagnostic purposes, the intracutaneous injection (Mantoux test) with a standard dose of 5 tuberculin units (0.0001 mg.) of purified protein derivative (PPD) is the most accurate test. Skillful administration and careful reading are essential.

2. For clinical screening when tuberculosis is not suspected, a multiple-puncture test is acceptable. If an equivocal reaction is obtained, give a Mantoux test using 5 tuberculin units.

3. For large-scale screening, multiple-puncture tests are acceptable for casefinding and for determining a rough index of tuberculous infection. Unless there are too many persons with small skin indurations or questionable reactions, all such persons should be retested with the standard Mantoux test.

4. For differential diagnosis when tuberculosis is suspected, the multiple-puncture test is an acceptable initial test. If a negative or equivocal reaction is obtained, a Mantoux test, using 5 tuberculin units of PPD, should be given. If the reaction is still negative, a stronger dose should be used in an effort to rule out tuberculous infection.

Regardless of the test used, the size of all reactions should be recorded in quantitative terms so that an excess number of small skin indurations will be detected. A skin induration of more than 10 mm. in reaction to 0.0001 mg. PPD should be considered an indication of tuberculous infection until proved otherwise. An induration of 5–10 mm. should be considered as questionable and the test should be repeated. An induration of 0–5 mm. should be considered a negative reaction.

In the tine test, a skin induration of 2 mm. or more is considered positive. If the results of the tine test are questionable, the Mantoux test should be given.

Followup Procedures

The tuberculin test is of little value unless appropriate followup programs are planned in advance and accurate records are kept. Primary emphasis in followup should be placed on persons who have larger skin indurations. Children who react positively should be referred promptly for diagnostic study. The study should include obtaining a complete history (with emphasis on contact with persons with active tuberculosis), physical examination, and chest X-ray.

Factors predisposing active disease. Once infection has occurred, morbidity rates are four times higher among persons who are 15 percent or more underweight for their height than in those who are overweight (*5*).

Substandard living conditions, especially poor and crowded housing, can increase the risk of contact with a patient with active disease. Exposure carries an unusually high risk for young children. The severity of primary dis-

ease is related directly to the intimacy of the contact and the amount of tubercle bacilli being released.

Surveillance of adult associates. Children in contact with anyone who has active tuberculosis should be tuberculin tested. Because of the high degree of tuberculin reactivity in such a group of contacts, a Mantoux test using first-strength (0.00002 mg.) PPD should be given. If the first test is negative after 48 to 72 hours, intermediate strength (0.0001 mg.) PPD should be administered. Positive reactors are referred promptly for diagnostic study. Adults with tuberculin-positive sputum should be removed from further contact with children.

Chemoprophylaxis and chemotherapy. In 1955, the Public Health Service initiated a study to determine the efficiency of isoniazid in preventing complications of primary tuberculosis (*6*). A total of 2,750 children who had positive reactions to tuberculin tests were followed. The study was limited to children under 3 years of age with asymptomatic primary tuberculosis. For 1 year, half received isoniazid and the others received placebo. During the first year 27 children in the control group developed definite extrapulmonary complications, including five cases of meningitis and one of miliary tuberculosis. The study group had two children with definite complications.

For infants less than 1 year of age who were tuberculin reactors, the risk of developing extrapulmonary complications within 2 years after diagnosis was 1 in 11. For tuberculin reactors 1 to 4 years of age, the risk was found to be substantial only if the roentgenograph showed definite tuberculosis. The rate of risk was 1 in 14 if the involvement was parenchymal, 1 in 36 if the involvement was hilar or paratracheal (*6*). Therefore, the American Academy of Pediatrics recommends that all children under 4 years of age who react positively to tuberculin should receive isoniazid for 12 months in a daily dose of 10 to 20 mg. per kilogram of body weight (*6*).

Treatment. Present-day drug therapy is highly effective in the treatment of pulmonary tuberculosis. Ninety-five percent of all patients with active disease who receive appropriate drug therapy from the time of diagnosis can recover. In tuberculous meningitis, the most serious complication in children, 80 percent have been reported to survive when therapy is initiated early and includes isoniazid. Good prognosis depends on early diagnosis, adequate treatment, and the age of the child.

Children seriously ill with tuberculous meningitis, miliary disease, or rapidly progressive pulmonary disease must be hospitalized and treated vigorously with antituberculosis drugs. Children with nonprogressive pulmonary disease are not dangerous to other children and should be allowed to attend school and pursue their usual activities if they are free from symptoms.

Treatment with isoniazid for 1 year should be given to positive reactors under 4 years of age and recent converters, especially adolescents and those in contact with active tuberculosis, who had Mantoux tests.

Treatment with isoniazid and para-aminosalicylic acid (PAS) for 18 months or longer is indicated for children clinically ill with progressive pulmonary disease, pulmonary infiltrates, or pleural effusion. A similar regimen should be prescribed for children who have lost weight or who have fever and those with nonpulmonary, bone, or renal disease; cervical node involvement; or large hilar nodes, with or without atelectasis.

Frequent observation, not necessarily with X-ray, every 2 to 3 months is indicated for negative reactors over 4 years old who are in contact with patients who have active tuberculosis and recent converters between 4 years and adolescence who have no signs of disease and who are not in contact with a patient with active disease.

Observation every 6–12 months is indicated for positive reactors over 4 years of age who are known to have converted more than 1 year in the past, or whose chest films show good calcification or no signs of tuberculosis, and who are not in contact with active tuberculosis.

Prevention

Preventive measures include improving nutritional status and general health, the standard of living (especially housing), and education. These measures constitute the long-range approach to most problems encountered with a disadvantaged, culturally different group.

More specific preventive measures include

those already mentioned: early casefinding, treatment of recent converters, adequate followup of close contacts of recent converters, prompt treatment and management of persons with active disease, and separation of patients from children.

Although Bacillus Calmette-Guerin (BCG) vaccine has not been recommended for general use in the United States, it has been recommended for persons exposed to greater than average risk of infection (*7*). It should be administered only to persons who are tuberculin negative. BCG has been recommended for tuberculin-negative children unavoidably exposed to infectious disease in the home and for tuberculin-negative infants and adolescents who live under substandard conditions in high-incidence areas. American Indian children may be in either of these groups. BCG vaccine is recommended for employees of tuberculosis sanitoriums, student nurses, and medical students.

Newborn infants who are to be given BCG vaccine do not require tuberculin testing before vaccination. Children in contact with tuberculosis should be followed as carefully as the unvaccinated. BCG is not a substitute for other control measures: it is only an additional method for use under special conditions.

Records and Evaluation

In any tuberculosis control program at least two kinds of records should be kept.

Family folders. In order to follow and supervise the health care of families at high risk to tuberculosis, a family folder is necessary. All family (or household) members and other close contacts should be viewed as an entity. Each step planned or taken for an individual family member should be considered part of the total family health plan. Both a tuberculosis case register and a family folder system are essential.

Service statistics. Some system of determining its effectiveness must be an integral part of any public health program. Records of mass tuberculin testing of children should enable determination, by age and geographic area, of the number of children tested and the number of positive reactors. These two factors will enable planners to determine whether to continue mass testing or confine their efforts to certain age groups or specific areas.

The number of positive reactors X-rayed and the results of the examinations will show the effectiveness of followup and the number and percent of positive reactors with active tuberculosis. Information obtained by the followup of contacts of positive reactors will yield the same kind of data about them.

Furthermore, the total analysis will tell the number of active cases found per total children tested. It will reveal the productivity in testing Indian children—both in positive reactors found and in cases of active tuberculosis found. Also, a record of expenditures in the program will show the cost of finding a positive reactor and of finding an active case.

Only by careful recording of events and steps taken can it be determined whether a program is carrying out its objectives.

Conclusion

In the past decade much progress has been made in coping with tuberculosis in the American Indian. It is clear, however, that tuberculosis is still a major problem in this group. An antituberculosis program, including casefinding, diagnosis, treatment, continuous supervision, prevention, and evaluation, should continue to be a major part of any general public health program for the American Indian.

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