Results of 20 Years of Tuberculosis Control in Alaska

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TWENTY-three years ago tuberculosis was considered the most urgent health problem in Alaska (*1*). The past two decades, however, have seen it brought under reasonable control. This achievement required a major effort. Moreover, control and eradication continue to present a challenge to a preventive health program.

Background

Tuberculosis was probably introduced among Alaska Natives by Europeans beginning in the 18th century. A careful study of 295 skeletons from western Alaska dating between 1 and 1000 A.D. by Dr. Charles W. Lester, an orthopedic surgeon working at the American Museum of Natural History in New York, revealed no evidence of tuberculosis. Records of the earliest visitors to Alaska make no mention of the disease, but within a few decades a number of observers began commenting on the frequency of hemoptysis and other manifestations of tuberculosis, which were well recognized by even nonmedical persons at the time.

The European visitors and Alaskan immigrants made contact with Alaska Natives at a time when tuberculosis was cresting in the countries from which the travelers came. Thus, the period from the mid-18th to the mid-20th century saw an essentially uncontrolled advance of tuberculosis in Alaska in a susceptible population that was living under conditions optimal for the disease's dissemination.

In 1950, the natives numbered 33,863 (15 percent of the total Alaska population of 226,167). Throughout this report, I will emphasize the native population's experience with the disease, since this group was most greatly affected. Deaths from tuberculosis among Alaska Natives 20 to 40 years ago were among the highest ever recorded for the disease (*2*). The morbidity was similar to that reported by Stein from Greenland; he stated that "even around 1950, one percent of the Greenlanders died annually of pulmonary tuberculosis" (*3*). These death rates may well represent the maximum effect of uncontrolled tuberculosis in a northern population living generally under primitive conditions.

Control Measures

Hospitalization. Before effective antituberculosis drugs were available, isolation in hospitals or sanatoriums of patients with active cases was the chief means of treatment of the disease and prevention of its spread. By the mid-1940s, some 4,000 active cases had been identified in the territory of Alaska, but only 70 beds were available for tuberculosis treatment in the territory. Thus, there were only 0.3 beds per tuberculosis death in Alaska,

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compared with 1.7 beds per tuberculosis death in the United States as a whole.

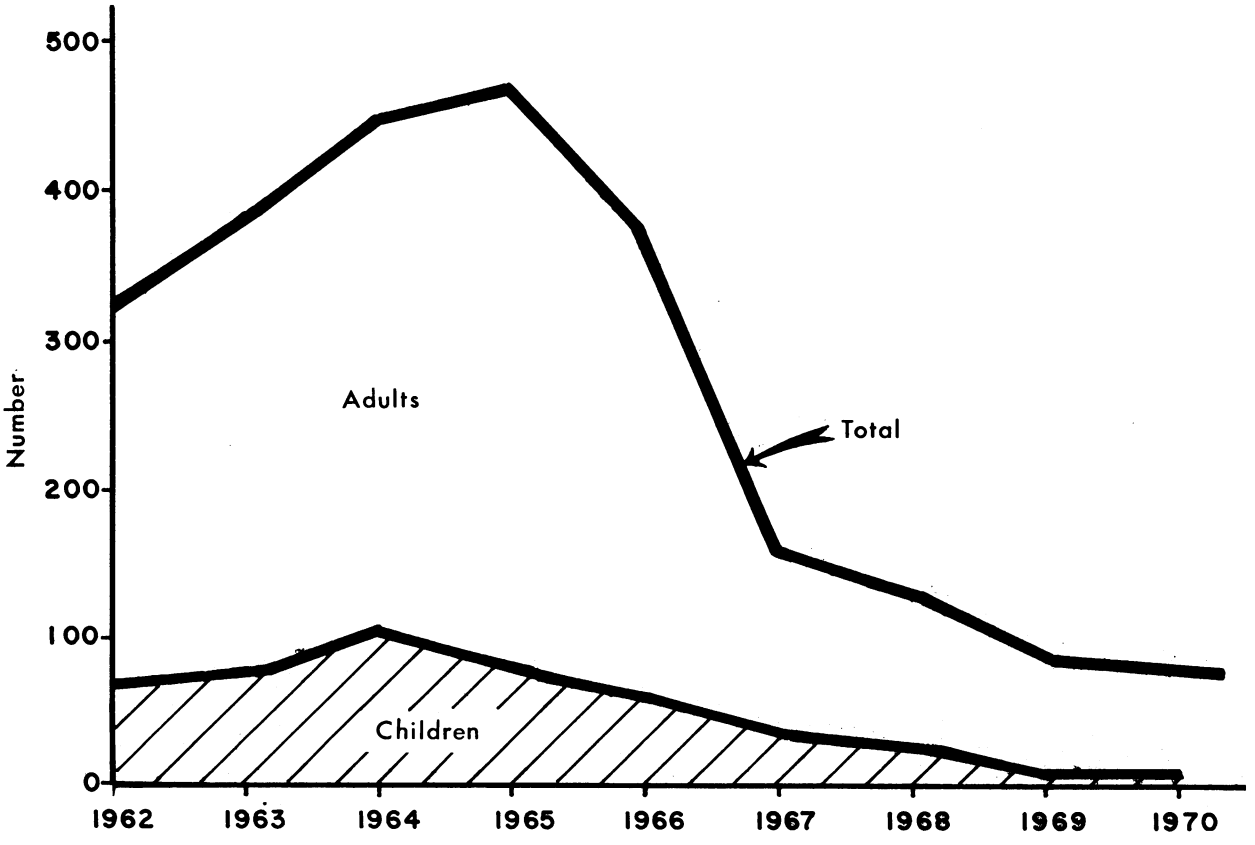
In 1947, the former U.S. Navy facility at Mt. Edgecumbe was renovated to provide 200 beds, mainly for children with bone tuberculosis. Here some of the first available streptomycin was used in conjunction with surgery. The 400-bed Alaska Native Hospital in Anchorage (name since changed to Alaska Native Medical Center) opened in 1953. It served as a center for treatment and referral to sanatoriums in the State of Washington. Since 1966, essentially all Alaska Natives with tuberculosis have been referred to the Anchorage facility.

Figure 1 shows the trend in tuberculosis bed utilization since 1962 for all Alaska Natives and for children alone. In 1964, an average of 50 or more children (14 years and under) in the Alaska Native Medical Center had primary tuberculosis or its complications. In May 1968, for the first time since tuberculosis beds were made available there, not one was occupied by a child. Since then there has been an occasional admission of a child with the disease. Tuberculous meningitis, common in children until recently, is now rarely seen.

Along with hospitalization and the administration of drugs, surgery has played a major role in treatment. In addition to many procedures instituted for extrapulmonary tuberculosis, approximately 2,500 thoracoplasties and pulmonary resections have been done (mostly resections) in the past 20 years. Until recently most pulmonary cavitary lesions that did not close promptly were resected.

BCG vaccination. The use of BCG vaccine in Alaska has been limited. In 1936 and 1938 Aronson gave it to nonreactors among southeastern Alaska Indians 1–19 years old (*4*). This effort is estimated to have reached no more than 500 persons from a population of 5,000 in that area. For a number of years in the late 1940s and early 1950s, the policy of both the Alaska Department of Health and the Indian Health Service was to encourage the giving of BCG vaccine to newborns and to tuberculin-negative children. Nevertheless, because of lack of personnel, and difficulty in delivering the vaccine to remote areas before it became outdated, this policy was never fully executed. An estimated total of 2 to 3 thousand BCG vaccinations were performed, mostly between 1949 and 1953. The exist-

Figure 1. Alaska Native hospitalizations for tuberculosis, adults and children, 1962–70



Registered nurse collects sputum samples on ward

ing records are not complete enough to allow followup evaluation. Essentially, no BCG vaccine has been used in Alaska since 1953.

Ambulatory chemotherapy. Ambulatory chemotherapy has been one of the major control measures used in Alaska since 1954. At that time, 1,500 patients were still awaiting hospitalization. An extensive program of administering isoniazid and paraamino salicylic acid to ambulatory patients under the direction of traveling nurses and local health aides was therefore undertaken. By 1956, a total of 1,600 persons, or 9 percent of the total population in 70 high-incidence villages, were receiving chemotherapy at home. The results of this project have been reported previously, and I will not comment upon them here except to state that during the period of observation a positive sputum was observed in only 3 percent of the treated patients as compared with 24 percent in a comparable untreated control group (*5*).

Since initiation of the special ambulatory chemotherapy project of 1954–56, this method of control has been applied mainly to patients after hospitalization and under the supervision of the regular public health nurse.

Preventive treatment. Isoniazid chemoprophylaxis has been applied extensively in Alaska. In 1957, one of the Public Health Service's isoniazid chemoprophylaxis trials was conducted in a high-incidence area in western Alaska (*6*). One-half of the 7,000 persons participating in the study received isoniazid during this trial. In 1963–64, the entire study population in the 28 villages, or approximately 7,000 persons, was offered 1 year of isoniazid.

Beginning in 1964, physicians with the Indian Health Service and the Alaska Department of Health began to prescribe isoniazid as a preventive to persons at risk. The guidelines provided by the American Thoracic Society were generally followed. By 1967, more than 2,500 persons, mostly Alaska Natives, were receiving isoniazid prophylaxis. The largest group to receive preventive isoniazid consisted of persons who had a positive tuberculin test and whose chest radiographic results were consistent with inactive tuberculosis.

Outside of the research project, communitywide chemoprophylaxis has been used only occasionally in small villages in which a number of conversions were found in the children. One may estimate that in the past decade more than 8,000 persons, mostly Alaska Natives, have had a year of isoniazid treatment that was recommended on an individual basis. The largest number of these persons were adults with

Community health aide gives followup care and instruction at patient's home

chest X-rays consistent with inactive tuberculosis.

Casefinding. Since essentially no BCG vaccine has been used in Alaska in the past 15 years and atypical mycobacteria are rarely encountered, the tuberculin test provides a useful and informative examination, especially for children. It is the practice of public health nurses to give the test annually to all children in the native communities who are not known reactors. In the urban areas of Alaska, first and seventh grade children, 6 and 14 years old, are tested. At the Alaska Native Medical Center, all persons admitted who are not known to be tuberculin positive are given a Mantoux test.

Twenty years ago primary infection with tuberculosis was almost inevitable among native children. This situation has changed dramatically. Today few tuberculin conversions are found, and those that do occur usually affect only a few households. In western Alaska in 1950, approximately 90 percent of the children were tuberculin positive by 6 years of age (*7*); in a recent survey, only 2 percent of the 6 year olds showed evidence of infection, and none of the group 5 years old and under were positive (*8*). When tuberculin conversion does occur, the source cases are sought out immediately.

In the predominantly native rural communities, all persons for whom positive tuberculin test results are available at the time of the X-ray technician's visit have a 14 by 17 inch chest roentgenogram. Certain high-risk groups in the urban areas are offered survey chest X-rays. One-half of the new active cases diagnosed in 1970 were discovered by chest X-rays (personal communication from Robert I. Fraser, MD, director of tuberculosis control, Alaska Department of Health and Social Services, Anchorage, January 15, 1971).

The laboratory is playing an increasing role in casefinding and management of tuberculosis. In 1970, 20 percent of the new cases discovered were initially detected by sputum cultures. Many of these so discovered, however, were minimal in extent and might otherwise have gone undiagnosed. Other features of this method that commend it at this time, especially in Alaska, are: (*a*) the specimen can be collected by the patient himself, a local health aide, or a visiting public health nurse in the village, at any frequency and at no great expense, and (*b*) the diagnosis, when positive, is definitive, and information on the patient's management as regards drug sensitivity is immediately available.

The goal of the Alaska State Tuberculosis Control Unit is to

obtain sputum cultures every 6 months on an ongoing basis for all persons with roentgenographic evidence of tuberculosis. The approximately 18,000 sputum examinations done annually in Alaska, largely on the 25,000 adult native population, indicate the intensity of this surveillance.

Since most of these sputum specimens are obtained from persons not having a cough productive of sputum, use of aerosol nebulizers to induce sputum production has been encouraged. These aerosol machines are placed near the tuberculosis clinics and general outpatient clinics and on hospital wards; they are also carried to villages by physicians and nurses.

Several aspects of the tuberculosis control program in Alaska are worthy of comment. One is that it has been characterized throughout by close cooperation, both in direct care and in research, between territorial agencies—later State agencies—and Federal agencies. Voluntary organizations and citizen input filled the gaps and served as catalysts. A second unique aspect is that although the program has been physician directed, it has always depended heavily on public health nurses to carry it to the scattered communities. Also, for two decades the chemotherapy and health aides have provided the day to day direct supervision and support of patients in the remote villages that have been so essential to the program's success. The final uncommon feature is the unusually high degree of cooperation among Alaska Natives in accepting treatment, whether is was hospitalization, surgery, or drug therapy.

Incidence and Disease Pattern

Figure 2 shows the tuberculosis death rate for Alaska Natives in comparison with the total Alaskan population and the general U.S. population. The death rate for Alaska Natives has declined from 653 per 100,000 in 1950 to the vanishing point. In 1968, and again in 1970, no deaths of Alaska Natives were reported in which tuberculosis was identified as the primary cause.

The incidence of tuberculosis for all Alaska and for Alaska Natives during the past 20 years can be seen in figure 3. These rates bear a striking resemblance to those reported by Stein and Lange from Greenland for the same period (*3*, *9*).

Figure 4 shows the changing pattern of tuberculosis by diagnostic category, including the extent of pulmonary disease (*10*). All categories of pulmonary disease showed a reduction, but most remarkable is the decline in primary infection. Of interest is the failure of the extrapulmonary cases to drop off correspondingly, a failure for which the reasons are not readily apparent. A possible explanation is that persons with inactive pul-

Figure 2. Tuberculosis death rates, 1950–70

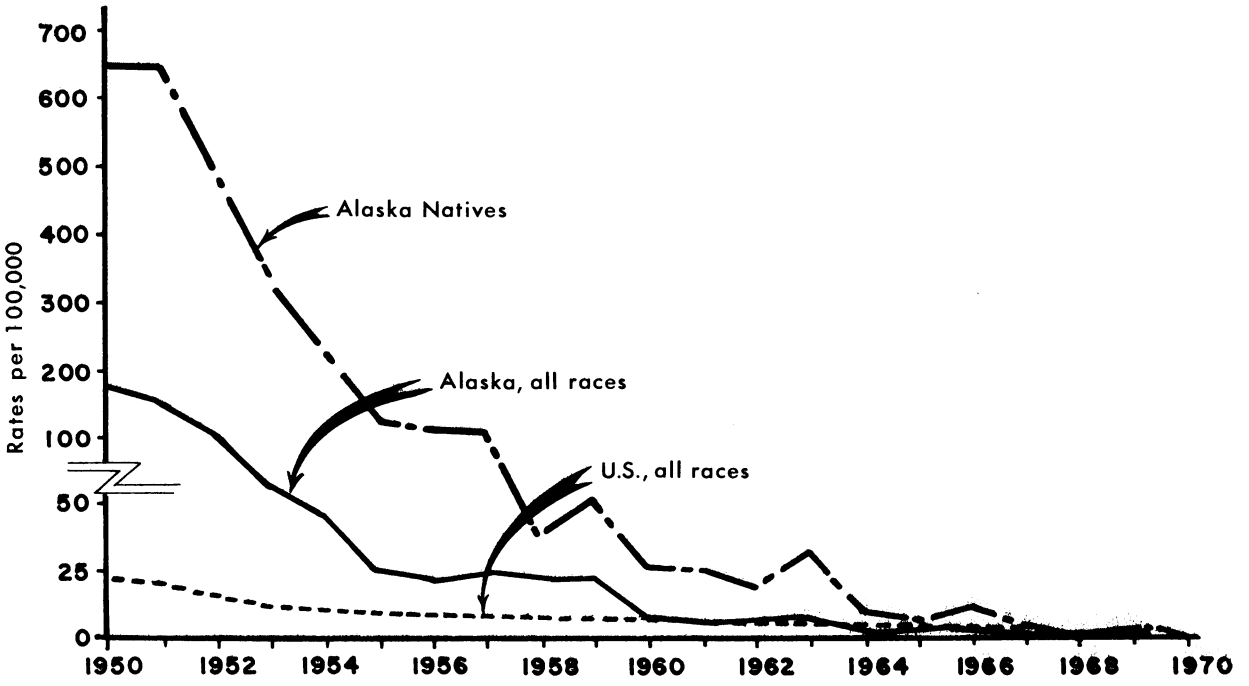


Figure 3. Tuberculosis incidence rates, 1952–70

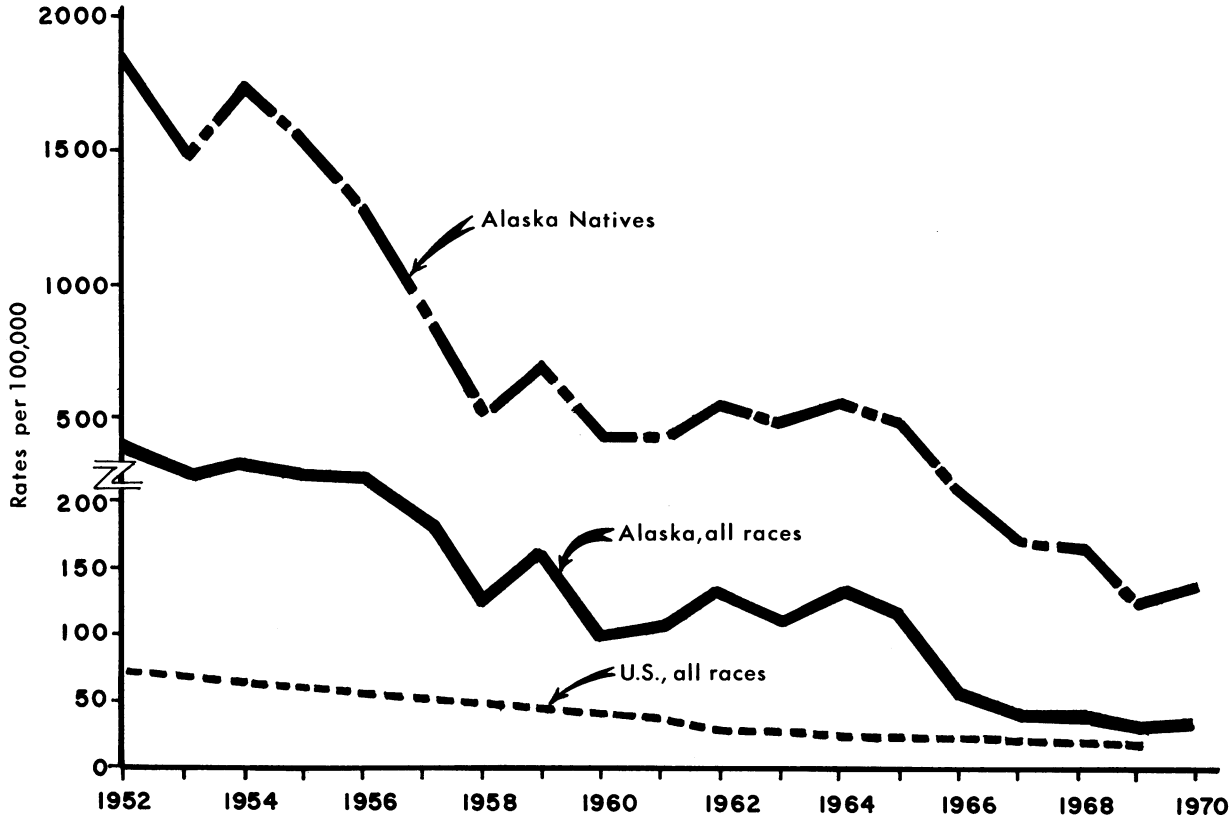


Figure 4. Cases of active tuberculosis by diagnostic category, all races, Alaska, 1964–69

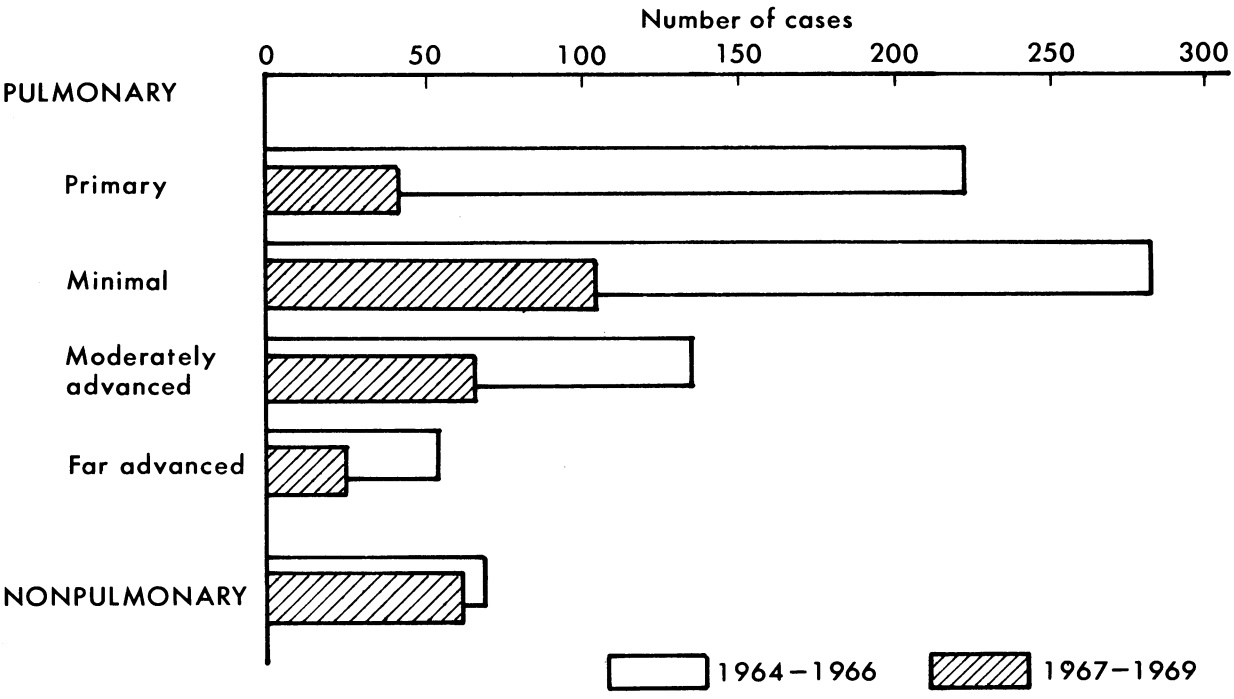
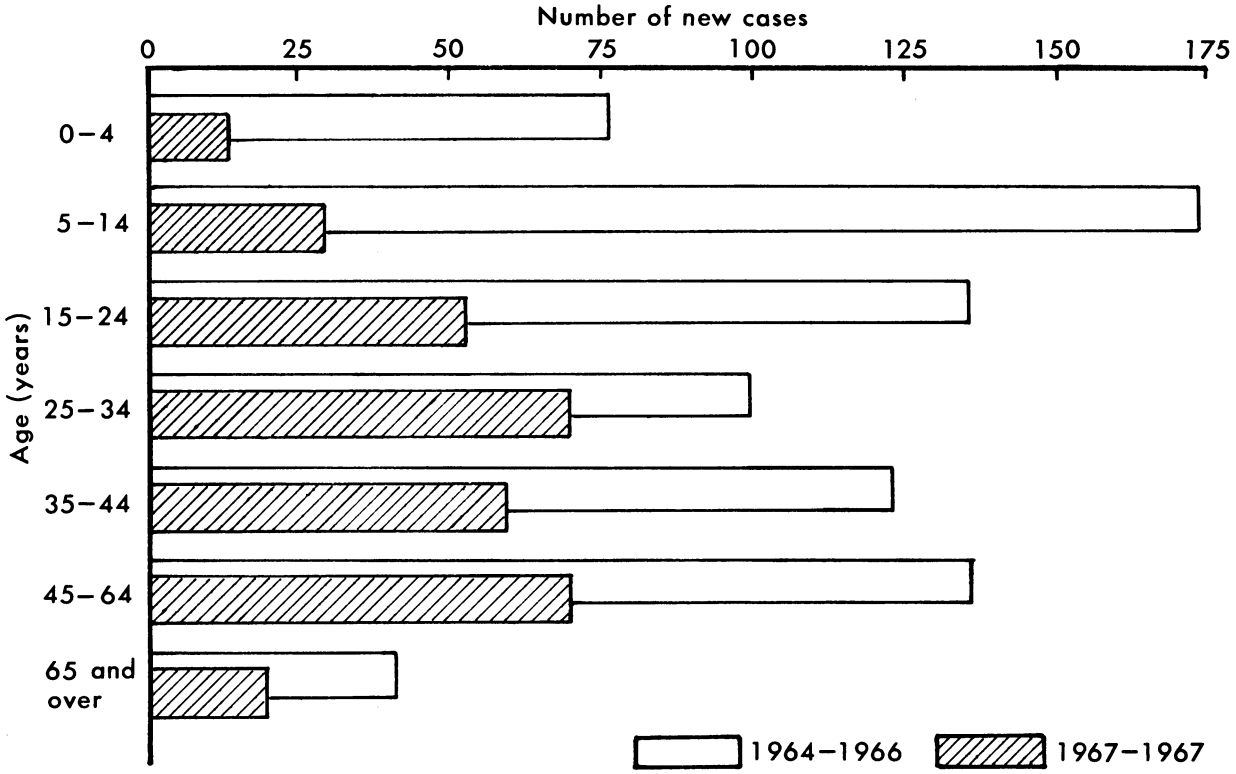


Figure 5. Cases of active tuberculosis by age of patient, all ages, Alaska, 1964–69



monary tuberculosis were more likely to have received a course of drug treatment than those with inactive nonpulmonary disease.

The age groups of the persons with new active cases are displayed in figure 5. Other than the general reduction of incidence, what is noteworthy is the almost total disappearance of cases in children under 4 years of age and the marked decline in those under 14. This decrease coincides with the almost total disappearance of tuberculin sensitivity in the age group under 4, a disappearance that is one of the most encouraging changes in the tuberculosis picture in Alaska in recent years.

The relationship between a high incidence of tuberculosis and poor socioeconomic conditions, especially poor housing, has often been pointed out. In fact, one observer, writing in 1953 specifically about tuberculosis among Alaska Natives, expressed the opinion that without improvement in their socioeconomic status the odds against effective control were "insuperable" (*11*). Nevertheless, significant improvement in the housing for Alaska Natives began to occur only recently and did not precede, but followed by several years, the marked drop in tuberculosis incidence and tuberculosis deaths. In other words, this sequence demonstrates that tuberculosis control, while difficult and expensive, is possible even under unfavorable socioeconomic conditions.

These results indicate that modern methods of tuberculosis control can be effective even when housing and economic conditions are unfavorable. The striking decline of the disease in children suggests that its ultimate eradication in Alaska is a realistic goal. Nevertheless, as a consequence of the earlier epidemic, the incidence in adults, while drastically reduced, is still excessive. Continued occurrence of the disease as a result of remote infection indicates that a vigorous program of surveillance and chemoprophylaxis will have to be maintained in Alaska for several more decades.

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In 1950, tuberculosis was the number one health problem in Alaska and the major health problem among the 34,000 Alaska Natives. The Alaska Natives had a death rate that year of 653 per 100,000. Tuberculosis affected all age groups and required a major portion of the total effort to provide health services for Alaska Natives.

The application, however, of vigorous control measures—hospitalization, surgical resection, ambulatory chemotherapy, and isoniazid chemoprophylaxis—between 1950 and 1970 resulted in the near elimination of tuberculosis as a cause of death among the Alaska Natives. The incidence rates in this group declined from 1,854 cases per 100,000 in 1952 to 154 in 1970. Tuberculosis has thus fallen from its position as the leading cause of death to an insignificant place. Dissemination of the disease has been largely halted. Few children are now affected by it.