THE WILLIAMSON COUNTY TUBERCULOSIS STUDY

A Twenty-Four–Year Epidemiologic Study

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FOREWORD

Tuberculosis in Tennessee in the early nineteen thirties was an affliction of the people sufficient to challenge the thought and attention of any who could see its enormity and the opportunity to combat it from a fresh approach. It was realized that the factors underlying the problem were numerous and required elucidation. The State was fortunate in having a Commissioner of its Department of Health who accepted the responsibility of initiating the effort in a methodical and carefully planned way. It seemed appropriate and promising to attempt to apply epidemiologic principles, notwithstanding some great difficulties inherent in a disease of such great chronicity and long duration. The time, the circumstances, and the mutual inspiration and imagination of Bishop and Frost combined to set off a closely linked study and campaign which, during the next quarter century, bore their fruit richly and abundantly.

The attitudes of these two men were distinguished by their honesty, by a certain intellectual humility reflecting the limited experience of themselves and others, and by the perception of their disciplined minds. Bishop knew he needed help and he knew where to go when he turned to Frost. Their initial achievement was in posing the right questions. These revealed freedom from prejudice and an insight and prescience which were truly remarkable, setting the tone which characterized the work throughout. The questions were clear and simple, and justified the expectation that some of the answers would be of a similar sort. With this solid footing the project was started in a community which was ideally suitable, not only because of its relatively stable population and prevalence of tuberculosis, but also because of its reasonable proximity to the university and the seat of state government, where interest and skill would be readily available and sustained. Unlike many long undertakings of this kind it continued consistently to its completion.

With the subsequent interposition of socioeconomic and other changes, especially specific drug therapy for tuberculosis, it is improbable that a study with this content can be conducted again. Its uniqueness, therefore, promises to be historic. But its merit, above all else, is in the clarity of its purpose, the faithfulness of its pursuit, the richness of its findings, and the honest objectivity of its interpretations.

Through the years, despite grievous losses, the work was carried on steadily by competent and devoted people representing the various disciplines which were brought to bear. This complete integration and report of the study is a testimonial to the greatness of their contributions and a fine service to all students of tuberculosis.

Each in his own way will judge and apply the various aspects and findings of the study as they fit with his particular interest and experience. One cannot avoid fascination with the byproduct of revelations of histoplasmosis—the weed discovered among the crops of tuberculosis or, to speak more prosaically, the calcifications among those insensitive to tuberculin. In general, there is much to clarify, substantiate, and add to our store of knowledge—be it in epidemiology, sociology, public health, clinical medicine, or other disciplines related to the understanding of tuberculosis. We may place strong confidence in the original conception of the study, its conduct, and its interpretations. All will appreciate the smoothly logical way in which it is presented.

J. Burns Amberson

DEDICATION

The untimely death of Roydon Simpson Gass on September 4, 1962 brought to a close more than thirty years dedicated to the control of tuberculosis. The co-authors of this report, in recognition of his contributions to the Williamson County Tuberculosis Study during its entire course, and in sorrow over the loss of an esteemed colleague and devoted friend, wish to dedicate this volume to his memory.

A. D.
R. H. H.
L. D. Z.

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History of the Study

A. The Tuberculosis Problem in Tennessee

As far back as the first official records were kept it was known that Tennessee had a higher tuberculosis death rate than the national average. Throughout the years, as the tuberculosis mortality curve for the nation showed a more or less regular decline, the curve for Tennessee showed a proportionate drop, so that in almost any year the tuberculosis death rate in this state was approximately 50 per cent higher than the nation's. It has been only in the last ten years or so that the tuberculosis mortality rate for Tennessee has dropped a little more sharply than the rate in the country as a whole.

Tennessee's excessive resident tuberculosis mortality was undoubtedly due in part to its relatively large nonwhite population. That was not the whole story, however. In the white population there was a marked rise in tuberculosis death rates beginning at age 50 (figure 1). Although not shown in the chart, death rates for females were higher than for males, while in the nation the rates were higher in males. The mortality rates in white rural residents were considerably higher than for those living in urban areas. This is exactly the reverse of the situation in the country as a whole. On the other hand, the experience of the Tennessee Negro did not differ appreciably from that of Negroes in the United States generally (figure 1). Although the rates for Negroes in Tennessee were slightly higher than the national average, they were not quite as excessive as the rates for the state's white population. The pattern of the resident Tennessee and United States tuberculosis mortality curves for Negroes was similar, and in Tennessee the urban rates slightly exceeded the rural.

All of these distinctive characteristics of the tuberculosis mortality in Tennessee made it apparent that studies done in other areas of the country, and control measures undertaken elsewhere, would very likely be inapplicable to the Tennessee problem. The stage was set for the development of special studies.

B. Pilot Studies

As Commissioner of the Department of Public Health of Tennessee, Dr. E. L. Bishop was deeply concerned with the unusual tuberculosis problem in the state. With the support of the Rosenwald Fund he established an epidemiologic study of tuberculosis in Trenton, Gibson County, in 1930. This study was largely exploratory in nature and it quickly demonstrated that the techniques employed in the study of acute communicable disease could not be applied without modification to the study of a chronic communicable disease such as tuberculosis.

Dr. Bishop called upon his former teacher, Dr. Wade H. Frost, professor of epidemiology at the Johns Hopkins School of Hygiene and Public Health, for guidance. Dr. Frost had a personal interest in tuberculosis because he had had the disease. Frost confessed his own lack of experience and the absence of guides or precedents in the epidemiologic study of a chronic disease. In a conference with Dr. Bishop on July 10, 1930, following a review of the work in Gibson County, he pointed up the deficiencies of the study, and made constructive suggestions concerning the clear definition of purposes and methods.

The chief objective of the Gibson County Study seems to have been the study of methods. In his discussion with Dr. Bishop on July 10, 1930, Frost outlined in some detail the kind of study he visualized. He stated:

> The basic material for the study should be an unselected series of cases of tuberculosis which have come to the notice of the State Department of Health through official morbidity reports or through examinations made in the chest clinic. Mortality records would seem to be useful in this series only if the death has been fairly recent and if the circumstances are such that the investigator can obtain approximately the same information

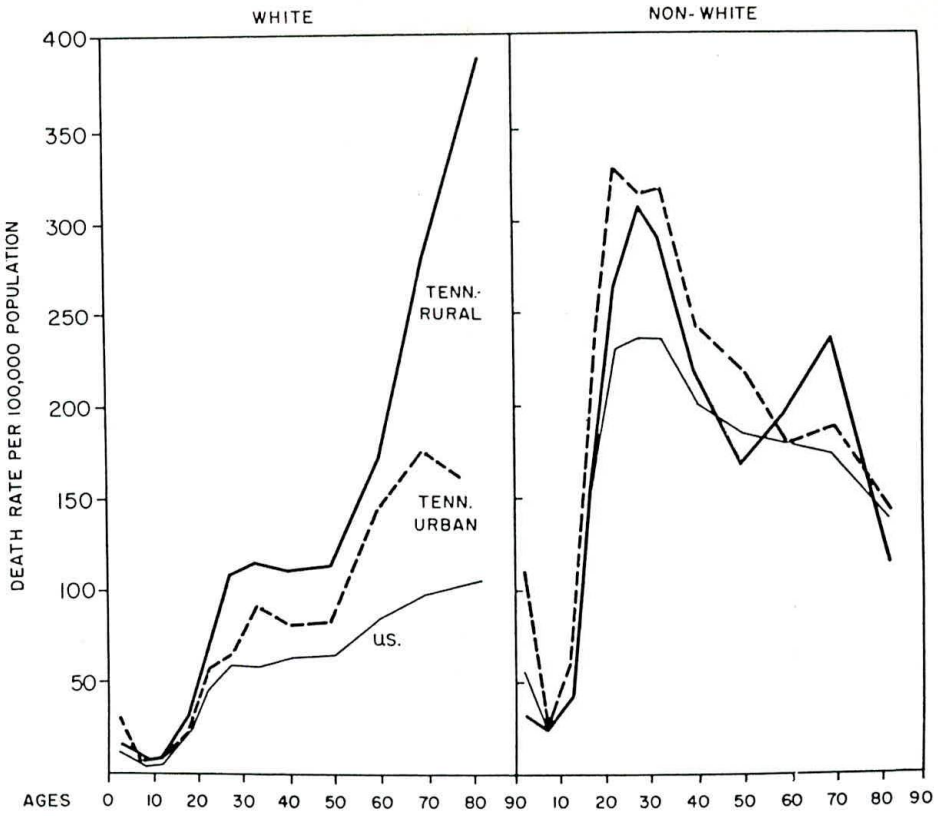

FIG. 1. Resident tuberculosis death rates by race and age group: average for 1933–1935 in rural and urban Tennessee, and in the United States in 1934.

that would have been available during the illness of the deceased.[1]

The verbatim statement is repeated here because the plan was followed exactly in the Williamson County Study later on.

Frost also outlined in detail the need to obtain the antecedent history of tuberculosis in present or former household members and to keep an exact record of duration and intimacy of contact. In addition, he recommended that economic, social, and industrial histories of the tuberculous patient be obtained. The clinical status and progress of disease were to be recorded. He listed the information it would be desirable to have for each household contact, and suggested the follow-up intervals for continued observation of the contacts. He also emphasized the importance of studying a group of control households for comparison with the tuberculosis households, and of tuberculin surveys in school children as a basis for comparison with similar age groups in families with tuberculosis.

In 1930 a second study, in reality more of a survey, was initiated in Kingsport, Sullivan County, Tennessee, with the support of the Rockefeller Foundation, of the International Health Division of which Dr. Frost was one of the scientific directors. The survey included 132 Negro families, almost all such families in Kingsport, whether or not they had a known case of tuberculosis. It was intended as a study to test new methods in the field. Here the modified life-table method was used to describe the risk experienced by contacts of known cases of tuberculosis. This concept is described in the section on Statistical Methodology.

In a letter to Dr. Bishop dated January 12, 1931, Dr. Frost reviewed the work of the Kingsport Study. He appeared pleased that the deficiencies of the Gibson Study had been largely corrected, and he recommended at least one more year of study, to be followed by analysis of the collected data, which he anticipated would require still another year of intensive work by a competent epidemiologist. With all of this, however, he realized that:

> It certainly will not give a final answer to any considerable number of the questions in the epidemiology of tuberculosis, but I am confident that it will give us a better basis for answering a certain number of questions and, in addition to facts

[1] Memorandum by Dr. Bishop of the conference with Dr. Frost.

that are added as a direct result of this study, I think we will have gained a good deal in experience and appreciation of studies of this general kind. I think it is the kind of study to which we must look more and more in the future, and that you are doing an excellent service in pointing the way.[2]

Soon after this letter there appears to have been some serious consideration of a plan to develop still a third study that would embody the lessons learned in Gibson and Sullivan counties, and that would have a longer duration. For the new study certain basic requirements were stated. A county with a full-time health department was considered essential; a stable population, characteristic of Tennessee, numbering about 25,000 people was desirable; and preferably, the county was to be close to Nashville where the consultative services of personnel of Vanderbilt University Medical Center and of the State Department of Public Health would be available. Williamson County fulfilled these requirements.

C. The Williamson County Study

In a long, detailed memorandum dated November 19, 1931, Frost first stated the objectives of the Williamson County Study (*see* the section on Objectives), and spelled out the organization and operation of the study. Much of what he wrote was similar to his recommendations for the Kingsport Study, but now he presented operational plans rather than suggestions. At this early date he still wrote of the first case as the "primary" case. He emphasized the investigation of the evolution of tuberculosis from infection to the development of disease, and a systematic epidemiologic and clinical study of tuberculosis of old age. He advocated setting up the study within the framework of the county health department with resident personnel on hand to carry out the work. He suggested that records of all deaths from tuberculosis and of all known cases be assembled and subjected to statistical study. All of the families of these patients were to be included in the study, with priority of visits given to those families with present cases or recent deaths. He outlined the investigative procedure for household contacts and the development of a family schedule that would record the comings and goings of each family member for the purpose of life-table calculations. It is clear from the memorandum that Frost had a study plan worked out with great precision and in considerable detail. His plan was followed closely in establishing the Williamson County Study, which was activated one month later, in December, 1931.

Following his analysis of the Kingsport Study data (1), Frost saw the need for establishing a substitute for the "primary" case. His development of the "index" case concept is described in the section on Statistical Methodology.

In the early planning of the Williamson County Study a decision was made to use the Opie classification for pulmonary tuberculosis (2) because his system seemed to be best suited to the study's needs in this regard. Dr. Opie served as consultant, and his schema for the graphic presentation of a household's experience with tuberculosis was later adopted. This schema proved to be most useful to the study personnel.

The Rockefeller Foundation, through its International Health Division, having supported the Kingsport Study, now undertook the partial support of the Williamson County Study, and continued its contributions without interruption throughout the 24 years during which the study actively collected data. The Foundation also rendered invaluable professional services to the study through periodic consultation of its expert personnel with the study personnel. The magnificent financial and professional contributions of the Rockefeller Foundation cannot be overestimated, and this opportunity is taken to express the gratitude of the Tennessee Department of Public Health.

At the time of its inception, and for about eight years after, the Williamson County Study operated without the benefit of county or state tuberculosis hospital beds for its patients. Furthermore, specific antituberculosis therapy was still a dream in 1931 and did not become a reality until about 17 years later. During the early years of the study, therefore, it was possible to observe the natural history of tuberculosis uninfluenced, in general, by man-made forces for the prevention and control of the disease.

As time went on, the focus of the study changed somewhat. Although no definite time limit was set, some of the forms that were devised and used allotted space for recording only five years of collected data. The Rockefeller Foundation's support was practically on a year-

[2] Letter to Dr. Bishop dated July 12, 1931.

to-year basis but, when it became apparent that Frost's concept of the "longitudinal section" of study of a chronic disease was sound and fruitful, the period of the study was extended again and again until it covered 24 years. The findings were reported in 19 papers and two books (3–23). The termination of the study at the end of 1955 was a painful decision, but it was based on the marked decline in the number of new cases in the community and households.

The longitudinal study of tuberculosis destroyed one concept and established another in its place. It was generally believed in the past that it was not necessary to observe tuberculosis contacts for more than two years after contact was broken because, if they did not develop the disease in that time, they were not apt to later. The study showed this concept to be in error. It will be demonstrated below during the presentation of the data that the interval between exposure and onset of disease is governed by factors that are not limited by temporal considerations except as they affect the age of the contact. The study demonstrated the need for prolonged observation of contacts through "critical" ages of life.

Rather early in the study, when the first analysis was made of tuberculin reactions and pulmonary calcification (5), another "sacred cow" was destroyed. It was shown that calcification was as often associated with tuberculin nonreactors as with reactors. The true meaning of this development was not understood at the time, but it became apparent when Christie and Peterson demonstrated the association of pulmonary calcification and histoplasmin sensitivity (24). Their discovery then led to the incorporation of histoplasmosis studies in the Tuberculosis Study (25–35). Two other developments stemmed from the unexpected finding of tuberculin-negative pulmonary calcification. One was the alteration of the Opie classification by the abandonment of "latent childhood tuberculosis" as the designation of uncomplicated pulmonary calcification. The other result, perhaps more significant, was the use of "blind" studies to evaluate the relationship of the tuberculin reaction and the presence of calcium in the lungs. Although this may not have been the first "blind" study, it was certainly among the early ones, and deserves mention as an established epidemiologic method of study.

Another epidemiologic concept that was emphasized, although it was not originated in the study, was the principle that factors influencing the occurrence of a communicable disease may operate long before any contact is established. In her analyses of the study data, Dr. Ruth R. Puffer showed that there was a familial susceptibility to tuberculosis apart from familial contact (22). She cited the original sources of this concept in her book, and showed how it was applied to the study data. In a sense this goes beyond Frost's treatment of antecedent history, since he was most concerned with historical evidence of past contact with tuberculosis. The familial susceptibility is based on heredo-constitutional factors that may operate to increase the risk of disease wholly apart from the influence of contact on such risk.

Over the years there were many changes in the personnel of the study. Considering the span of time, there was remarkably little turnover in some of the key personnel. Dr. Bishop was followed as Commissioner by Dr. W. Carter Williams, who was succeeded by Dr. R. H. Hutcheson, the incumbent. All maintained a keen interest in the details of operation and in accomplishments of the study, while they made sure that there were sufficient state appropriations for its support. Dr. Frost served as consultant epidemiologist until his untimely death in 1938. He paid many visits to Williamson County, and participated directly in the collection and analysis of data. He was succeeded by Dr. James A. Doull, who served from 1940 to 1949. Dr. R. S. Gass, the clinical consultant, was with the study through its entire life. Dr. Ruth R. Puffer served as statistician and consultant for all but the last few years of the study. The first epidemiologist, the late Dr. H. C. Stewart, functioned in that capacity for a total of 15 years, although not consecutively. Miss Ann Dillon was statistician for 14 years, then succeeded Dr. Puffer as consultant when the latter left to take up new duties with the World Health Organization. There were many others, public health nurses, technicians, secretarial and clerical personnel, who served the study devotedly for many years. Two of the nurses, Mrs. Condon W. Taylor and Miss Zetta Comer, were on the study staff for the entire period. An incomplete listing of the professional personnel is appended below. A complete listing would require a research project of unwarranted magnitude, ne-

cessitating a painstaking search of the files of the State Personnel Office. Omissions are not intentional, but are rather the result of blunted memory. The accomplishments of the study are a tribute to all of these people. The final salute belongs to the people of Williamson County whose cooperation was far beyond normal expectations.

Commissioners of Health

*Dr. E. L. Bishop
Dr. W. C. Williams
Dr. R. H. Hutcheson

Consultant Epidemiologists

*Dr. Wade H. Frost
Dr. Kenneth F. Maxcy
Dr. James A. Doull

Consultant Clinician

*Dr. R. S. Gass

Consultant Statisticians

Dr. R. R. Puffer
Ann Dillon

Directors of Division of Preventable Diseases

Dr. James A. Crabtree
*Dr. Crit Pharris
Dr. C. B. Tucker

*Deceased

Rockefeller Foundation Consultants

Dr. John Farrell
Dr. Eugene L. Opie
*Col. Fred Russell
Dr. George K. Strode
Dr. Hugh H. Smith

Epidemiologists

Dr. Jesse Ellington (Kinsgport Study)
*Dr. H. C. Stewart
Dr. R. L. Gauld
Dr.William J. Murphy
Dr. C. W. Wells
Dr. L. D. Zeidberg

Clinicians

Dr. William D. Hickerson
*Dr. Virginia Hickerson
Dr. E. F. Harrison
Dr. John Cunningham

Description of Williamson County

Williamson County is a rural, agricultural area of 593 square miles in the central part of Tennessee. About 350,000 acres (84 per cent of the land area) are devoted to farms. The population is largely native-born; many of the families date their residence from the first settlement of this section in about 1785. The county was organized in 1799 and named for the Williamson family. The county seat, Franklin, honored the name of Benjamin Franklin.

The population of the county has followed the trend of most agricultural areas. It has been decreasing slowly over the years from 26,321 in 1890 to 24,307 in 1950. The town of Franklin has grown in population to a small degree and numbered 5,475 inhabitants in the 1950 census. Negroes comprise approximately 22 per cent of the county population.

Tobacco and crop farming were the principal sources of farm income in the past, but in recent years dairy and cattle farming have become important. Tobacco is still the chief cash crop.

The town of Franklin has several relatively small industries. The largest of these, a stove factory, employed about 200 men.[3] In 1950 the effective buying income of the people of Williamson County was $622 per capita, compared with the statewide average of $874.

In the past, more than 20 physicians practiced in Williamson County. Although the largest number of them was concentrated in Franklin, practitioners were located in many areas of the county. The trend has been toward a decrease in the number of physicians, and almost all are in Franklin. However, good roads and a bus line from Franklin to Nashville, 18 miles distant, bring the medical facilities of the city within reach of Williamson County residents.

Three small private hospitals with a combined capacity of 40 to 50 beds were owned and operated by local physicians until recently, when a modern 50-bed county hospital was constructed.

The Williamson County Health Department is the third oldest full-time local health department in the state, having been activated in 1921. Until a few years ago it had a full-time health officer, but is currently operating with part-time services. The staff included a nurse supervisor and eight public health nurses at the height of

[3] This factory was closed recently.

the study activity, but normally includes five nurses including the supervisor. A sanitarian, typist, and clerk round out the staff. The Health Center in which they serve is a recently constructed building adjacent to the new county hospital.

Definitions

For the sake of clarity and to avoid misunderstanding, the following terms used in the study are defined:

Index case: The index case is the person with known or suspected tuberculosis in a household, who first came to the attention of the study and motivated the investigation of that household. This does not imply that the index case was the first to have occurred in that household, nor that it was the only one present at the time of discovery. The use of "case" is deplored in many quarters because it is an inanimate term. However, as used herein, "index case" designates a person and the term has now been used and accepted to such an extent that to abandon it would be to complicate greatly the presentation of study material and the discussion that follows it.

Prevalence case: A prevalence case is a household associate of an index case who was found to have latent apical or manifest tuberculosis on first examination within the period from six months prior to six months after the opening of the household for investigation. In analyses of the study published previously, the latent apical cases were presented separately from the manifest.

Incidence or "new" case: A household associate of an index case who developed latent apical or manifest tuberculosis under observation. Latent apical cases were not classified as "new" in previous analyses because their onset could not be determined, due to the absence of symptoms and signs. Their inclusion in the present analysis is based on the observation that many of them became manifest eventually and, when they did, a problem of classification arose. To call them "new" cases at that time would have appeared to ignore the knowledge that roentgenologically demonstrable disease had existed previously. The combination of latent apical and manifest cases in the present analysis produced results that differed from previously published study data. Because of the much greater frequency of latent apical cases among whites compared with that among nonwhites in the study, differences in attack rates between the two races are washed out to some degree. When comparisons in the past showed significantly higher attack rates in nonwhite households with sputum positive for *M. tuberculosis* compared with the rates in whites, the current analysis reveals differences that are only of borderline significance.

Household: A household is an aggregation of individuals, usually but not necessarily with blood or legal ties, who occupy a dwelling unit.

Household member: A household member is an individual who lives and sleeps in a household unit and shares a common table with other members of the household.

Household associate: A household associate is a household member other than the index case who was in the household with the index case at the time of his illness.

Close relative: A close relative is a parent, sibling, or child of an index case.

Other member: All other household members who are not close relatives of an index case are classified as "other members." This group includes more distant relatives, such as grandparents, grandchildren, aunts, uncles, cousins, et cetera, of an index case; relatives by marriage such as a spouse and "in-laws"; and others who have no relationship to the index case at all. It is a very heterogeneous group.

Prevalence: As used in the study, prevalence is always spoken of in connection with "prevalence of infection" or "prevalence of disease." It refers to the proportion of persons who have either condition at a given moment of time. The lapse of time, such as is required in defining a rate, is not inherent in the meaning of the term prevalence. It is not a rate, but a ratio. Because tuberculosis is a chronic disease that frequently has an insidious onset, infection or disease that was present six months before or six months after the household was first investigated was classified as "prevalent" for the purposes of the study, unless more precise information was available.

Incidence: Prevalence and incidence often appear in medical literature as synonymous terms, but they are not. Incidence is a rate of occurrence of some specific event among a specified population in a stated period (per year, month, day, week, hour, et cetera).

Person-year: One person observed for one year or two persons observed for one-half year each constitute one person-year; one person observed for five years has five person-years of experience, et cetera. It is a convenient device for taking account of the time element in a chronic disease of a sometimes long and variable incubation period.

"Sputum-positive" household: A household in which the index case has or has had sputum positive for tubercle bacilli at some time during the period of observation. Households in which the index case died before investigation are also included in this category.

Other-than-"sputum-positive" household: A household in which the index case has never had tubercle bacilli in the sputum, or one in which the index case has not had sputum examined. In 47 white and eight nonwhite households, the index case started out with a noninfectious sputum, but it later became infectious. The household was then reclassified as of the date of the finding that the sputum contained tubercle bacilli and the house-

hold experience was grouped with that of the infectious households.

Classification of tuberculosis: The classification used in the study is the one proposed by Opie (2). The Opie schema fits into the official classification of the National Tuberculosis Association as set forth in its publication *Diagnostic Standards and Classification of Tuberculosis*, 1931 edition, but it also differentiates "manifest" and "latent" disease. Manifest tuberculosis denotes evidence of disease by history and physical examination and includes manifest childhood tuberculosis. Although presumably no other confirmatory evidence is required, in actual practice roentgenographic confirmation was obtained in all but a few patients who were too ill to have chest films or who died. Latent apical tuberculosis indicates roentgenographic lesions usually—but not exclusively—limited to the apical regions of the lungs, without associated history, symptoms, or physical signs that could be considered characteristic of tuberculosis. Activity of the disease is neither inherent nor implied in the Opie terminology of manifest and latent apical disease. It is possible for manifest disease to be inactive, and active latent apical disease is conceivable, although it may be rare. Opie also describes latent childhood tuberculosis which denotes a lesion of the first infection type demonstrable roentgenographically, but without symptoms or physical signs. In the beginning of the study a diagnosis of latent childhood tuberculosis was made with great frequency because of the high prevalence of pulmonary calcifications in this area. Later, when it was shown that such calcification is often associated with a negative tuberculin reaction, the diagnosis was seldom made. Subsequently, it was shown that many of these calcifications were probably the result of histoplasmal infections.

Clinical Classification of Opie

Latent tuberculosis:

A. Latent tuberculosis with hypersensitiveness to tuberculin demonstrated by the intracutaneous test, but with no lesions of the lungs demonstrable by roentgenographic examination
B. Calcified nodules in the lung
C. Latent infiltration of childhood type:
   (a) Soft or flocculent (potentially progressive)
   (b) Strandlike (healed)
D. Tuberculosis of tracheobronchial lymph nodes:
   (a) Calcified
   (b) Massive caseous
E. Latent apical tuberculosis (adult type of latent tuberculosis):
   (a) Supraclavicular (see further subdivision)
   (b) Supra- and infraclavicular (see further subdivision)

Manifest tuberculosis:

F. Manifest pulmonary tuberculosis with sputum negative for tubercle bacilli:
   (a) Childhood type (primary type)
   (b) Adult type (reinfection)
G. Manifest pulmonary tuberculosis with tubercle bacilli in sputum:
   (a) Childhood type
   (b) Adult type
H. Tuberculosis of organs other than the lungs
I. Suspected tuberculosis
J. Miliary tuberculosis

Latent apical tuberculous lesions should be classified as follows:

I. Scant apical lesions indicated by salients or spots below the margin of the second rib
II. Apical lesions extending over half or more of the space above the clavicle
III. Lesions above and below the clavicle of the extent designated by the *Standards of the American Sanatorium Association* as minimal (but with no symptoms or physical signs significant of tuberculosis)

Stage of tuberculosis: The classification proposed by the National Tuberculosis Association in its publication *Diagnostic Standards and Classification of Tuberculosis* (1931 edition) is used.

Statistical Methodology

The story of Dr. Wade Hampton Frost's interest and participation in the study has been told in the Introduction. Dr. Kenneth F. Maxcy, as editor of a collection of Frost's papers published posthumously (36), describes him as the man who made the transition from descriptive to analytical epidemiology. To meet the needs of the new approach, he needed to find, adapt, or develop new analytical methods.

Frost's previous experience had been chiefly in the epidemiologic study of acute infectious diseases. When confronted with the special problems inherent in the study of a chronic disease, he realized that methods would have to be changed. He said that "... studies of tuberculosis must be carried out in *longitudinal section* rather than *cross section* as are studies of acute infections." It was necessary to develop a method, comparable to Chapin's secondary attack rate for acute infectious diseases, that would express the risk to associates of persons with tuberculosis. Such expression of risk could then be compared with the experience of persons in a control population. However, whereas in an acute disease the issue may be settled within a few days or weeks, for tuberculosis it may not be resolved for years. Frost stated that "... observation of the exposed group must extend

over a sufficient number of years to define the rates of morbidity and mortality prevailing in successive periods throughout the usual span of life" (1).

Person-years concept and the life-table method: In order to take account of the time factor, Frost modified methods he found in papers by Elderton and Perry on mortality of people treated in sanatoriums (37), and particularly in Weinberg's report of his study of mortality of children born of tuberculous parents (38). Guided by these he developed a modification of life-table construction which allowed him to define risk and experience in terms of "person-years." He used this method in the Kingsport Study to calculate age-specific mortality rates for comparison with rates in the general population (1). The method was later utilized in the Williamson County Study, in which its application to the analysis of retrospective data (4), course of disease (7), and observational morbidity and mortality data (10) was described. Of course the method has been used throughout the final analysis of the data presented in this paper.

In order to obtain the data required for the application of this method, it was necessary to know the date of establishment of the household, the former members present before the date of investigation but not currently in the household, and retrospective historic data concerning the occurrence of tuberculosis and deaths from the disease among former household members. Special forms were therefore devised; they were tested in the Kingsport Study, modified as indicated, and then used throughout the Williamson County Study, with other modifications that became necessary. The special forms were used for recording the information listed above. Reproductions of the forms used in this study are shown in the Appendix, pages 42–51.

Concept of the index case: The onset of a disease like tuberculosis is difficult to pinpoint because symptoms may be vague or altogether absent for a considerable period of time following the development of a lesion. It is often impossible, therefore, to determine the "primary" case of tuberculosis in a household in which more than one case has occurred. The *first* person in a household who comes to the attention of medical or health authorities because of tuberculosis is a definite entity, around which the experience of other household members can be observed. Frost designated such an individual the "index" case because the discovery of this person led to the investigation of his household associates. The index case may or may not be the very first person with tuberculosis in a specific household, but it is the first known to the investigator. Often, investigation turns up other diseased persons in the same household, and it may be impossible to establish the chronology or sequence of disease occurrence, and therefore impossible to designate the "source" case. Without a primary case it is not proper to speak of "secondary cases" or "secondary attack rates" in the sense used by Chapin in his studies of acute communicable diseases. Furthermore, by using the index case to identify the people at risk, the whole universe of such people is included. This would not be true in those instances in which a "primary" case of tuberculosis had died and no current case of the disease was present.

The index case becomes the pivotal or focal person in a household, the frame of reference, so to speak. Everything of epidemiologic import that happens in the household is related to the date of investigation of the household (which coincides closely with the date of discovery of the index case). The individual members of the household are identified in terms of their relationship to the head of the household and to the index case. Antecedent experience is measured back in time from the date of investigation. Prevalence data are related to the date of investigation, and observational or incidence data start with that date.

The use of the index case served another, more subtle, purpose. The Kingsport Study showed up a hidden bias or "joker," as Frost liked to designate it. When a comparison was made of antecedent mortality in the study households and in the control population, the former group unexpectedly showed lower rates for the ages 20 to 49 years. The "joker" was discovered by Frost who showed that in the study households the antecedent history was given usually by a parent who had been present at the time of establishment of the household, and was obviously alive. In the control families, however, the "informant" was not necessarily a parent, but was occasionally a survivor of a family that was broken by the death of a parent. This situation tended to swell the antecedent mortality rates in the control families. By eliminating the adult informant from the study household population

at risk, the adjusted rates came into line with the expected rates.

By casting the index case in the role of the excluded "informant," bias in the calculation of antecedent mortality was eliminated. Frost also pointed out that the index case, since he already had tuberculosis, should also be eliminated from any calculation of future risk of morbidity and mortality; otherwise, bias in the direction of increasing the rates would be introduced. By the ingenious development of his concept of the index case, Frost was able to overcome several serious methodologic obstacles to the epidemiologic study of chronic disease.

The use of the index case in the present study was described in two early papers that reported on study findings (4, 11).

Although both the index case and modified life-table concepts were developed and tested to some degree before the Williamson County Tuberculosis Study was initiated, their full utilization and exploitation were not achieved until Frost, as consultant to the study, built them into its program and personally observed their application to the longitudinal study of the chronic, infectious, communicable disease, tuberculosis.

Objectives

In the initial planning of the study, five general objectives were stated:

1. The systematic study of the familial incidence of tuberculosis
2. Investigation into the factors and circumstances related to the "breakdown" of an individual with the adult type of tuberculosis
3. Investigation into the evolution of tuberculous infection in childhood, especially of children who are in close contact with a tuberculous parent
4. An epidemiologic and clinical study of tuberculosis of old age
5. The development of a program of tuberculosis control designed to have practical state-wide application.

As the study developed, more emphasis was placed on the epidemiologic aspects of tuberculosis and less on its pathogenesis and clinical features. The latter were by no means neglected, but the total lack of adequate hospital facilities in the early part of the study and the shortage of hospital beds later on considerably hampered the originally intended clinical investigations.

The emphasis on the epidemiology of tuberculosis was clearly indicated five years after the study began in a memorandum by Dr. Wade Hampton Frost on December 28, 1936. Dr. Frost posed the following questions, which have become the heart of the study:

> Given a case of tuberculosis of designated clinical type brought to the attention of the clinic because of known or suspected tuberculosis (not because of discovery in the course of examination of a known contact):
>
> 1. What may one expect to find in the household associates of this individual examined at this time with respect to: frequency of infection as demonstrated by the tuberculin test; frequency of tuberculous lesions of various kinds as demonstrated by physical and x-ray examination?
> 2. What may one expect to find in the antecedent history of this household with respect to the rate of occurrence of: manifest tuberculosis; death from tuberculosis; death from other causes?
> 3. What may one expect to find in subsequent years with respect to the rate of: occurrence of manifest tuberculosis; mortality from this cause and from other causes?

Much of the material that has been reported in the past, and that will be presented here, actually contains answers to these questions.

Plan of the Study

The study was concerned with the experience of people as members of a household in which they were exposed to an individual with known tuberculosis, who was termed the "index case." The study was planned on a household, rather than on a familial basis, because it was believed that the inclusion of *all* household associates of a known tuberculous individual would provide information concerning their relative risk of developing the disease when the exposure factor was held more or less constant while relationship to the index case varied.

Source of cases: At the outset the households of all reported cases of tuberculosis carried on the register of the Williamson County Health Department, as well as the households of all those reported to have died of tuberculosis during the preceding five years, were included in the study. This plan produced an immediate large body of households for investigation and observation. As new cases of tuberculosis were discovered in the community, they and their households were added to the study group. In addition, known tuberculous persons who moved into the county were taken up for study.

New cases of tuberculosis became known to the study in any one of a number of ways. Many were referred by local physicians who had established a diagnosis, or suspected the presence of the disease. Others presented themselves to the study for roentgenographic examination either because they had symptoms, because they were motivated by health education activities even though they had no symptoms, or because they were required by regulation to have periodic chest films in order to qualify for positions (teachers, food handlers).

In the beginning, people with tuberculosis, whether the disease was active or inactive, were accepted by the study as index cases and their households were brought under investigation. In time, however, it was deemed advisable, because of the great load carried by the study staff, to limit acquisition of new households to those of persons with active, manifest tuberculosis. It was believed that this change would in no way alter the achievement of the original objectives, since inactive cases ordinarily would not be expected to give rise to other cases.

Initial investigation of the household: As soon as possible after the index case was discovered, the study epidemiologist and a public health nurse visited the patient's household. At this visit, in addition to the usual public health services rendered to a tuberculous patient and his family, the collection of study data began. A roster of current members of the household was recorded on Form 981 (Appendix, p. 42) which included, besides identifying data for each individual and his relationship to the head of the household, information concerning the date of establishment of the household, date of investigation, and date and result of the first examination of each person. Although, in the actual analysis of data, relationship was always classified with the index case as the point of reference, on the roster, relationship referred to the head of the household because his was the more stable position in the household. Relationship to the index case could then be determined from the recorded data. The current household roster form was subsequently used for periodic household checks (*see* below). A second form that was completed on the first investigation of a new household recorded information concerning former members of the household living elsewhere or dead (Form 982, Appendix, p. 43). Included were all members who had ever lived in the household at any time since its establishment, but who had moved or died before the household was opened for investigation. Here again, identifying data for each former household member were listed, together with information concerning the date and length of residence in the household, history of tuberculosis and date, current address if living, or cause and date of death if deceased. A third form (Number 983, Appendix, p. 44) completed at this time was the Environmental Record. This was a record of the socioeconomic and environmental hygienic status of the household, and included information concerning the type of dwelling, ownership or rental status; type of community; number of people in the dwelling, number of rooms, number of sleeping rooms, number of beds, and the sleeping arrangements; source and type of water supply, bathroom and toilet facilities; condition of screening if present; source of milk supply, whether pasteurized or not, and quantity consumed daily; tuberculin status of cows; evaluation of personal hygiene of household members; and summary of former residences in comparison with present quarters.

At the initial investigation of the household, arrangements were made for the examination of all household members. The head of the household was urged to bring all members to the study offices, located in the county Health Center, where chest films could be taken and examinations and tuberculin skin tests could be performed. Records of examinations were made on Forms 984 to 987 (Appendix, pp. 45–50). The initial examination of all household members soon after the discovery of the index case was of course essential in order to establish the baseline status of the household with respect to tuberculous infection and disease. In this way a large body of prevalence data was accumulated. These will be presented in a following section.

Continued observation of the household: At yearly intervals after a household was brought under investigation, the public health nurse visited to check the household roster. (When an active case of tuberculosis was present, the nurse visited the patient quite frequently; but for the purposes of the roster check she made a special annual visit.) The nurse carried her own record of the roster for reference, and recorded removals from or additions to the household since the previous check, with dates. Because the experience of household members was to be counted only during their residence in the household, it was essential to have precise dates (month and year) of removal or entry.

At the time of the household check the nurse inquired concerning the health of each member during the preceding year, recorded any reported illness by code on Form 988 (Appendix, p. 51), and wrote a note on the Nursing Notes sheet in the person's record (Form 987, Appendix, p. 50). At this time she also reminded the household members that they were due to return to the study offices for their periodic check which included at least a chest film, and at times a Mantoux test. White household associates less than five years of age were re-examined every six months, and adults were examined at yearly intervals. At first this plan was followed for nonwhite associates also, but later they were re-examined roentgenographically at six-month intervals regardless of age, because it had been found that, if there was a longer interval, some developed tuberculosis and progressed rapidly to an advanced stage before they were discovered.

Households continued to be observed periodi-

cally as long as the members remained a fairly intact unit and continued to reside in the county. Individual members were observed only during their residence in the household. If they removed, they were dropped from observation for the purposes of the study even though they might continue to live in the county. If they returned to the household at any time, observation was resumed as of the date of re-entry. Similarly, if a household removed from the county, observation was discontinued, but if and when it returned, observation was resumed. In some instances households became fragmented through marriage and removal of children after parents had died, so that the family ceased to exist as an integral unit. In such circumstances it was deemed profitless to attempt to follow all the separate splinters of a former household, and all the members were dropped from observation with the exception of the index case, if still living.

In time, as observation of household members continued over the years, new cases of tuberculosis developed among them. Some improved and achieved inactive status, others progressed to more advanced stages of the disease, and some died. These experiences form the basis of the incidence studies to be presented later.

In a community that is predominantly rural and agrarian, but in which approximately one-fourth of the population lives in a rural town, it is difficult to apply standards or criteria with which to measure the socioeconomic status. Nutrition is of recognized importance as a factor in tuberculosis. Poverty and malnutrition may be synonymous in urban environments, but such a relationship will not necessarily hold in an agrarian economy in which many of the people raise their own food and do not need much cash to supply this necessity. At the outset, therefore, one may question the importance of the socioeconomic factors in determining the occurrence of tuberculosis in a rural society. However, much has been written about this factor, and to neglect it entirely in a study of this kind is to court valid criticism. Besides, poverty means other things in addition to malnutrition, such as delayed and inadequate medical care, crowding, poor education and hygiene, inadequate rest and recreation, and so forth. It was deemed advisable, therefore, to investigate the influence of the socioeconomic factor in this study, recognizing meanwhile that it would be difficult to establish universally acceptable criteria for evaluating the socioeconomic status of the study households.

It was decided to set up only three major socioeconomic classifications, i.e., upper, middle, and lower. When each household was originally opened for investigation, an Environmental Record (Form 983) was completed by the epidemiologist, as described on page 10 of the text. Information was taken from this form, coded, weighted, and scored. The total score determined the classification according to standards that were set up arbitrarily by the study after consultation with a number of responsible people in the community and after deliberation by the study staff. No effort was made to devise standards for general use in other communities. The study was concerned only with the local situation, and attempted to determine what standards applied in the county. The following is an itemization of the various attributes considered, together with the score given each variant:

Item	Variant	Score
Rooms per person	2 or more	1
	1.0 to 1.9	2
	Less than 1	3
Persons per bed	Less than 2	1
	2	2
	More than 2	3
Persons per bedroom	2	1
	2.1 to 2.9	2
	3 or more	3
Water supply	In the house	1
	Outside—near house	2
	Outside—distant	3
Toilet facilities	Water closet in house	1
	Sanitary privy	2
	Open privy	3
	None	4
Bathing facilities	Present in house	1
	None in house	3
Screening	Good	1
	Defective	2
	None	3
Classification		
Upper socioeconomic class—town		7–8
rural		7–9
Middle socioeconomic class—town		9–14
rural		10–15
Lower socioeconomic class—town		15+
rural		16+

The same standards were used for both white and nonwhite households.

Composition of the Study Group

During the 24 years of the study, 828 households (680 white and 148 Negro) were under observation for periods of time ranging from a few months to the entire 24 years. In these households during this time there were 4,214 persons other than index cases (3,446 white and 768 Negro), distributed by age, sex, and race, as shown

in table 1. There were 110 more males than females in the white households, while in the Negro households there was an equal distribution by sex.

Household members were under observation for a total of 32,175.25 person-years, or an average of 7.6 years per person. The average length of observation was similar for whites and nonwhites, and the range was from a few months to the entire 24 years of the study. The distribution of the experience of household associates of the index case is shown in Table I[4] by age, sex, race, and relationship to the index case. Males contributed proportionately more to the total experience than females, particularly among the whites.

A comparison of the age, sex, and race distribution of the Williamson County population (estimated as of January 1, 1944, the mid-period of the study) and the household associates population is shown in Table II. In the households 81.8 per cent were white, while in the county the whites comprised 78.2 per cent of the population. The households had slightly more males, 51.8 per cent compared with 50.3 per cent in the county population. In both the white and Negro households there were comparatively fewer subjects less than five years of age, and more in the age group of 55 years and older than in the county population.

The average number of subjects in association with the index case at one time or another in each household was quite the same for both races (5.1 for white and 5.2 for nonwhite).

The study households were divided socioeconomically as follows (a few households could not be classified because of insufficient information):

White			*Negro*		
	Number	Per Cent		Number	Per Cent
Upper	68	10.2	Upper	2	1.4
Middle	294	44.2	Middle	56	38.1
Lower	304	45.6	Lower	89	60.5
Total	666	100.0	Total	147	100.0

Results

Earlier results of the study have been reported in nineteen papers and two books. A list of these will be found in the references. The present report generally covers the same material that has been presented in the past, but much of it now has the complete data for the 24 years. In some instances the material is handled differently than it was when originally reported. A few of the present analyses have never been reported before. Some previously published data are included as originally reported for the sake of completeness and because nothing new could be added by the inclusion of relatively meager later data.

In the presentation of the study data, findings are considered not significant if observed differences are less than twice their standard errors; of borderline significance if the difference is between 2.0 and 2.4 times its standard error; and significant if the difference is as much as or greater than 2.5 times its standard error.

Whenever feasible, observed rates were adjusted by using the age and sex distribution of the total household population as standard.

Household Studies

In an effort to answer the questions posed by Frost, the study material will be presented under the headings of "Antecedent History," "Prevalence Data," "Attack Rates," and "Death Rates."

Antecedent History

Historic data obtained from lay people are notoriously unreliable in most circumstances, and there is understandable hesitancy in attaching much validity to them. Special effort was made in the study, therefore, to substantiate the history of tuberculosis or death from the disease by recourse to existing official and nonofficial records and by a search of the memory and files of the local practicing physicians. In a small, relatively stable community such as Williamson County, the personal history of its inhabitants is generally pretty well known. Physicians have treated several generations of the same family in many instances. Records of vital statistics are frequently kept in the family Bible. From all of these sources, sufficient verification of historic data was obtained to allow the study personnel to place more confidence in this material than might ordinarily be accorded to it. That this confidence was not misplaced may be inferred from a comparison of historic and observational data in a previously reported analysis of the experience of children of an infectious parent (21).

By the application of life-table methods, the annual and cumulated morbidity and mortality from tuberculosis in study households of white persons was calculated for the ten years preceding the onset of disease in the index case, for the year of onset, and for the ten subsequent years. The results of the analyses are shown in Tables III and IV. These data were reported early in

[4] All tables with roman numerals are appendix tables.

TABLE 1

DISTRIBUTION OF HOUSEHOLD ASSOCIATES OF INDEX CASES BY AGE*, SEX, AND RACE
Williamson County, Tennessee, 1931–1955

Age Group	Total			White			Nonwhite		
	Total	Male	Female	Total	Male	Female	Total	Male	Female
Total	4,214	2,162	2,052	3,446	1,778	1,668	768	384	384
<5	743	366	377	613	298	315	130	68	62
5–14	1,003	553	450	808	448	360	195	105	90
15–24	845	416	429	687	333	354	158	83	75
25–34	455	245	210	374	206	168	81	39	42
35–44	372	196	176	305	166	139	67	30	37
45–54	282	139	143	236	119	117	46	20	26
55–64	245	121	124	193	96	97	52	25	27
65–74	173	80	93	143	68	75	30	12	18
75+	93	44	49	84	42	42	9	2	7
Unknown	3	2	1	3	2	1	—	—	—

* Age at beginning of observation.

the history of the study (4), but they include a rather large portion of the total study population because the greatest accumulation of households and individuals occurred at the beginning of the study, as described above. Actually involved were 468 index cases, 1,965 household associates present at the first investigation of the households, 777 former household contacts who were still alive at the time of first investigation but were living elsewhere, and 427 former contacts who had died before their households were brought under observation. These household associates contributed 16,928.25 person-years of experience. For both the infectious and other households, there was slightly more tuberculosis morbidity and mortality during the years following the onset of disease in the index case than before. What is of particular importance is the recognition of the fact that the households of the index cases had considerable experience of cases of tuberculosis and resulting deaths well before the discovery of the index case. The data also show the relatively greater risk of disease and death among associates of "sputum-positive," compared with other, index cases.

The antecedent history of 913 known tuberculous subjects revealed that in 63.5 per cent of those less than 45 years of age, and in 52.8 per cent of those more than 45, there had been tuberculosis in parents and/or siblings (16). This offers no surprise since the familial character of the disease had been recognized long before the bacteriologic era of medicine. It is noteworthy, however, that in each group referred to above, more than 22 per cent of the tuberculous subjects who reported familial disease had *not* had household contact with other diseased members of the family. This observation adds weight to the evidence suggesting a familial susceptibility to tuberculosis. This concept was described in the Introduction and developed in a monograph (22).

The foregoing is an anwser to the second question put by Dr. Frost in the memorandum quoted above concerning the antecedent history of tuberculosis in the study households.

Prevalence of Infection

As stated previously in the description of the study plan, it was important to know at the outset how many of the household associates of a newly discovered index case were already infected. Infection was measured by the reaction to the intradermal injection of Old Tuberculin. The tuberculin used throughout the study was from a lot obtained from and standardized by the Phipps Institute in Philadelphia. It was tested from time to time to be sure that it had lost none of its potency. Reactions counted as significant varied with the dosage used. Thus, when 0.01 mg. (1 tuberculin unit) was used, any induration of 5 mm. or more was considered positive. When 0.1 mg. of OT (10 tuberculin units) was used, only induration of 10 mm. or more was deemed significant. Although initially many persons who had negative reactions to 0.01 mg. were

retested with 1.0 mg. of antigen, these results have not been included in the final analysis because of the strong possibility of false positive reactions as shown by Palmer and his associates (39). Not all household associates were tested with tuberculin. However, it was assumed that the experience of the tested subjects was representative of the group.

By the time the index case had been discovered and the household members had been brought under observation, many of them were already infected. Infection appeared to depend on the amount of exposure and on the dosage of organisms. The influence of dosage on the risk of becoming infected is shown in comparing the percentage of reactors in "sputum-positive" and other households (Tables VA and B, VIA and B). When household associates were exposed to a "sputum-positive" index case, 3 of 4 became infected (71.4 per cent for white, and 70.2 per cent for nonwhite associates). On the other hand, when there was exposure to an index case in whom no sputum positive for *M. tuberculosis* had been demonstrated, slightly more than one of every 3 became infected (37.0 per cent for white, and 37.1 per cent for Negro household members). The risk of infection appeared to be almost twice as high in the "sputum-positive" households as in the others (figure 2). Most striking was the extraordinarily high frequency of infection among those less than 15 years of age in the "sputum-positive" households.

The percentage of tuberculin reactors increased with age in both "sputum-positive" and in "other-than-sputum-positive" white and Negro households. For white associates of "sputum-positive" index cases the prevalence of infection ranged from 46.2 per cent in those less than five years of age to 95.0 per cent in those 55 years of age and older. In the Negro households the respective percentages were 52.2 and 100.0. The increase of tuberculin reactors with age is not a manifestation of a greater susceptibility to infection in the older age groups, but is rather an expression of the cumulative effect of long-term exposure to a chronic communicable disease that may be present but undetected for a considerable period of time.

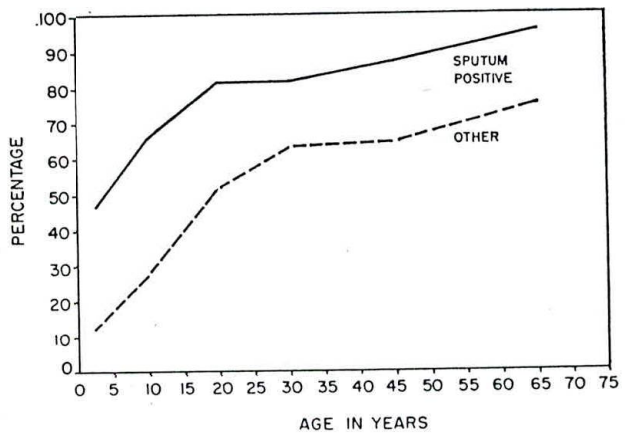

FIG. 2. Prevalence of tuberculous infection in white household associates, by age and sputum status of the index case, Williamson County, Tennessee, 1931–1955.

In a number of households the members were exposed not only to the index case but also to others, the "prevalent" cases, that had not been discovered before the household was opened for investigation. However, multiple exposure to more than one case of tuberculosis apparently had no effect on the prevalence of infection among the household associates. It is shown in Table VII that the adjusted percentage of reactors among those exposed to both index and prevalence cases is almost identical with the percentage among those exposed to an index case only (54.4 and 54.8, respectively).

Apart from the influence of exposure and dosage, infection occurred with equal frequency in males and females, and in white and Negro associates. It is important to bear this in mind, particularly when attack and death rates are considered. Whatever differences may be noted by sex and race in the risk of developing tuberculosis or dying of it, such differences are not based on any dissimilarity in the susceptibility to tuberculous infection.

Relationship to the index case had little influence on the risk of becoming infected. In the white households containing an infectious index case, the percentage of reactors was 73.8 for close relatives compared with 67.6 for other household members. When adjusted for age the difference is of borderline significance, but comparison at each age shows a consistently higher percentage of reactors for close relatives, with but one exception, the 15- to 24-year age group. In all other households, both white and Negro, relationship to the index case did not influence the prevalence of infection among associates.

The socioeconomic status of the households appeared to have a bearing on the frequency of infection only in the white households containing an infectious index case (Table VIII), but not in the others. In the former, the adjusted

percentage of reactors was 65.9 for the upper and middle socioeconomic classes, and 81.5 for the lower socioeconomic classes. Among children less than 15 years of age in the lower class households, 67 per cent were infected compared with 46.0 per cent in the combined upper and middle class households. This age group contributed most heavily to the higher frequency of infection among associates in lower class households.

In *summary*, it may be said that in these tuberculous households there was a high degree of susceptibility to infection that was not significantly influenced by sex, race, or socioeconomic factors. Age was of importance chiefly as a measure of the increasing opportunity to become infected over the years through repeated exposures in the household and in the community. Relationship to the index case appeared to have some significance in the white households containing an infectious index case. The most important factor seemed to be that of exposure within the household to an individual with sputum positive for *M. tuberculosis*. When this occurred, the risk of becoming infected was substantially greater than in a household in which no bacilli had been demonstrated in the sputum of the index case. This might be termed the "dosage factor," but it can be applied only loosely because of difficulty in quantitating it.

Prevalence of Disease

Because of the insidious nature of tuberculosis, undetected cases occur. From a public health standpoint it is extremely important to discover them. For the purposes of the study, their detection was imperative because it was essential to differentiate household members with and without disease in order to establish the identity of the group at risk. In white households 188 cases of previously undetected tuberculosis were found on first examination. In nonwhite households 41 prevalent cases were discovered.

The diagnosis of existing disease at the first investigation of the household depended largely on roentgenographic findings, supported by tuberculin tests and sputum examinations. However, early in the study a few patients were diagnosed on clinical criteria alone because they were too ill to be brought to the X-ray unit, and no portable equipment was available at that time.

Although the objective was to examine every household member, that goal was never achieved. In calculating the prevalence of tuberculosis in the study households a problem arose. If the population denominator was considered to be only those examined, the calculated prevalence was extraordinarily high because the examined group was heavily weighted with subjects who had symptoms. If, on the other hand, the entire household population present on first investigation was used as the denominator, the calculated prevalence was too low because this group included those with undiagnosed, asymptomatic disease who had not been examined physically or roentgenographically. After weighing the problem it was decided to use the whole household population as the denominator because it was believed that under continued observation most if not all of the undetected cases would eventually be discovered. Actually, several persons who had not been examined at the time when their household was first investigated were later discovered to have disease of such character that it was possible for the clinician to estimate its duration and include such cases among the "prevalent" rather than the "new." In the data presented below the whole household population was used as the denominator in calculating the prevalence of disease. This procedure differs from that followed in previously published analyses.

Since disease, when it occurs, must necessarily follow upon infection, parallel prevalence curves might be expected for both were it not for the fact that the interval between the two events may be long and variable in a chronic disease like tuberculosis. It is not surprising to find, therefore, that, although there is a general increase in the prevalence of tuberculosis with age among household associates, just as there was an increase in the percentage of those infected, the two curves are not exactly parallel (figure 3).

As with the prevalence of infection, the "dosage factor" appeared to have some influence on the prevalence of tuberculosis among household associates. In the white "sputum-positive" households 9.8 per cent (adjusted) of the members were found to have tuberculosis on first examination compared with 6.0 per cent in the "other-than-sputum-positive" households (Tables IX*A* and *B*). The difference was significant at the <0.01 level. In general the prevalence of disease tended to rise steadily with age up to 55 years. It was consistently higher at each age,

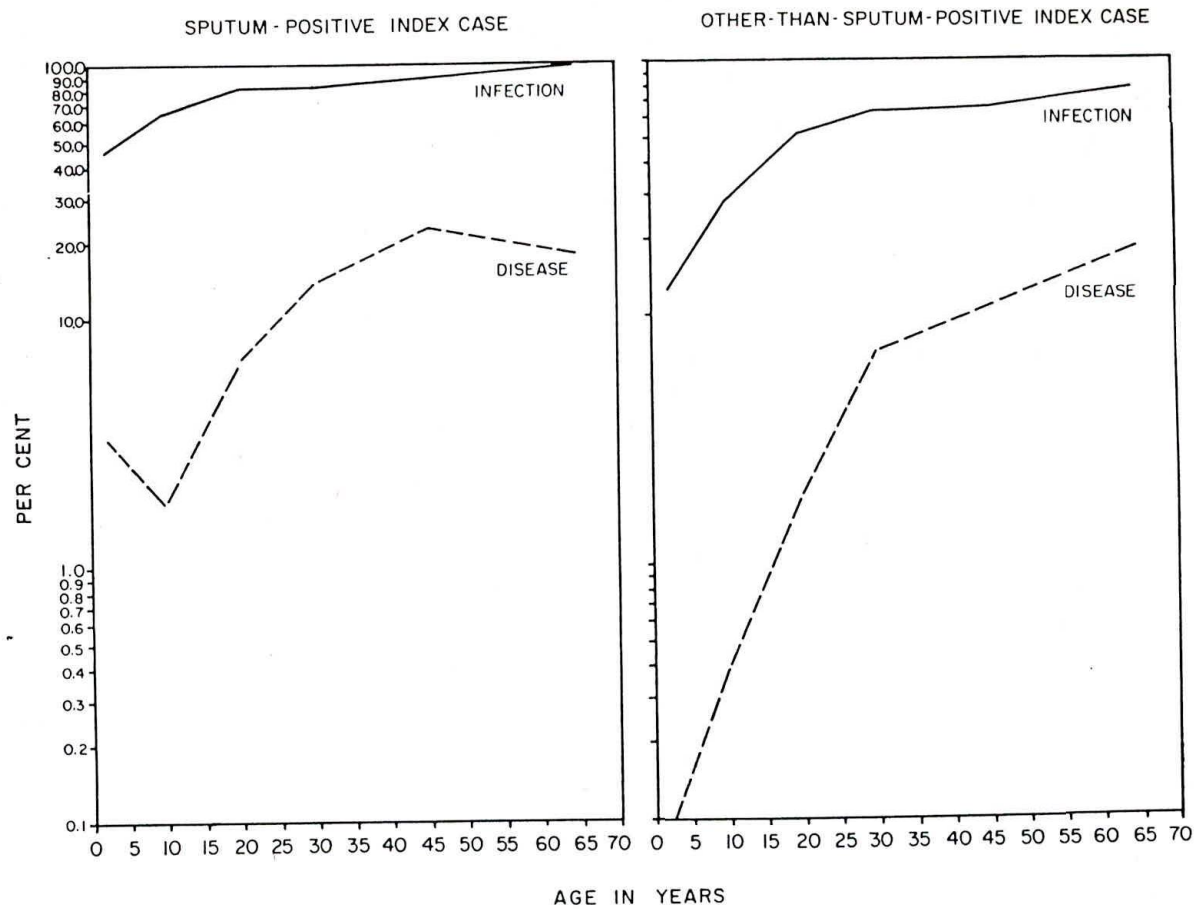

FIG. 3. Prevalence of tuberculous infection and disease among white household associates, by age and by the sputum status of the index case, Williamson County, Tennessee, 1931–1955.

except 55 years of age and older, in the "sputum-positive" households than in the others.

Among Negro associates, the comparison of "sputum-positive" households with other households revealed similar findings to those described for the whites (Tables X*A* and *B*). Prevalence of disease was significantly higher in the "sputum-positive" households than in the others; the levels in the former were consistently higher at each age; and they tended to rise regularly with age. Perhaps the most significant finding was the comparatively high prevalence of disease in Negro associates less than 15 years of age (5.2 per cent) compared with that in white households containing an infectious index case (2.3 per cent). After 15 years there was considerably more disease in the white associates, 15.0 per cent compared with 9.6 per cent in the nonwhite associates.

The higher prevalence of disease in the "sputum-positive" households was not surprising, since in them there was substantially more infection than in other households, and therefore a larger group with the potential of developing tuberculosis.

The sex factor appeared to have only a little influence on the prevalence of tuberculosis. In the "sputum-positive" households of white persons, adjusted percentages of 8.8 for males and 10.9 for females were not different (Table IX*A*). In the other white households the females, with an adjusted prevalence of 7.3 per cent, were only slightly higher than the males, with 4.9 per cent (Table IX*B*).

Among Negro associates there was also little difference in the prevalence of tuberculosis by sex. In the "sputum-positive" households the adjusted percentages of 7.1 for males and 9.5 for females were not significantly different (Table X*A*). In the other Negro households the numbers were too small for comparison.

It should be noted that, although the differences in the prevalence of disease in males and females were not large, they tended to be uniformly higher *in toto* in the female household associates, and were also generally higher at each age with the exception of those less than five years old. In that age group the males had more disease on first examination, and it will be shown

later that they also developed disease more frequently under observation.

A comparison of the prevalence of disease by race showed little difference in the totals, with percentages somewhat lower for Negro associates than for whites in both the "sputum-positive" and other households. Among the Negroes, the most significant finding was the relatively high prevalence of tuberculosis in those less than 15 years of age in "sputum-positive" households. This has been mentioned previously in the presentation of age-specific data for the prevalence of disease.

Considering that tuberculosis has been a more virulent and fatal disease in Negroes than in whites, it may be surprising at first glance that not more disease was found in the Negro households under study. It must be emphasized that these are prevalence data representing a count of survivors. It will be shown later in the discussion of the course of tuberculosis that it was generally a rapidly fatal disease in the Negro. As a result there were not as many survivors to be counted in the Negro households when they were brought under observation for the first time. In mass surveys done throughout the country it was subsequently demonstrated that there was a lower prevalence of tuberculosis in the Negro population, which was in accord with the study findings.

The chronicity of tuberculosis in the white household population was manifested also by the accumulation of prevalence cases in the older age group. Of the 188 white associates who had tuberculosis at the time the index case was discovered, 134 (71.3 per cent) were more than 35 years of age, compared with 20 of 41 nonwhite cases (48.8 per cent) in the same age group. By itself such a concentration of prevalence cases in older whites would not necessarily indicate chronicity unless it could be shown that cases developed at a much earlier age. This was indeed so, as will be reported below, because the highest attack rates among whites occurred in those between 15 and 34 years of age, and the highest death rates were observed in those more than 55 years of age.

An analysis of the prevalence of tuberculosis among household associates by their relationship to the index case showed generally more disease in close relatives than in other members. In nonwhite households containing an infectious index case and in white households containing other than "sputum-positive" cases, the differences were of borderline significance. In the white "sputum-positive" households the prevalence was slightly higher than in other associates. The consistency of the several observations gives weight to the differences, imparting to them a significance that is lacking when they are considered individually. A striking observation was made in comparing the age-specific prevalence by relationship. In both the white and nonwhite "sputum-positive" households, the close relatives less than five years of age had a high prevalence of tuberculosis, 7.7 and 5.3 per cent, respectively, while no disease was present on first examination of other household associates of the same age. This may be taken as a measure of the greater risk experienced by very young persons who were closely related to the index case. Although it is quite possible that a "dosage" factor was responsible at least in part, it is also probable that hereditary and constitutional factors may have been operating.

The influence of the socioeconomic factor on the prevalence of tuberculosis was suggestive but not clean cut. In the households of white "sputum-positive" cases the adjusted percentage with disease varied from 10.3 in the upper and middle socioeconomic classes to 11.4 in the lower socioeconomic class (Table XI*A*). The magnitude of the differences was not sufficiently great to be significant. In the other white households the prevalence was 5.4 and 7.4 per cent, respectively (Table XI*B*); here too, the variations could have been accounted for by chance alone. In both instances, however, the increase in prevalence was in the expected direction. The Negro households had too few persons of upper class socioeconomic status to make comparisons meaningful. There was no difference in the prevalence of disease in the combined upper and middle compared with lower class households (Table XII). In the other Negro households, the breakdown produced such small numbers that analysis was not feasible.

Briefly, in *summary*, it may be said that the sputum status of the index case exerted an appreciable influence on the prevalence of tuberculosis in household associates; prevalence tended to increase with age; females generally had consistently but not significantly more disease than males; there was slightly less disease in Negro associates than in white; and close relatives in general had more tuberculosis than other

household members, but the most significant difference was noted in close relatives less than five years of age. The influence of the socioeconomic factor was suggestive in the white but not in the Negro households.

Frost's first question, previously quoted, has been answered by these data concerning the frequency of tuberculous infection and disease among household associates at the time of discovery of the index case.

Attack Rates

Having established the baseline prevalence of infection and disease, it was possible to identify new cases of tuberculosis as they developed in the households under observation. Over the 24 years of the study, 105 new cases—68 white and 37 nonwhite—were discovered. At this point it may be well to emphasize again the definition of a "new" case as presented in the section "Definitions." For this final analysis of the study data, latent apical disease was included among the "new" cases, while in previous reports only the manifest cases were considered. The reasons for this change have been set forth previously. The purpose in again mentioning the change in the treatment of new cases is to indicate how and where it affected the results.

Aside from the effect of the change in definition on the attack rates, the factor of time exerted its influence also. In the last five years of the study very few new cases were discovered while the number of subjects under observation increased. Furthermore, all previously discovered new cases that survived and remained in their households continued to add to the accumulation of person-years of experience without adding to the number at risk. The result was a substantial population denominator increase of more than 35 per cent in the white "sputum-positive" households while the case increase was only 20 per cent. In the nonwhite "sputum-positive" households, only one new case was added in the last four years while the population (person-years) figures rose more than 16 per cent. The effect was to reduce the attack rate. The marked reduction in tuberculosis morbidity in later years is concealed in the total rates, but it was precisely because of that reduction that the study was finally terminated, having reached the point of "diminishing returns."

As was the case with both the prevalence of infection and disease in household associates, the attack rate was also markedly influenced by the "dosage" factor. In the "sputum-positive" households of whites, the adjusted rate of 4.5 per 1,000 person-years was significantly larger than the rate of 1.7 in other households (Tables XIII*A* and *B*). Similarly, in the "sputum-positive" households of nonwhites the attack rate was greater than in the other households, 8.2 compared with 2.9 per 1,000 person-years (Tables XIV*A* and *B*). In both races, the rates in the "sputum-positive" households were higher at practically every age than the corresponding age-specific rates in "other-than-sputum-positive" households (figures 4 and 5).

It may be argued that there should be substantially more new cases in the "sputum-positive" households because they harbor a much larger group of infected persons with the potential of developing tuberculosis. While this is undoubtedly true, there must be other factors operating because there is no true arithmetic relationship between the number infected and the attack rate. Among the whites, not quite twice as many were infected in the "sputum-positive" households as in the others, but the attack rate was almost three times as high in the former. The difference was even more marked in the Negro associates, in whom 1.6 times as many were infected and more than three times as many developed tuberculosis in the "sputum-positive" households compared with the others.

If there had been a true arithmetic relationship between infection and the development of disease, there would have been a steady rise in new cases with age. Such was not the case. In the white households containing an infectious index case, three peaks of incidence were noted: in those less than five years of age, 15 to 34 years, and older than 55 years (figure 6). In the nonwhite households containing an infectious index case, the incidence was also high in the less than five-year group, but the pubertal peak occurred earlier, at 10 to 14 years of age. The attack rate was again high after 55 years of age (figure 7). In the other households, whites showed the highest rates at 15 to 24 years, 13 of 32 cases occurring in that age group. In nonwhite other households 2 of the total of 6 cases occurred at ages five to nine.

The sexes showed no difference in total attack rates, just as they showed none for prevalence of infection. However, there was a decidedly unequal contribution to the incidence of

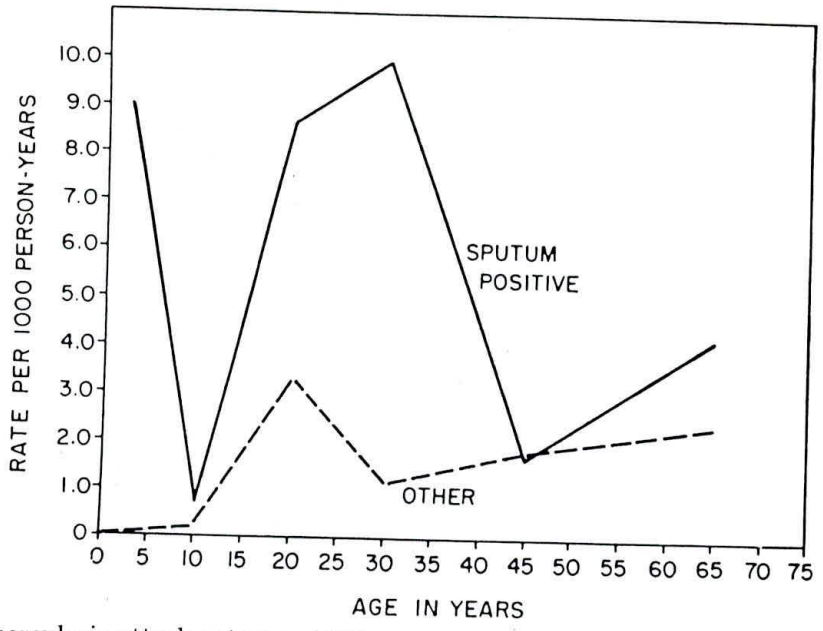

FIG. 4. Tuberculosis attack rate per 1,000 person-years among white household associates, by age and sputum status of the index case, Williamson County, Tennessee, 1931–1955.

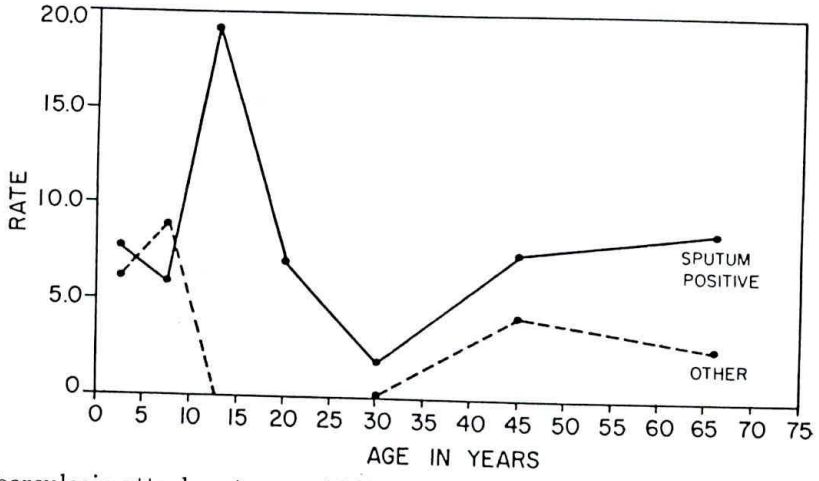

FIG. 5. Tuberculosis attack rate per 1,000 person-years among nonwhite household associates, by age and sputum status of the index case, Williamson County, Tennessee, 1931–1955.

new disease by males and females at each of the three critical levels described above. All of the new cases of persons less than five years of age were male. In the white "sputum-positive" households, attack rates were higher in the females 15 to 34 years of age than in males of corresponding age (15 to 24 years, 12.5 per 1,000 person-years compared with 5.9; 25 to 34 years, 14.8 compared with 4.7). At 55 years of age and older, the attack rate for males was 5.4, and for females 3.2 (figure 6). In Negro "sputum-positive" households the highest age- and sex-specific attack rate in the entire study was observed in Negro females 10 to 14 years of age. The rate of 31.4 per 1,000 person-years means that 3 per cent of the Negro females in this age group in the "sputum-positive" households developed tuberculosis every year. In these households there was an appreciably higher incidence of tuberculosis in males more than 55 years of age compared with that of females of the same age (figure 7).

The high incidence of disease at both ends of the span of life may be explained by poor resistance to infectious diseases during these periods. It is not clear, however, why the resistance of males should be poorer than that of females. Morbidity and mortality for all causes is higher in male infants than in female. The experience of the study infants appears to indicate a similar variability by sex for tuberculosis morbidity. There is nothing in the study data that offers

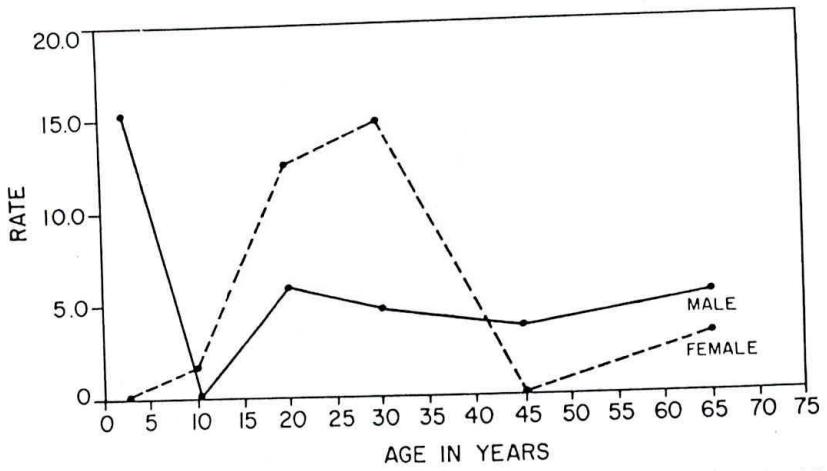

FIG. 6. Tuberculosis attack rate per 1,000 person-years among associates of white "sputum-positive" index cases, by age and sex, Williamson County, Tennessee, 1931–1955.

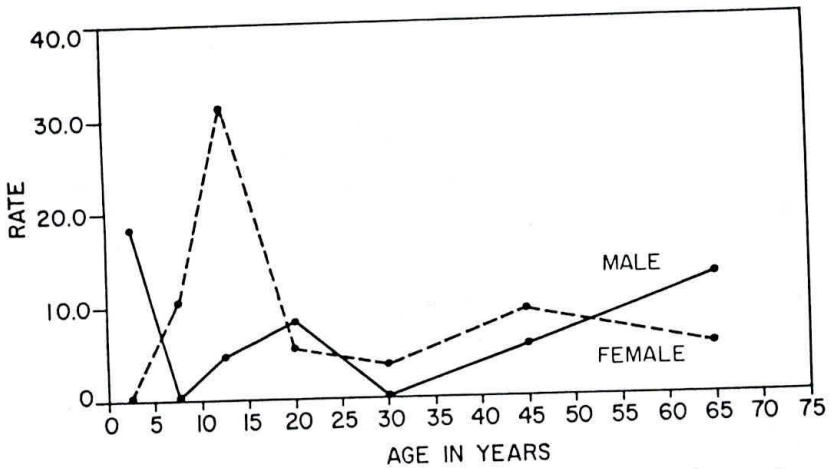

FIG. 7. Tuberculosis attack rate per 1,000 person-years among associates of nonwhite "sputum-positive" index cases, by age and sex, Williamson County, Tennessee, 1931–1955.

any explanation for this finding. The higher attack rate for pubertal and young adult females is also difficult to explain, despite the fact that this age period has been known to be critical for tuberculosis since Hippocrates first called attention to it.

It has been suggested that the decelerative phase of growth following the onset of the menses in the pubertal female is associated with a diminished ability to retain calcium and nitrogen, and that this may lower her resistance to tuberculosis (40). When the action of corticosteroids on tuberculosis became known, it was assumed by some that they might be responsible for the rise in incidence of and death from tuberculosis at puberty. However, there is currently no evidence to support such a view. It has been suggested by numerous writers that pregnancy may be an important factor in the occurrence of tuberculosis among young females. Rich (41) discusses this at some length. While pregnancy may be a factor in some situations, it was found to have no influence on tuberculosis in the study population, as will be shown below. Indeed, there is quite as much support for the belief that pregnancy, with its anabolic processes, actually may have a beneficial effect on tuberculosis, provided that the pregnant woman takes reasonably good care of herself. The question must be left there, for the study data do not provide an answer. They do provide, however, an index for tuberculosis control in emphasizing the peculiar susceptibility or poor resistance of the pubertal and young adult female to tuberculosis.

In the study households, white and Negro associates started out on equal terms with respect to the prevalence of infection at the time of investigation. It could be inferred that members of both races had similar risk of and susceptibil-

ity to infection. The subsequent experience of the two races was quite different, however. The incidence of tuberculosis was higher in Negro associates than in white, whether in "sputum-positive" or other households (figure 8). The adjusted incidence of 7.9 per 1,000 person-years in "sputum-positive" households of nonwhites had a standard error 2.2 greater than the rate of 4.5 in whites. The difference in white and nonwhite households containing other than "sputum-positive" cases was not quite as great. As was pointed out in the section "Definitions," the inclusion of latent apical cases influenced the white much more than the Negro associates. This is one indication of the greater severity of the disease that did develop in Negroes. Had these cases been excluded as in the past, the difference in white and Negro attack rates would have been much greater. It will be shown later that the stage of disease on first diagnosis was also more advanced in Negroes than in whites, and the death rates for the former were also higher.

The explanation for the greater frequency and severity of disease in the Negro has been the subject of considerable discussion and controversy over the years. The literature abounds with reports and studies that are contradictory and nullifying. There is sufficient material to support any contention that may be made, if one is willing to ignore the evidence on the other side. There are proponents of the belief that the generally poorer socioeconomic status of the Negro is responsible. Others contend that he has greater susceptibility or poorer resistance to tuberculosis as a racial characteristic. Still others support the belief that all can be explained on the basis of natural selection and the epidemic curve, the Negro having had only a scant 450 to 500 years of experience with the disease while the white man has had perhaps 5,000 years in which to weed out the most susceptible and produce a more resistant population. The study material provides no answer, but some data on the influence of the socioeconomic factor will be presented below.

Relationship to the index case appeared to increase the risk of developing tuberculosis in the white households containing an infectious index case. The adjusted rate of 6.8 per 1,000 person-years for close relatives was significantly higher than the rate of 1.8 for other members. In the nonwhite households containing an infectious

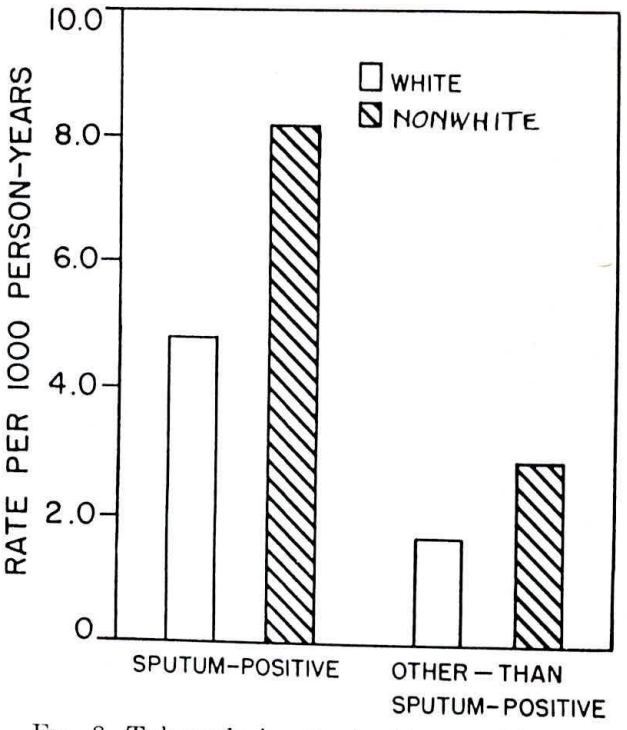

FIG. 8. Tuberculosis attack rate per 1,000 person-years, by race and sputum status of the index case, Williamson County, Tennessee, 1931–1955.

index case, the adjusted incidence of 9.8 per 1,000 person-years for close relatives, although almost twice as high as the rate of 5.0 for other members, was nevertheless not significantly higher, but was in the expected direction. In the white "other-than-sputum-positive" households the differences by relationship were small, and there were too few cases in other Negro households to make comparisons. Perhaps of the greatest significance is the high incidence of disease in close relatives less than 15 years of age in both white and Negro "sputum-positive" households, with little or no disease in other members of similar age. Tuberculosis is not inherited. It has been suggested that an heredoconstitutional factor may, however, determine susceptibility or resistance to the disease. The data presented here cannot be said to prove that such a factor is of any great significance in influencing the occurrence of tuberculosis. The study findings do fall in line with the studies of animals by Lurie (42) and of human twins by Kallmann and Reisner (43).

Analysis of attack rates by socioeconomic status did not yield consistent results. In the white "sputum-positive" households there was more new disease in the middle and lower socioeconomic classes than in the upper, but the in-

crease in rates was not progressive from the upper to the lower class (Table XV*A*). All of the new cases of those less than 15 years of age developed in the lower class households. The only new case of that age group in the white "other-than-sputum-positive" households was also in the lower class (Table XV*B*). In Negro households, all cases of those less than 35 years of age were found among the lower class group (Tables XVI*A* and *B*). In the "sputum-positive" households the lower socioeconomic class experienced significantly more tuberculosis than the combined upper and middle classes. There were only 2 cases in the latter, and, had all 31 cases been proportionately distributed, there would have been more than 7 cases.

A comparison of the attack rates in the lower class "sputum-positive" white and nonwhite households showed the respective rates to be 4.8 and 10.1 per 1,000 person-years. The difference was only of borderline significance. For the "other-than-sputum-positive" households of the lower socioeconomic class, there was no difference in the incidence of new tuberculosis by race. It is perhaps worth repeating at this point that the criteria for classifying the socioeconomic status were identical for both races. These findings suggest that, if such variables as exposure, dosage, and socioeconomic status were held constant, adjusted attack rates did not vary significantly in white and Negro household associates of known cases of tuberculosis, although the rates in Negro associates were uniformly higher than in whites. This uniformity may in itself be significant.

The singularly small impact of socioeconomic factors on the incidence of tuberculosis in the study population needs explanation, particularly in view of the almost universal agreement among investigators that these factors weigh heavily in determining the occurrence and distribution of the disease. In the first place, when many factors are operating, some may have considerably more influence than others. It appears that the exposure and dosage factors in the study households had an overwhelming impact, an impact so great that they may reasonably have dwarfed the effect of the other factors. This is not surprising in a communicable disease. Furthermore, in considering a factor such as the socioeconomic status, it is important to think in terms of time, place, and person. In a rural, agrarian society, many people raise much of the food they require. Poverty and malnutrition do not necessarily go hand in hand in such a situation, as is evident from the data presented below.

Nutrition studies were undertaken in Williamson County under the guidance of Dr. William J. Darby, Professor and Head of the Department of Biochemistry, and Director of the Division of Nutrition of Vanderbilt University School of Medicine. These were studies of the hemoglobin, erythrocyte count, packed cell volume, and total serum protein of randomly selected household members and other residents of the county. Although analyses of all the data were completed, only the data on hemoglobin will be discussed, and the discussion will be limited to white household associates who lived in rural sections of the county, that is, outside the single urban community in the county. In all, 229 persons were tested. Their average hemoglobin level for each age group and sex showed no significant variation by socioeconomic class (table 2). Values for males were almost uniformly higher than for females, but this is not considered unusual. Only 26 Negro household associates living in rural areas were tested, and the number was too small for meaningful analysis. Similarly, the number of white and Negro urban household residents tested was too small for consideration. It might be added parenthetically that a comparison of values on all tests between tuberculosis household members and other nonhousehold members of the community showed no essential differences between them. In any case, the foregoing data indicate that among the rural study population of Williamson County, the socioeconomic status did not influence the hemoglobin levels, which may be considered an index of nutrition.

The influence of pregnancy on the incidence of tuberculosis was also studied. It has been contended by some in the past that the actual pregnancy undermined the resistance of the pregnant woman, and placed her at greater risk of developing tuberculosis or of breaking down an existing quiescent disease. Others have claimed that the postpartum period, with all the physical and emotional stress associated with the care of a newborn infant, rather than the pregnancy itself, produced the greater risk of tuberculosis. For the purposes of the current analysis, the pregnancy and the postpartum periods were considered together and comprised the two-year period of the year before and the year after de-

TABLE 2

HEMOGLOBIN VALUES AMONG WHITE HOUSEHOLD MEMBERS (INCLUDING INDEX CASES) LIVING IN RURAL AREAS OF WILLIAMSON COUNTY, BY AGE, SEX, AND SOCIOECONOMIC STATUS, 1948–1951

Age Group	Total		Male		Female	
	Number Tested	Average Hemoglobin	Number Tested	Average Hemoglobin	Number Tested	Average Hemoglobin
Total						
Total	229	14.4	101	15.1	128	13.9
10–14	42	14.2	24	14.2	18	14.3
15–44	139	14.5	53	15.6	86	13.8
45+	48	14.5	24	15.0	24	13.9
Upper Socioeconomic Class						
Total	6	14.8	3	15.5	3	14.1
10–14	0	—	0	—	0	—
15–44	5	15.0	2	16.3	3	14.1
45+	1	13.9	1	13.9	0	—
Middle Socioeconomic Class						
Total	73	14.2	26	15.0	47	13.8
10–14	9	14.0	3	14.3	6	13.8
15–44	41	14.2	13	15.2	28	13.7
45+	23	14.4	10	14.9	13	13.9
Lower Socioeconomic Class						
Total	150	14.5	72	15.2	78	13.9
10–14	33	14.3	21	14.2	12	14.5
15–44	93	14.6	38	15.8	55	13.7
45+	24	14.6	13	15.2	11	13.9

livery. Only actual household observation was counted, so that for those who entered a household when already pregnant their experience was counted as of the date of entry. Similarly, if a woman left the household before delivery or before the postpartum year was completed, she was counted as having had household experience only for the period of her residence there. A woman who had a miscarriage was arbitrarily given three months of pregnancy experience, but the full postpartum year was counted. The results of the analysis are shown in table 3. In white households 25 new cases developed in women between the ages of 15 and 44. Of these, only 2 occurred during the pregnancy-postpartum period, and 23 at other times. The adjusted attack rates of 2.6 for pregnancy, and 5.3 for nonpregnancy periods, while not in the expected direction, are not significantly different. Among the Negro women, although the rates were higher during pregnancy, 9.5 compared with 2.6 adjusted, these too were not significantly different.

Thirteen white women had had tuberculosis before they became pregnant. During pregnancy and the postpartum period there was no evidence of progression of the disease in any of them. One woman actually improved and the disease became arrested during pregnancy. One died about two years post partum. The other 11 patients showed no change in the stage or activity of their disease. Among Negro females

TABLE 3

TUBERCULOSIS ATTACK RATES PER 1,000 PERSON-YEARS DURING PREGNANCY AND NONPREGNANCY PERIODS AMONG 15- TO 44-YEAR-OLD FEMALE HOUSEHOLD ASSOCIATES OF INDEX CASES, BY AGE AND RACE

Williamson County, Tennessee, 1931–1955

Age Group	Total			Pregnancy			Nonpregnancy		
	Person-Years Experience	New Cases		Person-Years Exerience	New Cases		Person-Years Experience	New Cases	
		Number	Rate		Number	Rate		Number	Rate
White Households									
Total adjusted rate*	5,122.00	25	4.9 *4.9*	674.50	2	3.0 *2.6*	4,447.50	23	5.2 *5.3*
15–24	2,409.50	17	7.1	284.00	1	3.5	2,125.50	16	7.5
25–34	1,362.00	8	5.9	284.00	1	3.5	1,078.00	7	6.5
35–44	1,350.50	0	—	106.50	0	—	1,244.00	0	—
Nonwhite Households									
Total adjusted rate*	1,258.50	6	4.8 *4.4*	317.00	3	9.5 *9.5*	941.50	3	3.2 *2.6*
15–24	511.75	2	3.9	125.25	2	16.0	386.50	0	—
25–34	382.25	1	2.6	131.50	1	7.6	250.75	0	—
35–44	364.50	3	8.2	60.25	0	—	304.25	3	9.9

* Adjusted by age, using the percentage distributions of the total white household population as standard.

there were 9 who had had tuberculosis at some time before they became pregnant. Seven of them showed no progression of disease during the pregnancy-postpartum period, while 2 progressed to more advanced disease. These data do not indicate that pregnancy or the postpartum period was associated with any unusual risk of developing tuberculosis or of worsening an existing disease among female household members of child-bearing age.

Part of Frost's third question, relative to the occurrence of tuberculosis in the household population under observation, has been answered by these studies. The answer may be *summarized* as follows: The factors that influenced the risk of developing tuberculosis in a household in which a known case was present were those of race, age, sex, sputum status of the index case and, to a minor extent, relationship to the index case, and the socioeconomic status of the household. Pregnancy did not affect the attack rate in women of child-bearing age.

Death Rates

Deaths from all causes are considered here in addition to deaths from tuberculosis in order to determine whether the tuberculous households under study had a mortality experience that differed from that of the general population.

The tuberculosis data are presented first. There were 23 deaths in white households and 29 in Negro households. Here again the "dosage" factor brought an appreciable weight to bear. Among white associates in "sputum-positive" households the mortality rate was 1.7 per 1,000 person-years (Table XVII*A*). This differed from the rate of 0.5 in other white households (Table XVII*B*) by a standard error of 2.3, with a value of P = >0.01 and <0.05. In the Negro households the respective rates of 6.6 and 1.9 for associates of "sputum-positive" and other index cases (Tables XVIII*A* and *B*) were different at the level of 2.4 S.E. In view of the higher prevalence of infection and higher incidence of tuberculosis in "sputum-positive" households compared with other households, it is to be expected that higher death rates would also obtain.

Deaths did not occur uniformly at all ages. In the "sputum-positive" households of whites there were three peaks of almost equal height: in those less than 5 years, at 25 to 34 years, and in those older than 55 years of age (figure 9). These

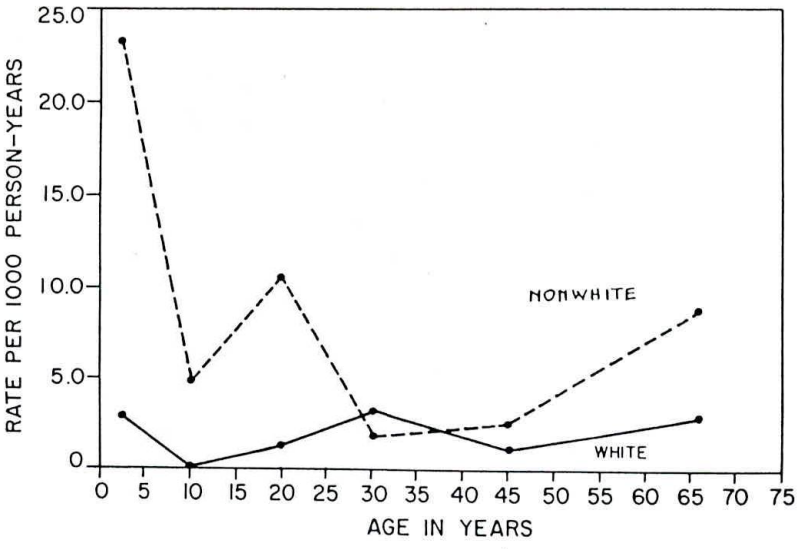

FIG. 9. Tuberculosis death rate per 1,000 person-years among associates of "sputum-positive" index cases, by age and race, Williamson County, Tennessee, 1931–1955.

peaks corresponded almost identically with the peaks of incidence for this same household group. There were no deaths in the five- to 14-year age group, the so-called "golden" years. These years were, however, not "golden" for the Negro associates in "sputum-positive" households in which there were 4 deaths with a rate of 5.0 per 1,000 person-years. The highest rate among Negroes (23.4) occurred in those less than five years of age. Two other high points were noted, 10.6 at 15 to 24 years, and 8.8 at 55 years and older. These peaks differed slightly from the high points of incidence. It may be recalled that the highest attack rate was observed at 10 to 14 years of age. In the "other-than-sputum-positive" households no deaths were recorded among whites less than 35 years of age. The peak in the Negro "other-than-sputum-positive" households occurred at 15 to 24 years when the rate was 5.2 per 1,000 persons per year. There was also one death in the five- to 14-year group, but none among the whites.

There was no difference in total death rates by sex for white or nonwhite, for "sputum-positive" or other households. There was, however, considerable variation in the rates by sex at specific ages. The only death of an individual less than five years of age in white "sputum-positive" households was in a male. At 25 to 34 years, and at 55 years and older, females showed the higher rates, 4.2 and 4.3, respectively. Thus, the peaks of death rates by sex differed slightly from the peaks for attack rates. Males had a higher incidence of tuberculosis at 55 years and older, but females had a higher death rate at this age. In the nonwhite "sputum-positive" households there were 3 deaths of persons less than five years of age. Two of these were males. Females had a higher death rate than males at 15 to 24 years, 13.5 compared with 8.3. The males had a higher rate at 55 years and older.

Racial differences in death rates were marked, nonwhite associates showing significantly higher rates than whites in both the "sputum-positive" and other households. In the former, the death rate for Negroes was 6.6 per 1,000 persons per year, and 1.7 for the whites. In the other households, the respective rates were 1.9 and 0.5. The most marked difference racially was in the age-specific death rates. Among whites in "sputum-positive" households only one of the 23 deaths occurred in persons less than 15 years of age, while among the Negroes there were 8 deaths in this age group of a total of 29 for associates of all ages. It may be significant that, during the last five years of the study, there were only 2 deaths from tuberculosis in white households and *none* in Negro households.

Relationship to the index case did not appreciably influence tuberculosis mortality. In both white and nonwhite "sputum-positive" households the death rate was higher among close relatives than among other members, but the differences were not significant. The only death that occurred in an associate less than five years of age in white "sputum-positive" households was that of a close relative of the index case. In

the Negro "sputum-positive" households, 6 of the 7 deaths that occurred in persons less than 15 years of age were those of close relatives.

In white households of "sputum-positive" cases, tuberculosis mortality did not vary significantly with socioeconomic class. Only one death was recorded in upper class households, in an individual more than 55 years of age. The only death that occurred in an associate less than five years of age was in a lower class household. In the nonwhite households of "sputum-positive" cases, however, the socioeconomic status appeared to have a marked influence on the tuberculosis mortality. There were so few upper-class households that they contributed little to the total picture. Only one death occurred in upper and middle class households compared with 24 in lower class households. The respective mortality rates were 1.1 and 8.4 per 1,000 person-years (Table XX*A*).

A comparison of "sputum-positive" households in the lower socioeconomic class by race showed the Negro tuberculosis mortality rate of 8.4 to be more than five times as high as the white rate of 1.6 (Tables XIX*A* and XX*A*). Since, in this comparison, the factors of sputum status of the index case and the socioeconomic class were held "constant," the differences observed would have to be explained on some other basis. This matter will be discussed more fully after the data for mortality from other causes have been presented.

A consideration of mortality from other, nontuberculous causes in the study households produced some interesting results. In both white and nonwhite "sputum-positive" households, death rates for other causes were slightly but not significantly higher than rates in other-than-"sputum-positive" households. In all households, death rates were high in the younger than five-year age group, fell from five to 14 years, then generally rose steadily with age as expected. In the nonwhite "sputum-positive" households the rate of 23.4 for associates less than five years of age was quite high.

In general there were no significant differences in death rates for other causes by sex, except in the white "sputum-positive" households in which the rate of 12.9 for males was significantly higher than the rate of 8.7 for females after adjustment for age.

By race, death rates for other causes were uniformly higher in Negro households than in white, for associates of both "sputum-positive" and other index cases. In the former, the rates for Negro and white were 15.6 and 10.9 per 1,000 person-years, respectively; in the latter, the rates were 12.5 and 9.3. In every instance, except one, death rates were also higher in each age group. The exception was in "other-than-sputum-positive" white households, in which the death rate for other causes among associates 55 years and older was higher than in the nonwhite households. In "sputum-positive" households, rates for Negro males were about 50 per cent higher than rates for white males, while Negro females had rates about three times as high as white females. Practically the same comparisons were noted in "other-than-sputum-positive" households.

Total death rates for causes other than tuberculosis were not appreciably influenced by socioeconomic factors. However, in white households all deaths except one in those less than 15 years of age occurred in lower class households. The one exception was in a middle class household. In Negro households all deaths of those less than five years of age were in the lower class.

In comparing white and Negro mortality rates for causes other than tuberculosis in each socioeconomic class individually, the rates for Negro associates were almost uniformly higher than those for the white associates. The reason for this is not apparent and can only be speculated upon. It might be assumed that persons of the same socioeconomic class, regardless of race (the same criteria for classification were used for both races), would be exposed to similar experiences with respect to medical care, preventive medical services, health education, and so forth, and might be expected, therefore, to react similarly to those forces in the environment that affect health, all other things being equal. The fact that the Negro has a much higher mortality than the white, class for class, indicates that all other things are *not* equal. For those who claim that the inequality is based on the physical inferiority of the Negro, the athletic records established by members of that race offer the most eloquent denial. It is more likely that the standards or criteria used for socioeconomic classification cannot be applied equally to both races because of inherent and incalculable social and cultural differences.

In *summary*, tuberculosis mortality rates were

higher in "sputum-positive" households than in others; they varied with age and paralleled fairly well the critical ages for attack rates; there were age-specific differences in death rates by sex; mortality rates were four and a half times as high in nonwhite "sputum-positive" households as in white; relationship to the index case appeared to exert an influence in producing higher death rates in close relatives than in other members in the younger age groups; and socioeconomic status seemed to show an effect chiefly in the nonwhite households with an infectious index case.

Deaths for causes other than tuberculosis in study households generally followed an expected pattern by age; rates were higher in "sputum-positive" households compared with those in others, but not significantly so; no difference by sex was noted except in white "sputum-positive" households where the rate for males was significantly higher than the rate for females; rates were almost consistently higher in Negroes than in whites *in toto* at all ages and, socioeconomically, class for class. The greatest difference by race was noted for the females. Negro females had death rates about three times as high as white females. Socioeconomic factors did not appreciably affect death rates except in the younger age groups.

Study of Cases

Interval between Exposure and Onset of Disease

The interval between exposure to "open" tuberculosis and the development of the primary focus of infection is probably very short. The sequence of events following infection may be so variable that it may range from a lifelong containment of the primary focus (the most common sequel) to the development of progressive, manifest tuberculosis. The temporal relationship between infection and disease may also vary considerably. There may be no demonstrable interval between these two events, as in infants, in whom the primary infection may progress immediately by local extension and by lymphogenous and hematogenous dissemination. In most instances, however, the usual picture is that of initial local containment of the primary infection, followed after a variable interval that may be many years by the development of reinfection tuberculosis. Some of the analyses of study data show this temporal relationship.

Experience of children of "sputum-positive" parents: These studies, which combined historic and observational data, were reported in detail in 1954, one year before the study was terminated (21). There was not sufficient additional material after the report to warrant the revision of tables or graphs. Some of the original data are reprinted with permission.

Although several different kinds of analyses were made of the material in this group of children of "sputum-positive" parents, the data relating to the interval between exposure and onset of disease are of prime importance here. The children were divided into four groups according to their age at first exposure to a parent with open tuberculosis: less than one year, one to four years, five to fourteen years, and fifteen years and older. Cumulative probabilities of developing tuberculosis were calculated (Table XXI), and showed that in children first exposed during the first year of life or after 15 years of age, tuberculosis tended to develop rapidly. When first exposure occurred between one and 15 years the production of disease tended to be delayed until after 15 years of age (figure 10). In some instances, the interval between exposure and disease development was 15 years or more. These findings tend to substantiate the data previously presented with respect to attack rates. They indicate that there are critical ages, infancy and puberty, during which first infection is extremely hazardous and often progresses quickly to manifest disease. Puberty also appears to be a critical period for the activation of previously contained infections, some of them apparently well controlled for upward of 15 years. These findings tend to support the proponents of the "autogenous reinfection" school of thought.

Experience of "new" cases: The "new" cases were those that developed during observation in the study households. For these cases there was not only a record of observed exposure to tuberculosis, but also a history of contact with tuberculosis before the household was brought under investigation. In many instances there had been exposure to several household members and a mixture of contact to "open" and "closed" disease. The interval between first exposure and onset of disease by type of ex-

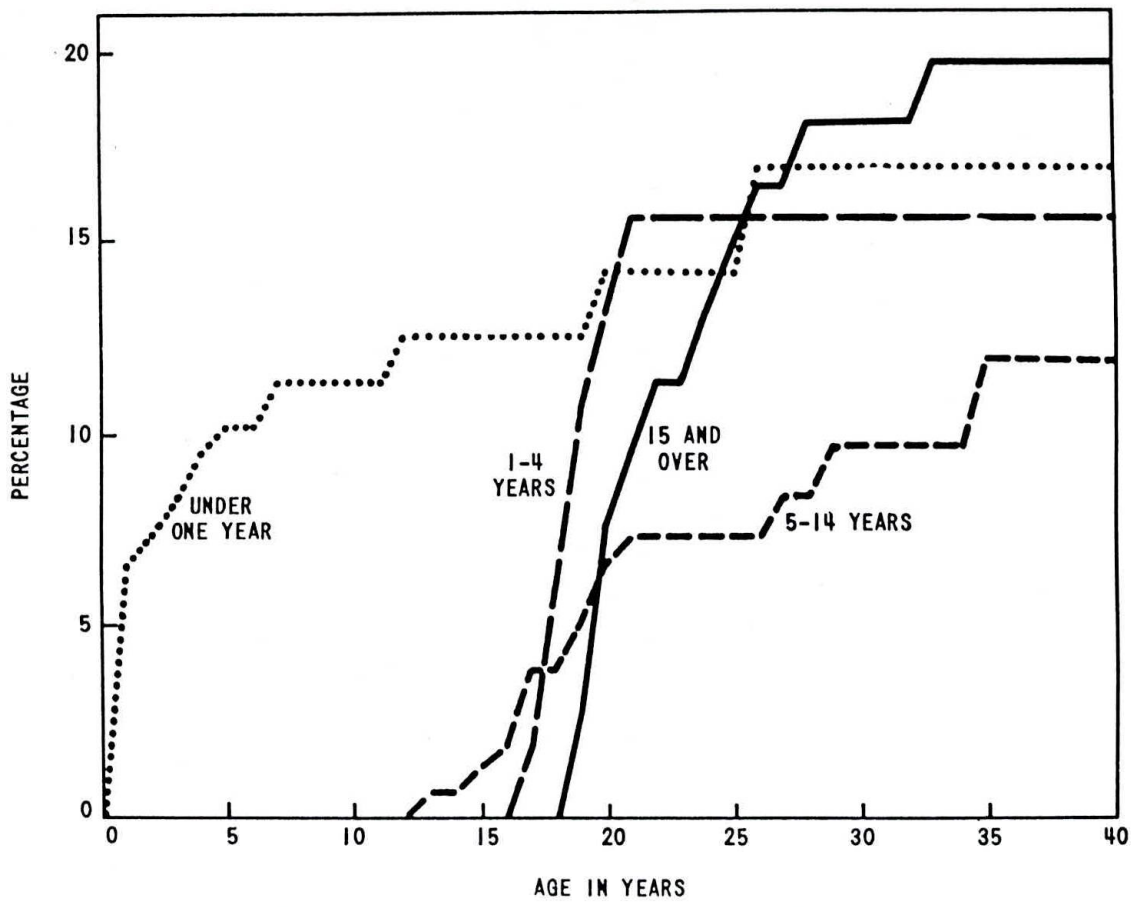

FIG. 10. Cumulative probability per 100 of developing tuberculosis, by age, for children of "sputum-positive" index cases, according to age at first exposure, Williamson County Tuberculosis Study.

posure and by age and race is shown in table 4. For the whites whose first exposure was to a person known to have tubercle bacilli in the sputum, the general pattern was one of a short interval between exposure and disease development for those less than one year of age and for the age groups of 15 to 34 and 55 years and older. These were also the critical ages during which the incidence of disease was high. In the age group of one to 14 years, the interval was generally more than 10 years. As a rule, intervals were somewhat shorter when first exposure was to an individual with infectious sputum than when initial exposure was not of that character.

The "new" cases in Negroes showed a different pattern. In them intervals were shorter in almost every age group. Only 4 of 30 Negro "new" cases whose first exposure was to "open" tuberculosis had intervals of more than 15 years compared with 10 of 29 among the whites. Whereas, as noted above, most of the white subjects in the one- to 14-year age group with initial exposure to a known infectious case had intervals between exposure and onset of disease of more than 10 years, Negro subjects in the same age group usually developed disease in less than five years.

Course of Disease

In the early years of the study the course of tuberculosis in the household population was practically unaffected by any man-made mitigating forces. Those were the years before the state tuberculosis hospital construction program had begun, and long before the current specific antituberculosis therapy became available. In effect, the natural course or history of tuberculosis was observed. In 1939 the first state tuberculosis hospital beds came into use, and after 1949 specific therapy was offered to patients.

Although tuberculosis mortality rates had been declining steadily over the years even before control measures came into being, the influence of such measures, including hospitalization and therapy, could not be discounted. With this consideration in mind, the study period was

TABLE 4

INTERVAL BETWEEN FIRST EXPOSURE TO TUBERCULOSIS AND ONSET OF DISEASE FOR "NEW" CASES, BY AGE AT FIRST EXPOSURE, BY TYPE OF EXPOSURE, AND BY RACE

Williamson County, Tennessee, 1931–1955

Age at First Exposure	White								Nonwhite						
	Interval in Years beween Exposure and Onset								Interval in Years between Exposure and Onset						
	Number of New Cases	<1	1-4	5-9	10-14	15-19	20+	Unknown	Number of New Cases	<1	1-4	5-9	10-14	15-19	20+
Exposure to Infectious Sputum at First Contact															
Total	29	2	9	1	6	8	2	1	30	4	13	3	6	1	3
<1	3	1	1	—	1	—	—	—	2	—	1	—	—	1	—
1-4	4	—	—	—	—	4	—	—	1	—	—	1	—	—	—
5-14	5	—	—	—	3	2	—	—	13	3	6	1	2	—	1
15-24	6	1	2	1	—	—	2	—	4	—	3	—	—	—	1
25-34	5	—	3	—	—	1	—	1	2	—	—	—	1	—	1
35-54	2	—	—	—	2	—	—	—	6	1	2	1	2	—	—
55+	4	—	3	—	—	1	—	—	2	—	1	—	1	—	—
Exposure to Infectious Sputum with Other Exposure First															
Total	16	—	2	6	1	2	4	1	2	—	—	1	1	—	—
<1	5	—	1	—	—	1	3	—	1	—	—	1	—	—	—
1-4	1	—	—	—	1	—	—	—	—	—	—	—	—	—	—
5-14	4	—	—	3	—	—	1	—	—	—	—	—	—	—	—
15-24	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
25-34	3	—	1	2	—	—	—	—	1	—	—	—	1	—	—
35-54	2	—	—	1	—	1	—	—	—	—	—	—	—	—	—
55+	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Unknown	1	—	—	—	—	—	—	1	—	—	—	—	—	—	—
No Exposure to Infectious Sputum															
Total	23	1	5	5	2	5	2	3	5	1	2	2	—	—	—
<1	2	—	—	—	—	2	—	—	1	—	1	—	—	—	—
1-4	2	—	—	—	1	1	—	—	—	—	—	—	—	—	—
5-14	4	—	—	1	—	1	—	2	1	1	—	—	—	—	—
15-24	4	1	2	—	—	—	1	—	—	—	—	—	—	—	—
25-34	1	—	1	—	—	—	—	—	1	—	—	1	—	—	—
35-54	7	—	1	4	—	1	1	—	1	—	—	1	—	—	—
55+	3	—	1	—	1	—	—	1	1	—	1	—	—	—	—

divided into three segments: 1931 to 1939, 1940 to 1948, 1949 to 1955. The cumulative probability of dying of tuberculosis was determined by using the life-table method, and was calculated by successive years for each period. Since mortality was greatly influenced by the stage of disease on first diagnosis, separate analyses were done by stage. Only among those with moderately advanced tuberculosis on first diagnosis, however, were the numbers sufficiently large to permit a comparison during the three periods. The results of the analysis are shown in figure 11. A marked decrease in the mortality risk was noted during the second period (1940–1948), but practically no change occurred in the third period. It must be borne in mind that no adjustment for age has been made and that the comparisons are based on crude data. In

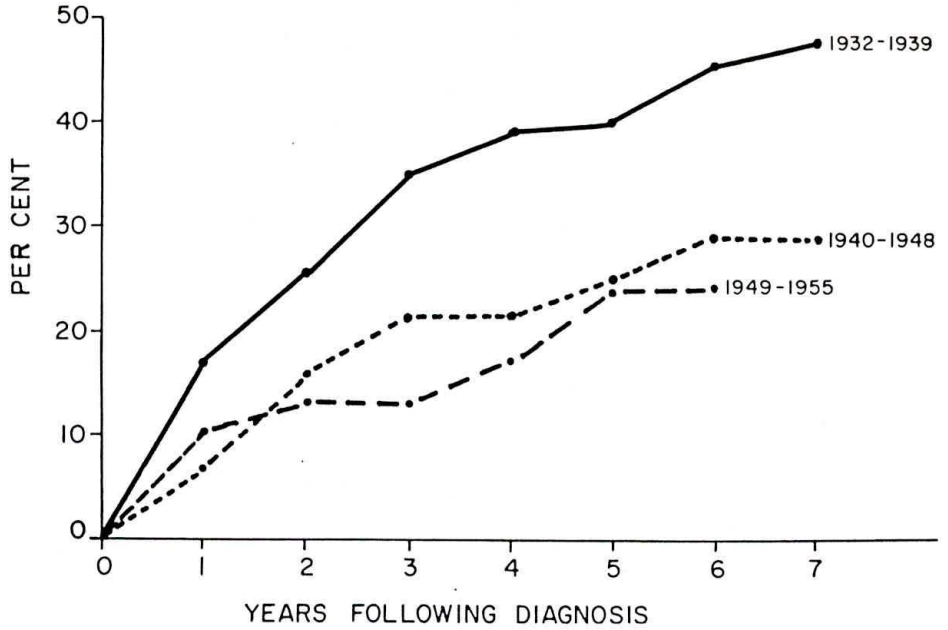

FIG. 11. Cumulative probability of dying in white persons diagnosed as having moderately advanced tuberculosis, for three periods of time, Williamson County, Tennessee, 1932–1955.

the earliest period a large portion of the deaths were among young people. In the last period deaths were predominantly in the older age groups. In all likelihood, a large share of the decline in deaths during the three periods may be attributed to the same causes that have brought about a steady decline in tuberculosis death rates over the last 60 years or more. The part played by hospitalization and drug therapy in reducing the mortality of study patients is difficult to assess. The absence of an appreciable difference in mortality in the second and third periods would suggest that the influence of hospitalization and drugs was not marked.

Stage of Disease on Diagnosis

Index, prevalence, and new cases: In all of the study households there were, in time, 1,124 cases of tuberculosis. Of these subjects, 790 (excluding 38 who died of tuberculosis just prior to opening the household) were index cases, 229 were prevalence cases, and 105 were new cases.

Because tuberculosis is an insidious disease, there is a marked tendency to delay in seeking medical care. Physical signs may be lacking in the earlier stages of tuberculosis. As a result the disease is often in an advanced stage when the diagnosis is first made. Delay in diagnosis means greater opportunity for infection of contacts. It is chiefly for these reasons that case-finding programs have been developed. The study plan offered an excellent opportunity to measure the effectiveness of case finding by comparing the stage of disease on diagnosis of index cases (which were usually discovered because of symptoms); of prevalence cases (discovered during contact investigation); and of new cases (discovered by periodic examination during observation). The results of this analysis are shown in table 5.

The most striking comparisons are noted in the "sputum-positive" households (figure 12). For the white index cases, 97.9 per cent were in the moderately or far advanced stage on first diagnosis compared with 100.0 per cent for Negro index cases. Only 19.4 per cent of white new cases were in the advanced stages of disease on diagnosis. Among the nonwhite new cases, on the other hand, the disease in 61.3 per cent was moderately or far advanced when discovered. Although this represented a considerable reduction in comparison with the status of the index cases, it was still inordinately high, and it pointed up the necessity for re-examining Negro household contacts more frequently than the yearly intervals that were apparently sufficient for the white study population.

As expected, index cases that did not have infectious sputum were generally in an earlier stage of disease on first diagnosis than those who had sputum positive for *M. tuberculosis*.

Prevalence cases were also, as a rule, diag-

TABLE 5

NUMBER AND PER CENT OF INDEX CASES, PREVALENT CASES, AND NEW CASES BY STAGE OF DISEASE ON DIAGNOSIS, BY SPUTUM STATUS OF THE INDEX CASE, AND BY RACE
Williamson County, Tennessee, 1931–1955

Stage of Disease	White						Nonwhite					
	Index Cases		Prevalent Cases		New Cases		Index Cases		Prevalent Cases		New Cases	
	Number	Per Cent	Number	Per Cent	Number	Per Cent	Number	Per Cent	Number	Per Cent	Number	Per Cent
Index Cases with Infectious Sputum												
Total	194	100.0	92	100.0	36	100.0	63	100.0	36	100.0	31	100.0
Manifest childhood	0	—	3	3.3	3	8.3	0	—	8	22.2	3	9.7
Latent apical and minimal	4	2.1	65	70.7	26	72.2	0	—	21	58.3	9	29.0
Moderately advanced	64	33.0	11	12.0	3	8.3	18	28.6	4	11.1	7	22.6
Fatal and far advanced	126	64.9	13	14.1	4	11.1	45	71.4	3	8.3	12	38.7
Index Cases with Other than Infectious Sputum												
Total	481*	100.0	89†	100.0	31‡	100.0	50	100.0	5	100.0	6	100.0
Manifest childhood	1	0.2	0	—	1	3.2	0	—	1	20.0	3	50.0
Latent apical and minimal	346	71.9	70	78.7	16	51.6	38	76.0	3	60.0	2	33.3
Moderately advanced	127	26.4	15	16.9	12	38.7	11	22.0	0	—	1	16.7
Fatal and far advanced	7	1.5	4	4.5	2	6.5	1	2.0	1	20.0	0	—

* Does not include 2 cases of undetermined classification.
† Does not include 7 cases of undetermined classification.
‡ Does not include 1 case of undetermined classification.

nosed in the minimal stage of tuberculosis. It must be remembered that these persons were discovered when a household was opened for investigation and contacts of the index case were examined for the first time. Most of these subjects either had no symptoms or had symptoms that were so vague or mild that they did not seek medical care. It was not surprising, therefore, to find that their disease was often minimal.

These study findings strongly support the emphasis that has been placed on case finding as a keystone of tuberculosis control. They demonstrate that not only has the unsuspected case of tuberculosis been discovered through such a program, but also that the stage of disease on discovery has been less advanced than that found in the symptomatic person who seeks medical care. Early diagnosis has led to more effective therapy, particularly since the avail-

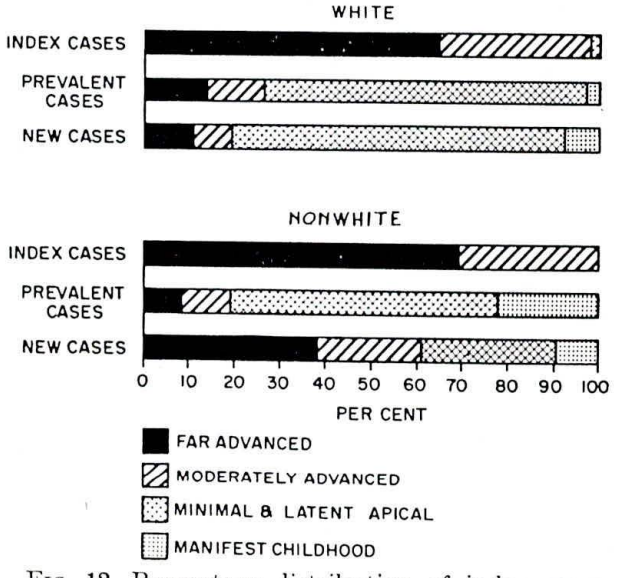

FIG. 12. Percentage distribution of index cases, prevalent cases, and new cases in "sputum-positive households," by stage of disease on first diagnosis and by race, Williamson County, Tennessee, 1931–1955.

ability of the antituberculosis drugs. It has also led, in many instances, to effective termination of contact between the tuberculous individual and his household associates.

Influence of socioeconomic status on stage of disease of index cases: It is often said that one of the concomitants of poverty is a delay in seeking medical care. The study data provided an opportunity to determine whether the stage of disease on diagnosis of index cases varied with the socioeconomic status. The tabulation of the data is shown in table 6. Index cases with infectious sputum in general were diagnosed in a late stage of disease regardless of their socioeconomic status. In fact, 83.3 per cent of persons in the upper socioeconomic class had far advanced tuberculosis when first diagnosed, compared with 54 per cent in the middle class and 71.2 per cent in the lower class. None of the upper class index cases were in the minimal stage, while two cases in each of the middle and lower classes were in the early stage of disease. Little difference by sex was noted.

For the "other-than-sputum-positive" index cases there was also little variation in the stage of disease on first diagnosis by socioeconomic status. Among upper class subjects, 77.3 per cent had latent apical or minimal disease, compared with 69.1 per cent in the middle class and 73.9 per cent in the lower class. There were no index cases with far advanced disease in the upper class households, while four with late disease were present in the middle class and three in the lower class. The disease in females appeared to have been discovered earlier than in males. If this were a reflection of the greater tendency of the male to delay seeking medical care, it is difficult to understand why it was not also apparent in the "sputum-positive" households.

It does not appear, therefore, that socioeconomic status influenced the speed with which the index cases sought medical care. Perhaps the insidious nature of tuberculosis is the much more important factor in influencing delay in obtaining medical attention.

Data for the Negro index cases are not presented because there were too few in the upper socioeconomic class and because the total number for all classes was small. A comparison of the stage of disease on diagnosis of index cases in lower class "sputum-positive" white and Negro households revealed no difference.

Community Studies

Although the study was designed primarily to observe the impact of tuberculosis on persons exposed in a household with a known case of the disease, it did not ignore the influence of the disease on the community. Community studies were done to provide comparisons with the tuberculous households. These studies included tuberculin and roentgenographic surveys and analyses of tuberculosis mortality and general mortality in the whole population.

Tuberculin Surveys

After the occurrence of pulmonary calcification in negative tuberculin reactors had been observed in the early years of the study, tuberculin and roentgenographic surveys of school children were undertaken to quantitate the relationship between calcium deposition and tuberculin sensitivity and to determine its significance. It will suffice to summarize results of five surveys done at two-year intervals between 1937 and 1945. These have been reported previously (5, 8, 15, 19).

In all, 5,828 tuberculin tests were done on white, and 1,478 tests on Negro school children between six and 20 years of age. The totals represented two or more tests completed on 1,482 white and 339 Negro subjects. Roentgenograms were obtained at the same time, so that eventually a series of sensitivity tests and chest films was available for a fairly large group of subjects. As a result of these studies it was possible to demonstrate that 83 per cent of the white and 72 per cent of the Negro children had pulmonary or tracheobronchial calcification, or both, while less than half of them manifested tuberculin sensitivity. Over the eight-year period of the surveys it was shown that the prevalence of sensitivity declined from 35.8 per cent to 20.0 per cent in the five- to nine-year group, from 48.6 to 33.3 in the 10- to 14-year group, and from 49.4 to 41.8 in the 15- to 19-year group. It was believed by the investigators that this decline was a reflection of the falling tuberculosis mortality rate during the same eight-year period. It was also established that a rather large proportion of the children reacted only to 1.0 mg. of tuberculin, and that the size of the reaction was frequently less than 10 mm. Some doubts were expressed concerning the significance of such a reaction, particularly since

TABLE 6

NUMBER AND PER CENT OF WHITE INDEX CASES BY STAGE OF DISEASE ON DIAGNOSIS, BY SPUTUM STATUS, BY SEX, AND BY SOCIOECONOMIC STATUS

Williamson County, Tennessee, 1931–1955

Stage of Disease	Total						Upper Socioeconomic Class						Middle Socioeconomic Class						Lower Socioeconomic Class					
	Total		Male		Female		Total		Male		Female		Total		Male		Female		Total		Male		Female	
	Number	Per Cent	Number	Per Cent	Number	Per Cent	Number	Per Cent	Number	Per Cent	Number	Per Cent	Number	Per Cent	Number	Per Cent	Number	Per Cent	Number	Per Cent	Number	Per Cent	Number	Per Cent
Infectious Sputum																								
Total	191*	100.0	100	100.0	91	100.0	24	100.0	14	100.0	10	100.0	87	100.0	44	100.0	43	100.0	80	100.0	42	100.0	38	100.0
Latent apical and minimal	4	2.1	2	2.0	2	2.2	0	—	0	—	0	—	2	2.3	1	2.3	1	2.3	2	2.5	1	2.4	1	2.6
Moderately advanced	63	33.0	34	34.0	29	31.9	4	16.7	4	28.6	0	—	38	43.7	17	38.6	21	48.8	21	26.2	13	31.0	8	21.1
Fatal and far advanced	124	64.9	64	64.0	60	65.9	20	83.3	10	71.4	10	100.0	47	54.0	26	59.1	21	48.8	57	71.2	28	66.7	29	76.3
Other than Infectious Sputum																								
Total	473*	100.0	194	100.0	279	100.0	44	100.0	19	100.0	25	100.0	207	100.0	78	100.0	129	100.0	222	100.0	97	100.0	125	100.0
Latent apical and minimal	341	72.1	119	61.3	222	79.6	34	77.3	14	73.7	20	80.0	143	69.1	43	55.1	100	77.5	164	73.9	62	63.9	102	81.6
Moderately advanced	125	26.4	72	37.1	53	19.0	10	22.7	5	26.3	5	20.0	60	29.0	34	43.6	26	20.2	55	24.8	33	34.0	22	17.6
Fatal and far advanced	7	1.5	3	1.5	4	1.4	0	—	0	—	0	—	4	1.9	1	1.3	3	2.3	3	1.4	2	2.1	1	0.8

* These add up to 664, which does not jibe with the figure of 680 given under "Composition of the Study Group." Two index cases served in two different households. In addition 14 households could not be classified socioeconomically because of insufficient information.

smaller dose would also have reacted to the larger. Inasmuch as the reverse is not necessarily true, the comparison will show minimal differences. Any decline in tuberculin reactors would therefore be more significant than if comparisons had been possible using the same strength of antigen in all three periods. The data show a regular decrease in the adjusted percentage of reactors over the entire period of the study, so that the final prevalence of 6.2 per cent is less than half of 12.7 per cent observed during the first period. For the white population, the decline was regular and steady. For the Negro, there was no change in the first two periods, but a sharp drop was noted in the third.

The prevalence of infection in household associates five to 19 years of age is shown by age and race for the three periods in Table XXIII*B*. Relatively few tests were done during the second and third periods, chiefly because the acquisition of new households during those years was quite small. Only 148 new households were brought under observation between 1940 and 1947, and 80 during 1948 to 1955. The small numbers make for some irregularity in the data, but on the whole the same decline observed in the clinic population was noted in the households. For the whole tested household population the prevalence of infection dropped from 50.8 per cent, adjusted, in the first period, to 27.9 per cent in the last. Among white household associates the decline was steady over the three periods. In the nonwhite it was irregular, but the smallness of numbers here makes an interpretation hazardous. Comparison of the clinic and household populations five to 19 years of age points up the markedly greater risk of infection among household associates (figure 15). Among the latter, the adjusted prevalence of 48.4 per cent was more than five times as high as that in the general population (9.2 per cent).

The decline in community and household infection is not surprising. In the later period the use of antituberculosis drugs produced relatively rapid reversal of infectiousness, with a reduction of the reservoir of organisms in the community. In addition, there was a swing of tuberculosis to the older age groups, and this may have resulted in the exposure of fewer children in the five- to 19-year-old group, as has been suggested by Robins (44).

From these observations it may be predicted

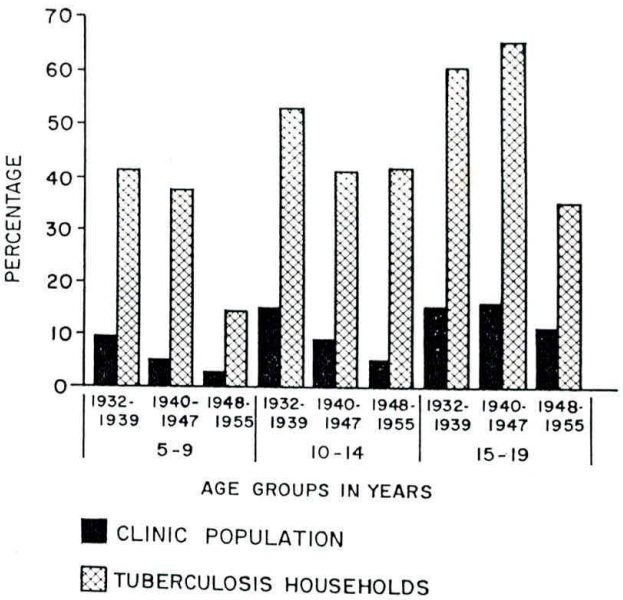

FIG. 15. Percentage of reactors to Old Tuberculin among persons five to 19 years of age in the clinic population and in associates of tuberculous households, by three periods of time, in Williamson County, Tennessee.

that there will be a future decline in tuberculosis morbidity in this community, since tomorrow's new cases may be expected to arise largely from today's infected population.

Mortality Studies

Comparison of county and household populations: Mortality rates for all causes and for tuberculosis were compared for the county population and for the household associates of index cases, as shown in table 7. Death rates for tuberculosis were higher among household associates, as expected. Mortality rates for all causes were similar in white household and county populations, but among Negro subjects the rate was 50 per cent higher in study households than in the county. In comparing the death rates for all causes in the nonwhite and white groups, the ratio was 1.4 to 1 for the county, and 2.0 to 1 for the adjusted rates in the study group. Tuberculosis mortality rates in the Negro and white showed a ratio of 2.3 to 1 for the county, and 6.2 to 1 for the household associates (adjusted). The excessive mortality for all causes in the Negro household group was in part due to the higher tuberculosis mortality rates in these persons. It was not the whole story, however, because, after the tuberculosis deaths were subtracted from the total, the death rates for all other causes were again higher

TABLE 7

AVERAGE ANNUAL DEATHS AND DEATH RATES IN WILLIAMSON COUNTY FOR ALL CAUSES AND FOR TUBERCULOSIS BY RACE, FOR THREE PERIODS OF TIME, AND TOTAL DEATHS AND DEATH RATES FOR ALL CAUSES AND FOR TUBERCULOSIS AMONG HOUSEHOLD ASSOCIATES, BY RACE

Williamson County, Tennessee, 1932–1955

Time Period	Population Group	Total				White Deaths				Nonwhite Deaths			
		Total		Tuberculosis		Total		Tuberculosis		Total		Tuberculosis	
		Annual Average Number	Rate Per 1,000	Annual Average Number	Rate Per 1,000	Annual Average Number	Rate Per 1,000	Annual Average Number	Rate Per 1,000	Annual Average Number	Rate Per 1,000	Annual Average Number	Rate Per 1,000
Total	Household associates	393*	12.2	52*	161.7	279*	10.6	23*	87.4	114*	19.5	29*	495.2
	Adjusted†		*11.4*		*176.9*		*9.3*		*82.5*		*18.8*		*514.9*
Total	County	244.2	9.3	14.7	59.1	176.9	9.1	9.0	46.3	67.3	12.4	5.7	105.0
1932–1939	County	247.1	10.2	22.5	92.9	170.4	9.1	12.2	65.4	76.5	14.0	10.2	187.2
1940–1947	County	248.4	10.0	14.4	57.8	180.2	9.3	9.5	48.9	68.1	12.5	4.9	89.7
1948–1955	County	237.1	9.7	7.2	29.6	180.1	9.3	5.2	27.1	57.0	11.1	2.0	39.0

* Deaths for whole study period.

† Using race-specific county population as standard.

in the household associates compared with those in the general county population.

Death rates for all causes and for tuberculosis during three periods of time, 1932 to 1939, 1940 to 1947, and 1948 to 1955, were compared in the county population. A steady decline was noted in each category through the three periods. However, if the tuberculosis death rates were subtracted from the total, the death rates for all other causes rose slightly in each period for white county residents, while the rates fell slightly for the Negroes.

The decline in tuberculosis death rates was striking in both races, but was more marked and more dramatic in the Negro population. The whites showed a drop in tuberculosis mortality from 65.4 per 100,000 in the first period to 27.1 in the third period, or a reduction of 58.5 per cent. In the Negro population, tuberculosis mortality rates declined from 187.2 per 100,000 in the first period to 39.0 in the last, or a drop of 79.1 per cent. Although in the 1932 to 1939 period the ratio of Negro to white deaths was 2.9 to 1, in the years from 1948 to 1955 it was only 1.4 to 1. These changes quantitate the clinical impression that the Negro began to handle his tuberculosis much better during the later years of the study than in the earlier period. The gap in tuberculosis mortality between white and Negro was narrowed remarkably during these years.

Comparison of Tennessee and United States mortality: In the "Introduction" it was shown that tuberculosis mortality was considerably higher in the older white population in Tennessee than in the United States. The reason for this phenomenon has been the subject of discussion and speculation for many years. The fact that the Tennessee pattern of mortality is now becoming apparent in the United States (at least for the males) has not clarified the situation.

A comparison of total and tuberculosis mortality for the population older than 55 years of age for two periods of time in Tennessee and the United States is shown in table 8. For the Tennessee population, the years 1933 and 1953 were compared. For similar population groups in the United States, the years 1934 and 1952 were used, because the data for these years were readily at hand and they were close enough to the other years to provide comparability.

First, a comparison of the two periods in Tennessee shows that total and tuberculosis mortality declined for all older than 55 and for each age group. The decline in tuberculosis mortality was the more striking. Although in the earlier year 5.4 per cent of all deaths were tuber-

TABLE 8

DEATH RATES FOR ALL CAUSES AND FOR TUBERCULOSIS, AND PROPORTION OF TUBERCULOSIS DEATHS TO ALL DEATHS, IN WHITE POPULATION MORE THAN 55 YEARS OLD, TENNESSEE AND THE UNITED STATES, FOR TWO PERIODS OF TIME

Age Group in Years	Tennessee			United States		
	Death Rate per 1,000, All Causes	Tuberculosis Death Rate per 100,000	Tuberculosis Deaths, Per Cent of All Deaths	Death Rate per 1,000, All Causes	Tuberculosis Death Rate per 100,000	Tuberculosis Deaths, Per Cent of All Deaths
	1933			1934		
Age 55 and older...	38.6	208.6	5.4	44.7	83.4	1.9
55–64.....	18.9	170.2	9.0	22.3	78.0	3.5
65–74.....	41.1	226.1	5.5	48.8	88.1	1.8
75 and older.....	119.1	333.4	2.8	128.6	94.7	0.7
	1953			1952		
Age 55 and older...	37.1	70.5	1.9	38.9	38.2	1.0
55–64.....	15.1	41.4	2.7	17.7	31.0	1.8
65–74.....	35.8	84.3	2.4	39.1	43.5	1.1
75 and older.....	108.7	132.2	1.2	108.6	50.8	0.5

culosis deaths, in 1953 only 1.9 per cent of the total mortality was caused by tuberculosis.

In the United States there was also a decline in total and tuberculosis mortality in the 18-year interval between the two periods. Here too, the decrease was noted not only in the totals but in each age group. The percentage of tuberculosis deaths was 1.9 in 1934, and fell to 1.0 in 1952.

Comparison of Tennessee and United States data shows several interesting facts. Mortality for all causes was lower in Tennessee than in the country at large in both periods, while tuberculosis mortality was considerably higher in the state. In the interval between the two periods the percentage of tuberculosis deaths in the state decreased 66 per cent, while the reduction was only 54 per cent in the United States.

The foregoing indicates that the higher mortality from tuberculosis in Tennessee was in place of, and not in addition to, mortality from other causes. It means, in effect, that older people died of tuberculosis rather than of other causes, such as heart disease or malignancy. In fact the mortality from these latter two causes in Tennessee was lower than the national rate.

The question also arises whether tuberculosis among the older white population was of long duration or of recent origin. An analysis of the experience of the white study population older than 55 years reveals that no uniform pattern of tuberculosis occurrence prevailed. Although it was often difficult to establish the date of onset of the disease because of its vague symptoms and insidious nature, according to the best judgment of the study clinicians, it appeared that in many instances the disease had been present for a considerable period of time in this group of elderly persons. Many showed a remarkable ability to live with the tubercle bacillus in an almost symbiotic relationship for more than 20 years—and in a few instances, for more than 30 years—before succumbing. On the other hand, it was evident that a number of older persons contracted their disease very shortly before diagnosis. A decline in resistance to infection, commonly seen in older people, may have been responsible for the activation of a previously quiescent infectious focus. In either case, the eventual death from tuberculosis of these older persons tended to raise the age-specific mortality rate to its unusually high level compared with the nation's rate.

Comparison of urban and rural mortality: In the "Introduction" it was noted that one of the oddities of Tennessee tuberculosis mortality was the higher rate in rural residents compared with that in urban residents. It would have been most desirable to have included the investigation of urban as well as rural tuberculous households in the study plan. But, because the study was limited to Williamson County, which is rural, no comparable data for an urban population were available. Of course, one could speculate that differences might be based on the comparative quality and availability of medical care, or on a variety of other environmental or host factors. It would be pure speculation, however, and as such would contribute nothing toward a definitive reason for the intriguing observation of the higher rural tuberculosis mortality in Tennessee.

Summary

Resident tuberculosis mortality rates for Tennessee differed from the national average in several respects: (*a*) year by year Tennessee rates were about 50 per cent higher than the Unites States average; (*b*) Tennessee age-specific rates for whites showed a marked rise after 50 years of age; (*c*) in the Tennessee white population the mortality rates were slightly higher in females than in males; and (*d*) the rates in the rural areas of Tennessee were higher than in the urban areas.

After preliminary pilot studies, the Tennessee Department of Public Health established a tuberculosis study in Williamson County, Tennessee, in 1931 in order to: conduct a systematic study of the familial incidence of tuberculosis; investigate the factors and circumstances related to the "breakdown" of an individual with the adult type of tuberculosis; investigate the evolution of tuberculous infection in childhood, particularly in children in close contact with a tuberculous parent; undertake an epidemiologic and clinical study of tuberculosis of old age; and develop a program of tuberculosis control for state-wide application to cope with the particular tuberculosis problem in Tennessee.

The study was organized on a household basis for the observation of members who were exposed to an "index" case of tuberculosis in the household. During the 24 years of the study, 828 households comprising 4,214 persons other

than index cases were observed for 32,175.25 person-years.

Antecedent history revealed that in the ten years prior to the discovery of the index case there had been considerable tuberculosis morbidity and mortality in the households. Both morbidity and mortality were appreciably higher in households in which the index case had sputum positive for *M. tuberculosis* than in other households. Among known tuberculous patients, more than half had a history of tuberculosis in parents and/or siblings.

Prevalence of infection among household associates varied with age and the sputum status of the index case. Infection increased with age. In "sputum-positive" households, more than 3 of 4 household associates were already infected when the index case was discovered. In other households less than 50 per cent of the associates were infected. Sex, race, relationship to the index case, and socioeconomic status did not appear to influence the prevalence of infection.

On first examination of household associates after discovery of the index case, a high frequency of previously undetected tuberculosis was found. The prevalence of disease was significantly influenced by the "dosage" factor; it tended to increase with age; females generally had more disease than males; less tuberculosis was found in Negro associates than in white; close relatives in general had more disease than other members, notably so in the age group younger than five years; and the socioeconomic factor was of suggestive importance among white but not among Negro associates.

The development of new cases of tuberculosis in the households under observation was influenced by a variety of factors. Three periods of life appeared to be critical: infancy, puberty, and old age. Pubertal females had higher attack rates than males of similar age. In infancy and old age the rates were higher for males than for females. Attack rates were higher in "sputum-positive" than in other households. Rates were also higher among Negro associates than among white. Close relatives had a slightly higher attack rate than other members, the difference being most marked in those less than 15 years of age. The socioeconomic status also influenced the attack rate in the younger age groups. Pregnancy and the postpartum period did not appear to be a factor in the attack rate for females between 15 and 44 years of age.

Tuberculosis mortality rates were higher in "sputum-positive" households than in others; they varied with age and closely paralleled critical ages for attack rates; death rates differed by sex at different ages; they were four and one-half times as high in nonwhite households as in white; relationship appeared to be a factor in the younger age groups; and socioeconomic status appeared to exert some influence in the nonwhite households containing "sputum-positive" persons.

Deaths from causes other than tuberculosis were not significantly higher in "sputum-positive" than in other households; the expected age pattern was noted; white males had higher death rates than white females in "sputum-positive" households only, with no difference noted in other households or among Negro associates; rates in Negroes were generally higher than in whites, *in toto*, at all ages, and socioeconomically, class by class. The greatest difference by race was noted for the females.

The interval between exposure and the development of tuberculosis varied in children of "sputum-positive" parents according to the age of first exposure. The probability of developing tuberculosis soon after exposure was high in infancy and in children 15 years of age and older. When first exposure occurred between one and 14 years of age, tuberculosis did not develop until after 15 years of age. The interval between exposure and onset of disease was generally shorter among Negro associates than among white.

The probability of dying of tuberculosis among white persons with moderately advanced tuberculosis on first diagnosis declined during the three consecutive eight-year periods of the study.

The value of case finding was shown by a comparison of the stage of disease on diagnosis of index and new cases. Index cases were predominantly in the advanced stage while more than half of the new cases were in the minimal or latent apical disease stage. Socioeconomic status did not appear to influence the stage of disease on diagnosis.

Tuberculous infection of the community and the household population five to 19 years of age showed about a 50 per cent decline during the three successive eight-year periods of the study. The level of infection was more than five times

as high in the household population as in the community.

Death rates for all causes and for tuberculosis were higher in the study population than in the community. In the general population the rates declined over the three successive eight-year periods, the most marked decline being noted among Negro residents, particularly for tuberculosis mortality, which dropped about 80 per cent. The ratio of Negro to white tuberculosis deaths declined from 2.9 to 1, to 1.4 to 1.

Tennessee tuberculosis mortality rates in those 55 years of age and older declined about 66 per cent from 1933 to 1953, while in the United States the decline was 54 per cent between 1934 and 1952. Mortality rates for all causes were lower, and for tuberculosis higher in the Tennessee population compared with the rates in the United States.

High tuberculosis mortality rates in those in the study population who were more than 55 years of age were about equally attributable to disease of long duration and to disease of recent onset.

Nutrition levels, using hemoglobin values as an index, did not vary with the socioeconomic status in the rural study and clinic populations.

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PRESENT MEMBERS OF HOUSEHOLD

HEAD OF HOUSEHOLD | DATE ESTABLISHED | DATE INVESTIGATED | HH. NO.

REASON FOR SELECTION OF HH. | CLASSIFICATION OF INDEX CASE | COLOR

IND. NO.	NAME	DATE OF BIRTH	SEX	MAR. STAT.	RELATION TO HEAD OF HH.*	DATE ENTERED HH.	DATE LEFT HH.	FIRST EXAMINATION		DATE ONSET TBC.	DATES CHECKED IN HOUSEHOLD												REMARKS
								DATE	CLASS														

REMARKS:

*SPECIFY RELATIONSHIP TO OTHER MEMBERS OF HOUSEHOLD WHERE NECESSARY.

INFORMANT NO. | SIGNED

WILLIAMSON COUNTY TUBERCULOSIS STUDY
TENNESSEE DEPARTMENT OF PUBLIC HEALTH - 981

FORMER MEMBERS OF HOUSEHOLD - LIVING ELSEWHERE OR DEAD

DATE HEAD OF HOUSEHOLD HH. NO.

IND. NO.	NAME (LIST LIVING MEMBERS FIRST)	W. I. OR D.	YEAR OF BIRTH	SEX	MAR. STATUS	RELATION TO HEAD OF HOUSE	IN HOUSEHOLD FROM	IN HOUSEHOLD TO	HISTORY OF TBC. WITH DATES	PRESENT ADDRESS OR CAUSE AND DATE OF DEATH

REMARKS

SIGNED

ENVIRONMENTAL RECORD

DATE _____ SOCIAL, ECONOMIC AND HYGIENIC STATUS OF THE HOUSEHOLD HH. NO. _____

A. COMMUNITY:

RURAL	AGRICULTURAL	PREDOMINATING WHITE	PROSPEROUS
SEMI-RURAL	INDUSTRIAL	PREDOMINATING COLORED	MEDIOCRE
URBAN	RESIDENTIAL	MIXED, WHITE AND COLORED	RUNDOWN

B. RESIDENCE:

SINGLE	OWNED, FREE	NO. OF ROOMS	NO. OF YEARS IN COMMUNITY
DUPLEX	OWNED, ENCUMBERED	NO. OF SLEEPING ROOMS	NO. OF YEARS IN HOUSE
APARTMENT	RENTED	NO. BEDS	NO. PEOPLE IN HOUSE
	RENTAL VALUE	SLEEPING ARRANGEMENTS	

C. SANITATION:

WATER SUPPLY:

CISTERN	IN HOUSE
WELL	NEAR HOUSE
SPRING OR STREAM	DISTANT
MAIN CONNECTIONS	

TOILET FACILITIES:
- WATER CLOSET
- SANITARY PRIVY
- OPEN PRIVY
- NONE

BATHING FACILITIES:
- SHOWER
- TUB
- NONE

SCREENING:
- GOOD
- DEFECTIVE
- NONE

MILK SUPPLY:
- COWS TBCLN. TESTED
- COWS NOT TESTED
- MILK PASTEURIZED
- MILK DEALER
- AMT. MILK USED

REMARKS ON EVIDENCE OF PERSONAL HYGIENE AND CLEANLINESS OBSERVED: _____

_____

_____

SUMMARY OF FORMER RESIDENCES: _____

_____

_____ SIGNED _____

WILLIAMSON COUNTY TUBERCULOSIS STUDY
TENNESSEE DEPARTMENT OF PUBLIC HEALTH - 983

INDIVIDUAL RECORD

NAME _____ COLOR _____ SEX _____ AGE _____ HH. AND IND. NO. _____

OCCUPATION _____ DATE OF RECORD _____

CONTACT WITH TUBERCULOSIS

NAME	RELATION	YEAR BEGUN	YEAR ENDED	TYPE OF CASE	TYPE CONTACT (HH., VISIT, ETC)	REMARKS

PAST ILLNESSES (GIVE DATES)

PLEURISY _____ PNEUMONIA _____ INFLUENZA _____ OTHER RESPIRATORY _____ OTHER DISEASES _____

HISTORY OF TBC. _____ ONSET _____

FAMILY MEMBERS

NAME	SEX	ADDRESS	YEAR BIRTH	YR. LAST OBSERV.	STATUS (W.I.D.)	CAUSE	HISTORY OF TUBERCULOSIS (WITH DATES)
PARENTS							
SIBLINGS							
CONSORT							
CHILDREN							

W.I.D. MEANS WELL, ILL, DEAD - USE REVERSE SIDE FOR LISTING ADDITIONAL SIBLINGS, CONSORTS, AND CHILDREN.

WILLIAMSON COUNTY TUBERCULOSIS STUDY
TENNESSEE DEPARTMENT OF PUBLIC HEALTH - 984

CLINICAL RECORD

NAME COLOR SEX AGE HH. AND IND. NO.

MARITAL STATUS BIRTHPLACE

MAILING ADDRESS	DIRECTIONS FOR FINDING HOUSE
1.	
2.	
3.	

PHYSICIAN ADDRESS

PREVIOUS DIAGNOSIS OF TUBERCULOSIS (GIVE DATE)

PREVIOUS MEDICAL CARE

CURRENT SYMPTOMS AND ILLNESS

	DATE	DATE	DATE	DATE	DATE
PLEURISY					
PNEUMONIA					
INFLUENZA					
BRONCHITIS					
OTHER (SPECIFY)					
HEMOPTYSIS					
DATE					
AMOUNT					

DATE																		
FATIGUE																		
COUGH																		
EXPECTORATION																		
PAIN IN CHEST																		
LOSS OF WEIGHT																		
NIGHT SWEATS																		
HOARSENESS																		
SHORTNESS BREATH																		
FEVERISH																		
AMENORRHEA																		
TEMPERATURE																		
PULSE																		
WEIGHT																		
HEIGHT (IN INCHES)																		

WHY DID PATIENT SEEK X-RAY EXAMINATION?

ONSET OF ILLNESS (DATE AND MANNER OF ONSET)

CHANGES IN SYMPTOMS AT REEXAMINATION

CODE: 0, SATISFACTORY; 1,2,3, SLIGHTLY, MODERATELY OR MARKEDLY UNSATISFACTORY.

WILLIAMSON COUNTY TUBERCULOSIS STUDY
TENNESSEE DEPARTMENT OF PUBLIC HEALTH - 985

NAME HH. AND IND. NO.

X-RAY EXAMINATIONS

DATE										
CLASSIFICATION										
CODE										
DATE										
CLASSIFICATION										
CODE										

SPUTUM EXAMINATIONS

DATE																										
RESULT																										
DATE																										
RESULT																										

SKIN TESTS

	TUBERCULIN										OTHER (SPECIFY)									
DATE																				
AMOUNT																				
RESULT																				

SUMMARY OF HOSPITALIZATION

DATE ADMITTED	HOSPITAL	TREATMENT	DATE DISCHARGED	RECOMMENDATIONS

OTHER TREATMENT AND CARE

TYPE (WITH DATES INSTITUTED AND DISCONTINUED)

CHANGES (WITH DATES)

CONTACT	
OCCUPATION	
ENVIRONMENT	
ECONOMIC STATUS	

REHABILITATION

DATE REFERRED TYPE TRAINING RECEIVED

DATE RETURNED TO WORK TYPE POSITION

FIRST EXAMINATION

NAME | COLOR | SEX | AGE | HH. AND IND. NO.

DATE | SEND REPORT TO DR. | ADDRESS

PHYSICAL EXAMINATION

GENERAL APPEARANCE	RETARDED MOTION
THYROID	DEPRESSIONS
GLANDS	ANEMIC
TONSILS	HEART
TEETH	

LEFT LUNG | SUMMARY OF FINDINGS | RIGHT LUNG

DIAGNOSIS (BY HISTORY AND PHYSICAL EXAMINATION)

X-RAY EXAMINATION

FILM TECHNIQUE USED | RECOMMENDED TECHNIQUE

OBJECTIVE DESCRIPTION - FILM NO.

DIAGNOSIS (ON ALL AVAILABLE DATA)

RECOMMENDATIONS | EXAM. BY

WILLIAMSON COUNTY TUBERCULOSIS STUDY
TENNESSEE DEPARTMENT OF PUBLIC HEALTH - 986

REEXAMINATION

NAME	COLOR	SEX	AGE	HH. AND IND. NO.
DATE SEND REPORT TO DR.	ADDRESS			EXAM. NUMBER

CHANGES IN PHYSICAL FINDINGS

TENTATIVE DIAGNOSIS

FILM TECHNIQUE USED	RECOMMENDED TECHNIQUE

X-RAY - OBJECTIVE DESCRIPTION - FILM NO.

DIAGNOSIS	RECOMMENDATIONS	EXAM. BY

DATE AGE SEND REPORT TO DOCTOR	ADDRESS	EXAM. NUMBER

CHANGES IN PHYSICAL FINDINGS

TENTATIVE DIAGNOSIS

FILM TECHNIQUE USED	RECOMMENDED TECHNIQUE

X-RAY - OBJECTIVE DESCRIPTION - FILM NO.

DIAGNOSIS	RECOMMENDATIONS	EXAM. BY

NURSING NOTES

NAME HH. AND IND. NO.

DATE	NOTES	WORKER

WILLIAMSON COUNTY TUBERCULOSIS STUDY
TENNESSEE DEPARTMENT OF PUBLIC HEALTH - 987

HOUSEHOLD RECORD OF ILLNESS

HEAD OF HOUSEHOLD

H.H. NO.

IND. NO.	NAME	DATE OF BIRTH	SEX	MAR. STAT.	RELATION TO HEAD OF H.H.	DATE OF HOUSEHOLD CHECK																	

RECORD DATES OF ENTRY OF NEW ASSOCIATES AND DATES OF REMOVAL OF THOSE WHO LEAVE. IF NO ILLNESS OCCURRED SINCE DATE OF PREVIOUS CHECK, INDICATE WITH "0" IF ILLNESS OCCURRED, SPECIFY BY CODE AND GIVE DETAILS ON INDIVIDUAL RECORD. USE REVERSE SIDE FOR INFORMATION PERTAINING TO THOSE WHO HAVE NO INDIVIDUAL RECORD.

CODE FOR ILLNESS

1. MEASLES
2. WHOOPING COUGH
3. PNEUMONIA
4. PLEURISY
5. INFLUENZA
6. SEVERE COLD (3 + WEEKS)
7. PREGNANCY
8. SERIOUS INJURY
9. OPERATION
10. OTHER (CONFINED TO BED)

WILLIAMSON COUNTY TUBERCULOSIS STUDY
TENNESSEE DEPARTMENT OF PUBLIC HEALTH - 988

TABLE I

PERSON-YEARS EXPERIENCE OF HOUSEHOLD ASSOCIATES OF INDEX CASES, BY AGE, SEX, RACE, AND RELATIONSHIP TO THE INDEX CASE
Williamson County, Tennessee, 1931–1955

Age Group	Total			Male			Female		
	Total	Close Relatives	Other Members	Total	Close Relatives	Other Members	Total	Close Relatives	Other Members
Total									
Total	32,175.25	16,765.50	15,409.75	16,654.00	8,851.50	7,802.50	15,521.25	7,914.00	7,607.25
<5	1,781.75	1,016.25	765.50	863.25	514.75	348.50	918.50	501.50	417.00
5–14	6,956.25	4,564.00	2,392.25	3,712.25	2,491.25	1,221.00	3,244.00	2,072.75	1,171.25
15–24	6,676.75	4,559.25	2,117.50	3,755.50	2,671.75	1,083.75	2,921.25	1,887.50	1,033.75
25–34	3,372.50	1,819.25	1,553.25	1,628.25	980.50	647.75	1,744.25	838.75	905.50
35–44	3,427.50	1,287.50	2,140.00	1,712.50	620.50	1,092.00	1,715.00	667.00	1,048.00
45–54	3,493.75	1,158.75	2,335.00	1,766.25	487.25	1,279.00	1,727.50	671.50	1,056.00
55–64	3,009.50	1,075.75	1,933.75	1,465.00	472.75	992.25	1,544.50	603.00	941.50
65–74	2,260.00	799.75	1,460.25	1,172.00	388.00	784.00	1,088.00	411.75	676.25
75+	1,190.25	485.00	705.25	574.50	224.75	349.75	615.75	260.25	355.50
Unknown	7.00	—	7.00	4.50	—	4.50	2.50	—	2.50
White									
Total	26,318.50	13,577.00	12,741.50	13,679.00	7,246.25	6,432.75	12,639.50	6,330.75	6,308.75
<5	1,492.25	828.25	664.00	719.75	414.25	305.50	772.50	414.00	358.50
5–14	5,666.75	3,841.50	1,825.25	3,055.75	2,100.50	955.25	2,611.00	1,741.00	870.00
15–24	5,444.75	3,835.75	1,609.00	3,035.25	2,215.50	819.75	2,409.50	1,620.25	789.25
25–34	2,620.00	1,444.50	1,175.50	1,258.00	776.00	482.00	1,362.00	668.50	693.50
35–44	2,766.75	1,004.00	1,762.75	1,416.25	533.50	882.75	1,350.50	470.50	880.00
45–54	2,902.00	854.00	2,048.00	1,494.00	405.00	1,089.00	1,408.00	449.00	959.00
55–64	2,520.75	787.75	1,733.00	1,246.00	354.25	891.75	1,274.75	433.50	841.25
65–74	1,862.50	568.25	1,294.25	954.00	264.00	690.00	908.50	304.25	604.25
75+	1,035.75	413.00	622.75	495.50	183.25	312.25	540.25	229.75	310.50
Unknown	7.00	—	7.00	4.50	—	4.50	2.50	—	2.50
Nonwhite									
Total	5,856.75	3,188.50	2,668.25	2,975.00	1,605.25	1,369.75	2,881.75	1,583.25	1,298.50
<5	289.50	188.00	101.50	143.50	100.50	43.00	146.00	87.50	58.50
5–14	1,289.50	722.50	567.00	656.50	390.75	265.75	633.00	331.75	301.25
15–24	1,232.00	723.50	508.50	720.25	456.25	264.00	511.75	267.25	244.50
25–34	752.50	374.75	377.75	370.25	204.50	165.75	382.25	170.25	212.00
35–44	660.75	283.50	377.25	296.25	87.00	209.25	364.50	196.50	168.00
45–54	591.75	304.75	287.00	272.25	82.25	190.00	319.50	222.50	97.00
55–64	488.75	288.00	200.75	219.00	118.50	100.50	269.75	169.50	100.25
65–74	397.50	231.50	166.00	218.00	124.00	94.00	179.50	107.50	72.00
75+	154.50	72.00	82.50	79.00	41.50	37.50	75.50	30.50	45.00
Unknown	—	—	—	—	—	—	—	—	—

TABLE II

COMPOSITION OF THE WILLIAMSON COUNTY POPULATION* AND THE HOUSEHOLD ASSOCIATES POPULATION, BY AGE, SEX, AND RACE
Williamson County, Tennessee, 1931–1955

Age Group	Williamson County						Households					
	Total		Male		Female		Total		Male		Female	
	Number	Per Cent	Number	Per Cent	Number	Per Cent	Person-Years	Per Cent	Person-Years	Per Cent	Person-Years	Per Cent
Total												
Total	24,855	100.0	12,501	50.3	12,353	49.7	32,175.25	100.0	16,654.00	51.8	15,521.25	48.2
<5	2,630	10.6	1,362	5.5	1,268	5.1	1,781.75	5.5	863.25	2.7	918.50	2.9
5–14	5,221	21.0	2,654	10.7	2,567	10.3	6,956.25	21.6	3,712.25	11.5	3,244.00	10.1
15–24	4,397	17.7	2,222	8.9	2,174	8.7	6,676.75	20.8	3,755.50	11.7	2,921.25	9.1
25–34	3,390	13.6	1,687	6.8	1,704	6.9	3,372.50	10.5	1,628.25	5.1	1,744.25	5.4
35–54	5,378	21.6	2,619	10.5	2,759	11.1	6,921.25	21.5	3,478.75	10.8	3,442.50	10.7
55+	3,839	15.4	1,957	7.9	1,881	7.6	6,459.75	20.1	3,211.50	10.0	3,248.25	10.1
Unknown	—	—	—	—	—	—	7.00	—	4.50	—	2.50	—
White												
Total	19,430	78.2	9,808	39.5	9,620	38.7	26,318.50	81.8	13,679.00	42.5	12,639.50	39.3
<5	1,992	8.0	1,039	4.2	953	3.8	1,492.25	4.6	719.75	2.2	772.50	2.4
5–14	4,062	16.3	2,071	8.3	1,991	8.0	5,666.75	17.6	3,055.75	9.5	2,611.00	8.1
15–24	3,415	13.7	1,734	7.0	1,680	6.8	5,444.75	16.9	3,035.25	9.4	2,409.50	7.5
25–34	2,604	10.5	1,311	5.3	1,293	5.2	2,620.00	8.1	1,258.00	3.9	1,362.00	4.2
35–54	4,247	17.1	2,072	8.8	2,175	8.8	5,668.75	17.6	2,910.25	9.0	2,758.50	8.6
55+	3,110	12.5	1,581	6.4	1,528	6.1	5,419.00	16.8	2,695.50	8.4	2,723.50	8.5
Unknown	—	—	—	—	—	—	7.00	—	4.50	—	2.50	—
Nonwhite												
Total	5,425	21.8	2,693	10.8	2,733	11.0	5,856.75	18.2	2,975.00	9.2	2,881.75	9.0
<5	638	2.6	323	1.3	315	1.3	289.50	0.9	143.50	0.4	146.00	0.5
5–14	1,159	4.7	583	2.3	576	2.3	1,289.50	4.0	656.50	2.0	633.00	2.0
15–24	982	4.0	488	2.0	494	2.0	1,232.00	3.8	720.25	2.2	511.75	1.6
25–34	786	3.2	376	1.5	411	1.7	752.50	2.3	370.25	1.2	382.25	1.2
35–54	1,131	4.6	547	2.2	584	2.3	1,252.50	3.9	568.50	1.8	684.00	2.1
55+	729	2.9	376	1.5	353	1.4	1,040.75	3.2	516.00	1.6	524.75	1.6

* Estimated as of January 1, 1944 (mid-period of study)

TABLE III*

ANNUAL AND CUMULATED MORTALITY AND MORBIDITY FROM TUBERCULOSIS IN HOUSEHOLDS OF MANIFEST "SPUTUM-POSITIVE" INDEX CASES DURING A 21-YEAR PERIOD BORDERING ON THE ONSET OF THE INDEX CASE

Williamson County, Tennessee

Year Relative to Onset of Index Case	Life Experience, Person-Years	Deaths (Tuberculosis)			Cases (Tuberculosis)		
		Number	Rate per 100	Cumulative Percentage	Number	Rate per 100	Cumulative Percentage
Prior							
10	186.00	—	—	—	—	—	—
9	196.25	—	—	—	1	0.51	0.51
8	207.25	1	0.48	0.48	2	0.97	1.48
7	213.00	—	—	0.48	—	—	1.48
6	221.25	—	—	0.48	2	0.90	2.38
5	239.25	1	0.42	0.90	2	0.84	3.22
4	255.00	3	1.18	2.08	2	0.78	4.00
3	262.00	—	—	2.08	1	0.38	4.38
2	275.25	—	—	2.08	1	0.36	4.74
1	285.50	—	—	2.08	—	—	4.74
Year of onset	339.00	—	—	2.08	7	2.06	6.80
Subsequent							
1	300.00	2	0.67	2.75	4	1.33	8.13
2	261.50	1	0.38	3.13	3	1.15	9.28
3	212.25	—	—	3.13	1	0.47	9.75
4	184.00	1	0.54	3.67	2	1.09	10.84
5	166.75	—	—	3.67	—	—	10.84
6	141.75	—	—	3.67	1	0.71	11.55
7	121.75	3	2.64	6.31	—	—	11.55
8	107.00	—	—	6.31	2	1.87	13.42
9	100.50	—	—	6.31	—	—	13.42
10	95.50	—	—	6.31	1	1.05	14.47
Total	4370.75	12	0.27	6.31	32	0.73	14.47

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TABLE IV*

ANNUAL AND CUMULATED MORTALITY AND MORBIDITY FROM TUBERCULOSIS IN HOUSEHOLDS OF MANIFEST "OTHER-THAN-SPUTUM-POSITIVE" INDEX CASES DURING A 21-YEAR PERIOD BORDERING ON THE ONSET OF THE INDEX CASE

Williamson County, Tennessee

Year Relative to Onset of Index Case	Life Experience, Person-Years	Deaths (Tuberculosis)			Cases (Tuberculosis)		
		Number	Rate per 100	Cumulative Percentage	Number	Rate per 100	Cumulative Percentage
Prior							
10	583.50	1	0.17	0.17	—	—	—
9	619.50	—	—	0.17	2	0.32	0.32
8	646.00	—	—	0.17	2	0.31	0.63
7	662.75	1	0.15	0.32	2	0.30	0.93
6	687.75	—	—	0.32	4	0.58	1.51
5	713.50	1	0.14	0.46	2	0.28	1.79
4	742.50	1	0.13	0.59	2	0.27	2.06
3	772.50	—	—	0.59	2	0.26	2.32
2	803.00	1	0.12	0.71	2	0.25	2.57
1	840.25	—	—	0.71	2	0.24	2.81
Year of onset	848.00	2	0.24	0.95	2	0.24	3.05
Subsequent							
1	742.00	—	—	0.95	2	0.27	3.32
2	626.50	—	—	0.95	3	0.48	3.80
3	540.75	—	—	0.95	1	0.18	3.98
4	492.75	1	0.20	1.15	3	0.62	4.60
5	459.00	1	0.22	1.37	2	0.44	5.04
6	420.50	3	0.71	2.08	1	0.24	5.28
7	377.25	—	—	2.08	—	—	5.28
8	344.75	1	0.29	2.37	4	1.68	6.96
9	324.75	1	0.31	2.68	—	—	6.96
10	310.00	—	—	2.68	—	—	6.96
Total	12,557.50	14	0.11	2.68	38	0.30	6.96

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TABLE VA

PREVALENCE OF INFECTION AMONG WHITE HOUSEHOLD ASSOCIATES OF "SPUTUM-POSITIVE" INDEX CASES, BY AGE, SEX, AND RELATIONSHIP TO THE INDEX CASE

Williamson County, Tennessee, 1931–1955

Age Group in Years	Total			Male			Female		
	Number Tested	Positive		Number Tested	Positive		Number Tested	Positive	
		Number	Per Cent		Number	Per Cent		Number	Per Cent
Total									
Total	350	250	71.4	175	120	68.6	175	130	74.3
<5	52	24	46.2	24	12	50.0	28	12	42.9
5–14	137	90	65.7	77	45	58.4	60	45	75.0
15–24	63	51	81.0	32	24	75.0	31	27	87.1
25–34	32	26	81.2	14	13	92.9	18	13	72.2
35–54	46	40	87.0	19	17	89.5	27	23	85.2
55+	20	19	95.0	9	9	*	11	10	90.9
Close Relatives									
Total	214	158	73.8	112	79	70.5	102	79	77.5
<5	29	15	51.7	14	7	50.0	15	8	53.3
5–14	106	76	71.7	61	41	67.2	45	35	77.8
15–24	47	37	78.7	24	18	75.0	23	19	82.6
25–34	13	12	92.3	5	5	*	8	7	*
35–54	12	11	91.7	4	4	*	8	7	*
55+	7	7	*	4	4	*	3	3	*
Other Members									
Total	136	92	67.6	63	41	65.1	73	51	69.9
<5	23	9	39.1	10	5	50.0	13	4	30.8
5–14	31	14	45.2	16	4	25.0	15	10	66.7
15–24	16	14	87.5	8	6	*	8	8	*
25–34	19	14	73.7	9	8	*	10	6	60.0
35–54	34	29	85.3	15	13	86.7	19	16	84.2
55+	13	12	92.3	5	5	*	8	7	*

* Less than 10 persons; no percentage calculated

TABLE V*B*

PREVALENCE OF INFECTION AMONG WHITE HOUSEHOLD ASSOCIATES OF "OTHER-THAN-SPUTUM-POSITIVE" INDEX CASES, BY AGE, SEX, AND RELATIONSHIP TO THE INDEX CASE

Williamson County, Tennessee, 1931–1955

Age Group in Years	Total			Male			Female		
	Number Tested	Positive		Number Tested	Positive		Number Tested	Positive	
		Number	Per Cent		Number	Per Cent		Number	Per Cent
Total									
Total	519	192	37.0	249	93	37.4	270	99	36.7
<5	81	10	12.4	37	9	24.3	44	1	2.3
5-14	243	67	27.6	130	37	28.5	113	30	26.6
15-24	97	50	51.6	46	24	52.2	51	26	51.0
25-34	35	22	62.9	9	4	44.4	26	18	69.2
35-54	39	25	64.1	17	12	70.6	22	13	59.1
55+	24	18	75.0	10	7	70.0	14	11	78.6
Close Relatives									
Total	358	99	27.7	170	51	30.0	188	48	25.5
<5	67	6	9.0	28	5	17.9	39	1	2.6
5-14	201	51	25.4	104	29	27.9	97	22	22.7
15-24	67	30	44.8	30	13	43.3	37	17	46.0
25-34	12	7	58.3	5	2	*	7	5	*
35-54	7	3	*	3	2	*	4	1	*
55+	4	2	*	0	0	—	4	2	*
Other Members									
Total	161	93	57.8	79	42	53.2	82	51	62.2
<5	14	4	28.6	9	4	*	5	0	—
5-14	42	16	38.1	26	8	30.8	16	8	50.0
15-24	30	20	66.7	16	11	68.8	14	9	64.3
25-34	23	15	65.2	4	2	*	19	13	68.4
35-54	32	22	68.8	14	10	71.4	18	12	66.7
55+	20	16	80.0	10	7	70.0	10	9	90.0

* Less than 10 persons; no percentage calculated

TABLE VIA

PREVALENCE OF INFECTION AMONG NONWHITE HOUSEHOLD ASSOCIATES OF "SPUTUM-POSITIVE" INDEX CASES, BY AGE, SEX, AND RELATIONSHIP TO THE INDEX CASE

Williamson County, Tennessee, 1931–1955

Age Group in Years	Total			Male			Female		
	Number Tested	Positive		Number Tested	Positive		Number Tested	Positive	
		Number	Per Cent		Number	Per Cent		Number	Per Cent
Total									
Total	218	153	70.2	98	66	67.3	120	87	72.5
<5	46	24	52.2	22	10	45.5	24	14	58.3
5–14	83	56	67.5	39	27	69.2	44	29	65.9
15–24	43	31	72.1	22	15	68.2	21	16	76.2
25–34	11	9	81.8	4	3	*	7	6	*
35–54	21	19	90.5	6	6	*	15	13	86.7
55+	14	14	100.0	5	5	*	9	9	*
Close Relatives									
Total	149	105	70.5	69	48	69.6	80	57	71.2
<5	31	16	51.6	16	7	43.8	15	9	60.0
5–14	62	42	67.7	27	20	74.1	35	22	62.9
15–24	29	22	75.9	17	12	70.6	12	10	83.3
25–34	5	4	*	1	1	*	4	3	*
35–54	13	12	92.3	3	3	*	10	9	90.0
55+	9	9	*	5	5	*	4	4	*
Other Members									
Total	69	48	69.6	29	18	62.1	40	30	75.0
<5	15	8	53.3	6	3	*	9	5	*
5–14	21	14	66.7	12	7	58.3	9	7	*
15–24	14	9	64.3	5	3	*	9	6	*
25–34	6	5	*	3	2	*	3	3	*
35–54	8	7	*	3	3	*	5	4	*
55+	5	5	*	0	0	—	5	5	*

* Less than 10 persons; no percentage calculated

TABLE VI*B*

PREVALENCE OF INFECTION AMONG NONWHITE HOUSEHOLD ASSOCIATES OF "OTHER-THAN-SPUTUM-POSITIVE" INDEX CASES, BY AGE, SEX, AND RELATIONSHIP TO THE INDEX CASE

Williamson County, Tennessee, 1931–1955

Age Group in Years	Total			Male			Female		
	Number Tested	Positive		Number Tested	Positive		Number Tested	Positive	
		Number	Per Cent		Number	Per Cent		Number	Per Cent
Total									
Total	62	23	37.1	40	17	42.5	22	6	27.3
<5	11	1	9.1	5	1	*	6	0	—
5–14	37	11	29.7	28	9	32.1	9	2	*
15–24	5	3	*	3	3	*	2	0	—
25–34	5	4	*	1	1	*	4	3	*
35–54	3	3	*	2	2	*	1	1	*
55+	1	1	*	1	1	*	0	0	—
Close Relatives									
Total	34	14	41.2	22	9	40.9	12	5	41.7
<5	7	0	—	4	0	—	3	0	—
5–14	19	8	42.1	15	6	40.0	4	2	*
15–24	4	2	*	2	2	*	2	0	—
25–34	2	2	*	0	0	—	2	2	*
35–54	2	2	*	1	1	*	1	1	*
55+	0	0	—	0	0	—	0	0	—
Other Members									
Total	28	9	32.1	18	8	44.4	10	1	10.0
<5	4	1	*	1	1	*	3	0	—
5–14	18	3	16.7	13	3	23.1	5	0	—
15–24	1	1	*	1	1	*	0	0	—
25–34	3	2	*	1	1	*	2	1	*
35–54	1	1	*	1	1	*	0	0	—
55+	1	1	*	1	1	*	0	0	—

* Less than 10 persons; no percentage calculated

TABLE VII

PREVALENCE OF INFECTION AMONG WHITE HOUSEHOLD ASSOCIATES ACCORDING TO EXPOSURE TO INDEX CASES AND PREVALENT CASES, OR INDEX CASES ONLY, BY AGE AND RELATIONSHIP

Williamson County, Tennessee, 1931–1955

Age Group in Years	Total			Associates of Prevalence Cases and Index Cases			Associates of Index Cases Only		
	Number Tested	Positive		Number Tested	Positive		Number Tested	Positive	
		Number	Per Cent		Number	Per Cent		Number	Per Cent
Total									
Total	804*	392	48.8	191	117	61.3	613	275	44.9
Adjusted†			*54.7*			*54.4*			*54.8*
<5	131	33	25.2	20	11	55.0	111	22	19.8
5–14	374	151	40.4	99	54	54.5	275	97	35.3
15–24	154	95	61.7	53	35	66.0	101	60	59.4
25–34	58	40	69.0	9	8	88.9	49	32	65.3
35–54	56	44	78.6	8	7	90.0	48	37	77.1
55+	31	29	93.5	2	2		29	27	93.1
Close Relatives									
Total	546	235	43.0	144	90	62.5	402	145	36.1
<5	94	20	21.3	15	10	66.7	79	10	12.7
5–14	302	122	40.4	79	45	57.0	223	77	34.5
15–24	110	63	57.3	42	28	66.7	68	35	51.5
25–34	22	16	72.7	7	6	‡	15	10	66.7
35–54	12	8	66.7	0	0	—	12	8	66.7
55+	6	6	‡	1	1	‡	5	5	‡
Other Members									
Total	258	157	60.9	47	27	57.4	211	130	61.6
<5	37	13	35.1	5	1	‡	32	12	37.5
5–14	72	29	40.3	20	9	45.0	52	20	38.5
15–24	44	32	72.7	11	7	63.6	33	25	75.8
25–34	36	24	66.7	2	2	‡	34	22	64.7
35–54	44	36	81.8	8	7	‡	36	29	80.6
55+	25	23	92.0	1	1	‡	24	22	91.7

* This total differs from that in Table V*A* and *B* because prevalence cases that had been tuberculin tested are not included here

† For age and relationship, using total white household population present on investigation, as standard

‡ Less than 10 persons; no percentage calculated

TABLE VIII

PREVALENCE OF INFECTION AMONG WHITE HOUSEHOLD ASSOCIATES OF INDEX CASES, BY AGE, SOCIOECONOMIC STATUS, AND SPUTUM STATUS OF THE INDEX CASE

Williamson County, Tennessee, 1931-1955

Age Group in Years	Total			Upper and Middle Socioeconomic Classes			Lower Socioeconomic Class		
	Number Tested	Positive		Number Tested	Positive		Number Tested	Positive	
		Number	Per Cent		Number	Per Cent		Number	Per Cent
"Sputum-positive" Index Cases									
Total	348	251	72.1	129	88	68.2	219	163	74.4
Adjusted			*75.7*			*65.9*			*81.5*
<5	50	24	48.0	11	3	27.3	39	21	53.8
5-14	136	90	66.2	39	20	51.3	97	70	72.2
15-24	64	52	81.2	29	24	82.8	35	28	80.0
25-34	32	26	81.2	11	9	81.8	21	17	81.0
35-54	46	40	87.0	26	20	77.0	20	20	100.0
55+	20	19	95.0	13	12	92.3	7	7	100.0
"Other-than-Sputum-positive" Index Cases									
Total	511	190	37.2	132	64	48.5	379	126	33.2
Adjusted			*48.5*			*51.6*			*48.2*
<5	79	10	12.7	10	2	20.0	69	8	11.6
5-14	244	68	27.9	46	15	32.6	198	53	26.8
15-24	92	48	52.2	35	20	57.1	57	28	49.1
25-34	35	22	62.9	15	8	53.3	20	14	70.0
35-54	37	24	64.9	12	9	75.0	25	15	60.0
55+	24	18	75.0	14	10	71.4	10	8	80.0

TABLE IXA

PREVALENCE OF TUBERCULOSIS AMONG WHITE HOUSEHOLD ASSOCIATES OF "SPUTUM-POSITIVE" INDEX CASES, BY AGE, SEX, AND RELATIONSHIP TO THE INDEX CASE

Williamson County, Tennessee, 1931–1955

Age Group in Years	Total			Male			Female		
	Number of Household Members	Cases		Number of Household Members	Cases		Number of Household Members	Cases	
		Number	Per Cent		Number	Per Cent		Number	Per Cent
Total									
Total	877	92	10.5	448	39	8.7	429	53	12.4
Adjusted			*9.8*			*8.8*			*10.9*
<5	92	3	3.3	43	2	4.7	49	1	2.0
5–14	218	4	1.8	125	1	0.8	93	3	3.2
15–24	179	12	6.7	97	4	4.1	82	8	9.8
25–34	87	12	13.8	45	7	15.6	42	5	11.9
35–54	175	39	22.3	82	16	19.5	93	23	24.7
55+	126	22	17.5	56	9	16.1	70	13	18.6
Close Relatives									
Total	500	43	8.6	263	18	6.8	237	25	10.6
Adjusted			*10.1*			*9.2*			*11.0*
<5	57	3	5.3	28	2	7.1	29	1	3.4
5–14	163	3	1.8	95	1	1.1	68	2	2.9
15–24	125	9	7.2	69	2	2.9	56	7	12.5
25–34	41	3	7.3	20	3	15.0	21	0	—
35–54	60	13	21.7	27	5	18.5	33	8	24.2
55+	54	12	22.2	24	5	20.8	30	7	23.3
Other Members									
Total	377	49	13.0	185	21	11.4	192	28	14.6
Adjusted			*9.5*			*8.3*			*10.7*
<5	35	0	—	15	0	—	20	0	—
5–14	55	1	1.8	30	0	—	25	1	4.0
15–24	54	3	5.6	28	2	7.1	26	1	3.8
25–34	46	9	19.6	25	4	16.0	21	5	23.8
35–54	115	26	22.6	55	11	20.0	60	15	25.0
55+	72	10	13.9	32	4	12.5	40	6	15.0

TABLE IX*B*

PREVALENCE OF TUBERCULOSIS AMONG WHITE HOUSEHOLD ASSOCIATES OF "OTHER-THAN-SPUTUM-POSITIVE" INDEX CASES, BY AGE, SEX, AND RELATIONSHIP TO THE INDEX CASE

Williamson County, Tennessee, 1931–1955

Age Group in Years	Total			Male			Female		
	Number of Household Members	Cases		Number of Household Members	Cases		Number of Household Members	Cases	
		Number	Per Cent		Number	Per Cent		Number	Per Cent
Total									
Total	1862	96	5.2	1001	39	3.9	861	57	6.6
Adjusted			*6.0*			*4.9*			*7.3*
<5	215	0	—	109	0	—	106	0	—
5–14	528	2	0.38	291	0	—	237	2	0.84
15–24	381	7	1.84	203	1	0.49	178	6	3.37
25–34	202	14	6.93	107	8	7.48	95	6	6.32
35–54	303	32	10.56	168	12	7.14	135	20	14.81
55+	233	41	17.60	123	18	14.63	110	23	20.91
Close Relatives									
Total	1094	43	3.9	580	17	2.9	514	26	5.1
Adjusted			*7.0*			*5.9*			*8.1*
<5	151	0	—	70	0	—	81	0	—
5–14	410	2	0.49	226	0	—	184	2	1.09
15–24	289	5	1.73	156	0	—	133	5	3.76
25–34	95	8	8.42	56	5	8.93	39	3	7.69
35–54	76	11	14.47	39	4	10.26	37	7	18.92
55+	73	17	23.29	33	8	24.24	40	9	22.50
Other Members									
Total	768	53	6.9	421	22	5.2	347	31	8.9
Adjusted			*4.7*			*3.6*			*6.0*
<5	64	0	—	39	0	—	25	0	—
5–14	118	0	—	65	0	—	53	0	—
15–24	92	2	2.17	47	1	2.13	45	1	2.22
25–34	107	6	5.61	51	3	5.88	56	3	5.36
35–54	227	21	9.25	129	8	6.20	98	13	13.27
55+	160	24	15.00	90	10	11.11	70	14	20.00

TABLE XA

PREVALENCE OF TUBERCULOSIS AMONG NONWHITE HOUSEHOLD ASSOCIATES OF "SPUTUM-POSITIVE" INDEX CASES, BY AGE, SEX, AND RELATIONSHIP TO THE INDEX CASE

Williamson County, Tennessee, 1931–1955

Age Group in Years	Total			Male			Female		
	Number of Household Members	Cases		Number of Household Members	Cases		Number of Household Members	Cases	
		Number	Per Cent		Number	Per Cent		Number	Per Cent
Total									
Total	464	36	7.8	228	15	6.6	236	21	8.9
Adjusted			*8.3*			*7.1*			*9.5*
<5	66	3	4.5	31	2	6.5	35	1	2.9
5–14	128	7	5.5	59	3	5.1	69	4	5.8
15–24	98	6	6.1	53	2	3.8	45	4	8.9
25–34	40	3	7.5	23	1	4.3	17	2	11.8
35–54	72	7	9.7	32	3	9.4	40	4	10.0
55+	60	10	16.7	30	4	13.3	30	6	20.0
Close Relatives									
Total	286	27	9.4	143	12	8.4	143	15	10.5
Adjusted			*10.5*						
<5	39	3	7.7	21	2	9.5	18	1	5.6
5–14	90	4	4.4	40	1	2.5	50	3	6.0
15–24	69	5	7.2	43	2	4.7	26	3	11.5
25–34	15	2	13.3	5	0	—	10	2	20.0
35–54	39	6	15.4	13	3	23.1	26	3	11.5
55+	34	7	20.6	21	4	19.0	13	3	23.1
Other Members									
Total	178	9	5.1	85	3	3.5	93	6	6.5
Adjusted			*4.8*						
<5	27	0	—	10	0	—	17	0	—
5–14	38	3	7.9	19	2	10.5	19	1	5.3
15–24	29	1	3.4	10	0	—	19	1	5.3
25–34	25	1	4.0	18	1	5.6	7	0	—
35–54	33	1	3.0	19	0	—	14	1	7.1
55+	26	3	11.5	9	0	—	17	3	17.6

TABLE XI*A*

PREVALENCE OF TUBERCULOSIS AMONG WHITE HOUSEHOLD ASSOCIATES OF "SPUTUM-POSITIVE" INDEX CASES BY AGE, SEX, AND SOCIOECONOMIC STATUS

Williamson County, Tennessee, 1931–1955

Age Group in Years	Total			Upper and Middle Socioeconomic Classes			Lower Socioeconomic Class		
	Number of Household Members	Cases		Number of Household Members	Cases		Number of Household Members	Cases	
		Number	Per Cent		Number	Per Cent		Number	Per Cent
Total									
Total	864	91	10.5	397	47	11.8	467	44	9.4
Adjusted			*10.7*			*10.3*			*11.4*
<5	88	2	2.3	28	1	3.6	60	1	1.7
5–14	214	4	1.9	60	1	1.7	154	3	1.9
15–24	178	12	6.7	83	5	6.0	95	7	7.4
25–34	85	12	14.1	44	7	15.9	41	5	12.2
35–54	173	39	22.5	88	17	19.3	85	22	25.9
55+	126	22	17.5	94	16	17.0	32	6	18.8
Male									
Total	442	38	8.6	200	17	8.5	242	21	8.7
Adjusted			*9.6*						
<5	41	1	2.4	15	0	—	26	1	3.8
5–14	124	1	0.8	40	0	—	84	1	1.2
15–24	96	4	4.2	45	1	2.2	51	3	5.9
25–34	44	7	15.9	22	4	18.2	22	3	13.6
35–54	81	16	19.8	38	6	15.8	43	10	23.3
55+	56	9	16.1	40	6	15.0	16	3	18.8
Female									
Total	422	53	12.6	197	30	15.2	225	23	10.2
Adjusted			*12.0*						
<5	47	1	2.1	13	1	7.7	34	0	—
5–14	90	3	3.3	20	1	5.0	70	2	2.9
15–24	82	8	9.8	38	4	10.5	44	4	9.1
25–34	41	5	12.2	22	3	13.6	19	2	10.5
35–54	92	23	25.0	50	11	22.0	42	12	28.6
55+	70	13	18.6	54	10	8.5	16	3	18.8

TABLE XI*B*

PREVALENCE OF TUBERCULOSIS AMONG WHITE HOUSEHOLD ASSOCIATES OF "OTHER-THAN-SPUTUM-POSITIVE" INDEX CASES BY AGE, SEX, AND SOCIOECONOMIC STATUS

Williamson County, Tennessee, 1931–1955

Age Group in Years	Total			Upper and Middle Socioeconomic Classes			Lower Socioeconomic Class		
	Number of Household Members	Cases		Number of Household Members	Cases		Number of Household Members	Cases	
		Number	Per Cent		Number	Per Cent		Number	Per Cent
Total									
Total	1836	94	5.1	711	46	6.5	1125	48	4.3
Adjusted			*6.0*			*5.4*			*7.4*
<5	212	0	—	39	0	—	173	0	—
5–14	525	2	0.4	107	0	—	418	2	0.5
15–24	373	7	1.9	154	2	1.3	219	5	2.3
25–34	200	14	7.0	108	6	5.6	92	8	8.7
35–54	296	32	10.8	153	22	14.4	143	10	7.0
55+	230	39	17.0	150	16	10.7	80	23	28.8
Male									
Total	987	39	4.0	368	18	4.9	619	21	3.4
Adjusted			*4.7*						
<5	108	0	—	19	0	—	89	0	—
5–14	289	0	—	60	0	—	229	0	—
15–24	199	1	0.5	79	1	1.3	120	0	—
25–34	105	8	7.6	61	1	1.6	44	7	15.9
35–54	164	12	7.3	74	7	9.5	90	5	5.6
55+	122	18	14.8	75	9	12.0	47	9	19.1
Female									
Total	849	55	6.5	343	28	8.2	506	27	5.3
Adjusted			*7.5*						
<5	104	0	—	20	0	—	84	0	—
5–14	236	2	0.8	47	0	—	189	2	1.1
15–24	174	6	3.4	75	1	1.3	99	5	5.1
25–34	95	6	6.3	47	5	10.6	48	1	2.1
35–54	132	20	15.2	79	15	16.7	53	5	9.4
55+	108	21	19.4	75	7	9.3	33	14	42.4

TABLE XII

PREVALENCE OF TUBERCULOSIS AMONG NONWHITE HOUSEHOLD ASSOCIATES OF "SPUTUM-POSITIVE" INDEX CASES, BY AGE, SEX, AND SOCIOECONOMIC STATUS

Williamson County, Tennessee, 1931–1955

Age Group in Years	Total			Upper and Middle Socioeconomic Classes			Lower Socioeconomic Class		
	Number of Household Members	Cases		Number of Household Members	Cases		Number of Household Members	Cases	
		Number	Per Cent		Number	Per Cent		Number	Per Cent
Total									
Total	464	36	7.8	122	11	9.0	342	25	7.3
Adjusted			*7.8*			*7.0*			*8.0*
<5	66	3	4.5	12	0	—	54	3	5.6
5–14	128	7	5.5	20	1	5.0	108	6	5.6
15–24	98	6	6.1	19	1	5.3	79	5	6.3
25–34	40	3	7.5	11	0	—	29	3	10.3
35–54	72	7	9.7	29	3	10.3	43	4	9.3
55+	60	10	16.7	31	6	19.4	29	4	13.8
Male									
Total	228	15	6.6	60	6	10.0	168	9	5.4
Adjusted			*6.1*						
<5	31	2	6.5	5	0	—	26	2	7.7
5–14	59	3	5.1	9	0	—	50	3	6.0
15–24	53	2	3.8	9	1	*	44	1	2.3
25–34	23	1	4.3	7	0	—	16	1	6.2
35–54	32	3	9.4	11	2	18.2	21	1	4.8
55+	30	4	13.3	19	3	15.8	11	1	9.1
Female									
Total	236	21	8.9	62	5	8.1	174	16	9.2
Adjusted			*9.4*						
<5	35	1	2.9	7	0	—	28	1	3.6
5–14	69	4	5.8	11	1	9.1	58	3	5.2
15–24	45	4	8.9	10	0	—	35	4	11.4
25–34	17	2	11.8	4	0	—	13	2	15.4
35–54	40	4	10.0	18	1	5.6	22	3	13.6
55+	30	6	20.0	12	3	25.0	18	3	16.7

* Less than 10 persons; no percentage calculated

TABLE XIIIA

TUBERCULOSIS ATTACK RATES PER 1,000 PERSON-YEARS AMONG WHITE HOUSEHOLD ASSOCIATES OF "SPUTUM-POSITIVE" INDEX CASES, BY AGE, SEX, AND RELATIONSHIP TO THE INDEX CASE
Williamson County, Tennessee, 1931–1955

Age Group in Years	Total			Male			Female		
	Person-Years	New Cases		Person-Years	New Cases		Person-Years	New Cases	
		Number	Rate		Number	Rate		Number	Rate
Total									
Total	7,476.00	36	4.8	3,803.75	17	4.5	3,672.25	19	5.2
Adjusted			*4.5*			*4.1*			*4.8*
<5	333.75	3	9.0	196.00	3	15.3	137.75	0	—
5–14	1,351.50	1	0.7	772.00	0	—	579.50	1	1.7
15–24	1,489.00	13	8.7	850.25	5	5.9	638.75	8	12.5
25–34	903.50	9	10.0	429.75	2	4.7	473.75	7	14.8
35–54	1,729.00	3	1.7	814.50	3	3.7	914.50	0	—
55+	1,669.25	7	4.2	741.25	4	5.4	928.00	3	3.2
Close Relatives									
Total	4,018.75	29	7.2	2,175.00	13	6.0	1,843.75	16	8.7
Adjusted			*6.8*						
<5	176.50	3	17.0	111.50	3	26.9	65.00	0	—
5–14	861.75	1	1.2	519.75	0	—	342.00	1	2.9
15–24	1,004.75	13	12.9	621.50	5	8.0	383.25	8	20.9
25–34	533.75	7	13.1	278.75	2	7.2	255.00	5	19.6
35–54	690.00	1	1.4	304.75	1	3.3	385.25	0	—
55+	752.00	4	5.3	338.75	2	5.9	413.25	2	4.8
Other Members									
Total	3,457.25	7	2.0	1,628.75	4	2.5	1,828.50	3	1.6
Adjusted			*1.8*						
<5	157.25	0	—	84.50	0	—	72.75	0	—
5–14	489.75	0	—	252.25	0	—	237.50	0	—
15–24	484.25	0	—	228.75	0	—	255.50	0	—
25–34	369.75	2	5.4	151.00	0	—	218.75	2	9.1
35–54	1,039.00	2	1.9	509.75	2	3.9	529.25	0	—
55+	917.25	3	3.3	402.50	2	5.0	514.75	1	1.9

TABLE XIII*B*

TUBERCULOSIS ATTACK RATES PER 1,000 PERSON-YEARS AMONG WHITE HOUSEHOLD ASSOCIATES OF "OTHER-THAN-SPUTUM-POSITIVE" INDEX CASES, BY AGE, SEX, AND RELATIONSHIP TO THE INDEX CASE

Williamson County, Tennessee, 1931–1955

Age Group in Years	Total			Male			Female		
	Person-Years	New Cases		Person-Years	New Cases		Person-Years	New Cases	
		Number	Rate		Number	Rate		Number	Rate
Total									
Total	18,835.50	32	1.7	9,870.75	15	1.5	8,964.75	17	1.9
Adjusted			*1.7*			*1.6*			*1.9*
<5	1,158.50	0	—	523.75	0	—	634.75	0	—
5–14	4,315.25	1	0.2	2,283.75	0	—	2,031.50	1	0.5
15–24	3,955.75	13	3.3	2,185.00	4	1.8	1,770.75	9	5.1
25–34	1,716.50	2	1.2	828.25	1	1.2	888.25	1	1.1
35–54	3,939.75	7	1.8	2,095.75	5	2.4	1,844.00	2	1.1
55+	3,749.75	9	2.4	1,954.25	5	2.6	1,795.50	4	2.2
Close Relatives									
Total	9,558.25	14	1.5	5,071.25	6	1.2	4,487.00	8	1.8
Adjusted			*1.5*						
<5	651.75	0	—	302.75	0	—	349.00	0	—
5–14	2,979.75	1	0.3	1,580.75	0	—	1,399.00	1	0.7
15–24	2,831.00	8	2.8	1,594.00	2	1.3	1,237.00	6	4.9
25–34	910.75	1	1.1	497.25	1	2.0	413.50	0	—
35–54	1,168.00	2	1.7	633.75	2	3.2	534.25	0	—
55+	1,017.00	2	2.0	462.75	1	2.2	554.25	1	1.8
Other Members									
Total	9,277.25	18	1.9	4,799.50	9	1.9	4,477.75	9	2.0
Adjusted			*1.9*						
<5	506.75	0	—	221.00	0	—	285.75	0	—
5–14	1,335.50	0	—	703.00	0	—	632.50	0	—
15–24	1,124.75	5	4.4	591.00	2	3.4	533.75	3	5.6
25–34	805.75	1	1.2	331.00	0	—	474.75	1	2.1
35–54	2,771.75	5	1.8	1,462.00	3	2.1	1,309.75	2	1.5
55+	2,732.75	7	2.6	1,491.50	4	2.7	1,241.25	3	2.4

TABLE XIV*A*

TUBERCULOSIS ATTACK RATES PER 1,000 PERSON-YEARS AMONG NONWHITE HOUSEHOLD ASSOCIATES OF "SPUTUM-POSITIVE" INDEX CASES, BY AGE, SEX, AND RELATIONSHIP TO THE INDEX CASE
Williamson County, Tennessee, 1931–1955

Age Group in Years	Total			Male			Female		
	Person-Years	New Cases		Person-Years	New Cases		Person-Years	New Cases	
		Number	Rate		Number	Rate		Number	Rate
Total									
Total	3,780.00	31	8.2	1,821.50	12	6.6	1,958.50	19	9.7
Adjusted			*7.9*			*6.0*			*9.7*
<5	128.25	1	7.8	54.75	1	18.3	73.50	0	—
5–9	337.50	2	5.9	144.00	0	—	193.50	2	10.3
10–14	464.75	9	19.4	210.25	1	4.8	254.50	8	31.4
15–24	851.00	6	7.1	481.50	4	8.3	369.50	2	5.4
25–34	518.75	1	1.9	254.00	0	—	264.75	1	3.8
35–54	801.75	6	7.5	365.50	2	5.5	436.25	4	9.2
55+	678.00	6	8.8	311.50	4	12.8	366.50	2	5.5
Close Relatives									
Total	2,294.25	24	10.5	1,151.00	9	7.8	1,143.25	15	13.1
Adjusted			*9.8*						
<5	75.50	0	—	34.50	0	—	41.00	0	—
5–9	198.75	2	10.1	89.00	0	—	109.75	2	18.2
10–14	281.75	9	31.9	135.75	1	7.4	146.00	8	54.8
15–24	545.50	6	11.0	349.00	4	11.5	196.50	2	10.2
25–34	292.25	0	—	160.00	0	—	132.25	0	—
35–54	440.00	2	4.5	138.25	0	—	301.75	2	6.6
55+	460.50	5	10.9	244.50	4	16.4	216.00	1	4.6
Other Members									
Total	1,485.75	7	4.7	670.50	3	4.5	815.25	4	4.9
Adjusted			*5.0*						
<5	52.75	1	19.0	20.25	1	49.4	32.50	0	—
5–9	138.75	0	—	55.00	0	—	83.75	0	—
10–14	183.00	0	—	74.50	0	—	108.50	0	—
15–24	305.50	0	—	132.50	0	—	173.00	0	—
25–34	226.50	1	4.4	94.00	0	—	132.50	1	7.5
35–54	361.75	4	11.1	227.25	2	8.8	134.50	2	14.9
55+	217.50	1	4.6	67.00	0	—	150.50	1	6.6

TABLE XIV*B*

TUBERCULOSIS ATTACK RATES PER 1,000 PERSON-YEARS AMONG NONWHITE HOUSEHOLD ASSOCIATES OF "OTHER-THAN-SPUTUM-POSITIVE" INDEX CASES, BY AGE, SEX, AND RELATIONSHIP TO THE INDEX CASE

Williamson County, Tennessee, 1931–1955

Age Group in Years	Total			Male			Female		
	Person-Years	New Cases		Person-Years	New Cases		Person-Years	New Cases	
		Number	Rate		Number	Rate		Number	Rate
Total									
Total	2,076.75	6	2.9	1,153.50	4	3.5	923.25	2	2.2
<5	161.25	1	6.2	88.75	1	11.3	72.50	0	—
5–9	222.00	2	9.0	127.00	2	15.7	95.00	0	—
10–14	265.25	0	—	175.25	0	—	90.00	0	—
15–24	381.00	0	—	238.75	0	—	142.25	0	—
25–34	233.75	0	—	116.25	0	—	117.50	0	—
35–54	450.75	2	4.4	203.00	1	4.9	247.75	1	4.0
55+	362.75	1	2.8	204.50	0	—	158.25	1	6.3
Close Relatives									
Total	894.25	2	2.2	454.25	1	2.2	440.00	1	2.3
<5	112.50	1	8.9	66.00	1	15.2	46.50	0	—
5–9	120.00	0	—	76.50	0	—	43.50	0	—
10–14	122.00	0	—	89.50	0	—	32.50	0	—
15–24	178.00	0	—	107.25	0	—	70.75	0	—
25–34	82.50	0	—	44.50	0	—	38.00	0	—
35–54	148.25	1	6.7	31.00	0	—	117.25	1	8.5
55+	131.00	0	—	39.50	0	—	91.50	0	—
Other Members									
Total	1,182.50	4	3.4	699.25	3	4.3	483.25	1	2.1
<5	48.75	0	—	22.75	0	—	26.00	0	—
5–9	102.00	2	19.6	50.50	2	39.6	51.50	0	—
10–14	143.25	0	—	85.75	0	—	57.50	0	—
15–24	203.00	0	—	131.50	0	—	71.50	0	—
25–34	151.25	0	—	71.75	0	—	79.50	0	—
35–54	302.50	1	3.3	172.00	1	5.8	130.50	0	—
55+	231.75	1	4.3	165.00	0	—	66.75	1	15.0

TABLE XV*A*

TUBERCULOSIS ATTACK RATES PER 1,000 PERSON-YEARS AMONG WHITE HOUSEHOLD ASSOCIATES OF "SPUTUM-POSITIVE" INDEX CASES, BY AGE, SEX, AND SOCIOECONOMIC STATUS

Williamson County, Tennessee, 1931–1955

Age Group in Years	Total			Upper Socioeconomic Class			Middle Socioeconomic Class			Lower Socioeconomic Class		
	Person-Years	New Cases		Person-Years	New Cases		Person-Years	New Cases		Person-Years	New Cases	
		Number	Rate		Number	Rate		Number	Rate		Number	Rate
Total												
Total	7,375.50	36	4.9	696.00	1	1.4	2,898.75	17	5.9	3,780.75	18	4.8
<5	317.75	3	9.4	16.75	0	—	121.00	0	—	180.00	3	16.7
5–14	1,310.00	1	0.8	35.75	0	—	362.25	0	—	912.00	1	1.1
15–24	1,473.50	13	8.8	104.50	1	9.6	474.00	8	16.9	895.00	4	4.5
25–34	900.00	9	10.0	89.00	0	—	398.00	5	12.6	413.00	4	9.7
35–54	1,707.50	3	1.8	164.00	0	—	700.25	0	—	843.25	3	3.6
55+	1,666.75	7	4.2	286.00	0	—	843.25	4	4.7	537.50	3	5.6
Male												
Total	3,757.25	17	4.5	226.75	0	—	1,462.00	7	4.8	2,068.50	10	4.8
<5	186.00	3	16.1	11.75	0	—	76.50	0	—	97.75	3	30.7
5–14	754.00	0	—	18.25	0	—	236.00	0	—	499.75	0	—
15–24	845.00	5	5.9	46.00	0	—	259.25	3	11.6	539.75	2	3.7
25–34	425.25	2	4.7	20.75	0	—	179.50	2	11.1	225.00	0	—
35–54	806.00	3	3.7	46.00	0	—	357.00	0	—	403.00	3	7.4
55+	741.00	4	5.4	84.00	0	—	353.75	2	5.7	303.25	2	6.6
Female												
Total	3,618.25	19	5.3	469.25	1	2.1	1,436.75	10	7.0	1,712.25	8	4.7
<5	131.75	0	—	5.00	0	—	44.50	0	—	82.25	0	—
5–14	556.00	1	1.80	17.50	0	—	126.25	0	—	412.25	1	2.4
15–24	628.50	8	12.7	58.50	1	17.1	214.75	5	23.3	355.25	2	5.6
25–34	474.75	7	14.74	68.25	0	—	218.50	3	13.7	188.00	4	21.3
35–54	901.50	0	—	118.00	0	—	343.25	0	—	440.25	0	—
55+	925.75	3	3.2	202.00	0	—	489.50	2	4.1	234.25	1	4.3

TABLE XV*B*

TUBERCULOSIS ATTACK RATES PER 1,000 PERSON-YEARS AMONG WHITE HOUSEHOLD ASSOCIATES OF "OTHER-THAN-SPUTUM-POSITIVE" INDEX CASES, BY AGE, SEX, AND SOCIOECONOMIC STATUS
Williamson County, Tennessee, 1931–1955

Age Group in Years	Total			Upper Socioeconomic Class			Middle Socioeconomic Class			Lower Socioeconomic Class		
	Person-Years	New Cases		Person-Years	New Cases		Person-Years	New Cases		Person-Years	New Cases	
		Number	Rate		Number	Rate		Number	Rate		Number	Rate
Total												
Total	18,624.50	32	1.7	1,261.00	0	—	6,544.75	16	2.4	10,818.75	16	1.5
<5	1,151.00	0	—	51.00	0	—	225.75	0	—	874.25	0	—
5–14	4,271.75	1	0.2	128.00	0	—	839.00	0	—	3,304.75	1	0.3
15–24	3,906.75	13	3.3	150.75	0	—	1,113.50	7	6.3	2,642.50	6	2.3
25–34	1,685.50	2	1.2	147.75	0	—	687.75	2	2.9	850.00	0	—
35–54	3,894.25	7	1.8	358.50	0	—	1,646.25	1	0.6	1,889.50	6	3.2
55+	3,715.25	9	2.4	425.00	0	—	2,032.50	6	3.0	1,257.75	3	2.4
Male												
Total	9,760.50	15	1.5	598.00	0	—	3,237.50	7	2.2	5,925.00	8	1.4
<5	523.25	0	—	25.00	0	—	96.50	0	—	401.75	0	—
5–14	2,257.75	0	—	82.50	0	—	410.25	0	—	1,765.00	0	—
15–24	2,164.00	4	1.8	84.50	0	—	547.50	1	1.8	1,532.00	3	2.0
25–34	816.25	1	1.2	53.50	0	—	325.75	1	3.1	437.00	0	—
35–54	2,065.75	5	2.4	188.50	0	—	843.75	1	1.2	1,033.50	4	3.9
55+	1,933.50	5	2.6	164.00	0	—	1,013.75	4	3.9	755.75	1	1.3
Female												
Total	8,864.00	17	1.9	663.00	0	—	3,307.25	9	2.7	4,893.75	8	1.6
<5	627.75	0	—	26.00	0	—	129.25	0	—	472.50	0	—
5–14	2,014.00	1	0.5	45.50	0	—	428.75	0	—	1,539.75	1	0.6
15–24	1,742.75	9	5.2	66.25	0	—	566.00	6	10.6	1,110.50	3	2.7
25–34	869.25	1	1.2	94.25	0	—	362.00	1	2.8	413.00	0	—
35–54	1,828.50	2	1.1	170.00	0	—	802.50	0	—	856.00	2	2.3
55+	1,781.75	4	2.2	261.00	0	—	1,018.75	2	2.0	502.00	2	4.0

TABLE XVI*A*

TUBERCULOSIS ATTACK RATES PER 1,000 PERSON-YEARS AMONG NONWHITE ASSOCIATES OF "SPUTUM-POSITIVE" INDEX CASES, BY AGE, SEX, AND SOCIOECONOMIC STATUS

Williamson County, Tennessee, 1931–1955

Age Group in Years	Total			Upper and Middle Socioeconomic Classes			Lower Socioeconomic Class		
	Person-Years	New Cases		Person-Years	New Cases		Person-Years	New Cases	
		Number	Rate		Number	Rate		Number	Rate
Total									
Total	3,780.00	31	8.2	908.00	2	2.2	2,872.00	29	10.1
<5	128.25	1	7.8	22.00	0	—	106.25	1	9.4
5–14	802.25	11	13.7	98.00	0	—	704.25	11	15.6
15–24	851.00	6	7.1	135.50	0	—	715.50	6	8.4
25–34	518.75	1	1.9	119.00	0	—	399.75	1	2.5
35–54	801.75	6	7.5	245.00	1	4.1	556.75	5	9.0
55+	678.00	6	8.8	288.50	1	3.5	389.50	5	12.8
Male									
Total	1,821.50	12	6.6	397.00	0	—	1,424.50	12	8.4
<5	54.75	1	18.3	10.50	0	—	44.25	1	22.6
5–14	354.25	1	2.8	52.50	0	—	301.75	1	3.3
15–24	481.50	4	8.3	79.00	0	—	402.50	4	9.9
25–34	254.00	0	—	57.50	0	—	196.50	0	—
35–54	365.50	2	5.5	84.50	0	—	281.00	2	7.1
55+	311.50	4	12.8	113.00	0	—	198.50	4	20.2
Female									
Total	1,958.50	19	9.7	511.00	2	3.9	1,447.50	17	11.7
<5	73.50	0	—	11.50	0	—	62.00	0	—
5–14	448.00	10	22.3	45.50	0	—	402.50	10	24.8
15–24	369.50	2	5.4	56.50	0	—	313.00	2	6.4
25–34	264.75	1	3.8	61.50	0	—	203.25	1	4.9
35–54	436.25	4	9.2	160.50	1	6.2	275.75	3	10.9
55+	366.50	2	5.5	175.50	1	5.7	191.00	1	5.2

TABLE XVI*B*

TUBERCULOSIS ATTACK RATES PER 1,000 PERSON-YEARS AMONG NONWHITE ASSOCIATES OF "OTHER-THAN-SPUTUM-POSITIVE" INDEX CASES, BY AGE, SEX, AND SOCIOECONOMIC STATUS

Williamson County, Tennessee, 1931–1955

Age Group in Years	Total			Upper and Middle Socioeconomic Classes			Lower Socioeconomic Class		
	Person-Years	New Cases		Person-Years	New Cases		Person-Years	New Cases	
		Number	Rate		Number	Rate		Number	Rate
Total									
Total	2,066.75	6	2.9	478.00	2	4.2	1,588.75	4	2.5
<5	160.75	1	6.2	17.00	0	—	143.75	1	7.0
5–14	483.75	2	4.1	35.75	0	—	448.00	2	4.5
15–24	380.50	0	—	50.00	0	—	330.50	0	—
25–34	233.75	0	—	42.00	0	—	191.75	0	—
35–54	445.25	2	4.5	186.75	2	10.7	258.50	0	—
55+	362.75	1	2.8	146.50	0	—	216.25	1	4.6
Male									
Total	1,144.50	4	3.5	188.25	1	5.3	956.25	3	3.1
<5	88.75	1	11.3	6.50	0	—	82.25	1	12.2
5–14	298.75	2	6.7	20.75	0	—	278.00	2	7.2
15–24	238.75	0	—	34.50	0	—	204.25	0	—
25–34	116.25	0	—	9.50	0	—	106.75	0	—
35–54	197.50	1	5.1	61.50	1	16.3	136.00	0	—
55+	204.50	0	—	55.50	0	—	149.00	0	—
Female									
Total	922.25	2	2.2	289.75	1	3.5	632.50	1	1.6
<5	72.00	0	—	10.50	0	—	61.50	0	—
5–14	185.00	0	—	15.00	0	—	170.00	0	—
15–24	141.75	0	—	15.50	0	—	126.25	0	—
25–34	117.50	0	—	32.50	0	—	85.00	0	—
35–54	247.75	1	4.0	125.25	1	8.0	122.50	0	—
55+	158.25	1	6.3	91.00	0	—	67.25	1	14.9

TABLE XVIIA

NUMBER OF DEATHS AND DEATH RATES PER 1,000 PERSON-YEARS FOR ALL CAUSES, FOR TUBERCULOSIS, AND FOR NONTUBERCULOUS CAUSES AMONG WHITE HOUSEHOLD ASSOCIATES OF "SPUTUM-POSITIVE" INDEX CASES, BY AGE, SEX, AND RELATIONSHIP TO THE INDEX CASE

Williamson County, Tennessee, 1931–1955

Age Group in Years	Total							Male							Female						
	Person-Years	All Causes		Tuberculosis		Other		Person-Years	All Causes		Tuberculosis		Other		Person-Years	All Causes		Tuberculosis		Other	
		Number	Rate	Number	Rate	Number	Rate		Number	Rate	Number	Rate	Number	Rate		Number	Rate	Number	Rate	Number	Rate
Total																					
Total	7,474.00	94	12.6	13	1.7	81	10.9	3,801.75	55	14.5	6	1.6	49	12.9	3,672.25	39	10.6	7	1.9	32	8.7
Adjusted			*12.3*							*15.4*							*9.0*				
<5	333.75	4	12.0	1	3.0	3	9.0	196.00	3	15.3	1	5.1	2	10.2	137.75	1	7.3	0	—	1	7.3
5–14	1,351.50	5	3.7	0	—	5	3.7	772.00	4	5.2	0	—	4	5.2	579.50	1	1.7	0	—	1	1.7
15–24	1,489.00	7	4.7	2	1.3	5	3.4	850.25	3	3.5	1	1.2	2	2.3	638.75	4	6.3	1	1.6	3	4.7
25–34	903.50	7	4.7	3	3.3	4	4.4	429.75	4	9.3	1	2.3	3	7.0	473.75	3	6.3	2	4.2	1	2.1
35–54	1,729.00	13	7.5	2	1.2	11	6.3	814.50	9	11.0	2	2.5	7	8.5	914.50	4	4.4	0	—	4	4.4
55+	1,669.25	58	34.7	5	3.0	53	31.7	741.25	32	43.2	1	1.3	31	41.9	928.00	26	28.0	4	4.3	22	23.7
Close Relatives																					
Total	4,018.75	47	11.7	9*	2.2	38	9.5	2,175.00	29	13.3	5	2.3	24	11.0	1,843.75	18	9.8	4	2.2	14	7.6
Adjusted			*13.2*																		
<5	176.50	4	22.7	1	5.7	3	17.0	111.50	3	26.9	1	9.0	2	17.9	65.00	1	15.4	0	—	1	15.4
5–14	861.75	4	4.6	0	—	4	4.6	519.75	3	5.8	0	—	3	5.8	342.00	1	2.9	0	—	1	2.9
15–24	1,004.75	5	5.0	2	2.0	3	3.0	621.50	1	1.6	1	1.6	0	—	383.25	4	10.4	1	2.6	3	7.8
25–34	533.75	4	7.5	2	3.7	2	3.7	278.75	2	7.2	1	3.6	1	3.6	255.00	2	7.8	1	3.9	1	3.9
35–54	690.00	5	7.2	1	1.4	4	5.8	304.75	3	9.8	1	3.3	2	6.5	385.25	2	5.2	0	—	2	5.2
55+	752.00	25	33.2	3	4.0	22	29.2	338.75	17	50.2	1	3.0	16	47.2	413.25	8	19.4	2	4.8	6	14.6
Other Members																					
Total	3,455.25	47	13.6	4	1.2	43	12.4	1,626.75	26	15.9	1	0.6	25	15.3	1,828.50	21	11.5	3	1.6	18	9.9
Adjusted			*11.2*																		
<5	157.25	0	—	0	—	0	—	84.50	0	—	0	—	0	—	72.75	0	—	0	—	0	—
5–14	489.75	1	2.0	0	—	1	2.0	252.25	1	4.0	0	—	1	4.0	237.50	0	—	0	—	0	—
15–24	484.25	2	4.1	0	—	2	4.1	228.75	2	8.7	0	—	2	8.7	255.50	0	—	0	—	0	—
25–34	369.75	3	8.1	1	2.7	2	5.4	151.00	2	13.2	0	—	2	13.2	218.75	1	4.6	1	4.6	0	—
35–54	1,039.00	8	7.7	1	1.0	7	6.7	509.75	6	11.8	1	2.0	5	9.8	529.25	2	3.8	0	—	2	3.8
55+	917.25	33	36.0	2	2.2	31	33.8	402.50	15	37.3	0	—	15	37.3	514.75	18	35.0	2	3.9	16	31.1

* In a previous report (20) the total deaths were shown as 10. Since that report it was learned that a child of two years who had been included in that total had actually died some six months after removal from his household.

TABLE XVII*B*

NUMBER OF DEATHS AND DEATH RATES PER 1,000 PERSON-YEARS FOR ALL CAUSES, FOR TUBERCULOSIS AND FOR NONTUBERCULOUS CAUSES AMONG WHITE HOUSEHOLD ASSOCIATES OF "OTHER-THAN-SPUTUM-POSITIVE" INDEX CASES BY AGE, SEX, AND RELATIONSHIP TO THE INDEX CASE

Williamson County, Tennessee, 1931–1955

Age Group in Years	Total							Male							Female						
	Person-Years	All Causes		Tuberculosis		Other		Person-Years	All Causes		Tuberculosis		Other		Person-Years	All Causes		Tuberculosis		Other	
		Number	Rate	Number	Rate	Number	Rate		Number	Rate	Number	Rate	Number	Rate		Number	Rate	Number	Rate	Number	Rate
Total																					
Total	18,835.50	185	9.8	10	0.5	175	9.3	9,870.75	108	10.9	5	0.5	103	10.4	8,964.75	77	8.6	5	0.6	72	8.0
Adjusted			*10.6*							*11.8*							*9.3*				
<5	1,158.50	5	4.3	0	—	5	4.3	523.75	3	5.7	0	—	3	5.7	634.75	2	3.2	0	—	2	3.2
5–14	4,315.25	3	0.7	0	—	3	0.7	2,283.75	3	1.3	0	—	3	1.3	2,031.50	0	—	0	—	0	—
15–24	3,955.75	4	1.0	0	—	4	1.0	2,185.00	2	0.9	0	—	2	0.9	1,770.75	2	1.1	0	—	2	1.1
25–34	1,716.50	5	2.9	0	—	5	2.9	828.25	3	3.6	0	—	3	3.6	888.25	2	2.3	0	—	2	2.3
35–54	3,939.75	27	6.9	2	0.5	25	6.4	2,095.75	15	7.2	1	0.5	14	6.7	1,844.00	12	6.5	1	0.5	11	6.0
55+	3,749.75	141	37.6	8	2.1	133	35.5	1,954.25	82	42.0	4	2.0	78	40.0	1,795.50	59	32.9	4	2.2	55	30.7
Close Relatives																					
Total	9,558.25	60	6.3	4	0.4	56	5.9	5,071.25	31	6.1	2	0.4	29	5.7	4,487.00	29	6.5	2	0.4	27	6.1
Adjusted			*11.2*																		
<5	651.75	2	3.1	0	—	2	3.1	302.75	1	3.3	0	—	1	3.3	349.00	1	2.9	0	—	1	2.9
5–14	2,979.75	3	1.0	0	—	3	1.0	1,580.75	3	1.9	0	—	3	1.9	1,399.00	0	—	0	—	0	—
15–24	2,831.00	1	0.4	0	—	1	0.4	1,594.00	0	—	0	—	0	—	1,237.00	1	0.8	0	—	1	0.8
25–34	910.75	2	2.2	0	—	2	2.2	497.25	1	2.0	0	—	1	2.0	413.50	1	2.4	0	—	1	2.4
35–54	1,168.00	10	8.6	1	0.9	9	7.7	633.75	4	6.3	0	—	4	6.3	534.25	6	11.2	1	1.9	5	9.3
55+	1,017.00	42	41.3	3	2.9	39	38.4	462.75	22	47.5	2	4.3	20	43.2	554.25	20	36.1	1	1.8	19	34.3
Other Members																					
Total	9,277.25	125	13.5	6	0.6	119	12.9	4,799.50	77	16.0	3	0.6	74	15.4	4,477.75	48	10.7	3	0.7	45	10.0
Adjusted			*10.0*																		
<5	506.75	3	5.9	0	—	3	5.9	221.00	2	9.0	0	—	2	9.0	285.75	1	3.5	0	—	1	3.5
5–14	1,335.50	0	—	0	—	0	—	703.00	0	—	0	—	0	—	632.50	0	—	0	—	0	—
15–24	1,124.75	3	2.7	0	—	3	2.7	591.00	2	3.4	0	—	2	3.4	533.75	1	1.9	0	—	1	1.9
25–34	805.75	3	3.7	0	—	3	3.7	331.00	2	6.0	0	—	2	6.0	474.75	1	2.1	0	—	1	2.1
35–54	2,771.75	17	6.1	1	0.4	16	5.7	1,462.00	11	7.5	1	0.7	10	6.8	1,309.75	6	4.6	0	—	6	4.6
55+	2,732.75	99	36.2	5	1.8	94	34.4	1,491.50	60	40.2	2	1.3	58	38.9	1,241.25	39	31.4	3	2.4	36	29.0

TABLE XVIIIA

NUMBER OF DEATHS AND DEATH RATES PER 1,000 PERSON-YEARS FOR ALL CAUSES, FOR TUBERCULOSIS, AND FOR NONTUBERCULOUS CAUSES AMONG NONWHITE HOUSEHOLD ASSOCIATES OF "SPUTUM-POSITIVE" INDEX CASES, BY AGE, SEX, AND RELATIONSHIP TO THE INDEX CASE

Williamson County, Tennessee, 1931–1955

Age Group in Years	Total							Male							Female						
	Person-Years	All Causes		Tuberculosis		Other		Person-Years	All Causes		Tuberculosis		Other		Person-Years	All Causes		Tuberculosis		Other	
		Number	Rate	Number	Rate	Number	Rate		Number	Rate	Number	Rate	Number	Rate		Number	Rate	Number	Rate	Number	Rate
Total																					
Total	3,780.00	84	22.2	25	6.6	59	15.6	1,821.50	39	21.4	11	6.0	28	15.4	1,958.50	45	23.0	14	7.1	31	15.9
Adjusted			*24.9*							*24.6*							*25.1*				
<5	128.25	6	46.8	3	23.4	3	23.4	54.75	3	54.8	2	36.5	1	18.3	73.50	3	40.8	1	13.6	2	27.2
5–14	802.25	4	5.0	4	5.0	0	—	354.25	0	—	0	—	0	—	448.00	4	8.9	4	8.9	0	—
15–24	851.00	11	12.9	9	10.6	2	2.4	481.50	5	10.4	4	8.3	1	2.1	369.50	6	16.2	5	13.5	1	2.7
25–34	518.75	7	13.5	1	1.9	6	11.6	254.00	5	19.7	0	—	5	19.7	264.75	2	7.6	1	3.8	1	3.8
35–54	801.75	15	18.7	2	2.5	13	16.2	365.50	6	16.4	1	2.7	5	13.7	436.25	9	20.6	1	2.3	8	18.3
55+	678.00	41	60.5	6	8.8	35	51.7	311.50	20	64.2	4	12.8	16	51.4	366.50	21	57.3	2	5.5	19	51.8
Close Relatives																					
Total	2,294.25	58	25.3	20	8.7	38	16.6	1,151.00	26	22.6	9	7.8	17	14.8	1,143.25	32	28.0	11	9.6	21	18.4
Adjusted			*26.8*																		
<5	75.50	5	66.2	2	26.5	3	39.7	34.50	2	58.0	1	29.0	1	29.0	41.00	3	73.2	1	24.4	2	48.8
5–14	480.50	4	8.3	4	8.3	0	—	224.75	0	—	0	—	0	—	255.75	4	15.6	4	15.6	0	—
15–24	545.50	11	20.2	9	16.6	2	3.6	349.00	5	14.3	4	11.5	1	2.8	196.50	6	30.5	5	25.5	1	5.0
25–34	292.25	3	10.3	0	—	3	10.3	160.00	3	18.8	0	—	3	18.8	132.25	0	—	0	—	0	—
35–54	440.00	7	15.9	0	—	7	15.9	138.25	2	14.5	0	—	2	14.5	301.75	5	16.6	0	—	5	16.6
55+	460.50	28	60.8	5	10.9	23	49.9	244.50	14	57.3	4	16.4	10	40.9	216.00	14	64.8	1	4.6	13	60.2
Other Members																					
Total	1,485.75	26	17.5	5	3.4	21	14.1	670.50	13	19.4	2	3.0	11	16.4	815.25	13	15.9	3	3.7	10	12.2
Adjusted			*21.9*																		
<5	52.75	1	19.0	1	19.0	0	—	20.25	1	49.4	1	49.4	0	—	32.50	0	—	0	—	0	—
5–14	321.75	0	—	0	—	0	—	129.50	0	—	0	—	0	—	192.25	0	—	0	—	0	—
15–24	305.50	0	—	0	—	0	—	132.50	0	—	0	—	0	—	173.00	0	—	0	—	0	—
25–34	226.50	4	17.7	1	4.4	3	13.3	94.00	2	21.3	0	—	2	21.3	132.50	2	15.1	1	7.5	1	7.5
35–54	361.75	8	22.1	2	5.5	6	16.5	227.25	4	17.6	1	4.4	3	13.2	134.50	4	29.7	1	7.4	3	22.3
55+	217.50	13	59.8	1	4.6	12	55.2	67.00	6	89.6	0	—	6	89.6	150.50	7	46.5	1	6.6	6	39.9

TABLE XVIII*B*

NUMBER OF DEATHS AND DEATH RATES PER 1,000 PERSON-YEARS FOR ALL CAUSES, FOR TUBERCULOSIS, AND FOR NONTUBERCULOUS CAUSES AMONG NONWHITE HOUSEHOLD ASSOCIATES OF "OTHER-THAN-SPUTUM-POSITIVE" INDEX CASES, BY AGE, SEX, AND RELATIONSHIP TO THE INDEX CASE

Williamson County, Tennessee, 1931–1955

Age Group in Years	Total							Male							Female						
	Person-Years	All Causes		Tuberculosis		Other		Person-Years	All Causes		Tuberculosis		Other		Person-Years	All Causes		Tuberculosis		Other	
		Number	Rate	Number	Rate	Number	Rate		Number	Rate	Number	Rate	Number	Rate		Number	Rate	Number	Rate	Number	Rate
Total																					
Total	2,076.75	30	14.4	4	1.9	26	12.5	1,153.50	15	13.0	2	1.7	13	11.3	923.25	15	16.2	2	2.2	13	14.0
Adjusted			*16.7*							*15.3*							*18.5*				
<5	161.25	2	12.4	0	—	2	12.4	88.75	2	22.5	0	—	2	22.5	72.50	0	—	0	—	0	—
5–14	487.25	3	6.2	1	2.1	2	4.1	302.25	2	6.6	1	3.3	1	3.3	185.00	1	5.4	0	—	1	5.4
15–24	381.00	4	10.5	2	5.2	2	5.2	238.75	2	8.4	0	—	2	8.4	142.25	2	14.1	2	14.1	0	—
25–34	233.75	1	4.3	0	—	1	4.3	116.25	1	8.6	0	—	1	8.6	117.50	0	—	0	—	0	—
35–54	450.75	7	15.5	1	2.2	6	13.3	203.00	2	9.9	1	4.9	1	4.9	247.75	5	20.2	0	—	5	20.2
55+	362.75	13	35.8	0	—	13	35.8	204.50	6	29.3	0	—	6	29.3	158.25	7	44.2	0	—	7	44.2
Close Relatives																					
Total	894.25	11	12.3	1	1.1	10	11.2	454.25	5	11.0	0	—	5	11.0	440.00	6	13.6	1	2.3	5	11.3
Adjusted			*15.2*																		
<5	112.50	2	17.8	0	—	2	17.8	66.00	2	30.3	0	—	2	30.3	46.50	0	—	0	—	0	—
5–14	242.00	0	—	0	—	0	—	166.00	0	—	0	—	0	—	76.00	0	—	0	—	0	—
15–24	178.00	1	5.6	1	5.6	0	—	107.25	0	—	0	—	0	—	70.75	1	14.1	1	14.1	0	—
25–34	82.50	0	—	0	—	0	—	44.50	0	—	0	—	0	—	38.00	0	—	0	—	0	—
35–54	148.25	3	20.2	0	—	3	20.2	31.00	0	—	0	—	0	—	117.25	3	25.6	0	—	3	25.6
55+	131.00	5	38.2	0	—	5	38.2	39.50	3	75.9	0	—	3	75.9	91.50	2	21.9	0	—	2	21.9
Other Members																					
Total	1,182.50	19	16.1	3	2.5	16	13.6	699.25	10	14.3	2	2.9	8	11.4	483.25	9	18.6	1	2.1	8	16.5
Adjusted			*17.9*																		
<5	48.75	0	—	0	—	0	—	22.75	0	—	0	—	0	—	26.00	0	—	0	—	0	—
5–14	245.25	3	12.2	1	4.1	2	8.1	136.25	2	14.7	1	7.3	1	7.3	109.00	1	9.2	0	—	1	9.2
15–24	203.00	3	14.8	1	4.9	2	9.9	131.50	2	15.2	0	—	2	15.2	71.50	1	14.0	1	14.0	0	—
25–34	151.25	1	6.6	0	—	1	6.6	71.75	1	13.9	0	—	1	13.9	79.50	0	—	0	—	0	—
35–54	302.50	4	13.2	1	3.3	3	9.9	172.00	2	11.6	1	5.8	1	5.8	130.50	2	15.3	0	—	2	15.3
55+	231.75	8	34.5	0	—	8	34.5	165.00	3	18.2	0	—	3	18.2	66.75	5	74.9	0	—	5	74.9

TABLE XIX*A*

DEATH RATES PER 1,000 PERSON-YEARS FOR ALL CAUSES AND FOR TUBERCULOSIS AMONG WHITE HOUSEHOLD ASSOCIATES OF "SPUTUM-POSITIVE" INDEX CASES, BY AGE, SEX, AND SOCIOECONOMIC STATUS

Williamson County, Tennessee, 1931–1955

Age Group in Years	Total					Male					Female				
	Person-Years	All Causes		Tuberculosis Deaths		Person-Years	All Causes		Tuberculosis Deaths		Person-Years	All Causes		Tuberculosis Deaths	
		Number	Rate	Number	Rate		Number	Rate	Number	Rate		Number	Rate	Number	Rate
Total															
Total	7,375.50	94	12.7	13	1.8	3,757.25	55	14.6	6	1.6	3,618.25	39	10.8	7	1.9
Adjusted			*11.9*					*13.4*					*10.3*		
<5	317.75	4	12.6	1	3.1	186.00	3	16.1	1	5.4	131.75	1	7.6	0	—
5–14	1,310.00	5	3.8	0	—	754.00	4	5.3	0	—	556.00	1	1.8	0	—
15–24	1,473.50	7	4.8	2	1.4	845.00	3	3.6	1	1.2	628.50	4	6.4	1	1.6
25–34	900.00	7	7.8	3	3.3	425.25	4	9.4	1	2.4	474.75	3	6.3	2	4.2
35–54	1,707.50	13	7.6	2	1.2	806.00	9	11.2	2	2.5	901.50	4	4.4	0	—
55+	1,666.75	58	34.8	5	3.0	741.00	32	43.2	1	1.3	925.75	26	28.1	4	4.3
Upper Socioeconomic Class															
Total	696.00	11	15.8	1	1.4	226.75	6	26.5	0	—	469.25	5	10.7	1	2.1
Adjusted			*10.8*												
<5	16.75	0	—	0	—	11.75	0	—	0	—	5.00	0	—	0	—
5–14	35.75	0	—	0	—	18.25	0	—	0	—	17.50	0	—	0	—
15–24	104.50	0	—	0	—	46.00	0	—	0	—	58.50	0	—	0	—
25–34	89.00	1	11.2	0	—	20.75	1	48.2	0	—	68.25	0	—	0	—
35–54	164.00	3	18.3	0	—	46.00	1	21.7	0	—	118.00	2	16.9	0	—
55+	286.00	7	24.5	1	3.5	84.00	4	47.6	0	—	202.00	3	14.9	1	5.0
Middle Socioeconomic Class															
Total	2,898.75	46	15.9	6	2.1	1,462.00	31	21.2	3	2.1	1,436.75	15	10.4	3	2.1
Adjusted			*12.8*												
<5	121.00	0	—	0	—	76.50	0	—	0	—	44.50	0	—	0	—
5–14	362.25	0	—	0	—	236.00	0	—	0	—	126.25	0	—	0	—
15–24	474.00	2	4.2	1	2.1	259.25	0	—	0	—	214.75	2	9.3	1	4.7
25–34	398.00	1	2.5	1	2.5	179.50	1	5.6	1	5.6	218.50	0	—	0	—
35–54	700.25	7	10.0	1	1.4	357.00	7	19.6	1	2.8	343.25	0	—	0	—
55+	843.25	36	42.7	3	3.6	353.75	23	65.0	1	2.8	489.50	13	26.6	2	4.1
Lower Socioeconomic Class															
Total	3,780.75	37	9.8	6	1.6	2,068.50	18	8.7	3	1.5	1,712.25	19	11.1	3	1.8
Adjusted			*11.4*												
<5	180.00	4	22.2	1	5.6	97.75	3	30.7	1	10.2	82.25	1	12.2	0	—
5–14	912.00	5	5.5	0	—	499.75	4	8.0	0	—	412.25	1	2.4	0	—
15–24	895.00	5	5.6	1	1.1	539.75	3	5.6	1	1.9	355.25	2	5.6	0	—
25–34	413.00	5	12.1	2	4.8	225.00	2	8.9	0	—	188.00	3	16.0	2	10.6
35–54	843.25	3	3.6	1	1.2	403.00	1	2.5	1	2.5	440.25	2	4.5	0	—
55+	537.50	15	27.9	1	1.9	303.25	5	16.5	0	—	234.25	10	42.7	1	4.3

TABLE XIX*B*

DEATH RATES PER 1,000 PERSON-YEARS FOR ALL CAUSES AND FOR TUBERCULOSIS AMONG WHITE HOUSEHOLD ASSOCIATES OF "OTHER-THAN-SPUTUM-POSITIVE" INDEX CASES, BY AGE, SEX, AND SOCIOECONOMIC STATUS

Williamson County, Tennessee, 1931–1955

Age Group in Years	Total					Male					Female				
	Person-Years	All Causes		Tuberculosis Deaths		Person-Years	All Causes		Tuberculosis Deaths		Person-Years	All Causes		Tuberculosis Deaths	
		Number	Rate	Number	Rate		Number	Rate	Number	Rate		Number	Rate	Number	Rate
Total															
Total	18,624.50	182	9.8	10	0.5	9,760.50	106	10.9	5	0.5	8,864.00	76	8.6	5	0.6
Adjusted			*10.4*					*11.4*					*9.3*		
<5	1,151.00	5	4.3	0	—	523.25	3	5.7	0	—	627.75	2	3.2	0	—
5–14	4,271.75	3	0.7	0	—	2,257.75	3	1.3	0	—	2,014.00	0	—	0	—
15–24	3,906.75	4	1.0	0	—	2,164.00	2	0.9	0	—	1,742.75	2	1.1	0	—
25–34	1,685.50	5	3.0	0	—	816.25	3	3.7	0	—	869.25	2	2.3	0	—
35–54	3,894.25	27	6.9	2	0.5	2,065.75	15	7.3	1	0.5	1,828.50	12	6.6	1	0.5
55+	3,715.25	138	37.1	8	2.2	1,933.50	80	41.4	4	2.1	1,781.75	58	32.6	4	2.2
Upper Socioeconomic Class															
Total	1,261.00	13	10.3	0	—	598.00	6	10.0	0	—	663.00	7	10.6	0	—
Adjusted			*6.7*												
<5	51.00	0	—	0	—	25.00	0	—	0	—	26.00	0	—	0	—
5–14	128.00	0	—	0	—	82.50	0	—	0	—	45.50	0	—	0	—
15–24	150.75	0	—	0	—	84.50	0	—	0	—	66.25	0	—	0	—
25–34	147.75	0	—	0	—	53.50	0	—	0	—	94.25	0	—	0	—
35–54	358.50	2	5.6	0	—	188.50	1	5.3	0	—	170.00	1	5.9	0	—
55+	425.00	11	25.9	0	—	164.00	5	30.5	0	—	261.00	6	23.0	0	—
Middle Socioeconomic Class															
Total	6,544.75	93	14.2	4	0.6	3,237.50	54	16.7	2	0.6	3,307.25	39	11.8	2	0.6
Adjusted			*10.2*												
<5	225.75	1	4.4	0	—	96.50	1	10.4	0	—	129.25	0	—	0	—
5–14	839.00	0	—	0	—	410.25	0	—	0	—	428.75	0	—	0	—
15–24	1,113.50	1	0.9	0	—	547.50	1	1.8	0	—	566.00	0	—	0	—
25–34	687.75	1	1.5	0	—	325.75	0	—	0	—	362.00	1	2.8	0	—
35–54	1,646.25	17	10.3	1	0.6	843.75	11	13.0	0	—	802.50	6	7.5	1	1.2
55+	2,032.50	73	35.9	3	1.5	1,013.75	41	40.4	2	2.0	1,018.75	32	31.4	1	1.0
Lower Socioeconomic Class															
Total	10,818.75	76	7.0	6	0.6	5,925.00	46	7.8	3	0.5	4,893.75	30	6.1	3	0.6
Adjusted			*10.9*												
<5	874.25	4	4.6	0	—	401.75	2	5.0	0	—	472.50	2	4.2	0	—
5–14	3,304.75	3	0.9	0	—	1,765.00	3	1.7	0	—	1,539.75	0	—	0	—
15–24	2,642.50	3	1.1	0	—	1,532.00	1	0.7	0	—	1,110.50	2	1.8	0	—
25–34	850.00	4	4.7	0	—	437.00	3	6.9	0	—	413.00	1	2.4	0	—
35–54	1,889.50	8	4.2	1	0.5	1,033.50	3	2.9	1	1.0	856.00	5	5.8	0	—
55+	1,257.75	54	42.9	5	4.0	755.75	34	45.0	2	2.6	502.00	20	39.8	3	6.0

TABLE XXA

DEATH RATES PER 1,000 PERSON-YEARS FOR ALL CAUSES AND FOR TUBERCULOSIS AMONG NONWHITE HOUSEHOLD ASSOCIATES OF "SPUTUM-POSITIVE" INDEX CASES, BY AGE, SEX, AND SOCIOECONOMIC STATUS

Williamson County, Tennessee, 1931–1955

Age Group in Years	Total					Male					Female				
	Person-Years	All Causes		Tuberculosis Deaths		Person-Years	All Causes		Tuberculosis Deaths		Person-Years	All Causes		Tuberculosis Deaths	
		Number	Rate	Number	Rate		Number	Rate	Number	Rate		Number	Rate	Number	Rate
Total															
Total	3,780.00	84	22.2	25	6.6	1,821.50	39	21.4	11	6.0	1,958.50	45	23.0	14	7.1
Adjusted			*24.2*					*23.7*					*24.7*		
<5	128.25	6	46.8	3	23.4	54.75	3	54.8	2	36.5	73.50	3	40.8	1	13.6
5–14	802.25	4	5.0	4	5.0	354.25	0	—	0	—	448.00	4	8.9	4	8.9
15–24	851.00	11	12.9	9	10.6	481.50	5	10.4	4	8.3	369.50	6	16.2	5	13.6
25–34	518.75	7	13.5	1	1.9	254.00	5	19.7	0	—	264.75	2	7.6	1	3.8
35–54	801.75	15	18.7	2	2.5	365.50	6	16.4	1	2.7	436.25	9	20.6	1	2.3
55+	678.00	41	60.5	6	8.8	311.50	20	64.2	4	12.8	366.50	21	57.3	2	5.5
Upper and Middle Socioeconomic Classes															
Total	908.00	23	25.3	1	1.1	397.00	12	30.2	0	—	511.00	11	21.5	1	2.0
Adjusted			*17.4*												
<5	22.00	0	—	0	—	10.50	0	—	0	—	11.50	0	—	0	—
5–14	98.00	0	—	0	—	52.50	0	—	0	—	45.50	0	—	0	—
15–24	135.50	0	—	0	—	79.00	0	—	0	—	56.50	0	—	0	—
25–34	119.00	3	25.2	0	—	57.50	2	34.8	0	—	61.50	1	16.3	0	—
35–54	245.00	4	16.3	0	—	84.50	2	23.7	0	—	160.50	2	12.5	0	—
55+	288.50	16	55.4	1	3.5	113.00	8	70.8	0	—	175.50	8	45.6	1	5.7
Lower Socioeconomic Class															
Total	2,872.00	61	21.2	24	8.4	1,424.50	27	19.0	11	7.7	1,447.50	34	23.5	13	9.0
Adjusted			*26.1*												
<5	106.25	6	56.5	3	28.2	44.25	3	67.8	2	45.2	62.00	3	48.4	1	16.1
5–14	704.25	4	5.7	4	5.7	301.75	0	—	0	—	402.50	4	10.0	4	10.0
15–24	715.50	11	15.4	9	12.6	402.50	5	12.4	4	9.9	313.00	6	19.2	5	16.0
25–34	399.75	4	10.0	1	2.5	196.50	3	15.3	0	—	203.25	1	4.9	1	4.9
35–54	556.75	11	19.8	2	3.6	281.00	4	14.2	1	3.6	275.75	7	25.4	1	3.6
55+	389.50	25	64.2	5	12.8	198.50	12	60.5	4	20.2	191.00	13	68.1	1	5.2

TABLE XX*B*

DEATH RATES PER 1,000 PERSON-YEARS FOR ALL CAUSES AND FOR TUBERCULOSIS AMONG NONWHITE HOUSEHOLD ASSOCIATES OF "OTHER-THAN-SPUTUM-POSITIVE" INDEX CASES, BY AGE, SEX, AND SOCIOECONOMIC STATUS

Williamson County, Tennessee, 1931–1955

Age Group in Years	Total					Male					Female				
	Person-Years	All Causes		Tuberculosis Deaths		Person-Years	All Causes		Tuberculosis Deaths		Person-Years	All Causes		Tuberculosis Deaths	
		Number	Rate	Number	Rate		Number	Rate	Number	Rate		Number	Rate	Number	Rate
Total															
Total	2,066.75	30	14.5	4	1.9	1,144.50	15	13.1	2	1.7	922.25	15	16.3	2	2.2
Adjusted			*15.4*					*13.5*					*17.5*		
<5	160.75	2	12.4	0	—	88.75	2	22.5	0	—	72.00	0	—	0	—
5–14	483.75	3	6.2	1	2.1	298.75	2	6.7	1	3.3	185.00	1	5.4	0	—
15–24	380.50	4	10.5	2	5.3	238.75	2	8.4	0	—	141.75	2	14.1	2	14.1
25–34	233.75	1	4.3	0	—	116.25	1	8.6	0	—	117.50	0	—	0	—
35–54	445.25	7	15.7	1	2.2	197.50	2	10.1	1	5.1	247.75	5	20.2	0	—
55+	362.75	13	35.8	0	—	204.50	6	29.3	0	—	158.25	7	44.2	0	—
Upper and Middle Socioeconomic Classes															
Total	478.00	15	31.4	2	4.2	188.25	6	31.9	1	5.3	289.75	9	31.1	1	3.5
Adjusted			*24.5*												
<5	17.00	1	58.8	0	—	6.50	1	*	0	—	10.50	0	—	0	—
5–14	35.75	0	—	0	—	20.75	0	—	0	—	15.00	0	—	0	—
15–24	50.00	1	20.0	1	20.0	34.50	0	—	0	—	15.50	1	64.5	1	64.5
25–34	42.00	0	—	0	—	9.50	0	—	0	—	32.50	0	—	0	—
35–54	186.75	5	26.8	1	5.4	61.50	2	32.5	1	16.3	125.25	3	24.0	0	—
55+	146.50	8	54.6	0	—	55.50	3	54.1	0	—	91.00	5	54.9	0	—
Lower Socioeconomic Class															
Total	1,588.75	15	9.4	2	1.3	956.25	9	9.4	1	1.0	632.50	6	9.5	1	1.6
Adjusted			*10.7*												
<5	143.75	1	7.0	0	—	82.25	1	12.2	0	—	61.50	0	—	0	—
5–14	448.00	3	6.7	1	2.2	278.00	2	7.2	1	3.6	170.00	1	5.9	0	—
15–24	330.50	3	9.1	1	3.0	204.25	2	9.8	0	—	126.25	1	7.9	1	7.9
25–34	191.75	1	5.2	0	—	106.75	1	9.4	0	—	85.00	0	—	0	—
35–54	258.50	2	7.7	0	—	136.00	0	—	0	—	122.50	2	16.3	0	—
55+	216.25	5	23.1	0	—	149.00	3	20.1	0	—	67.25	2	29.7	0	—

* Less than 10 person-years; no rate calculated

TABLE XXI

NEW CASES OF TUBERCULOSIS WITH CUMULATIVE PROBABILITY PER 100 OF CHILDREN OF "SPUTUM-POSITIVE" INDEX CASES DEVELOPING TUBERCULOSIS, ACCORDING TO AGE AT FIRST EXPOSURE
Williamson County, Tennessee

Age Group in Years	Age at First Exposure							
	Less than 1 Year		1 to 4 Years		5 to 14 Years		15 Years and Older	
	New Cases	Cumulative Probability per 100	New Cases	Cumulative Probability per 100	New Cases	Cumulative Probability per 100	New Cases	Cumulative Probability per 100
<1	8	6.6						
1	1	7.4						
2	1	8.3						
3	1	9.2						
4	1	10.2						
5	—	10.2						
6	1	11.3						
7	—	11.3						
8	—	11.3						
9	—	11.3						
10	—	11.3						
11	1	12.5						
12	—	12.5			1	0.7		
13	—	12.5			—	0.7		
14	—	12.5			1	1.3		
15	—	12.5			1	1.9		
16	—	12.5	1	2.0	3	3.8		
17	—	12.5	2	6.2	—	3.8		
18	—	12.5	2	10.7	2	5.1	1	2.9
19	1	14.2	1	13.1	2	6.5	2	7.6
20	—	14.2	1	15.6	1	7.2	1	9.6
21	—	14.2	—	15.6	—	7.2	1	11.4
22	—	14.2	—	15.6	—	7.2	—	11.4
23	—	14.2	—	15.6	—	7.2	1	13.2
24	—	14.2	—	15.6	—	7.2	1	14.8
25	1	16.8	—	15.6	—	7.2	1	16.4
26	—	16.8	—	15.6	1	8.3	—	16.4
27	—	16.8	—	15.6	—	8.3	1	18.1
28	—	16.8	—	15.6	1	9.6	—	18.1
29	—	16.8	—	15.6	—	9.6	—	18.1
30	—	16.8	—	15.6	—	9.6	—	18.1
31	—	16.8	—	15.6	—	9.6	—	18.1
32	—	16.8	—	15.6	—	9.6	1	19.7
33	—	16.8	—	15.6	—	9.6	—	19.7
34	—	16.8	—	15.6	1	11.8	—	19.7
35	—	16.8	—	15.6	—	11.8	—	19.7
36	—	16.8	—	15.6	—	11.8	—	19.7
37	—	16.8	—	15.6	—	11.8	—	19.7
38	—	16.8	—	15.6	—	11.8	—	19.7
39	—	16.8	—	15.6	—	11.8	—	19.7

TABLE XXII

NUMBER OF PERSONS TESTED FOR THE FIRST TIME WITH TUBERCULIN (0.1 MG. OF OT—2+ OR MORE REACTION) AND NUMBER AND PERCENTAGE POSITIVE BY AGE GROUP, SEX, AND RACE

Williamson County, Tennessee, 1951-1955

Age Group in Years	Total			Male			Female		
	Number Tested	Positive		Number Tested	Positive		Number Tested	Positive	
		Number	Per Cent		Number	Per Cent		Number	Per Cent
Total									
Total	7,765	1,210	15.6	3,643	575	15.8	4,122	635	15.4
*Adjusted**			*24.8*			*26.4*			*23.3*
<5	743	11	1.5	377	3	0.8	366	8	2.2
5-9	1,971	56	2.8	963	28	2.9	1,008	28	2.8
10-14	1,627	84	5.2	830	40	4.8	797	44	5.5
15-19	702	72	10.3	340	39	11.5	362	33	9.1
20-29	679	148	21.8	252	67	26.6	427	81	19.0
30-39	769	269	35.0	311	128	41.2	458	141	30.8
40-49	615	261	42.4	261	122	46.7	354	139	39.3
50-59	351	168	47.9	152	78	51.3	199	90	45.2
60+	308	141	45.8	157	70	44.6	151	71	47.0
White									
Total	6,205	901	14.5	2,938	439	14.9	3,267	462	14.1
*Adjusted**			*23.2*			*24.6*			*21.7*
<5	559	9	1.6	285	3	1.1	274	6	2.2
5-9	1,571	41	2.6	762	23	3.0	809	18	2.2
10-14	1,319	60	4.5	682	29	4.3	637	31	4.9
15-19	544	51	9.4	269	27	10.0	275	24	8.7
20-29	560	109	19.5	215	54	25.1	345	55	15.9
30-39	617	199	32.3	259	98	37.8	358	101	28.2
40-49	492	192	39.0	217	93	42.9	275	99	36.0
50-59	294	133	45.2	126	62	49.2	168	71	42.3
60+	249	107	43.0	123	50	40.7	126	57	45.2
Nonwhite									
Total	1,560	309	19.8	705	136	19.3	855	173	20.2
*Adjusted**			*31.1*			*33.1*			*29.1*
<5	184	2	1.1	92	0	—	92	2	2.2
5-9	400	15	3.8	201	5	2.5	199	10	5.0
10-14	308	24	7.8	148	11	7.4	160	13	8.1
15-19	158	21	13.3	71	12	16.9	87	9	10.3
20-29	119	39	32.8	37	13	35.1	82	26	31.7
30-39	152	70	46.1	52	30	57.7	100	40	40.0
40-49	123	69	56.1	44	29	65.9	79	40	50.6
50-59	57	35	61.4	26	16	61.5	31	19	61.3
60+	59	34	57.6	34	20	58.8	25	14	56.0

* Population of Williamson County estimated as of July 1, 1953, used as standard population

TABLE XXIII*A*

ADJUSTED* PREVALENCE OF INFECTION AMONG SCHOOL CHILDREN 5 TO 19 YEARS OF AGE, BY AGE AND RACE FOR THREE PERIODS OF TIME

Williamson County, Tennessee, 1932–1955

Age Group in Years	Total			1932–1939			1940–1947			1948–1955		
	Number Tested	Positive		Number Tested	Positive		Number Tested	Positive		Number Tested	Positive	
		Number	Per Cent		Number	Per Cent		Number	Per Cent		Number	Per Cent
Total												
Total	11,354	1,018	9.0	2,572	344	13.4	4,330	440	10.2	4,452	234	5.3
*Adjusted**			*9.2*			*12.7*			*10.3*			*6.2*
5–9	4,107	210	5.1	877	85	9.7	1,200	66	5.5	2,030	59	2.9
10–14	4,732	444	9.4	1,234	188	15.2	1,845	169	9.2	1,653	87	5.3
15–19	2,515	364	14.5	461	71	15.4	1,285	205	16.0	769	88	11.4
White												
Total	8,761	645	7.4	1,736	194	11.2	3,517	291	8.3	3,508	160	4.6
*Adjusted**			*7.8*			*11.3*			*8.1*			*5.5*
5–9	3,211	144	4.5	632	56	8.9	957	44	4.6	1,622	44	2.7
10–14	3,621	265	7.3	792	98	12.4	1,493	104	7.0	1,336	63	4.7
15–19	1,929	236	12.2	312	40	12.8	1,067	143	13.4	550	53	9.6
Nonwhite												
Total	2,593	373	14.4	836	150	17.9	813	149	18.3	944	74	7.8
*Adjusted**			*14.4*			*17.6*			*18.3*			*8.8*
5–9	896	66	7.4	245	29	11.8	243	22	9.1	408	15	3.7
10–14	1,111	179	16.1	442	90	20.4	352	65	18.5	317	24	7.6
15–19	586	128	21.8	149	31	20.8	218	62	28.4	219	35	16.0

* Using the percentage distribution of 5- to 19-year-old subjects in the Williamson County population, 1950 census, as standard

TABLE XXIII*B*

ADJUSTED* PREVALENCE OF INFECTION AMONG 5- TO 19-YEAR-OLD HOUSEHOLD ASSOCIATES OF INDEX CASES, BY AGE GROUP AND RACE, FOR THREE PERIODS OF TIME

Williamson County, Tennessee, 1932–1955

Age Group in Years	Total			1932–1939			1940–1947			1948–1955		
	Number Tested	Positive		Number Tested	Positive		Number Tested	Positive		Number Tested	Positive	
		Number	Per Cent		Number	Per Cent		Number	Per Cent		Number	Per Cent
Total												
Total	635	303	47.8	495	260	52.5	86	37	43.0	54	16	29.6
*Adjusted**			*48.4*			*50.8*			*47.6*			*27.9*
5-9	236	91	38.6	175	73	41.7	40	15	37.5	21	3	14.3
10–14	264	133	50.5	210	111	52.9	32	13	40.6	22	9	40.9
15–19	135	79	58.5	110	66	60.0	14	9	64.3	11	4	36.4
White												
Total	485	219	45.1	364	178	49.0	71	26	36.6	50	15	30.0
*Adjusted**			*46.8*									
5-9	179	63	35.2	125	48	38.4	35	12	34.3	19	3	15.8
10–14	201	94	46.8	156	79	50.6	25	7	28.0	20	8	40.0
15-19	105	62	59.0	83	51	61.4	11	7	63.6	11	4	36.4
Nonwhite												
Total	150	84	56.0	131	72	55.7	15	11	73.3	4	1	25.0
*Adjusted**			*54.2*									
5–9	57	28	49.1	50	25	50.0	5	3	†	2	0	—
10–14	63	39	62.0	54	32	59.2	7	6	†	2	1	†
15–19	30	17	56.7	27	15	55.6	3	2	†	0	0	—

* Using the percentage distribution of 5- to 19-year-old subjects in the Williamson County population, 1950 census, as standard

† Less than 10 subjects; no percentage calculated