Technical Discussions

CD15/DT/2 Rev. 1 (Eng.)
3 October 1964
ORIGINAL: ENGLISH

TUBERCULOSIS ERADICATION: A TASK FOR ACTUAL PLANNING AND FUTURE ACTION

TUBERCULOSIS IN WELL-DEVELOPED COUNTRIES

Dr. William R. Barclay
University of Chicago, Illinois

TABLE OF CONTENTS

TUBERCULOSIS IN WELL-DEVELOPED COUNTRIES

Dr. William R. Barclay
University of Chicago, Illinois

INTRODUCTION

Tuberculosis is a major global health problem and it is high on the list of public health problems confronting us in the Americas. Tuberculosis morbidity and mortality vary greatly from one country to another and in geographic areas within countries. My purpose today is to describe and analyze the tuberculosis problem in the two most northern countries of the Americas, the United States of America and Canada. Although these two countries are political entities, they are highly similar in all other ways and it is appropriate that from the health aspect we consider them together. The United States of America and Canada are technologically and economically highly developed. They are what some people call "developed countries" in contrast to the so-called "developing countries". In a pure sense, this is a misnomer for all countries are developing, none remain static. However, from the point of view of tuberculosis control let us term them "highly developed" and use their present state as a yardstick against which to measure tuberculosis control in other parts of the Americas.

DEFINITION OF THE DISEASE

Every disease has both a biological and a social aspect. What is an undesirable or abnormal state of health depends to a large extent on the point of view of a society at a particular time. For example, in the United States of America obesity is now regarded as undesirable and unhealthy. Diets, exercise and medications are medically prescribed to bring the patient into what is termed a "normal weight range". On the other hand, many societies regard obesity not only as the sign par excellence of robust good health, but also as reflecting psychological equanimity and social success.

What constitutes "the disease, Tuberculosis" is also highly dependent on the social and economic structure for which the definition is being made, for defining a disease state also defines a series of consequences. For example, health statistics, epidemiological investigation, diagnostic procedures and treatment measures depend on the definition that is made. One could define tuberculosis as existing when a person excretes tubercle bacilli by smear. The definition could be changed by adding the words, "smear and/or culture". Further refinement occurs if one defines the disease as the excretion of tubercle bacilli or as the presence of a changing, characteristic, lung infiltrate in a person who is tuberculin positive. Some epidemiologists would define tuberculosis as any of the above plus a recent conversion of the tuberculin test. Undoubtedly the definition of a disease must change as the social and economic structure changes, but at any given time a health service must be quite clear about the definition of the disease in question.

HISTORICAL BACKGROUND

To gain a proper perspective it is essential to examine the tuberculosis problem from a historical point of view. The population of the United States of America in 1820 was only eleven million persons. This was at the beginning of the period of massive immigration from Europe which increased the population to thirty-one million by 1860. The potato famine in Ireland in the 1840's and the crowded and unfavorable conditions in many other European countries encouraged migrants to seek a new life but the conditions which stimulated migrants to leave Europe were also those that favored their being heavily tuberculinized. Arrival in the new world brought hardship to many and did not permit attention to immediate personal health problems. Scandinavians and Germans, a group not heavily tuberculinized, and other persons from a rural background and in vigorous good health, migrated westward to open agricultural land brought little tuberculosis with them and created a pattern of living unfavorable to the spread of TB. Those originating in the crowded cities of Europe were prone to remain in large American cities and the Irish in particular tended to remain in the East coast ports. They were heavily infected with tuberculosis and today show a high incidence of TB. Thus, history established certain geographic patterns of tuberculous disease in the United States of America that is currently reflected in large rural areas in the midwest and west being relatively TB free, while the large coastal and Great Lakes cities show a high incidence of the disease. In 1812 the tuberculosis death rate in New York City stood at 700, in 1882 it was 370. In 1910 it had fallen to 180 and in 1963 it was only 8 per one hundred thousand. New York is an excellent example of what happened in tuberculosis rates in a large American city over a period of 150 years. The greatest decline in tuberculosis in this period occurred prior to the advent of chemotherapy and indeed, before the establishment of sanatoria. Therefore, we should have regard for many factors other than medical in planning a tuberculosis control program. Economic depression, changes in social behavior, alteration in living patterns, e.g., urbanization, fluctuations in birth rates and death rates all exert an effect and can nullify the most careful projections as to future case rates. We cannot be complacent about any case or death rate, no matter how small they may be.

Two other historical facts played major roles in the tuberculosis picture in the United States of America. One of these was the conquest of the American Indian and his subsequent confinement to Indian Reservations under conditions almost ideally created to spread TB. Second, was Negro slavery followed by emancipation into a social, economic and educational status that made him an easy target for consumption.

The decline of TB in North America from its peak in the 19th century came about not so much as a consequence of planned medical programs but rather as a consequence of social and economic changes that improved living standards, but which have left certain highly tuberculinized groups in a backwater of social progress in which they seem destined to remain despite serious efforts on their behalf by government health and welfare agencies.

With this as a general background, we can now examine tuberculosis as it exists in Canada and the United States of America today.

EPIDEMIOLOGY

GEOGRAPHIC

Figure 1 indicates the distribution of newly reported cases of tuberculosis in the United States of America in 1962. Note that the disease occurs mainly in the large coastal and Great Lake port cities, leaving the central area of the country relatively free. Examination of the geographic distribution within cities also reveals a sharp localization of cases. Figure 2 shows the distribution of newly reported cases within Chicago. The areas of high incidence are those highly congested with inferior social and economic development and areas predominantely Negro. Thus, TB is found in a relatively few square miles in a country with a vast total area. This is more a consequence of historical accident than planned control.

RACIAL

Although the total number of TB cases is greater in the Caucasian, a racial majority, than in the Negro population, the incidence is higher in the Negro. Despite attempts to completely integrate living patterns, these attempts are not successful and racial and national groups segregate themselves in large American cities. This grouping tends to concentrate tuberculosis into areas and a certain concentration of disease raises transmission to a point where this factor per se keeps the disease a constant, undiminishing threat. The same situation holds true with the North American Indian. Neither the Indian nor the Negro has particular racial susceptibility to tuberculosis but they both suffer from socio-economic disadvantages that favor the spread of the disease. In a sense, tuberculosis is a secondary effect of the living pattern of certain groups and cannot be successfully combatted by efforts directed solely to the secondary effect. The real solution lies in the correction of the socio-economic and educational aspects of the problem. However, I shall come back to these factors later.

MAGNITUDE OF THE PROBLEM

Figure 3 shows the new active case rate for the United States of America as a whole for the period 1953-1962. It will be seen that there is a steady decline and that currently the case rate is below 30 per hundred thousand. This figure has little real meaning, however, for it is an average of rates that vary from 121 in Alaska to 8 in Utah. Even these rates do not adequately tell the story, however, for in some areas of large cities the case rates stand as high as 400 or above per hundred thousand residents, rates quite as high as in the underdeveloped countries. Moreover, both the United States of America and Canada have found that one cannot project a declining case rate in a straight line and anticipate an early eradication of this disease. Once the rate has dropped below 30, a continuing drop becomes harder and harder to maintain, and as a matter of

fact, the case rate curve seems to be flattening out somewhere between 20 and 30 cases per hundred thousand people per year and may remain in this range for an indefinitely long period of time. Let us remember that biological rise and fall follow a logarithmic curve and therefore, any effect achieved where rates are high has an enormous numerical value compared to the same effect achieved where rates are low. Since we have set eradication as the ultimate goal, it might also be well to call to your attention that a logarithmic decline can never reach zero. Experience in the United States of America can give encouragement to other countries that the enforcement of standard health procedures will rapidly lower the tuberculosis case rate to approximately 25 per hundred thousand but leaves unanswered the question as to how to proceed from this point to the final goal of eradication. Undoubtedly, new techniques will have to be engineered to bring about the final eradication of tuberculosis.

In South and Central America there are undoubtedly similar historical, geographical and racial components to the tuberculosis problem. These should be carefully analyzed and then corrective measures applied to those areas where the incidence is at its greatest. If one accepts that current standard measures against tuberculosis will reduce rates to 25 per 100,000 but extraordinary measures, costly to implement are required to drive rates below this figure, then the approach at this time is obvious. Action should be confined to the highest incidence areas even at the expense of neglecting those segments of society with the lower rates. Thus, the first step in eradication would be to even out the rates in a nation to some low, arbitrarily set figure, always concentrating the major effort at that segment of the population with the highest rates. In the United States of America, for example, almost the whole effort should be exerted in restricted areas of the large cities and for the time being, only a token effort be directed in the rural, low incidence areas.

TUBERCULOSIS SERVICES

SOURCES OF RESPONSIBILITY

In the United States of America and Canada, health is not primarily a Federal responsibility, but is reserved as one of the states' rights. In actual practice, health is largely a problem for local community action; thus, tuberculosis control is under the direction of either city or county appointed bodies. However, the federal government does assume responsibility for tuberculosis services for Indians, Eskimos, persons in the Armed Forces and for a large proportion of the war veteran population. This fragmentation of treatment services is a major weakness since the standards applied vary widely both with respect to medical philosophy and financial resources. One of the greatest defects is lack of a national case register that would permit the following of a tuberculosis case even though he might move from one community to another. Since the American people tend to be highly mobile it would seem essential that ultimately some federal control be exercised over tuberculosis rather than leaving follow-up services entirely within the hands of local communities.

Ideally the program against tuberculosis should be conducted by local authorities, but the overall planning and direction and the establishment of standards for diagnosis, statistical reporting and treatment should rest with a central authority.

At this time, we should look beyond national control of tuberculosis to hemispheric control if the goal is to be eradication. Certainly, the first step is a national case register for each country. Electronic data processing makes possible storage and recovery of information on a scale heretofore undreamed of and certainly brings into the realm of practicality a case register of the Americas. Migration of peoples will increase rather than decrease and every crossing of a national boundary brings the individual under official scrutiny without invasion of the rights of privacy. Re-entry into the United States of America from abroad is almost the only mechanism we now have to implement smallpox vaccination. It could also be used to evaluate the tuberculosis status of an individual.

Although health education is a powerful force for encouraging people to recognize symptoms and submit to medical examination, it is not practical to leave tuberculosis detection an individual responsibility. Institutions and agencies that deal with people most at risk of having Tuberculosis should conduct a Tuberculosis detection program. For example, jails, hospital emergency rooms, courts of law, social agencies and employment bureaus can effectively screen by x-ray. People sick with one disease tend to be sick with other diseases. In fact, the population seems to divide itself into those who are well with no health problems and those who are sick and have many health problems. Therefore, screening a hospital population tends to reveal more Tuberculosis than a comparable screening of the public at large.

TUBERCULOSIS SERVICES

An important aspect of tuberculosis services is the ratio of beds to new cases. In 1962 there were 53,000 new cases of tuberculosis and a total bed capacity of 60,000. Allowing for a proportion of these beds not being suitable for use and allowing for geographic maldistribution, the beds were numerically adequate. For the United States of America as a whole, 75 percent of the currently available beds are occupied. The highest occupancy, 94 percent being in Alabama and the lowest, 54 percent, being in Wyoming. The current trend is to close obsolete facilities and to encourage the use of tuberculosis beds in major medical centers, particularly close to medical schools, thus ensuring an intensive and active treatment philosophy rather than that of isolation with bed rest. Thus, there has been the closing of many rural Sanatoria and a concentration of tuberculosis hospitals into large metropolitan areas.

Modern chemotherapy has reduced the importance of hospital care and reduced the length of hospital stay. Everyone is now aware of the experiments in total outpatient care of the tuberculous, and the successes achieved in this approach. Certainly, where resources are limited

they should be concentrated on the equipping of outpatient clinics rather than being spent on hospital construction.

Clinics need not be elaborate in construction or furnishings. In fact, a large number of clinics located conveniently close to the population at risk and staying open at hours convenient to the patient are preferable to a few deluxe establishments. A place to sit, a supply of drugs, and a sympathetic and understanding, trained lay worker are the essential ingredients of a clinic.

In the United States of America, outpatient treatment is generally weaker than is the hospital program. This is accounted for by many factors: the staffs tend to be inferior, some patients receive follow-up care from their private physicians rather than from an official outpatient facility and outpatient services are seldom coordinated under the same health authority as are hospital services. The ideal situation is obtained when the outpatient clinic is conveniently located to the community it serves, when the physician serves both in the clinic and in the hospital, where the health team of doctor, nurse, social worker and rehabilitation officer work with the patient both in and out of hospital. This team should also assume responsibility for the case-finding program among contacts of the patient. Although the anti-tuberculosis drugs hold the key to controlling tuberculosis they are quite ineffectual if the patient is not convinced he must take the drugs consistently for a long period of time. The indoctrination of the patient is extremely important and this requires a good clinic staff with ample time to spend on each patient visit. These ideals are not attained in the majority of our clinics.

Thought should be given to training local people as lay health workers. They can better appreciate the multitude of social and economic problems that are so important in Tuberculosis than can the highly trained professional person. Technical judgements require trained technical skills, but execution of the program can be carried out by local people under supervision.

Shortage of medical personnel constitutes one of the greatest weaknesses of our tuberculosis control program. The concept that tuberculosis is no longer an important disease has placed a barrier in the way of recruiting young physicians. Moreover, the field of tuberculosis is static today and has shown no signs of dramatic developments that would normally attract physicians. In the curriculum of medical schools, the subject of tuberculosis is superficially covered and the graduating student's knowledge of this disease is often inadequate.

Case-finding techniques vary widely from one community to another. Each community runs its own program. Sometimes this is conducted by a voluntary health agency, sometimes by the Sanatorium Board and other times by the local Board of Health. In all communities, however, the private physician is still a major source of reporting new cases. The private physician plus the private hospital account for almost half of the new cases reported. This is undoubtedly true because tuberculosis is becoming

more and more a disease of the elderly who seek medical attention for symptoms that may be unrelated to tuberculosis but which bring him under the scrutiny of a physician. It also reflects the fact that tuberculosis often goes hand in hand with other types of disability that lower patient resistance and bring about reactivation of old healed disease. Improvement in tuberculosis diagnostic services in general hospitals and education of the private practitioner of medicine to sharpen his clinical acumen with respect to tuberculosis would appear to be a most important means of improving detection of new cases.

To eradicate tuberculosis it will probably be necessary to completely revise our thinking about the place of bed care, the kind of physician who supervises the care and the degree to which all physicians should be involved in the program. Emphasis should be placed on outpatient treatment and bed care used only for the contagious phase of the disease or for those severely physiologically crippled.

The contagious period for Tuberculosis under drug treatment is probably very short, in most cases only a few eeeks. In the few weeks of hospital care the patient can be intensively indoctrinated about: the nature of his disease, how to protect his family and the importance of taking drugs. The physicians treating tuberculosis should be trained and utilized in the diagnosis and treatment of all pulmonary diseases to sustain their interest and attract top calibre people. All practicing physicians should be repetitively indoctrinated by seminars, medical briefs, papers on scientific programs and refresher courses on tuberculosis diagnosis and treatment.

MEDICAL, SOCIAL PROBLEMS

Diagnostic tests for tuberculosis are now sufficiently refined and treatment measures are now sufficiently effective that it should be feasible to eradicate tuberculosis. However, social, economic and education barriers prevent the effective use of our efficient diagnostic and treatment tools. Active tuberculous disease produces such mild symptoms, if any symptoms at all, that the majority of patients are not alarmed and do not seek medical aid. As a matter of fact, it requires a high degree of medical sophistication and indoctrination to bring about an awareness of ill health due to tuberculous disease. The pressing social and economic problems that confront those susceptible to tuberculosis are so great that in contrast the disease, tuberculosis, appears to be a rather minor disability. Many patients who suspect that they may be ill will purposely avoid coming under medical scrutiny because confinement in a hospital will only further compound their social and economic difficulties. Although ours is supposed to be a country with almost universal literacy, this is not entirely true and people who live in areas of high tuberculosis incidence are in many cases, literate at only the third grade level. It is therefore difficult to appeal to these people via posters, magazines, or newspaper articles. In the field of health communication we have made very little use of radio, television, street demonstrations and house to house word of mouth canvassing.

At the present time, the organization of urban life is more and more favoring situations which bring about the spread of tuberculosis rather than situations which would assist in the control of the disease. More and more people are being crowded into less and less space, a situation which will increase transmission of the tubercle bacillus. A fixed pattern of behaviour such as taking the same bus to work every morning, eating in the same cafeteria, frequenting the same places of recreation brings groups of people together repeatedly and favours spread of tuberculosis. This type of living pattern will become even more rigid with increasing urbanization and makes eradication of TB an urgent goal if we are to attain it before the population explosion and its associated problems put the goal beyond our reach.

OTHER MYCOBACTERIAL INFECTIONS

Decline in the incidence of human type tuberculous infection in the United States of America has permitted more critical diagnostic evaluation of individual cases and brought about an awareness of infection caused by other mycobacteria. Photochromogenic bacilli and Battey bacilli produce pulmonary disease indistinguishable on x-ray from that caused by the human strain of bacillus. One sanitorium in the Chicago area has 7 percent of its admissions accounted to non-human type tubercle bacilli and skin testing individuals with tuberculin made from specific strains has shown that certain areas of the United States of America suffer from endemic infections with atypical tubercle bacilli. Skin reactivity to tuberculin produced by the atypical bacilli make the use of the Mantoux test less valuable than it might otherwise be as a case-finding tool. Moreover, the disease produced by atypical bacilli responds less favorably to chemotherapy than does human type tuberculosis, and often this atypical disease must be treated by surgical procedures in addition to bed rest and chemotherapy. This places an increased burden on the treatment facilities of tuberculosis sanitoriums, particularly with respect to staffing problems. Because one cannot assume that infection with atypical bacilli creates absolute immunity to superinfection with human bacilli, the newly admitted case to a tuberculosis sanatorium in some parts of our country must be isolated from other patients until the nature of his infection has been clearly defined. The atypical infections are not currently believed to be contagious, and passed from one human to another. Nevertheless, they have been treated from an administrative point of view, as if they were ordinary tuberculosis, and this can create unnecessary hardship on the patient in terms of job restriction and isolation from his family and community.

The magnitude of the atypical infections in the United States of America is not yet clearly known, but if it remains at a constant level, as indeed it will unless we define the source of the infection, and if increasing control over human infection causes the incidence of this disease to decline, then the atypical infections will assume an ever greater relative importance.

CHEMOTHERAPY AND CHEMOPROPHYLAXIS

More than a decade of experience with chemotherapy that includes Isoniazid has brought forth the following important facts which will undoubtedly influence the future course of tuberculosis. First, if multiple drug therapy including Isoniazid, is given in an adequate dosage on a regular basis for an adequate period of time, more than 95 per cent of treated cases will obtain a sputum negative status and will not require surgical intervention, other than to eliminate open-negative cavities that may persist on the x-ray. Secondly, the relapse rate from adequately treated cases is extremely low, and much below anything achieved by treatment procedures used in the pre-chemotherapy era. Thirdly, although bed rest is a widely practiced treatment procedure in conjunction with chemotherapy, it is probably not essential, and is certainly not vital to the effectiveness of the chemotherapy program. Fourthly, the infectivity of a tuberculous case rapidly declines with the initiation of chemotherapy, and in most cases, this does not last beyond the first few weeks of treatment. From the above facts, we may conclude that it becomes vital to detect tuberculosis before extensive lung destruction has taken place, since chemotherapy will effectively halt further progress of the disease, but does little to restore damaged tissues. It is also vital to create some sort of mechanism to bring people under treatment and keep them on sustained treatment, since the weaknesses of chemotherapy lie not in the drugs themselves, but in their application to the patients. The role of the TB hospital in the over-all treatment picture is much reduced.

Chemoprophylaxis of tuberculosis in the light of reports published to date must be considered less successful than chemotherapy. This may not be the fault of the drugs, but rather the fault of the patient, who fails to regularly take the drugs, probably because the pressures to protect oneself are not as great as the pressures to cure oneself of the disease. On the other hand, it is also possible that chemoprophylaxis is only effective against multiplying organisms, and does nothing to eradicate from the body those bacilli which are in a dormant state, and which may not reach a state of bacterial activity until after chemoprophylaxis has been withdrawn. However, the effectiveness of chemoprophylaxis as shown by the United States Public Health Service trials is impressive enough to encourage its widespread use among recent tuberculin converters, especially children and for the intimate contacts of a newly discovered, active case.

Actually the experiments in chemoprophylaxis are rather preliminary ones and the initial, limited success should stimulate bold new experiments. If INH given twice a week would exert a prophylactic effect, it would solve many of the problems encountered in daily administration of a drug. Perhaps a course of prophylaxis given three months a year for a four year period would accomplish more than 12 consecutive months of prophylaxis. There are many other facets of drug administration that require research before INH can be used as fully effective tool in eradication.

B.C.G.

The most neglected tool for the control of tuberculosis in the United States of America is the employment of B.C.G. vaccine for those socioeconomic groups known to be at the greatest risk. This situation shows signs of being corrected by the recent action taken in New York City to vaccinate seventh grade school children in areas of the city where tuberculosis exhibits its highest incidence. It is difficult to explain the reluctance of public health authorities in the United States of America to accept this tool, when it has been so widely used in Canada, Mexico and Central and South America. Not only is B.C.G. as effective in prophylaxis as chemoprophylaxis, but it enjoys the distinct advantage of a single administration versus daily administration over a prolonged period of time.

If tuberculosis is to be truly eradicated and not just controlled at some acceptable incidence level, then vaccination will become the second most important tool next to social and economic reforms. No vaccination method can protect against overwhelming exposure of people nutritionally and socially poverty stricken. It can, however, eliminate tuberculosis from a people with even minimally acceptable standards of shelter and food intake.

Vaccination of the whole population at risk should be undertaken, probably starting at birth and repeated at 7 to 10 year intervals on a compulsory basis. This, as is the case with the other measures, would require vigorous implementation to be effective. If even a small segment of the population escapes control measures, they can form a nucleus of infection that threatens all. Although mass B.C.G. vaccination would compromise the value of the tuberculin test as an epidemiological tool this is not sufficient reason to abandon the great value of vaccination.

SUMMARY

At the present time, the United States of America enjoys a relatively low incidence of new cases of tuberculosis. However, there are areas of significant weakness in tuberculosis control, most obvious in the large urban centers. Failure to adopt an aggressive attitude towards lowering the incidence in these high incidence areas could very well lead to a general resurgence in case rates and make the eradication of tuberculosis a much more difficult problem than it poses at the present time. The principal defects in our control program lie in the following areas:

1. Lack of a national case register.
2. Shortage of trained medical personnel in the field of tuberculosis.
3. Weaknesses in tuberculosis teaching in medical schools.
4. Confusion created by atypical acid-fast infection.
5. Socioeconomic and educational barriers that stand between the susceptible population and the modern tools of diagnosis and chemotherapy.
6. Failure to use B.C.G. vaccine in selected high-risk groups.

There are seven steps I consider essential to the development of a strong program geared to the eradication of tuberculosis:

1. Define the tuberculosis problem in your country, in terms of the size of the problem and the social groups it attacks. In other words, establish the epidemiology of the disease for your area.
2. Launch your major effort in those areas with the greatest amount of disease. This may involve planned neglect of some sections of the community.
3. Encourage strong local services but establish over-all planning, guidance and evaluation at a federal level.
4. Coordinate the attack on TB with the attack on other social and health problems.
5. Emphasize the major role of Isoniazid in treatment. Other measures are secondary and should not compromise the use of Isoniazid in an adequate dose for a long period.
6. Upgrade the teaching of tuberculosis in medical schools.
7. Plan for a comprehensive vaccination program among groups of people most at risk of developing tuberculosis.

FIGURE 1

DISTRIBUTION OF TB CASES IN THE U.S. BY COUNTY, 1962

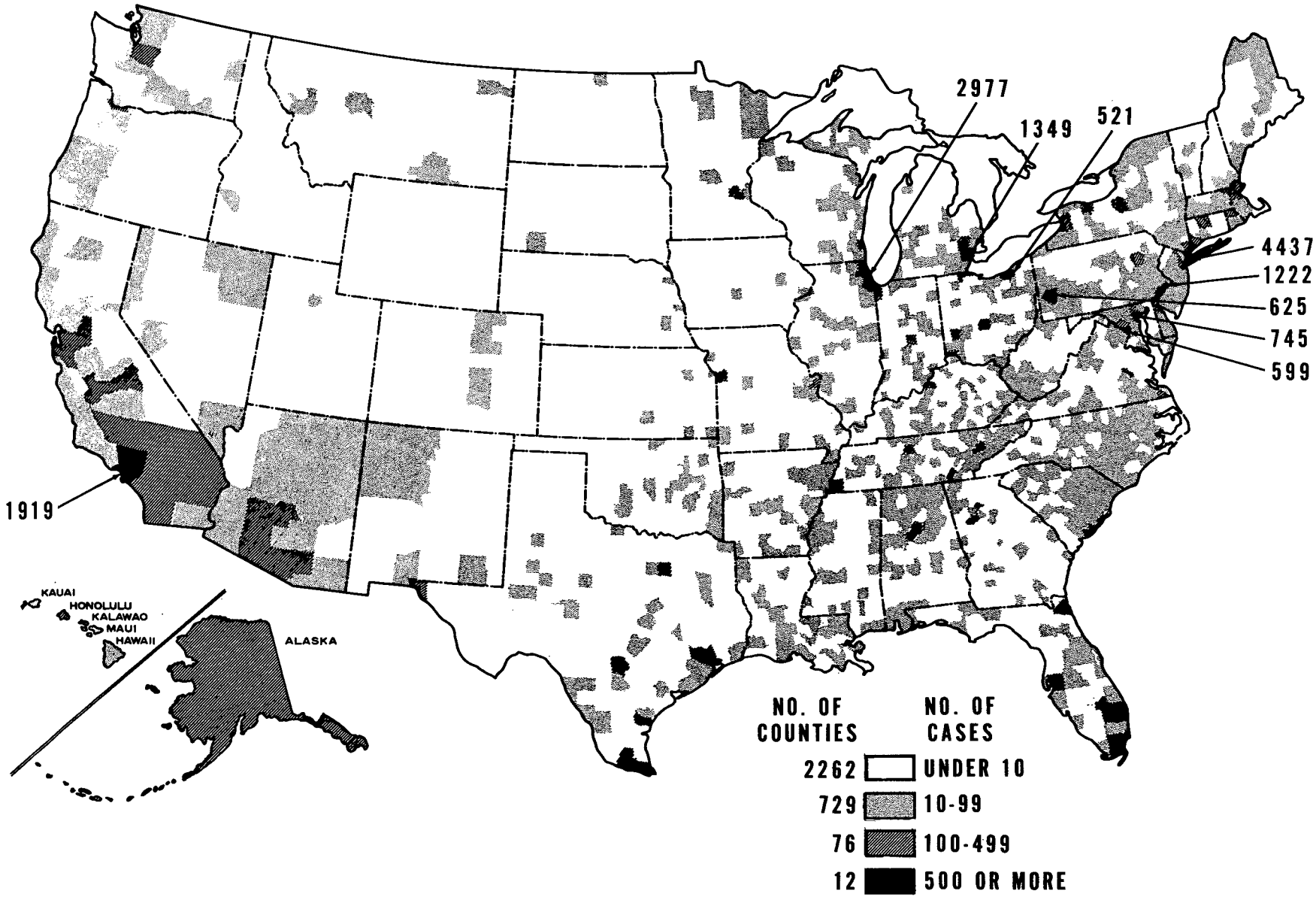

FIGURE 2

TUBERCULOSIS

NEW ACTIVE CASE RATES AND DEATH RATES UNITED STATES, 1953-1961