different from that of an uninfected individual - Koch's phenomenon. Years later, the tuberculin test became the indispensable tool of the epidemiologists.

So intense must have been his disenchantment with the failure of tuberculin that he gave up research in the field of tuberculosis altogether and went on a microbe hunting spree all over the globe. He visited several countries, including India and discovered the causative micro-organisms of several diseases like cholera, sleeping sickness, relapsing fever, Rinderpest, Anthrax etc.

Robert Koch may well be described as the father of the discipline of Microbiology. His techniques of making and staining of smears, culture techniques etc. are still in vogue today. He was responsible for making microbiology as the basis of public health measures. Harley Williams has very rightly called Robert Koch 'the greatest technician in Medical Research'.

Honours came to him galore. He was elected a member of the German Academy of Sciences and was awarded the Noble Prize in Medicine in 1905 for his outstanding work on tuberculosis. In his memorable address at the Noble Prize Award function, he said with uncanny foresight "I have performed my investigations in the interest of public health, to which I hope they will bring greatest benefit. To combat tuberculosis, I recommend prevention of infection by isolation of the patient in hospitals or screening at home, disinfection of the patient's excretion, care of the patient in organised dispensaries, information and health education of the population and, above all, of the patients and their families and compulsory registration of all cases". It is a great tribute to him that the control of tuberculosis even today, 77 years later, is based, almost entriely on these principles, except for the addition of chemotherapy which became available in 1947 and has so revolutionised the management that tuberculosis has ceased to be a puplic health problem in many developed countries and isolation is no longer necessary.

The Centenary of the discovery of the bacillus is being celebrated this year all over the world. Befitting tributes are rightly being paid to Robert Koch, a colossus amongst medical scientists of all times. The Centenary should, however, also be an occasion for taking stock of the state of tuberculosis control in our country, consolidating our achievements and devising ways and means to improve our strategy in respect of those procedures where our achievement has so far been unsatisfactory. It is an irony that inspite of the technology and know-how of control being available, tuberculosis still continues to be our Public Health Enemy No. 1. With the revised strategy in respect of case-finding and treatment in the rural areas under the National Programme, the added impetus of tuberculosis being given a priority in the 20-Point Programme of the Prime Minister, it should not be difficult to tame tuberculosis before the 20th Century ends. This will be possible only if all medical and para-medical personnel, voluntary organisations and the community as a whole put their shoulders together with a sense of commitment in the fight against this scourge.

TUBERCULOSIS IN INDIA — THE PROSPECT*

S. SIVARAMAN**

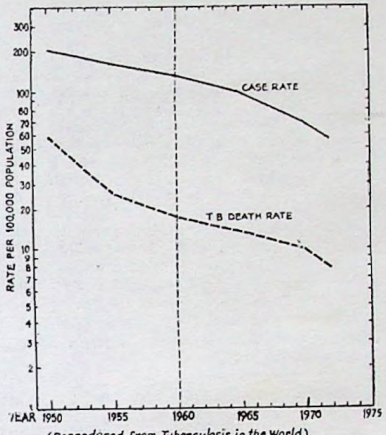
I am grateful to the Executive Committee of the T.B. Association of India for their kind gesture in inviting me to deliver the Wander TAI Oration. Realising the honour that has been bestowed on me by this award, I must confess that my contribution in the field of Tuberculosis research, compared to that of my illustrious predecessors, is insignificant. Only stalwarts in our speciality have been selected so far to deliver the prestigious Wander Oration, and this time the Tuberculosis Association has chosen a humble Tuberculosis worker to discharge the responsibility. My distinguished fellow delegates must, therefore, bear with me if I make a deviation from the earlier Orations.

The topic I have chosen for today's talk is 'Tuberculosis in India—The Prospect'. The topic, I think, is quite relevant, as persons eminently placed in the Tuberculosis control activities in our country have expressed different opinions on the matter.

Global Tuberculosis situation—General considerations

In the present day context, the problem of communicable diseases cannot be examined parochially. This is all the more true in the case of a disease like Tuberculosis, a worldwide problem of great importance. According to W.H.O. reports, Tuberculosis remains a widespread disease in developing countries, and even in a number of technically advanced countries, it often causes more deaths than all other notifiable diseases combined. Available data suggest that there are 15-20 million infectious cases of Tuberculosis in the world. In some areas of Africa, Asia and Oceania the annual incidence of Pulmonary Tuberculosis is as high as 250-200/100,000 population. It is believed that in several countries, the initial epidemic stage of the disease has passed and the natural trend of Tuberculosis is on the decline. Thus Tuberculosis death-rate tends to concentrate in the older age groups, and fewer deaths occur in children. Likewise, new cases also tend to shift to the older age groups. Adult males have higher Tuberculosis rates than females. In a few countries, however, the rates for both males and females tend to be nearly equal. The majority of new cases reported are pulmonary with or without a smear positive report. Tuberculosis Meningitis, once a serious complication seen often in children, is getting rarer. Extrapulmonary Tuberculosis continues to be a dilemma in that more and more new cases of this type are being reported, particularly from countries of the world where anti Tuberculosis campaigns have been most advanced.

The World, Selected Countes Tuberculosis Case Rates & Death Rates



(Reproduced from Tuberculosis in the World)

Fig. 1

The advent of chemotherapy brought in a remarkable reduction in Tuberculosis mortality. Between 1950 and 1960 the average reduction in mortality that occurred was 69%. The fall in incidence rate was rather slow to appear. Between 1960 & '70 the decline in case rates and death rates was about equal according to information available from countries with a good reporting system. At the beginning of this century, Tuberculosis was the leading cause of death in many countries. During the past 30 years Tuberculosis deaths have

*Wander-T.A.I. Oration, 1981

**Deputy Director of Health Services (TB), Kerala.

decreased to the point that in countries having reliable statistics, Tuberculosis is responsible for a very small proportion of deaths from all causes. However, in some countries including ours, Tuberculosis continues to be the leading cause of death among communicable diseases. Even today, with all the modern facilities available, millions continue to develop the disease and many die of it.

Data on the risk of Tuberculous infection has certain advantages over other epidemiological indices. But, unfortunately, this information is not available for many countries. However, information available from a few countries suggests that in the technically advanced countries, the risk of infection is low. According to Bleiker of Netherlands (1973) it is probable that in the majority of the developed nations, the risk of Tuberculous infection is below 5/1000; may be 1-3/1000 and in a few countries this may even be below 1/1000. He concluded that the risk of tuberculous infection was declining in the developed countries by about 10% or more each year. Some studies done or assisted by the TSRU and ITSC (International Tuberculosis Surveillance Centre) have helped to determine the risk of infection and its trend in many countries, both developed and developing. The risk of infection in developing countries was thus found to be between 1-4% (10-40/1000). Again, in the developing countries the risk of Tuberculous infection was seen decreasing only slowly or it remained static.

Tuberculosis situation in the different regions and countries of the world

Encouraged by the global eradication of Smallpox, the question is being asked by many as to whether Tuberculosis could be eradicated next. To gain perspective on this question, the U.S. Department of Public Health, Education and Welfare division collected world statistics from various sources and a world-wide status of Tuberculosis has been critically assessed in a book entitled 'Tuberculosis in the World' (1976). Antony M. Lowell, chief of the Statistics and Analysis Section of the U.S.D.P. utilised W.H.O. reports, statistical publications from various countries for compiling the data on the world Tuberculosis situation and, wherever necessary, available information was obtained through personal correspondence with numerous National Health Service officials. The data I furnish on the Tuberculosis situation today regarding all countries except India are only extracts/reproductions from this useful book.

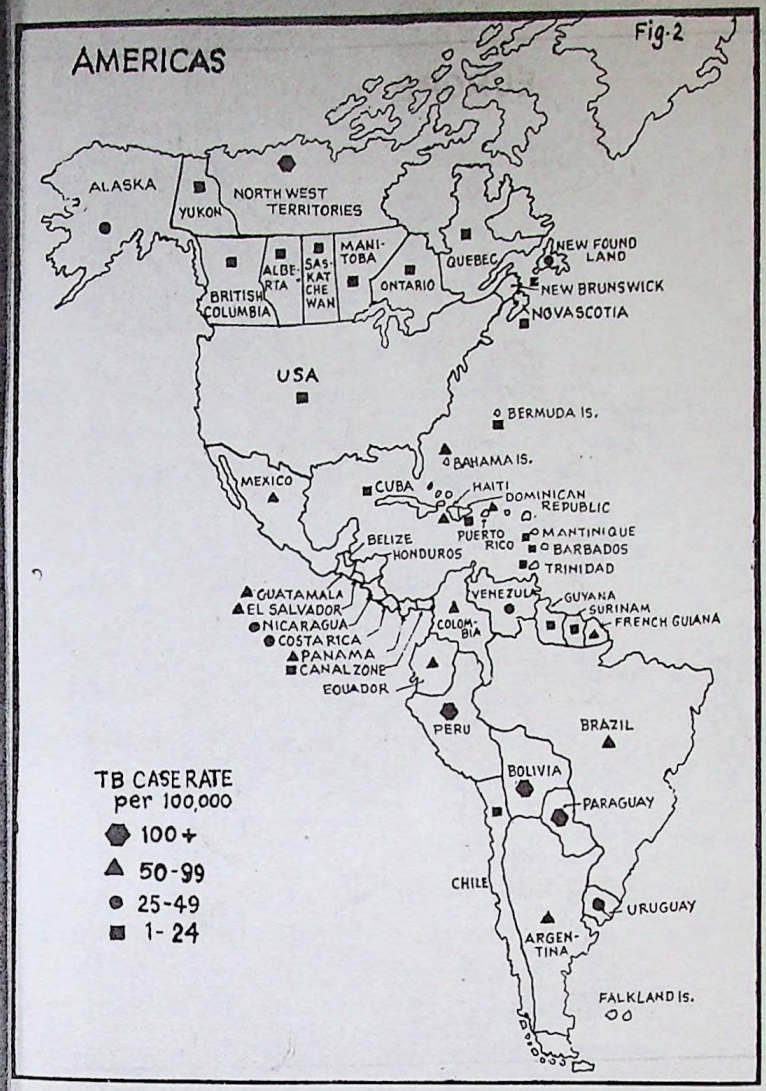
Western Hemisphere

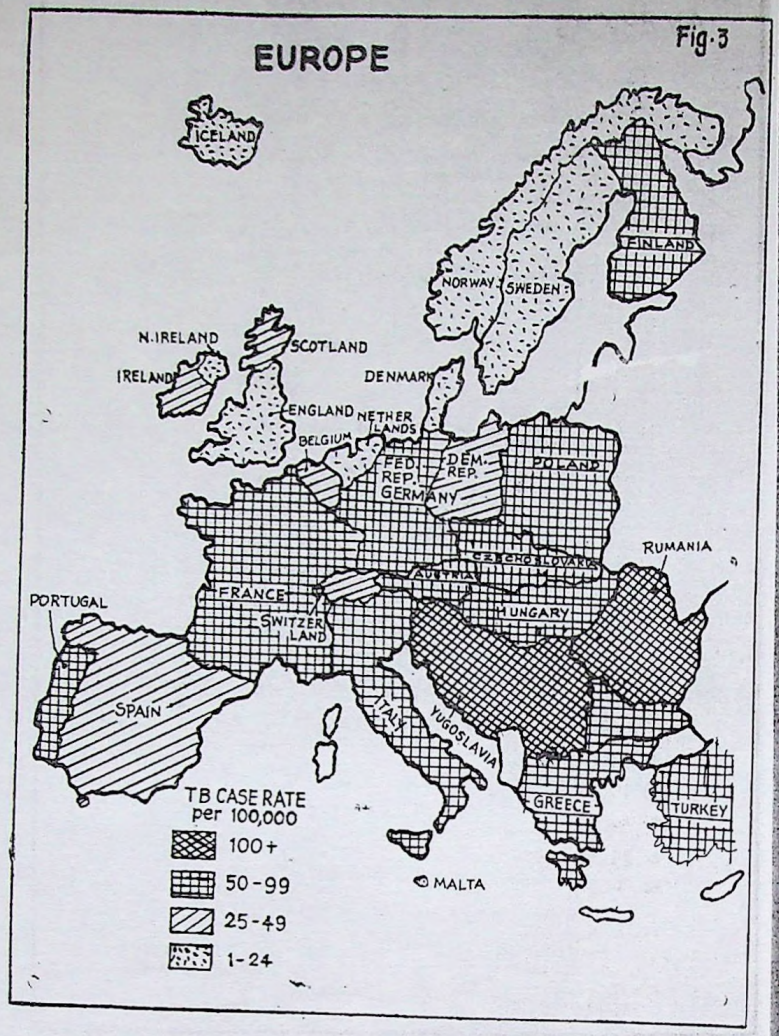
From the statistics available for 1973, the North-West territories of Canada, Mexico, Guatemala, El Salvador, Honduras, Panama, Bahama Islands, Haiti, Puerto Rico, Guadeloupe, Peru, Bolivia, Paraguay, Ecuador, Columbia, French Guyana, Brazil and Argentina had a case rate above 50/100,000 population. Of the above, the North-West territories of Canada, Peru, Bolivia and Paraguay registered case rates above 100/100,000 population. Bolivia had a case rate of 413/100,000, one of the world's highest. This country with a population around 5 million in 1972 registered 9,029 new cases. About 53% of the population of Bolivia consisted of Native Indians. In certain areas of this Republic even 62% of the population was found infected with a 10% infection rate in the 0-4 year age-group.

The lowest case rates in the region were observed in Canada, U.S.A., Belize, the Canal Zone of Panama, Cuba, Jamaica, Dominican Republic, Virgin Islands, Bermuda, Martinique, Barbados, Trinidad, Guyana and Surinam.

In Canada, the notification rate in 1973 was 16.1/100,000 with a very low rate of 7/100,000 in certain areas and a high rate of 279/100,000 among the Eskimos. Case rate among the native Indians was 158/100,000. 16.9% of all cases of Tuberculosis consisted of non-respiratory Tuberculosis. Tuberculosis death rate in Canada in 1972 was only 2.1/100,000. The Province of Ontario with 8 million residents forming 36% of Canada's population in 1973 accounted for 28% of their new cases. Of the 1176 new cases notified in Ontario Province in 1973 only 39.5% were born in Canada. 9.4% were native Indians and the rest 51.1% were emigrants (Chinese, Indians, Pakistanis and other Asians). A network of units, Tuberculosis Clinics and Sanatoria make up the system of Tuberculosis control in Canada. About 83% of Patients are treated as out-patients and only 17% are admitted for treatment to hospitals. Prophylactic drug treatment is being given.

In the United States of America notification rate of Tuberculosis was reported as 14.2/100,000 in 1974. Death-rate had fallen by then to 1.7/100,000. Maior reduction in case rate was noticed in Pulmonary Tuberculosis. Extrapulmonary Tuberculosis manifestations appeared to be slowly increasing. All States, large cities and county health departments have some type of TB control programme as part of their public health activities. Since 1960, Tuberculosis control division of their Public Health





ervice coordinates governmental, voluntary nd professional activities in Tuberculosis conrol. Even though the local or State Health gencies conduct the Tuberculosis programme est suited to their special circumstances, they ll follow approved standards in respect of revention, treatment, classification and reportng of tuberculosis cases. In the United States lso, domiciliary treatment is given to about 1% of their patients. Since 1962, the percentage of patients receiving hospitalised treatment has been steadily declining. While in 1962, 2% of the patients had hospitalised treatment, n 1974 only 19% got hospitalised. Between 1972 and '74 at least from 389 out of over 000 counties, there were no new cases of Tuberculosis. In about 1700 counties case ate during the above period was 1.14/100,000.

Europe

Rumania, Yugoslavia, Italy, Austria, France, Hungary, Czechoslovakia, West Germany, Poland, Finland, Portugal, Bulgaria and Greece had notification rates above 50/100,000. *Rumania* and *Yugoslavia*, however, had a notification rate of over 100/100,000. Countries with rates below 24 were Norway, Sweden, Denmark, Netherlands, England & Wales and Northern Ireland. Notification rates for England and Wales, Sweden, Netherlands, Norway and Denmark were 23.4, 20.5, 17.5, 13.9 and 13.1 respectively.

Rumania had a very high case rate of 492/100,000 in 1950, by 1969 but it had fallen to 129. Yugoslavia on the other hand had a rate of 280/100,000 in 1950 and by 1973 it had fallen only to 108.

England & Wales registered a steady decline in their Tuberculosis incidence, i.e. 7.5% every year during the period 1960-1967. However, the position changed in 1968 and until 1973, the average annual decline was only 3.1% a year. A survey undertaken in 1971 showed that this was largely due to immigration from countries such as India, Pakistan and Africa. For those born in India, Tuberculosis incidence rate in England was 25 times higher than for those born in that country. For persons born in Pakistan it was still worse—54 times higher. Though England & Wales had a notification rate of 23/100,000 population, the decline in mortality had been considerable, with the result that by 1973 it had fallen to 2.7/100,000.

Africa (Fig. IV) has many adverse conditions. The population is widely scattered. Undernourishment and ignorance among the people of that continent in general are very high. Health resources are scarce and its distribution is unequal. The refore Tuberculosis, Malaria, Leprosy, Yellow fever, Trachoma etc. flourish there. Tuberculosis is regarded as a major problem in most of the countries of Africa.

Morocco, Spanish Sahara, Mauritania, Mali, Togo, Swaziland and South Africa have a notification rate exceeding 100/100,000. Many countries such as Libya, Egypt, Senegal, Ghana, Nigeria, Gabon, Congo, Zaire, Kenya, Angola, Tanzania & Zimbabwe have notification rates above 50/100,000. For countries like Sudan, Algeria, Ethiopia, Somalia, Botswana, Zambia, Ivory Coast etc. notification rates are not available. Niger & Cameroon, however, have notification rates below 24/100,000.

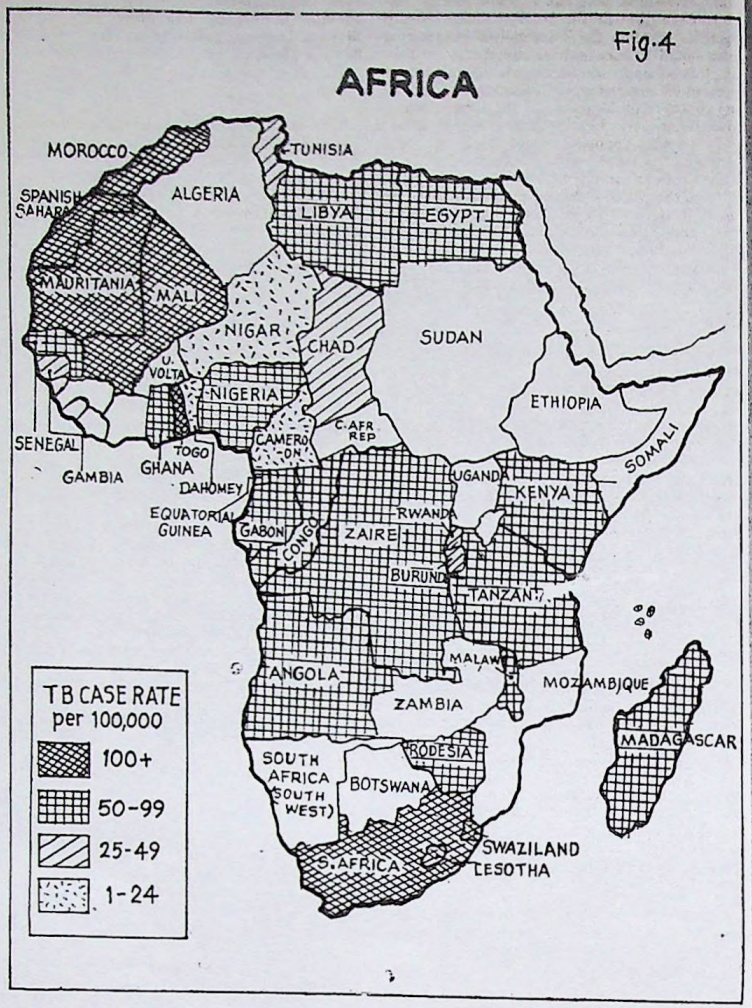
Though this continent on the whole has a serious Tuberculosis problem, the sum total of the problem is confined to a population of about 30 crores (less than half the population of India). Already control activities have begun in some countries and the trend of Tuberculosis can be expected to decline.

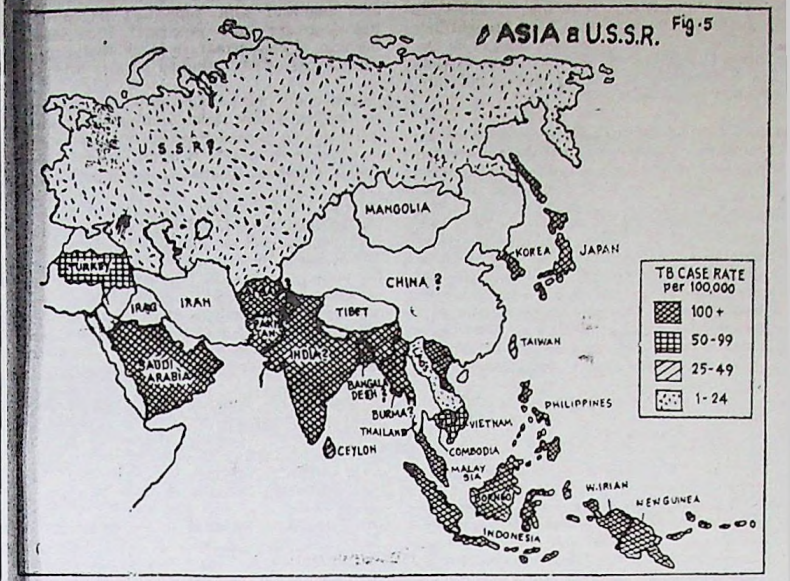
Asian countries (Fig. V) *& countries of the Western Pacific region of W.H.O. excluding India*

Among the countries of Asia high notification rates have been recorded in countries such as Saudi Arabia, Japan, Korea, Hongkong, Vietnam, Malaysia, Singapore, Philippines, Indonesia and most of the Islands in the Pacific. Regarding Pakistan, Afghanistan and Bangladesh, though reliable data are not available, there is every reason to believe that the problem is probably at its worst in these countries. Macao, an island in the western Pacific region, with a high density of population of 16,250 persons/sq. k.m., has one of the world's highest morbidity and mortality rates recorded in 1973. The morbidity rate was 469/100,000 population and the mortality was reported as 76.1/100,000.

Afghanistan, Pakistan & Bangladesh

In Afghanistan, overall infection rate is reported as around 50% of the population. In Pakistan, available information shows that prevalence of Tuberculosis in the 1970s was as high as 4.7%, may be the highest now reported in the world. Bangladesh with a population of 70 million people reported 84% infection and an infection rate of 46% in the 0-10 year age group. It would therefore appear that Pakistan and Bangladesh probably have the most serious Tuberculosis problem in the whole world.





U.S.S.R. consisting of 1/6th of the Earth's surface had an ostimated population of 25 crores (1974). In early 1960s large scale anti TB measures started in this country. In 1968 it was further strengthened by enacting suitable legislation for the improvement of Public Health in general. The general Public Health and special anti TB measures have resulted in the improvement of epidemiological indices in the U.S.S.R. During the period 1964-73 Tuberculosis morbidity dropped by 47.5% in that country. This was especially impressive in children. Morbidity of extrapulmonary Tuberculosis also declined to the point that almost no cases of some forms of disease were notified in the U.S.S.R. Genito-urinary Tuberculosis was the most common disease among the extrapulmonary diseases.

BCG vaccination is considered in the U.S.S.R. as the most effective preventive measure. Mass vaccination to the new born and revaccination upto the age of 18 years and in some cases upto 30 years are given. Chemoprophylaxis is considered second in importance as a preventive measure. With all the great achievements in Tuberculosis control in that country, they still consider Tuberculosis as an important health problem that affects considerably the well-being of the people and the economy of the country. Eradication of Tuberculosis in the U.S.S.R., they believe, is one of their important State tasks. Exact morbidity and mortality positions are not known.

In China, with the largest population among the countries of the world, statistics of Tuberculosis morbidity, mortality etc. were not available to the W.H.O. in 1973. However, those who have visited that country observed that there has been a remarkable improvement of Public Health due to elimination of most serious infectious diseases including a reduction in their Tuberculosis problem. All the same, the extent and variety of literature that have appeared on Tuberculosis control and treatment in Chinese Journals suggest that Tuberculosis is still a disease of maior concern in that country.

In 1949, China probably had a Tuberculosis prevalence of 3-9% and the estimated Tuber-

culosis mortality during that period was 230/100,000 population. A decade of anti-Tuberculosis campaigning in China brought in a decline of Tuberculosis prevalence in their cities to 1%. In 1958, Tuberculosis mortality in Peking was 46/100,000 population with a further reduction later.

Tuberculosis in children used to be very common, especially Tuberculosis Meningitis (1/3rd of Tuberculosis in children). Even during 1950s China was up-to-date in the treatment of Tuberculosis and started using S.M., I.N.H., PAS, Viomycin etc. A nation-wide BCG vaccination began in China in the mid-fifties. Immediate goal was to vaccinate all new borns and all healthy children below 15 years. By 1964 more than 90% of newborns were vaccinated. Manpower to meet this programme was organized by selecting teachers of Nurseries or Elementary Schools and by training them in Tuberculin testing and BCG vaccination.

Japan—Immediately after the second World War, Tuberculosis was so widespread in Japan that the morbidity rate for Pulmonary Tuberculosis was 10%. The mortality also was as high as 187.2/100,000 population. Anti-TB measures started very early in Japan. In 1951 a TB control Law was enacted. It laid down methods for diagnosing and treating patients and for protecting the population. The law also allocated various tasks at Governmental level and at each of the Prefectures. The law thus provided for BCG vaccination and registration of all new cases. Even compulsory hospitalisation of patients was enforced. With such a vigorous campaign, ably supported by the Japan Anti-TB Association, the achievement of Tuberculosis problem reduction was unique. By 1973, the case rate had fallen to 118/100,000 population. In 1969, the case rate was 196. Death rate (1973) was only 11/100,000. There was a remarkable reduction in the notification of extrapulmonary tuberculous disease.

Philippines with40 million population scattered over7000 islands stretching over 1000 miles had a very high notification rate of 328/100,000 (1972). Death rate during this period was 64/100,000. The trend of Tuberculosis in this country however appeared to show a decline since the year 1969.

Oceania Fig. VI.

Indonesia. Population of 125 million (1973) scattered over 5 large and/3000 small islands forms an arc between Asia and Australia. This country launched TB control activities in 1952 when BCG vaccination received high priority. Case detection by sputum examination and treatment with supervised intermittent treatment are now practised. Tuberculosis problem is considered very high with a prevalence rate of 0.6% sputum positive patients.

No doubt the problem of Tuberculosis in the Western Pacific region is a major one with some adverse factors. However, the population involved in this region is below 30 crores (excluding mainland—China).

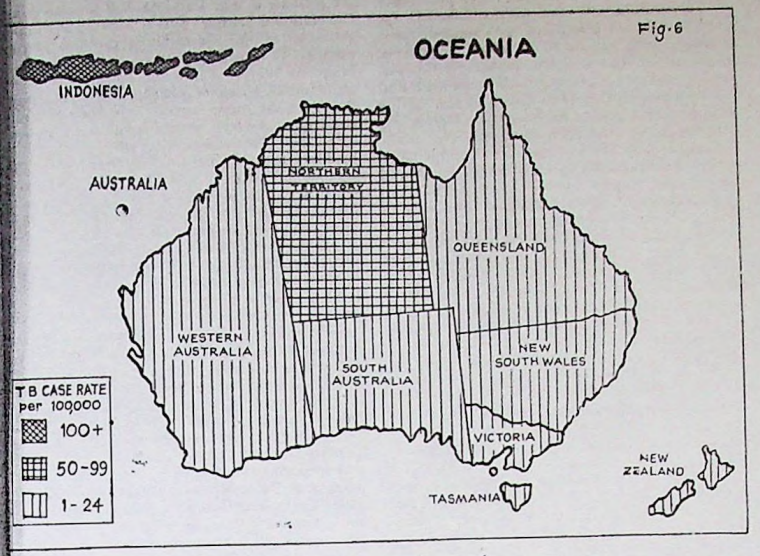
Australia has a very low notification rate of 10.5/100,000 (1973). Tuberculosis mortality during this period was also very low 1/100,000. This is one of the lowest death rates prevailing. In Western Australia, non-Australian born persons contribute 50% of the cases. Case rate for non-Australians ranges from 18–31/100,000 compared to 8–12/100,000 for Australian born persons. Non-Australian born comprise 27% of the population.

New Zealand. Population is 89% Europeans, natives 8%, Emigrants from Pacific Islands 2% and others 1%. Overall notification rate in NewZealand was steadily declining until recent years when due to large scale migration, the trend of decline has slo[illegible] down.

The Tuberculosis situation in our country

Tuberculosis is known to have existed in India from time immemorial. It continues to be a major problem of public health interest. Until recently our knowledge regarding its distribution in India in different age groups, sexes, and also in different places was meagre. Even today there are widespread misconceptions regarding the diagnosis of the disease and its treatment. If in the past, there were no health statistics and no notification on the morbidity and mortality, even today the system that prevails in India is far too incomplete and unsatisfactory. Though it is a disease of antiquity, actual statistics on the incidence, prevalence, mortality etc. of Tuberculosis became available in any part of the world within the last hundred years only (we know that the disease was proved with certainty as a communicable disease, and the causative agent was isolated only about 100 years ago).

For the first time in the history of Tuberculosis in our country it was only in 1920 that any epidemiological data on this disease was collected. Sir Leonard Rogers, on the basis of 22 long years of postmortem studies conducted in Calcutta, found that 17% of the total deaths were due to Tuberculosis. On the basis of the decennial estimate of crude mortality for



1911-21, the Tuberculosis mortality for India was computed for the first time as 800 per 100,000. This was probably not a true estimate as the postmortem studies were on hospital deaths and it is unlikely that hospital deaths could truly represent the actual death rate. It was Lancaster, who from Rogers's estimates and from other available information computed mortality for some of the Cities in India and reported that in most of the Indian Cities the mortality rate would be higher than 400 per 100,000. Later in 1949 Mc Dougal estimated Tuberculosis mortality in India as 200 per 100,000. Frimodt-Moller's estimate during this period for Madanappalle and surrounding rural areas was 253 per 100,000. He also found a rapid decline in the Tuberculosis mortality in that area to a low level of 21.1 per 100,000 by 1954-55 (explained as a result of intensive anti-tuberculosis measures introduced in that area). A longitudinal study to estimate the Tuberculosis mortality was undertaken by Chakraborty et al from National Tuberculosis Institute during the period 1961-68. They found the annual cause specific death rate due to Tuberculosis as 84 per 100,000 population aged 5 years and above and this represented about 9% of mortality due to all causes in that population. The death rates were the highest in 55 years and over—age group and the lowest mortality was in the 5-14 years group. An increasing trend in mortality with increasing age was also noticed. According to Official reports, Tuberculosis mortality for our country as a whole is 80-100/100,000. One thing is very clear, and that is, as in all countries of the world the mortality trend in India is certainly one of decline. However, we shall not lose sight of the fact that a mortality rate over 80/100,000 population is the highest death rate now in existence anywhere in the world. This, no doubt, is highly disturbing.

Tuberculosis infection as an index of the Tuberculosis situation in a country has growing importance. For the first time in India, Dr. Ukil in Bengal, one of the pioneers in T.B. work introduced Tuberculin testing and BCG vaccination in our country. Though countrywide Tuberculin surveys have not so far been carried out in India, extensive testing was done as part of our BCG Campaign from the year 1948. With all the lacunae and limitations inherent in this effort, for the first time, it became

possible for us to estimate the overall prevalence of Tuberculous infection in the different age groups. Without going into the details of those findings—well known to all of us, I wish to mention that it became evident that infection was widespread in our country both in the rural and urban areas. The risk or chance of contracting infection by a person in India was so high that one had every possibility of acquiring it before one reached 20 years of age. Considerable work in this line was done by Ukil, Benjamin, Sikand Pamra, Raj Narain, I.C.M.R. and the National Tuberculosis Institute. I wish to refer only to one study done in South India by the National Tuberculosis Institute from 1961-68. Prevalence of infection in that population group was 30% (25% for female and 35% for males). The rate increased with age upto 45 years. In the case of females there was a slowing down after the age of 15 years in contrast to that for males. The incidence of infection, a very useful epidemiological index, was also obtained from this study which showed a rate ranging from 0.84% to 1.5%. This broadly corresponds to the 1-2% reported by Frimodt-Moller. The BCG prevention study done in Madras showed the infection rate in the study area to be considerably higher. For all purposes we can believe that the annual infection rate in India today may be anything between 1-2% or 10 to 20/1,000. Compared to the infection rate of 5/1,000 for many of the developing nations and 1-3/1,000 for the developed nations, our infection rate is at least double the average of developing nations and 10 times that of developed nations. In a few of the developed countries, the infection rate has fallen to very low levels of below 1/1,000. Thus the available annual rate of infection in our country also depicts the serious nature of our Tuberculosis situation.

Prevalence and Incidence of Tuberculosis in India.

For the first time in 1945 Dr. P.V. Benjamin estimated from certain observations that about 2.5 million persons suffered from Tuberculosis in our country. During 1955-58, when the National Tuberculosis Sample Survey was conducted in India under Dr. Benjamin's initiative (ICMR Survey), we got for the first time many useful baseline data which helped us to appreciate the extent and nature of the problem of Pulmonary Tuberculosis in our country. Since then we know that the disease was widely prevalent throughout the length and breadth of India and that even in rural India the prevalence of the disease was almost the same as in the urban areas. We also found that males suffered more from pulmonary tuberculosis compared to the females and that in the males particularly the disease prevalence increased with the increase in age. Two and half decades after the National Sample Survey today, for making estimates of the Tuberculosis problem in our country we largely depend on the results of the National Survey. This predicament is certainly unfortunate. However, after the National Sample Survey, some other surveys have been carefully conducted at Delhi, Madanapalle and Bangalore all of which show that the prevalence of bacillary cases of Tuberculosis was about 400/100,000 population, a finding in agreement with the National Sample Survey. It was also found that this rate did not appreciably change until 1968. At least in the Delhi area a reduction of bacillary cases was noticed, bringing down its prevalence to 200-300/100,000 population. There is not much evidence for us to believe that this is happening in the rest of our country.

Without permanent and extensively spread out diagnostic facilities, and notification of detected cases it is very difficult to give convincing information on the incidence of Tuberculosis in our country. But some longitudinal studies have been carried out in Delhi, Bangalore and Madanapalle. The overall incidence rate of Tuberculosis from the studies done at Delhi and Madanapalle, though not strictly comparable, was 340 and 410/100,000 respectively. However, a longitudinal study undertaken by the National Tuberculosis Institute in a rural population of South India found annual incidence rate for Tuberculosis as around 100/100,000 population. It must however, be pointed out that whereas Bangalore rate was based on fresh bacillary cases only, the Delhi, Madanapalle rates were in respect of all cases judged as active, including abacillary cases. In any case one has to admit that an important information such as attack rate of Tuberculosis applicable to our country as a whole is woefully lacking.

Regarding the trend of Tuberculosis in India, we have no statistical data applicable to the country. That means we really do not know how the Tuberculosis situation in our country has responded to three decades of BCG vaccination programme and the National TB Control Programme in operation for about one and half decades. Therefore, opinions are varied. According to Dr. Nagpaul (1978) "there are reasons to believe that India had more than one epidemic of Tuberculosis since the time of yore. The present epidemic might have started in the 17th century. There is evidence that the present epidemic has been declining since the turn of the 20th century. The natural decline at present is very slow, probably because of the prevailing poverty, malnutrition and over crowding. The District Tuberculosis programme, even at the present level of efficiency, has a potential of accelerating the natural decline." The study undertaken by National Tuberculosis Institute in a rural South Indian population where virtually no Tuberculosis control facilities existed showed the following:

"The annual rate of Tuberculosis infection in previously uninfacted children and in adults was found to be about 1% (10/1000). The incidence of Tuberculosis (confirmed by culture) was about 1/1000 (excluding children below 5 years). About 30% of newly detacted cases came from the population uninfected at an earlier survey. ** Prevalence of disease was a 4 times the incidence. Among cases found in the initial survey 50% died within 5 years, about 20% continued to excrete bacilli after 5 years, and the remaining 30% got cured spontaneously. There was no evidence of an increase in drug-resistance among the newly diagnosed cases. The prevalence and incidence of infection showed a significant decrease during the 5 years in the age groups 0-24 and 0-34, respectively. At each survey, infection rate among the new born, tested for the first time at the survey, also showed a decline. The overall prevalence of disease also decreased from the first to the 3rd survey, but showed a slight increase in the 4th. However this was below that found at the 1st survey." Pamra in Delhi also found a slight decline in the prevalence of Tuberculosis in the city area. This area however had a good and comprehensive anti-TB service. Frimodt-Moller reported the decline in disease in six turns with a good tuberculosis service to be not different significantly from the decline in the other six control towns without any special tuberculosis service (Fimodt-Moller, 1981). These findings of Bangalore, Delhi and Madanapalle together with the characteristic of Chronic Pulmonary Tuberculosis now increasingly seen in the country, the shift in the age group in which more and more cases of tuberculosis are seen —all indicate the declining trend of tuberculosis in our country, however small it is. This, no doubt, is an encouraging feature of the Tuberculosis situation in India. Concerted action taken now will help us to bring down our Tuberculosis situation.

Tuberculosis Control Activities in India

The National Tuberculosis Sample Survey revealed the urgent need for a nation-wide TB Control Programme in our country. The new information that the bulk of the TB patients in the country stayed in the rural areas and Tuberculosis was widely scattered made it imparative that the programme in the country should be one that reached every nook and corner. Therefore, in the year 1959, Govt. of India established the National Tuberculosis Institute at Bangalore to formulate a comprehensive, realistic and economically feasible Tuberculosis Programme for the entire country. By 1962 National Tuberculosis Institute could evolve a programme for the country based on very solid scientific data obtained from the studies undertaken at the National Tuberculosis Institute, Chemotherapeutic Research Centre, Madras and other valuable studies and the experience gained from within the country and all over the world. According to Dr. Banerjee "The findings of the sociological studies done at National Tuberculosis Institute provided an entirely new direction to the strategy for dealing with the problem of Tuberculosis in India. In the first place, as already a large number of patients were actively seeking treatment at various health institutions, top priority was to be given in a national programme for providing services to those who had a felt need (Programme ought to be a felt need oriented one). As those who had felt need sought treatment at institutions of general health services, Tuberculosis services ought to be provided as an integral component of the general health services. Diagnosis and treatment of about 52% of infectious Tuberculosis who were worried enough to seek treatment on their own initiative would require very great effort. Logistically it implied an administrative effort to examine the sputa of as as many as 30 million cases of chronic cough who were reporting at over 12,000 (now it is about 20,000) health institutions scattered all over the country to identify about a million of infectious patients. Bangalore study revealed that as many as 90% of the patients who visited the different health institutions did not get any facility even to get diagnosed as cases of Tuberculosis and were sent back mostly with a bottle of cough mixture."

In view of the sociological studies made by the National Tuberculosis Institute, our National Tuberculosis Control Programme is sociologically oriented and is an attempt to meet a felt need. It is also epidemiologically aimed in order to cut the transmission of infection. Another good thing about our National Tuberculosis control programme is that it is operationally flexible, or it has a flexibility that will allow for

**Prevention trial in Chingleput showed a different situation. The number of new tuberculosis cases developing from the initially uninfected was particularly low in that population. The disease in the infected group was 17 time more-a really peculiar and noteworthy phenomenon.

local, sociological, administrative, operational and other variations.

Our National Control Programme is defined as "an organised effort which aims to bring under control the problem of Tuberculosis in the community through defined objectives, activities and resources. It comprises of well-known anti-TB measures knit into a comprehensive, practical, acceptable and economically feasible programme."

The objective is to reduce Tuberculosis in our country sufficiently quickly to the level where it ceases to be a public health problem.

The operational objectives laid down are:

(1) "To vaccinate with BCG a majority of the eligible (if possible more than 70%) in the community, in an efficient manner.

(2) To detect maximum number of TB patients with symptoms from among the out patients attending Health institutions and to treat them adequately; in doing so, to give priority to sputum positive TB patients.

(3) To undertake the above activities from all health institutions, as an integral part of the general health services".

It is not only the Government medical institutions wherein the control activities are to be organised. Private medical institutions and practitioners should be involved in all the activities in the manner posible. A District T.B. Centre, one for every district, located at the district headquarters is to form the nucleus of the District TB Control Programme. According to Dr. Nagpaul, "applying the National Sample Survey findings to the average Indian district, it was estimated that there would be 5000 infectious Tuberculosis patients and 3-4 times that number with X-ray shadow suggestive of the disease but sputum negative, to be dealt with at any time. This pool of 'cases' and 'X-ray suspects' constitute the problem of Tuberculosis in a district. Programme performance potential studies have shown that District TB Control Programme is capable of discovering in one year 46% of the entire pool of infectious cases in the district."

Our National Tuberculosis Programme Today

Quarterly progress report of the District TB Control Programmes for the period ending 1980 issued from the Directorate General of Health Services, New Delhi shows that out of 400 districts in our country, there are only 320 districts with TB control programmes which means that 1/5th of the districts in India are without a programme. In an average Indian district there are about 50 implementable peripheral health institutions. The report shows that the programme has been implemented on an average only in 33 peripheral institutions. It would appear from the report that about 34% of the peripheral health institutions in the country are without a programme in the already established District TB control programmes. Thus, on the whole about 47% of the country even today is not covered by the TB control programmes. This geographical coverage is reported as fairly satisfactory. I beg to differ and say that this is rather unsatisfactory.

Average case detection performance of a District Tuberculosis Control Programme in our country can be judged from the quarterly reports issued from the Directrate General of Health Services. According to the report for the period ending December 1980, a total of 1,23,353 cases of Tuberculosis were diagnosed through the reporting District TB Centres. Of these 10,293 were cases of extrapulmonary Tuberculosis.

Table I

Table shows average case detection performance in our N.T.P. in a quarter (quarter ending December 1980). Of the cases detected 8.2% were extrapulmonary tuberculosis and the remaining were pulmonary tuberculosis. Bacillary cases of pulmonary tuberculosis constituted 24.3% of the total and abacillary pulmonary tuberculosis cases formed the balance 67.5%.

When we look at the performance of D.T.Cs and P.H.Is in our N.T.P., we see that the P.H.Is contribute only 33.8% of all cases detected. The bulk of cases are even today detected in the D.T.C.s Another interesting observation is that even in the P.H.Is cases of Pulmonary tuberculosis detected are largely abacillary and not bacillary which means that more than direct sputum microscopy, our general medical institutions are relying on other methods including X-ray examination for case detection. Therefore, we can conclude that the case detection in P.H.Is on the whole is poor and the outlook is not one of detection of infectious cases of pulmonary tuberculosis by sputum examination. This only means that the very philosophy of our N.T.P. has not been understood/appreciated by persons working in the general health institutions.

TABLE. 1

N.T.P. (INDIA)-Case Detection in an Average Quarter

CASES DETECTED	D.T.Cs.	P.H. Is.	TOTAL
All types	81,645 (66·2)	41,708 (33·8)	123,353
Pulmonary Tuberculosis (bacillary)	19,283 (64·1)	10,800 (35·9)	30,083 (24·3)
Pulmonary Tuberculosis (abacillary)	54,034 (65·1)	29,143 (34·9)	83,177 (67·5)
Extra Pulmonary Tuberculosis	8,328 (82·5)	1,765 (17·5)	10,093 (8·2)

Figures in brackets show percentage value

It is rather difficult to get figures of T.B. patients detected each year in our country. On an average about 5-6 lakhs patients of all forms are detected through reporting D.T.Ps. (All D.T.Ps do not send reports and some reports are incomplete). If we guess that an equal number of patients are also detected in our country from institutions not covered by D.T.Ps. possibly 10-12 lakhs patients are detected each year. This means that only 10-15% of the total T.B. patients (if the total tuberculosis prevalence is 1.2%) are detected each year in India.

About case holding, particularly successful treatment completion by patients, information is not available in the quarterly reports. However according to Dr. Nagpaul's estimate about 45% of detected patients are either cured or became sputum negative in a period of one year in an area covered by D.T.P.

As regards BCG vaccination coverage, we have no data. Moreover the 'indirect protective action' of BCG has been reported as zero by the Madras study.

Epidemiological Model

As the evolution of Tuberculosis starting from infection—disease—recovery or death is now better known, one can prepare an epidemiological model for tuberculosis in a community or country. A simple model prepared by Dr. Azuma (Japan) which is a modification of Waaler's model is shown in Fig. VII.

This model subdivides a given population into six groups. Numerical values of these groups are called 'variables'. Variables vary with time and are therefore not constant.

SIMPLE EPIDEMETRIC MODEL OF TUBERCULOSIS
(modified from Waaler's model)

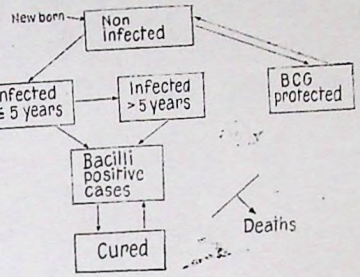


Fig. 7

Numerical values for the flow between variables are called "parameters". Birth-rate, Infection-rate, BCG vaccination coverage, protective effect of BCG, case rates (annual incidence of the disease) death-rate, (crude and cause specific) and cure rate with or without a programme are some of the parameters for the above model. If initial values of variables are known, and values of parameters are available, the dynamics of tuberculosis in a community becomes clear. Such a model approach is particularly useful in India for predicting the trend of tuberculosis. As reliable values for most of the parameters are not available for our country, determination of the future trend

of tuberculosis becomes difficult. However, Dr. Nagpaul worked out the trend of tuberculosis problems in our country using a very simple model.

According to him, the District Tuberculosis Programme, even at the present level of efficiency, has a potential of accelerating the natural decline of tuberculosis in India. He very roughly calculated that without other epidemiological 'flows' there would be 4.8% annual decrease in our problem over and above the natural decline.

TABLE 2

Estimated Sputum Positive Cases in Average Indian District with & without District Tuberculosis programme at the end of one year

	Fate of prevalence cases during one year					
	No. of Cases at t1 (prevalence)	Dead (sputum negative)	Cured (sputum negative)	Remaining (sputum positive)	Cases added (incidence)	No. of Cases at t1 (prevalence)
Without programme (natural time-trend)	5,000	700	1,000	3,300	1700	5,000
With programme Not diagnosed	4,224	590	845	2789	1,700	4,761
Diagnosed	776	147	357	272		
Total	5,000	737	1,202	3,061		

Reproduced from "Tuberculosis in India" by Dr. Nagpaul Journal of the Indian Medical Association

In the estimate of Dr. Nagpaul, expected reduction in the prevalence in an area without a programme due to death occurring in the patients was at the rate of 14% a year. This was the crude death rate for the country. The same rate was applied for patients not diagnosed in an area with a programme. However, a rate of 19% was applied in calculating reduction by death in the group of patients detected in the programme area. This appears to be somewhat unlikely. If the rate of 14% was also applied to the group of detected patients in the programme, the estimated problem reduction would be 4% instead of 4.8%.

Earlier, I worked out that our N.T.P. has achieved only about 50% geographical coverage. Therefore with the type of programme that we now have, the annual problem reduction will be around 2%. If the programme does not change in coverage and efficiency and the general conditions of living standard remain static, by 2000 AD our problem will be that of 5.3 million cases of Pulmonary Tuberculosis.

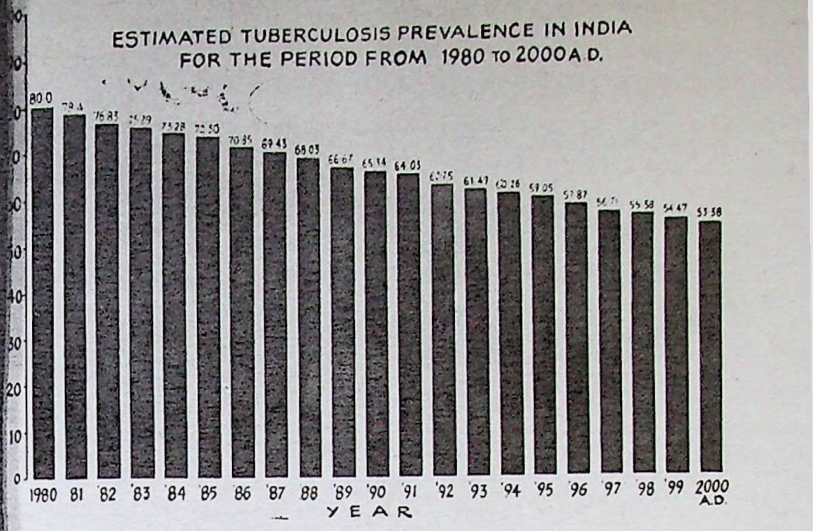
Fig. VIII

If the rate of growth of population noticed during the last two decades is to continue for the coming two more decades, our population would touch 1000 million mark by 2000 A.D. With all our efforts in family planning programme, the decade growth rate of population in India was 24.80 for 1961-71 and 24.75 for 71-81. If this unfortunate thing continues, the prevalence of Pulmonary Tuberculosis by 2000 AD would be 0.5% and 0.12% for total problem and prevalence of infectious cases respectively. To arrive at the above figures, the problem of Tuberculosis in India in 1980 was arbitrarily considered as the one found by Dr. Pamra for Delhi area in his 5th survey (1972-73), i.e. 2.8/1000 (Bacillary cases) and 12/1000 (Total active cases). This was accepted for calculation purposes as the all India prevalence rate since no other reliable figures were available. Prevalence for 1973 in Delhi where active anti-TB measures were in operation could justifiably be applied as the near true all India prevalence rate for the year 1980. All these approximations have been made to have an idea of the possible effect of the programme in our country.

It would thus appear that Tuberculosis will have a slow downward trend in the next two decades to come and tuberculosis may continue as a major public health problem for many years. I am not trying to say that the problem cannot be tackled in a period of 20-30 years. If Japan could lower their problem considerably during the past three decades, we could also achieve it provided we work together to create a favourable situation.

If our national Tuberculosis Control Programme does not function properly, it is not due to any inherent defect in the programme. On the contrary it is the poor coverage, and operational and managerial problems that are responsible for the poor performance. As our learned President once said it is in short due to human failure that the programme does not function properly, a human failure in which we all have contributed. It is upto us to decide what we should do to control our Tuberculosis problem. It is again upto us to din into the ears of our decision makers the seriousness of our Tuberculosis situation and what is to be done in the matter. There is very little justification in not having a countrywide programme. By a countrywide programme, I mean a programme in which every medical practitioner and institution in our country discharge their duties in the matter of controlling this malady. If suitable legislation is to be enacted, it is again upto us to advise our decision makers. I have often felt

Fig 8



that a T.B. Control Law, if enacted, could help us in fixing standards for case detection, case holding, classification of various forms of disease, notification of morbidity & mortality etc. Such a T.B. Control Law will ensure better participation by individuals and institutions and also create an awareness of the problem and programme in the minds of the lay public. Any developmental activity, and no doubt a programme like Tuberculosis control needs the knowledgeable cooperation of many for its success. T.B. Control Law if enacted would be a short cut in achieving such cooperation. It is also unlikely to interpret such an enactment as undemocratic.

The much talked of "Health for all by 2000 AD" and "Primary Health Care" which is the strategy for achieving the above concept has been accepted in India. A well thought out and planned Primary Health Care, properly established, will go a long way in carrying out our TB control programme most successfully. However, we have to take lessons from our Family Planning and National TB Control Programme. If like the Family Planning Programme into which a sizeable amount of our scarce resources have been pumped did not produce the desired impact on the growth of our population, the same might get repeated in the Primary Health Care Programme. Such an eventuality should not occur.

Before I conclude, a word about the Father of French Phthisiology and former Secretary General of the International Union against Tuberculosis. Professor Etinnie Bernard. In a tribute to this great man who passed away on the 6th June, 1980, the Bulletin of the International Union in its December, 1980 number published his short life sketch. I wish to quote a few lines from this memorial. "Some morning, when I left the Hospital, I wanted to shout at those who passed by and seemed so indifferent. It couldn't go on like that, and one morning I had the conviction—not the evangelical conviction of the Christian, but a conviction, nontheless, that the struggle against the scourge of Tuberculosis would henceforth be my vocation. This conviction has never left me in more than forty years." This was what he used to feel in the early days of his career as head of a hospital department treating Tuberculosis in women, and what he did thereafter. We in our country will have to shout at our fellow men in the medical profession and tell them that

we can no longer be indifferent to our Tuberculosis situation. Jointly we may then shout to the decision makers and tell them what is to be done.

Before I finish, let me thank all of you for listening to me so patiently. I take this opportunity to thank the House of Wanders for the keen interest they show in the activities of TB control in India and particularly for instituting the Wander TAI Oration.

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