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TUBERCULOSIS—A WORLD PROBLEM

Tuberculosis as a disease entity was known centuries ago. The fact that the disease is communicable was also known since long. However, this disease as a public health problem affecting the community as a whole came to be increasingly recognised mainly after the discovery of the tubercle bacillus in 1882. By the turn of the present century, national associations and country-wide programmes for the control of tuberculosis were organised in most of the countries of the world. With increased communication between different countries, and interchange of ideas, during the last few decades tuberculosis has been recognised as a world problem. The establishment and activities of world organisations such as the International Union Against Tuberculosis and other bodies as the World Health Organisation, U.N.I.C.E.F., etc. bear testimony to this fact.

One of the results of the study of the epidemiology of tuberculosis from a global point of view has been the realisation that the economically under-developed countries of the world, namely, Latin America, Africa, the Middle East and the East Asian countries, are at present the main reservoirs of tuberculosis, and that unless the disease is brought under control in these areas where it is more or less endemic, total victory over it is not possible.

The fact that the first International Tuberculosis Conference ever to be held in any Eastern country, is to take place in New Delhi early in January 1957, points towards a recognition on the part of world tuberculosis strategists, of the shift of emphasis and attention from the West to the East.

The position regarding tuberculosis in the west is fairly well assessed, whereas the knowledge about its seriousness in the underdeveloped countries is still meagre. The first step towards tackling the problem in these latter areas is to obtain reliable information about it. The data available at present will be reviewed and discussed at the forthcoming Conference. The coming together of large numbers of tuberculosis workers, particularly from these areas will, it is hoped, help not only in assessing the extent of the problem, but also in formulating practical measures to deal with it.

Research in Tuberculosis in India

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Organisations charged with the task of supporting research are constantly faced with the question of how much fundamental research and how much research of an applied nature should be supported. Applied research can be planned and centrally directed whereas fundamental research must be left to individual effort and allowed to grow according to individual genius. Each national organisation follows its own system of priority depending upon the urgency of practical problems awaiting research and solution. It has been the established policy of the Indian Council of Medical Research to give high priority to research directed towards the solution of immediate practical problems without prejudicing the natural growth of fundamental knowledge. With the discovery of effective anti-bacterial drugs against tuberculosis, research in this field has entered a new and exciting phase during the past decade or so. It has now become the meeting ground of clinicians, laboratory workers and social workers and rests on a broad biological front. Fundamental studies in the laboratory on the metabolic requirements and biological behaviour of tubercle bacilli, clinical studies on patients and epidemiological observations in the field are being made in a coordinated manner and the traditional boundaries between the laboratory workers, clinicians and the field workers are being broken. It is in this context of a rapidly changing situation that the Indian Council of Medical Research had to formulate its policy. The problem of tuberculosis in India is a vast one from the public health point of view and it is essential that the Council should orientate its policy in terms of the requirements of the existing situation. At the same time the Council could not neglect fundamental studies on tubercle bacilli, the mechanism of infection, the nature of drug resistance etc.

In this note a brief reference will be made to the problem of tuberculosis in India and to the manner in which the Council is aiding a study on this problem.

The Tuberculosis Problem in India

Tuberculosis is a major public health problem for India being second only to Malaria. The Health Survey and Development Committee estimated in 1954 that there were probably some 2½ million persons suffering from active tuberculosis in the country and that the mortality from tuberculosis alone would be in the neighbourhood of 5,00,000 deaths a year. These are no doubt very rough approximations; nevertheless, they give an idea of the magnitude of the problem. The Committee was of the opinion that in order to deal with this situation there should be a minimum of 500,000 hospital beds and about 4,000 tuberculosis clinics. These were clearly impossible to achieve within a reasonable time with the resources of the country.

It must be remembered, however, that when the Committee made these recommendations the approach to the control of tuberculosis was chiefly defensive in nature and was conceived in individual terms of isolating and treating active cases of tuberculosis in institutions. Treatment itself was of a palliative nature and no drug was available which could specifically attack the tubercle bacillus. All efforts were concentrated on building up the resistance of the individual against the disease. The

emphasis was on sanatoria, good food and fresh air and surgery in special cases. The whole process was slow and expensive and the results in the end were not rewarding.

The advent of effective anti-tubercular drugs and the increasing evidence in favour of the preventive value of B.C.G. vaccination now makes it possible to adopt positive methods of prevention on a large scale and accordingly the national policy in India today is to lay the greatest emphasis on preventive measures. Towards this end, a nationwide B.C.G. vaccination programme has been launched in 1951. According to present indications it is hoped to complete vaccination of all non-reactors among India's estimated 170 million susceptables by 1960 (Benjamin 1955).

Side by side with this programme it is proposed to employ the anti-tubercular drugs on a mass scale after careful trial and assessment in an effort to bring down as rapidly as possible the quantum of infection in the community. The number of chest clinics for the treatment of frank cases and for the detection of active disease in contacts is also being increased.

The Research Programme

Taking stock of the entire situation with special reference to the needs of practical programmes for the control of tuberculosis stated above, the Council has decided to support the following programmes of research. Some of the projects listed below have already been initiated while others are in the process of initiation.

The whole range of studies in tuberculosis may be broadly classified into three categories although the boundary lines separating them are not always clear cut:

1. Epidemiological Studies,
2. Clinical Studies and
3. Fundamental Studies.

Under the present circumstances, it was felt that highest priority should be given to epidemiological research. Although a large volume of work had already been done on the epidemiology of the disease in other countries, living conditions and social customs in India are so different that it is necessary to have a full picture of the factors that contribute to the spread of the disease under Indian conditions before large scale preventive measures can be undertaken. Furthermore, as already indicated there are few reliable studies made on the precise extent and magnitude of the tuberculosis problem in India. It was, therefore, considered that immediate attention should be given to determining the morbidity rate in India in different regions and in the various socio-economic and nutritional groups. It was also considered necessary to encourage clinical research, particularly studies dealing with the effect of recently developed anti-tubercular drugs on the clinical course of tuberculosis. Here again there is a mass of information available from work carried out in other countries, but it was considered justifiable to undertake similar studies in India as the clinical type of tuberculosis in India is somewhat different from that in the Western Countries. It was also felt that a positive contribution could be made from India in this field by undertaking studies on the efficacy of various remedies mentioned in the ancient systems of indigenous medicine. With regard to fundamental studies, the Council have decided to sponsor such studies around individual workers who have a previous background and experience in this field.

1. Epidemiological Investigations

A systematic survey of pulmonary tuberculosis in the various cross sections of the population of the country was commenced last year on a countrywide basis. A Sub-committee was specially appointed to plan and direct the survey. The object of this survey was to find out the tuberculosis morbidity rate by mass x-ray and by bacteriological examination of those cases showing significant lung shadows. Mobile x-ray units were organised for this purpose in six places in the country and the survey covered both rural and urban population. Considerable ground has been covered in this survey and a clearer picture of the incidence of the disease is beginning to emerge. Future studies are planned to extend this activity to include representative samples from all regions in the country and also to study some of the factors responsible for the spread of the disease.

Investigations on the age of primary infection have also been undertaken and these have opened up a new field in the study of the significance of positive tuberculin reactions. It became clear that a number of non-specific factors might contribute to a positive tuberculin reaction. A scheme is now under way for the study of the effectiveness of selection of various groups for B.C.G. vaccination according to accepted standards for tuberculin testing .The study is also designed to evaluate the different procedures used in B.C.G. vaccination and to collect data on post vaccination tuberculin sensitivity.

2. Clinical Research

Of the recently developed chemotherapeutic agents against tuberculosis, it is now well known that streptomycin, para-amino-salicylic acid (PAS) and isonicotinic acid hydrazide (isoniazid) when used in judicious combination, are capable of suppressing an infective focus although they may not eradicate all live bacilli. The problem of drug resistance has tended to damp the initial enthusiasm and all therapeutic procedures today are directed towards minimising this risk while at the same time suppressing the infection. The most desirable length of treatment with these drugs is still a matter of investigation. There are indications that it may be necessary to revise the prevailing attitude towards drug resistance. It appears that resistance to isoniazid and persistence of bacilli in the spitum of treated cases need not necessarily imply clinical activity of the disease. There is a distinct possibility that some of the isoniazid resistant bacilli might also lose their virulence, a phenomenon which is associated with a deficiency of catalase in the organisms. The Council is supporting studies on chemotherapeutic control of tuberculosis under controlled hospital conditions. The appearance of drug resistance in such treated cases and the virulence of resistant organisms in guineapigs are also being studied.

There is, however, one project which needs special mention. In a country where for a long time to come adequate facilities for the isolation and treatment of the active case of tuberculosis is not practicable, the importance of providing adequate treatment in the patients' homes cannot be over-emphasised. There is reason to believe that by a controlled use of chemotherapeutic agents, it may be possible to evolve a method of treatment under home conditions which can break the chain of person to person infection and render an infectious person non-infectious. This study has now been undertaken in collaboration with the British Medical Research Council and the World Health Organisation.

3. Fundamental Research

Fundamental studies on the mechanism of drug resistance of tuberculosis bacilli are being carried out under the auspices of the Council. The metabolic requirements

of tubercule bacilli are also under investigation. It is proposed to study the role of malnutrition on the host-parasite relationships in tuberculosis.

CONCLUDING OBSERVATIONS

Tuberculosis is a social disease and none of the measures referred to above will achieve full measure success unless the disease is tackled simultaneously at the social level. Even before the introduction of the new antibacterial drugs tuberculosis has been decreasing in the technologically advanced countries in the world largely as a result of improvement in the general standards of living conditions and this is shown most clearly in these countries by a shift in the age distribution of tuberculin reactors. India is now passing through a phase of intensive social and economic development and in the near future substantial improvements in living standards are expected and these by themselves might tend to alter the morbidity pattern in the community. It is reasonable to expect a reduction in the childhood infection rate in the community and an increase in the number of primary infections in adults. Preventive programmes and research organisations must keep this factor in mind as primary tubercular infection in adulthood, which will become increasingly common, behaves somewhat differently from that of childhood tuberculosis and from lesions that develop in adults as a result of reinfection. Childhood tuberculosis is predominantly a lymphatic phenomenon while adult infection is characterised by involvement of the lung parenchyma.

The increasing use of chemotherapeutic agents in the treatment of tuberculosis has tended to focus attention on a direct attack on the tubercle bacillis. The nutritional requirements for the growth of the bacilli are being studied intensively in an effort to block its growth by suitable antimetabolites. In all this activity, there is a danger that the factor of resistance of the tissues of the host in overcoming an infection is receding into the background. There is a great need for a renewal of the attack on tuberculosis through building up the defences of the host. Already there is evidence to show that this may be possible through the use of surface-active agents and as Scadding (1955) has recently pointed out, perhaps it is from this direction that the next advance in the treatment of the tuberculosis will come.

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The Scope and Limitations of Tuberculosis Hospitals and Sanatoria

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Consumption as a disease entity was known and described many centuries ago. Directions for the care of consumptive patients and perscriptions for their treatment are found in various ancient medical books of Eastern as well as Western countries. The fact that tuberculosis is a communicable disease was also known long before the discovery of the tubercle bacillus. However, organized efforts to protect the community from infection are of comparatively recent origin. These efforts took the form of institutions for the isolation and nursing of the sufferers. Such institutions in early 19th century Europe were the results of local community efforts or sponsored by religious organisations. Charity was the source of funds. Sisters of Mercy looked after and nursed the patients, as part of their religious duties and service. In these early institutions relief of suffering and protection of the healthy were the aims rather than the cure of the patients, because consumption was considered an incurable disease.

Early Sanatoria

Special institutions came to be established for the treatment of tuberculosis because of certain characteristics of the disease itself. The fact that tuberculosis is a dreaded infectious disease made it necessary that the sufferers should be separated from the healthy, and placed in institutions where special provisions are made for personal hygiene and prevention of infection. Secondly, the disease, in the majority of cases being of a long and chronic nature, it was found desirable that arrangements should be made for patients to settle down for months or years together and adopt a restful regulated mode of life with provision for a liberal supply of good food. Thirdly since no medicinal or other forms of direct attack on the disease were known and treatment was mostly "nature cure", emphasis came to be laid on climate, fresh air and surroundings. Naturally sanatoria came to be situated away from crowded cities, in cool mountain tops and plateaus, in forests and deserts and other places of specially beneficial climates where the air is dry and free of dust and noise, and the surroundings clean, restful and beautiful.

Factors Which Have Changed the Character of Sanatoria

The last two decades of the 19th century and the first of the 20th, marked an important epoch in the history of tuberculosis. In 1882 Robert Koch discovered the tubercle bacillus. In 1892 Forlanini induced his first Artificial Pneumothorax on a living human being. In 1895 Roentagen discovered x-rays. It was also during this period (1887) that Sir Robert Philip formed his Edinburgh anti-tuberculosis scheme. With the microscope and x-rays for diagnosis, and collapse measures for treatment, the whole outlook for tuberculous patients was changed. Early in the 20th century, sanatoria were opened in many countries of the world including India. Soon, thoracoplasty. came to be accepted as a safe and valuable procedure in the collapse therapy of pulmonary tuberculosis. In spite of all these advances in sciences, technique and organization, the early detection of tuberculosis remained difficult and the treatment

long and arduous. Throughout the first half of the 20th century, rest, fresh air, regulated life and diet and collapse therapy formed the mainstay of treatment. Under the impact of active forms of collapse therapy during the latter half of this period, the comparative importance of climate and surroundings receded and sanatoria gradually took on the nature of surgical hospitals with a quicker turn-over than before and came to be located nearer to large centres of population.

Another factor which has come in during the last one decade and which has changed the character of tuberculosis hospitals to a great extent is, the advent of the antibiotics. The new drugs are bringing under the surgeon's knife, many cases that would have been unfit for surgical treatment in the pre-antibiotic days. The potent anti-microbial drugs have also made it possible for surgeons to attempt more drastic forms of pulmonary resection than hitherto. Thus, tuberculosis hospitals have now become more of the nature of surgical centres than ever before.

FACTORS LIMITING THE SCOPE OF TUBERCULOSIS HOSPITALS

1. The Advent of Anti-biotics

The anti-biotics have accentuated and accelerated the change of old-time sanatoria into modern tuberculosis hospitals with emphasis on surgical treatment and shorter periods of hospitalization. This is only one aspect of the change brought about by the antibiotics. The impact of the discovery of drugs effective against the tubercle bacillus one after another in quick succession during the last decade, has been so revolutionary, that at the beginning, hopes ran high that tuberculosis was already conquered; that there was no need any more for special hospitals for tuberculosis because the patients could as well be treated in general hospitals or in the patients' own homes by general practitioners; that the death rate was falling so rapidly that there would be no need for adding any more to the existing beds for tuberculosis; that the need for the various forms of collapse therapy would vanish because anti-biotics had made resection surgery so safe and effective; that "We are in the presence of one of the most sensational happenings that can be observed in the field of public health"; that anti-biotics have declared a general amnesty for tuberculoss patients, from their long periods of incarceration in hospitals; that as effective treatment as was formerly given in sanatoria could now be delivered in the patients' homes by an army of technicians with short term training and armed with the anti-biotics; and so on.

However a decade of world-wide war against tuberculosis with the extensive aid of all the known anti-microbial drugs has shown that the tubercle bacillus cannot be beaten so easily as experts thought. Their powers of survival and technique of resistance are great and varied. Like most of the small enemies of mankind, given favourable conditions, they are capable of multiplying in such quick geometrical progression, that a few may grow to millions in a short period of time. Unlike many other micro-organisms they have the power of living in the absence of moisture and surviving in the dry state for long periods of time. This enables them to reach the lungs of new hosts in the form of dust. They have a fatty coat of armour that protect them against some forms of attack against them. They have the power of destroying human tissues around them and preparing for themselves dugouts in which they remain comparatively safe from attacks by drugs carried by the blood stream. They are adepts in going "underground" and lying low until fresh opportunities offer for carrying on guerrilla warfare. During the last ten years, the anti-biotics have brought to the forefront, some of the special powers of defence which tubercle bacilli possess. They have the ability to gradually immunise themselves against the drugs; and when attacked, they can go into a kind of hybernation or turn malingerers and simulate death so well, that it becomes a difficult problem for bacteriologists and clinicians to say whether they are really dead or still have the power of revival in them.

No. The anti-biotics have not conquered the tubercle bacillus and there is no room for complacency or undue optimism in the fight against tuberculosis. However the anti-biotics have profoundly affected the epidemiology and treatment methods of tuberculosis; and this in turn, has affected the scope for tuberculosis hospitals.

Since the advent of the anti-biotics, death rates have fallen precipitously in nearly all countries. However, the morbidity and incidence rates have not kept pace with this. For example, in 1938 about 25,000 died of tuberculosis in England and Wales; in 1955 the number of deaths was only about 6,500. In contrast, the number of new cases diagnosed of tuberculosis in the U.K. in 1936 was about 40,000 and in 1954 the figure was about the same. Even allowing for the effect of more extensive use of mass radiography and other case finding methods, the disparity between changes in mortality and incidence are too striking to be explained away. The fact is that the anti-biotics while curing many early cases outright, are only prolonging the lives of many others, without curing them. More and more people are now living with tuberculosis than the death rates would indicate. While many who might have needed institutional treatment in pre-anti-biotic days are being cured in their homes, others who might have died off before, are now needing hospitalization for surgical treatment.

Thus, while a considerable over-all reduction in the need for more hospital beds has taken place, there has been a relative increase in the demand for surgical beds. The fact that some long established and famous tuberculosis hospitals have had to close down since the advent of anti-microbial drugs, is not entirely due to reduction in the incidence of tuberculosis. It has been partly due to the fact that the anti-biotics have made the treatment of tuberculosis cheaper than before and brought such treatment nearer to the homes of the patients. They are the paying beds in costly private sanatoria which have fallen in demand rather than the cheap or free beds in the hospitals maintained out of public funds. While a good deal of the curative work by collapse methods done by tuberculosis specialists before, can now be carried out with the help of anti-biotics by general practitioners and even by technicians, there has been a relative increase in the demand for highly trained surgical teams required to deal with "solid foci" and "residual cavities" which persist after anti-biotic treatment, and to do "salvage operations" for the far advanced cases that are being pulled back to life by the anti-biotics, from the very jaws of death.

Thus the effect of the antibiotics on the scope of tuberculosis hospitals may be said to be an overall reduction in the demand for beds, especially paying beds, and a shift towards the surgical side as against the old type of sanatorium beds for long term conservative treatment.

2. Lack of Funds

The anti-biotic as a factor limiting the scope and demand for tuberculosis hospitals is of recent origin. The most important and long-standing obstacle in the way of providing adequate number of beds for the treatment of tuberculosis patients in this country has been lack of funds. Not money, but the lack of it, has apparently been the root of all evil. The argument runs as follows:- Prevention is better than cure and money is scarce; therefore cheap preventive measures should be given priority over provision of costly beds for treatment. Every year about 5 lakhs die of tuberculosis in this country and there at least 25 lakhs of patients needing treatment. A minimum of 5 lakhs beds are required for dealing with this situation on an adequate national basis. The cost of building and equiping a bed is about Rs. 8,000. At that rate, the capital costs for building 8 lakhs beds will amount to Rs. 400 crores. The cost of maintaining a bed for one year is about Rs. 1,800. Therefore the maintenance of 5 lakhs beds would come to Rs. 90 crores every year. Obviously expenditure on this scale on one disease alone is beyond the resources of the country. It was mainly for this reason that India had to fall back upon "Organized Home Treatment" even in pre-antibiotic days.

In recent years, this picture has changed considerably. As ever before, prevention remains better than cure especially in a disease like tuberculosis where the treatment is still long, costly and uncertain. However it is well to remember that in a widespread infectious disease like tuberculosis where the source of infection is the patient himself, prevention and cure cannot be separated into watertight compartments. Elimination of the sources of infection is the fundamental essential for any effective and measurable programme of prevention. The way to eliminate the sources of infection is to isolate and treat the infectious cases until they are cured or at least rendered non-infectious. Thus isolation and cure are the well-tried bed-rock of prevention.

The anti-biotics have lessened the cose of treatment in a number of ways. They have reduced the average period of treatment of individual cases and lessened the need for highly trained technical staff for carrying out treatment. They have made domiciliary and ambulant treatments much more practicable and effective. Enquiries are now going on under the direction of many research bodies including the Indian Council of Medical Research, into the effectiveness of home treatment of tuberculosis by anti-biotics. Preliminary findings seem to indicate that reasonably adequate and effective treatment can be given to about 60 % of all cases, in their own homes. This would mean that the number of institutional beds required for the treatment of tuberculosis in India will have come down from 5 lakhs to 2 lakhs. This is a tremendous gain in state and public expenditure. It should be remembered, however, that the number of beds available at present namely about 20,000 is only one tenth of the numbers required. The present is no time to rest contented and hope that things might improve still further with or without the advent of more powerful anti-biotics in the future. At the same time there is no need any more to throw up one's hands and say that the number of beds required are so great and the costs so heavy that to attempt to provide for sufficient institutional treatment of tuberculosis in India is beyond all practicability. It may be remembered that the number of beds for tuberculosis quadrupled since independence.

The diminution in the number of beds required, has greatly reduced the national expenditure for building and maintaining tuberculosis beds. There are ways and means of reducing the national budget for the provision of tuberculosis beds still further.

One method by which it would be possible to cut the cost of institutional treatment, is to make full use of modern surgery aided by anti-biotics. It is true that present day surgery, especially pulmonary resections are costly operations. But maintaining patients for long periods of time on slow non-surgical forms of treatment is costlier in the long run. Patients who are left with indolent stationary lesions after anti-biotic treatment, have to stay in hospitals for months or years together if left without surgical treatment. With modern surgery however, a good number of them can be made fit to leave the hospital in three or four months. A quick surgical turn over would thus be better for the patient and cheaper for the state and community.

Another way of reducing costs is by building cheaper hospitals. As mentioned above, the costs that are usually quoted are Rs. 8,000 per bed for building and Rs. 1,800 per bed per year for maintenance. These figures pertain to institutions built and run on the model of Western sanatoria. Some of the missionary institutions in India have shown that first rate tuberculosis work can be done at much lower cost. Brick and mortar do not make a sanatorium, nor are costs always a measure of the quality of service rendered. The Indian climate makes it possible to reduce sanatorium buildings to exceedingly simple structures. There are few items of equipment which cannot be made in India. The major items of expenditure in a sanatorium are on staff salaries and patients' diet. The anti-biotics have made it possible for a few trained doctors with the help of technicians to supervise and maintain the non-surgical treatment of

large numbers of patients. Except in post-operative cases, the nursing of tuberculosis is comparatively simple and inexpensive and a few trained nurses with the help of locally trained nursing orderlies can look after several times more patients than would be possible in general hospitals for acute cases. The average tuberculosis patient does not need any very special diet. Ordinary wholesome food which every man should have is all that most patients need. The smaller the institution the higher the *per capita* cost of maintenance. Experience in Western countries has shown that with proper organization as many as 5,000 patients can be looked after efficiently in a single medical centre in one block of buildings. In such large centres, maintenance cost per bed can be reduced considerably by reduction in the number of highly paid supervisory and technical staff, and by common services and stores and bulk supplies for the various departments.

It might be said that such large cheap institutions are likely to lower the standards of medical services in the country. The answer is that it is better to have a broad-based plan to isolate and give cheap but adequate treatment to all infectious cases than to give high class treatment and luxurious amenities to a few and leave the vast majority to shift for themselves.

3. Nature and Organization of Existing Tuberculosis Hospitals and Sanatoria

The majority of sanatoria and tuberculosis hospitals in India are run by private bodies. Many of these are managed out of funds made up of fees paid by well-to-do patients. Admissions in these institutions were regulated by considerations of ability to pay fees and curability of disease rather than by infectivity, home conditions or urgency for isolation and treatment. The average Indian villager seldom knew about the existence or value of such institutions, and even if he knew, he could not afford to go to such institutions. Thus even the few institutions that existed, were serving the rich and educated rather than the poor and ignorant—the early curable ones, rather than the far advanced and highly infectious. With the impact of independence and the expansion of social services, the people have begun to consider the care of all the sick of the land as a fundamental right to be demanded from the State. As the socialistic pattern and the welfare state idea permeate society, this demand will increase in volume and force and more and more institutions for the poorer classes and the more desperately ill, will become unavoidable. Apart from medical and public health considerations, humanity and social justice will demand it. Institutions meant purely for the isolation of the incurables were never in public favour because hope of survival rises eternal even in the hearts of the desperately ill, and patients would not stay in such institutions. Now, there is no more need for such institutions because with antibiotics and surgery a good deal can be done for even far advanced cases, although all cannot be saved.

Very little by way of rehabilitation is being done in the existing tuberculosis institutions in the country. The demand for rehabilitation is likely to increase in the future, because the number that are crippled but not cured are on the increase as a result of the antibiotics. Surgery will salvage some of these, but care and rehabilitation will be required for many.

A Proposal

From what has been said above, it will be seen that the need for more tuberculosis beds, is not past. But the present type of institutions are not likely to meet future needs. Tuberculosis institutions of the future, in economically under-developed countries with a high tuberculosis prevalence and with the ambition of a socialistic welfare state in view, will have to be cheap institutions where all patients are admitted whether rich or poor, early or advanced. In such institutions preference in admission will have to be given to those who are most infectious and those whose home conditions demand isolation urgently. A surgical section with a quick turn-over, and a section for rehabilitation should form parts of such institutions.

Tuberculosis is a greater menace in the larger and more crowded cities, than elsewhere. By force of circumstances India has acquired much experience in community projects, in building and managing refugee colonies and developing cottage industries and small scale agriculture for growing more food. It is suggested that, in order to meet the demand for the new type of tuberculosis centres mentioned above, small tuberculosis townships be built within five miles of the largest and most heavily infected cities. These may be designed to accommodate and care for about 1000 tuberculous patients and to house about two to three thousand persons in all including patients, staff and families. The township should be built physically and functionally around a community centre and a hospital. The community centre should include a community hall for instruction and recreation and for occupational therapy projects, a primary school, a library (which may be in the community hall), a general store (shop), a post office, a workshop, a small printing press, a store for agricultural tools and seeds, garages for ambulance, staff car, truck and tractor, a small park, and play ground and water and electricity sources (if they are not available from city sources) etc.

The hospital will consist of administrative, radiological, pathological, surgical, dispensary, catering and stores departments. To this, will be attached 100 beds for surgical treatment and 400 beds for medical treatment. The community centre and the hospital may take up about 50 acres of land. Around this will be arranged the staff quarters, rehabilitation cottages, community farms, grazing grounds, disinfection and sewage disposal plants etc. The rehabilitation cottages will consist of about 500 brae-acre plots with a small specially planned and cheaply built cottage in each. One isolated room in each house will be for the tuberculous patient and the rest of the house, for the family. The rehabilitation projects could be partly centralized in the community hall and workshop and partly distributed among the cottages. The type of projects selected for rehabilitation should be such that the products of works will be largely consumed in the township itself.

. The management could be in the hands of the State Government, the city corporations -or a statutory body or registered association of public men interested in the project. The Government should provide the necessay land free of cost.

The township is planned for a medical and public health purpose. Therefore the Medical Director of the hospital should be in charge of the township both medically and administratively. The hospital staff should include a trained surgical team, a radiologist and a bacteriologist. The medical officer in charge, should be assisted by a general (non-medical) manager with administrative experience, an accountant and office staff, a man with training in agriculture and cottage industries, and a person with engineering qualifications sufficient to carry out building projects and sanitary installations. In addition, the necessary staff for the other units like, school, community hall, workshop etc. will have to be provided. The medical staff should consist of a minimum number of trained doctors and nurses for surgical and supervisory work and a sufficient number of technicians and nursing orderlies for routine medical and nursing duties. There is no reason why intelligent and literate patients under rehabilitation should not be trained to carry out the administration of anti-biotics and routine nursing duties.

If all the avenues for reduction of costs, such as the use of cheap local material for building, self dieting of all patients living in cottages, growing of as much food as possible in the township itself, the use of more technicians and nursing orderlies on the staff etc. are explored, it may be possible to cut by half the building and maintenance costs quoted above namely Rs. 8,000 per bed and Rs. 1,800 per patient per year.

An experimental project along these lines near a city like Delhi, Calcutta or Kanpur is likely to enlist public and Government interest and support. Seeing that

ways and .means of tackling the tuberculosis problem in a cheap but effective manner are being sought by all underdeveloped countries, a pilot project of this kind may be of interest to other countries and also to the international bodies engaged in anti-tuberculosis work.

SUMMARY

The manner in which special institutions for the isolation and treatment of tuberculosis came to be organized, is traced and the factors which gradually changed their character from the orthodox type of climatic sanatoria into active treatment centres is described.

The effect of the discovery of x-rays and collapse therapy on the outlook for patients and the nature of sanatoria is described. As active and effective treatment of tuberculosis became possible, the importance of climate arid surroundings became less and less and sanatoria changed into surgical hospitals situated near big cities.

With the advent of anti-microbial drugs effective against tuberculosis it became possible to treat larger number of patients in their own homes by non-specialists; and the mortality from tuberculosis fell to a great extent in neatly all countries. These developments reduced the need for beds in special hospitals and sanatoria. However the anti-biotics failed to cure all cases that they were able to save from death. Thus a relative increase in the demand for beds to provide surgical treatment and rehabilitation to those salvaged cases, has taken place.

It is pointed out that the chief obstacle to the provision of an adequate number of beds to isolate and treat all infectious cases in the country, has been the lack of funds; that the anti-biotics have reduced the total number of beds required in the country and that modern surgery has made it possible to diminish cost of treatment by reducing the period of treatment in hospitals.

A suggestion is made that cheap tuberculosis townships be built near big cities for the isolation, surgical and antibiotic treatment and rehabilitation of all tuberculous patients irrespective of curability or ability to pay for treatment. Ways and means of reducing building and maintenance costs of such institutions are explored.

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The Place of Tuberculosis Clinics and Domiciliary Service in Tuberculosis Control in India

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The functions of a "Tuberculosis Dispensary" as originally evolved by Sir Robert Philip used to be classified under the following headings:

(a) Establishment of the diagnosis of tuberculosis by: (1) History taking; (2) Physical Examination; (3) Examination of sputum; (4) Mantoux testing and- (5) X-ray examination.

(b) The maintenance of proper records concerned with the individual patient, his treatment and other types of administrative and public health records.

(c) Collection of data which will help in deciding on local peculiarities of the Tuberculosis problem. For example, the records of the Government Tuberculosis Institute, Madras, show that in the city itself tuberculosis is widely prevalent among mill workers, tailors and *beedi* workers; outside the city, weavers in Conjeevaram have a high incidence and quite a number of cases come from villages showing that the rural areas are not free from tuberculosis.

(d) The continuous supervision of contacts by periodic examinations as also the education of the family in matters of tuberculosis control.

(e) Surveys of selected groups of population served by the dispensary; the groups being those wherein a high incidence is expected.

(f) To serve as a liaison between the private practitioner who always sees the patient first and the institutions such as hospitals and sanatoria in the neighbourhood which can admit the patient for specialized treatment. Institutions into which a patient is taken not so much on his own needs for institutional care but on the requirements of public health will be discussed in further detail later in this paper.

(g) The carrying out of a minimum of curative treatment. Indeed in the functions of the dispensary as originally stated, it was always insisted that curative treatment should occupy the least time of the dispensary which was really a public health institution.

Since the early days, more and more functions have been added on to the clinic, B.C.G. vaccination and mass miniature radiography being perhaps the most important among them. Besides, the clinic's limited function with regard to the curative treatment referred to above was sought to be considerably enlarged even as early as 1934 when H. Batty Shaw wrote as follows:

"The enormous expenditure of money on sanatoria should be stopped and instead money should be spent in providing every tuberculosis officer with the facilities of a local pulmonary institute equipped with the means of carrying out full clinical, bacteriological and skiagraphic examination of the lungs and provided with an adequate number of beds for the carrying out:

(a) of the more rapid, more effective and less costly collapse methods of treatment of pulmonary tuberculosis in its truly early stages and,

(b) for accommodating advanced invalids suffering from this disease *near* their homes which they should no longer occupy."

During the twentytwo years that have elapsed since these words were written, the trends in tuberculosis treatment and control have considerably increased the importance of the clinic.

The anti-microbial therapy with streptomycin, INH and PAS in the order of their efficacy, though not in the chronological order of their discovery has undoubtedly produced a revolution in our ideas regarding the best ways of organizing control programmes in tuberculosis. It is unfortunate, however, that these ideas have not yet been followed up with the necessary action which is so logical and so urgent. The curative function of a clinic which Batty Shaw wanted to be enlarged has now to be given such prominence that indeed the clinic will overshadow most other institutions devoted to the treatment of tuberculosis.

The clinic has been called the axis about which all antituberculosis work should revolve. If this was so in the early years of this century, it is certainly much more of a fact at the present time.

What then should be the plan of action of a clinic ? As has been pointed out already, the clinic should be linked up with a local isolation hospital for the segregation of open cases whom it is impossible to segregate in their own homes. If we are really to put across to the tuberculosis patient the benefits of the knowledge we possess today, the procedure to be followed should be as follows:

(1) Every facility for early diagnosis of tuberculosis will be available to the community by the provision of properly equipped and properly run clinics on the basis of one to one hundred thousand of the population, if not to fifty thousand.

(2) Every case of tuberculosis, particularly, the open cases, will be immediately admitted into the local isolation hospital as soon as they are discovered. Tuberculosis should be regarded as an acute infectious disease much in the same way as pneumonia or typhoid fever. When a person with either of these latter diseases knocks at the door of an institution, he is not simply entered on a waiting list and asked to come after weeks or months. There is no reason why tuberculosis should be handled in a different way simply because it cannot, when left untreated, kill as quickly as pneumonia or typhoid can. What the profession and the public should be made to realise is that an early case of caseo-pneumonic tuberculosis requires urgent treatment which can arrest the disease as also prevent the infection from spreading to others. There is no doubt that today we have the weapons to bring about this-wonderful result. When we have the means to cure and to prevent, it is really surprising that our lethargy and fear to act boldly should stand in the way of achieving them.

(3) Within a week of admission, all the studies on the patient will be completed including the study of the patient's economic and living conditions and then the patients will be distributed according to the following groups:

(a) The patients for whom isolation is possible in their own homes will be sent back to the homes with advice regarding the disposal of the sputum and the

enforcing of such advice by periodic home visits by the health visitors attached to the Clinic.

(b) The patients with not so recent disease and more especially those with cavities, who are likely to require surgical measures sooner or later will be sent to the nearest hospital or sanatorium for a proper assessment of their condition and the over-all planning of their treatment at a conference of specialists which will include the thoracic surgeon. After arriving at the decisions regarding the plan of his treatment, the patient may be returned to his home if isolation there is possible.

(c) The patient living in a single room tenement with no possibility of isolation will continue to stay on in the isolation hospital.

(d) All the patients will be started on the appropriate regime of chemotherapy.

(4) An intense drive will be undertaken to discover patients before they experience symptoms obtrusive enough to compel their seeking medical help. Mass miniature surveys in other parts of the world have brought out certain facts which are worth remembering:

(a) Surveys in so-called general practitioner sessions have yielded ten times the number of cases yielded by surveys of unselected groups.

(b) Contact surveys and surveys in special groups known to have a high incidence in particular localities are also likely to yield good dividends.

Prior to 1945 when the treatment of tuberculosis required long months of sanatorium care with or without collapse therapy, one was naturally hesitant to undertake mass surveys in a country with a bare infinitesimal fraction of the required number of tuberculosis beds. At the 7th Tuberculosis Workers' Conference held at Bombay in November 1949 the present writer expressed his opinion on this subject in the following terms:

> "The slogan 'Go and get him' may be all right in the U.S.A. where the open case of Tuberculosis has been effectively brought under control with a death-rate in many cities of 40 or less per 100,000. But in our large cities thousands of active open cases totally incapacitated and .with distressing symptoms and obviously a source of the gravest danger to the community, are being allowed to die for want of adequate facilities to take them on hand, treat them and segregate them out of their overcrowded dwellings. So long as we have not got the means to deal with the further enormous number of cases that will be discovered by Mass Miniature Radiography, it does not appear to *be* a uesful procedure in the situation existing in our country at present. A Tamil saying questions the wisdom of the mother of six children going round the sacred *peepul* tree to be blessed with a seventh child when the first six are scouring their food plates in greedy hunger."

To-day, however, with proper organization, it should be possible to take care of every active case in the correct way without the need for hospitalising most of them. As a matter of fact, it is imperative that cases should be discovered as early as possible so that the disease may be effectively checked with chemotherapy alone.

In this connection one cannot sufficiently emphasize the urgent need for routinely x-raying every new case admitted into the general hospitals, particularly into the medical wards. The work carried out already in this direction in the U.S.A. should convince any one of the ultimate value and economy of this procedure. In fact, it has been suggested that every patient above the age of fifteen consulting his doctor for any ailment should be submitted to a survey film without cost to himself as an effective case-finding programme. In 1950 it was estimated that more than 40,000 unrecognised

cases of pulmonary tuberculosis were being admitted into general hospitals in the U.S.A. each year. India this number must be several times greater. The benefits to the hospital in initiating such a programme have been listed as follows:

(1) Protection of personnel;

(2) Provision for a permanent record of the patient;

(3) Improvement in staff efficiency and

(4) Better service to patients.

The suggested benefits to the community are:

(1) More effective case-finding;

(2) Earlier diagnosis of case when treatment is more effective;

(3) Greater protection through the isolation of open cases; and

(4) The discovery of other significant chest conditions.

It has been pointed out that general hospital admissions constitute a special population group which is readily accessible for study and handling under ideal conditions since professional personnel and scientific equipment are easily available for the necessary diagnostic services.

The cost involved in such miniature x-ray studies is quite small. By obtaining a routine survey film the period of hospitalization can be definitely reduced apart from the other advantages discussed above with savings in total cost of medical care. In any case, it should be granted that human economy should be considered more important than administrative economy.

(5) Primary infection in children should be given much more attention than what is done at the moment. The modernization of the pediatric services should mean the recognition of every child getting infected for the first time and the following up of the primary focus to ensure that it is not leading to progressive disease. The place of modern chemotherapy in primary infection of children is still not settled. Indeed, the most conflicting views have been expressed. There are chest physicians who would rather avoid specific chemotherapy in the management of a primary complex which is showing undoubted evidence of healing and would reserve their use only for cases of progressive primary tuberculosis. On the other hand, based on tfee work on experimental animals, the suggestion has been made that every child should be treated with isoniazid as soon as mantoux conversion occurs even though unaccompanied by any clinical disability whatever. It is obviously difficult to decide on the duration of the administration of the drug, the possibilities of producing I.N.H. resistant strains and the problems that will arise when later on, reinfection takes place. The last consideration is particularly important in a country where the chances of reinfection are so great as in India. The tuberculosis clinic is the place from which studies on questions like these can be planned and most effectively carried out.

(6) *Financial Assistance:* Every newly diagnosed case must be interviewed by the health visitor who is really both a nurse and a socialworker. She will explain to the patient the physician's assessment of his condition and recommendations for treatment and help in making arrangements for the carrying out of the medical care required. Further she will go carefully into the social and economic adjustments that may be needed

and arrange for any financial assistance that the family may require during the absence of the wage-earner as an in-patient in a tuberculosis institution. It is a matter for some pride to us in Madras that one of the first organisations in India for affording economic relief to the patients' family was started in Madras City in 1950. Such financial help is a very important inducement to the wage-earner to seek medical care in time and to remain in the institution for as long as his condition demands it. Money spent in this direction is a sound investment by the community to ensure isolation of the open case as also to provide better living conditions and increased resistance to the contacts, particularly the children who have been exposed to the infection. Studies in the origin of poverty have consistently shown the relationship between the premature death of the head of the family and poverty.

The arrangements we now have for rendering financial aid are more in the nature of a token or a pointer to the problem and do not really deal with the situation fully. The clinic is the only institution which can attempt to answer the following questions:

How many patients have to give up their work ? How many families are rendered destitute? How much is the amount required to keep the families running on their immediate needs ? How many children require the services of a foster mother because their own mothers are too ill to look after them ?

One is perhaps really afraid to get the true answers to the above questions on account of the magnitude of the problem.

(7) *Education:* One of the important functions of a tuberculosis clinic is to educate the community with regard to problems connected with the causation and control of tuberculosis. This can be undertaken by the employment of the usual techniques of public health education such as the exhibition of posters in the clinic itself, participation in medical exhibitions, the distribution of leaflets, the personal explanations and advice regarding sputum disposal, diet and other matters given by the health visitors, but undoubtedly the best educative propaganda will be the many-sided activities of the clinics themselves.

The general practitioners in the area should be invited to study the working of the clinic and to refer their problems to the clinic medical officers. It is essential that the records of the clinic should contain information regarding all open cases in the community whether under the treatment of the clinic or under the treatment of private practitioners.

(8) *Association and Seals Sales:* It is a point for consideration whether the voluntary agencies like the tuberculosis associations and Seals Sale Campaign committees should not really function from the clinic as their headquarters. While in the large State headquarters, the voluntary agencies may be in a position to have their own accommodation, in smaller places it will be most useful to locate them in the clinic itself. The cooperation of the ex-patients and their relatives will be most readily available to look after the extra correspondence, accounting and other work involved in the conduct of the Seals Sales Campaign.

(9) *Artificial Pneumothorax:* The clinic has a great responsibility in maintaining a careful follow-up of all the patients in whatever way the initial disposal of the patient was done. After the discharge from the sanatorium or hospital, it is again the responsibility of the clinic to conduct periodical check-ups to ensure that the improvement in the patient's health

is kept up. In this connection I would make a plea for a greater use of artificial pneumothorax in a certain type of case in which chemotherapy alone will not suffice. Artificial pneumothorax is still an extremely useful procedure provided it is managed by one who understands its proper use and limitations and one can keep a personal watch throughout the period of treatment. Many patients who had A.P. treatment in the early thirties long before chemotherapy came to our aid are still alive and doing well. With modern antimicrobials, the procedure in the case where it is properly indicated can be carried out with greater safety and success than before. This is a method of surgical treatment which the clinic has employed on a rather extensive scale in the past and should continue to be one of the legitimate functions of the clinic in the future also.

CONCLUSION

The effectiveness of a Tuberculosis Control Programme depends not merely on the detection of cases but on the isolation and care of infectious cases and on the provision for adequate follow-up of the non-infectious cases. It has already been indicated above how in an ideal organisation the attempt should be to hospitalize every open case initially and then to redistribute the cases among the hospital or sanatorium undertaking surgical procedures, the home where isolation and treatment are possible and the isolation wards for the type of patient in whom neither of the preceding disposals is indicated. It is suggested that the wards for preliminary sorting and the wards for isolation should be constructed on the cheapest type designs and should be located right in the heart of the large cities. Attempts to locate such an institution far away from the patients' home had always failed in the past. The well-to-do patient who can make arrangements to leave his home and provide for the care of the family during his absence can no doubt travel to these distant sanatoria but such an institution really serves absolutely no public health purpose. It is essential that every such institution should be linked up with a carefully planned and comprehensive control programme in the city.

Considering the great importance of the tuberculosis clinic and the isolation hospital in the present context of control with chemotherapy, the Standing Technical Committee of the Tuberculosis Association of India has rightly given the greatest importance to the provision of these. The following was the recommendation of the Committee to the Planning Commission as regards the Second Five Year Plan period:

(i) That during the next five years every district in India should have at least one tuberculosis clinic and in addition every town with a population of 100,000 or more should have also a clinic. These clinics can be attached to district or other hospitals, but should have preferably their own buildings, x-ray and laboratory.

(ii) In certain areas where the incidence of tuberculosis is high, it is advantageous to provide for the x-ray apparatus an attachment for taking miniature x-ray films as this would allow large numbers to be covered at comparatively less cost. Further these areas may have, if possible, a mobile x-ray outfit also to serve the rural areas.

(iii) For the successful working of these clinics, in addition to full-time paid doctors and administrative staff, there should be radiographers, laboratory technicians, medical social workers and adequate number of health visitors, depending on the area and the size of the population to be served. It was suggested that for a population of 100,000 a minimum of four health visitors should be employed.

(iv) All clinics should have, as far as possible, at least a few beds at their disposal either directly attached to the clinics or in near by institutions

for isolation and treating cases which cannot be isolated or treated in their homes because of overcrowding and unhygienic conditions.

(v) As it has been found that prolonged treatment by new antibiotics and follow up are essential for the proper control of the disease, provision should be made in the regular budget of the institutions for drugs and extra diet to cover at least a period of 9 months for all the patients who are unable to bear the expenses either wholly or partially.

For the carrying out of these recommendations, it may be found necessary to subsidize the States. Such subsidy may be needed either for upgrading the existing clinics or establishing new ones. At present, there are 165 clinics in India. It is suggested that provision may be made for upgrading 100 existing clinics and starting of additional 200 clinics during the next five year period. The cost of x-ray and equipment for the laboratory of each clinic is estimated to be about Rs. 50,000 and a total Rs. 1.5 crores would be needed for this purpose. However, in addition to this, for all the clinics that will be established or that may be upgraded, provision for recurring expenses on a sliding scale should be made in the Second Five Year Plan. This should be on the basis of 75% for the first year, 50% for the second year, 25% for the third year, 10% for the four year. The estimated annual running cost per clinic is about Rs. 75,000. This will involve a sum of Rs. 1.69 crores for the first year, Rs. 1.12 crores for the second year, Rs. 0.56 crores for the third year and Rs. 0.23 crores for the fourth year, making a total of Rs. 3.6 crores for maintenance. Grand total for non-recurring and recurring expenditure will be Rs. 5.1 crores.

The question of the bed-accommodation required in the present context is discussed in another part of this journal. However, the Technical Committee has insisted that the provision of beds should be developed in or near the cities and in admitting cases priority should be given to those to whom domiciliary service or isolation in the home is impossible. There are numerous reasons .for regarding home treatment as not as ideal as hospital treatment. But where beds available are totally insufficient, home treatment using modern anti-tuberculous drugs is obviously the next best procedure.

The need for an initial short period of admission has been emphasized earlier in the paper. If the location of these segregation beds is determined properly, the cost of running them may be cut down very much. Self-dieting with a small supplement of nutritive foods should be possible.

All told, it is time we start proclaiming from the house-tops, “Scrap the Waiting List”. The Waiting List has absolutely no place or meaning in tuberculosis administration in 1956.

Rehabilitation of the Tuberculous- A Practical Approach

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In the absence of practical experience of the subject, I cannot show results of any practical work done in the field, but can only indicate what appears to me a possible beginning towards the solution of this difficult problem of rehabilitation in our context. The problem is indeed, complex and difficult as can be judged from the fact that nowhere in the world has this problem yet been solved fully and satisfactorily. Further, no single method to meet all the requirements of all persons has yet been found. No doubt, that we shall be groping our way through—our only light being the experience of those ahead of us. Our National Tuberculosis Control Programme in the Second Five Year Plan is concentrated around schemes for domiciliary service from the tuberculosis clinics. Being associated with the Organised Home Treatment Scheme from its-inception in 1940,1 have visualized the problem from this aspect only, though it is to be admitted that it is too complex a problem to be fully comprehended from any single viewpoint. I can, therefore, only attempt to explain a clinic's possible approach to this problem, *i.e.* rehabilitation through 'Work Centre'. This has been suggested in the annual reports of this Centre and has now been accepted as a part of the National Tuberculosis Control Programme in the Second Five Year Plan,

Rehabilitation & Tuberculosis Control

Tuberculosis Control Programmes include three activities: *viz.* prevention, treatment and rehabilitation. These activities are intimate and closely linked and are indeed different aspects of prevention.

The aim of all treatment in all diseases, and so it must also be in tuberculosis, is the restoration of the individual, as far as possible physically, psychologically, socially and economically as a useful member of the family and society in general. Briefly speaking it means restoration of the individual to his former status. In achieving this object one has to remember the fundamental characteristics of tuberculosis. Tuberculosis is a chronic and an infectious disease and has also functional and social consequences. Time is still an essential element in the treatment of the disease. Medical treatment therefore, in many patients, ends only in an apparent arrest, which is liable to frequent relapses unless after the end of the medieal treatment, the individual is protected over a long period to allow stabilisation of the lesions. Though the advent of antibiotics will certainly improve the situation, but for the present a period of five years at the end of the medical treatment is considered a 'critical period' for the tuberculous, during which relapses and deaths are common. Return to unsuitable environment—be they physical, social or economic is usually responsible for such relapse. Both from point of view of medical achievement and social placement, the highest target would be obtained when a stage and position is reached where the chances of relapse are no more than fresh attack rate in the community. Emphasis, therefore,

on immediate results of medical treatment can make one forget the real entity: Tuberculosis on the one hand, and the true end of treatment on the other. Medical treatment to be complete must merge in the long social treatment, which assures against relapses and provides for rehabilitation, thus overcoming social and functional consequences of the disease. Rehabilitation, therefore, is not only the aim of treatment but is a means of completing the treatment and becomes treatment itself. By preventing relapses and keeping down the sources of infection it is one of the essential steps in prevention.

General Principles of Rehabilitation

It is said that rehabilitation in tuberculosis should begin not later than the day the patient enters the sanatorium. It would stand to reason that when the patient is treated in his own home, rehabilitation should start the moment the diagnosis of tuberculosis is disclosed to the patient. The object is that the patient should know from the very beginning that there is still a future for him. Such an approach to a psychosomatic illness like tuberculosis is essential. Diversional, recreational, occupational, vocational therapy, work tolerance tests, colonisation, or placement in the original or in a new job, are only pathways leading to the same goal of finally securing a complete or partial economic independence for the individual. To put briefly, finding a 'Therapeutic Occupation' and a 'Prophylactic job' so to speak, are the aims and means of all rehabilitation in tuberculosis.

The complex and varying requirements of different patients are responsible for a number of rehabilitation programmes. Some of these, no doubt, are only philosophies in rehabilitation while others are in actual operation. The general types of programmes are: (i) in-sanatorium programmes, (ii) colonies, (iii) sheltered workshops, (iv) industrial programmes, (v) night sanatoria, and (vi) home-bound programmes. The existence of multiple solutions for a single problem would at once suggest that none of these solutions is complete, and each deals only with a certain facet of the complex problem. Nothing so far devised has proved to be a complete answer for all individuals' rehabilitation, therefore, has to be individualised and not put on any set pattern.

Rehabilitation & Care Colonies

Rehabilitation through an 'After Care Colony' associated with a Sanatorium, or a 'village settlement' like the world famous Papworth & Preston Hall Colonies, is one of the recognised methods. Papworth's success and uniqueness has, in the minds of those who have seen or heard of it, made it synonymous with rehabilitation of the tuberculous. It is often not realised that such a settlement is only for those who, after a long residence at the sanatorium and after a long training in the attached technical workshop, qualify not only physically and industrially, but most important of all psychologically for the settlement. The main criticism of such colonies is that they can only help a small minority of patients, and are also expensive to start and run. Further, the industries organised in such colonies are highly technical and needing a fairly high level of technical and general educational background in the individual. The industries unless highly subsidised (directly or indirectly), or protected by monopoly, cannot afford to pay standard rates of wages to sub-standard labour. Those who have organised and administered such institutions can appreciate the difficulties of such a programme—difficulties which are ignored by all appreciative admirers of this unique experiment. Dr. MacDougal, ex-Director of the Rehabilitation Colony at Preston Hall in his paper on 'Rehabilitation of the Tuberculous', read before the Seventh Tuberculosis Workers Conference held in Bombay in 1949 said, "In this country, of which I know so little, I would not for one moment dare to express an opinion of the possibility of

emulating Papworth and Preston Hall, unless it is certain that you have all the material and financial resources, to meet the responsibility that such a scheme involves." The difficulties must be many, so much so, that Papworth has not been able to reproduce itself in the country of its origin even after a unique and successful existence of over thirty years. Agricultural colony has also been suggested as a rehabilitation measure for under-developed countries. This too, would not suit Indian conditions, because apart from other objections, agricultural work is neither sheltered nor very remunerative. Further all treatment facilities are at present only available in cities.

Rehabilitation and settlement in a colony are, therefore, not synonymous. Village settlement is not the whole answer to the rehabilitation problem, and is only a part of the answer for some patients. As an alternative to a permanent settlement in a colony, the trend now is to let the patients choose for themselves, and for social, economic, and- psychological reasons, to allow and encourage the patients to live with their families throughout the period of training, and early employment, while remaining under the care and supervision of the nearest tuberculosis clinic. It is a scheme of hardening through productive work and the psychological value of earning is retained. Such an approach emphasizes the importance of the sheltered workshop as a means of rehabilitation, which naturally can be availed by a much larger segment of the tuberculous patients.

Nature & Extent of the Problem in India

The natural steps to the solution of any problem are firstly to define the problem and secondly to investigate the principles on which a sound foundation can be laid. With poor health statistics, no exact estimates of the problem to be faced are possible. But an estimated figure of 2½ million—needing treatment and/or care, are enough to suggest that the problem can be colossal.

In 1954, an analysis of the data in respect of rehabilitation problems of patients treated at the New Delhi Tuberculosis Centre a few years earlier, showed that a very large majority of those living were working—thus superficially suggesting that there was hardly any problem of rehabilitation. Death often clinched the problem of rehabilitation; and those who had the means of completing the treatment had also the means of rehabilitating themselves. High mortality arising from insufficient treatment leading to relapse and death is also an argument for rehabilitation as much as for good treatment. Our programmes, therefore, have initially to emphasize the necessity of good treatment facilities. Good treatment, while reducing the number of relapses, will by warding off deaths increase the numbers to be rehabilitated and also add to the number of chronic invalids.

In making a rough estimate of the problem to be faced in Delhi, for example, I may be permitted to draw on the 1955 figure for the New Delhi Tuberculosis Centre. Out of the 1,501 new male cases diagnosed as suffering from pulmonary tuberculosis in 1955, 435 i.e. 29 % fell under occupations needing heavy manual labour and trades dangerous to others (e.g. food handlers). But this figure, though significant from the point of view of those needing change of their profession after treatment, does not give any base line for economic levels, as the remaining group of 71 % are also likely to contain a large percentage of the underprivileged. For example, we find that nearly 30 % drop off from treatment during the first three months, mostly due to economic reasons. Among these defaulters, the unsuitably employed constitute only 37 %, thus suggesting a wide distribution of economic distress and adding to the number likely to need rehabilitation. The tight employment market hardly leaves any scope for light jobs in the open market and therefore, 94 % of the unskilled workers and heavy manual workers had to return to their original jobs—a situation which can only end in the catastrophe of relapses and deaths. Modern antibiotics have, no doubt, improved the situation

and even in our domiciliary service we find that among those who complete treatment as advised, nearly 80% are rendered non-infectious, and nearly 60% are fit for light jobs within six to nine months. Short period (6 months to 2 years) follow-up studies on-those who complete treatment satisfactorily show relapse rate of about 12%. Fatality among those who complete treatment in the same group is only 2%, whereas it is 18% amongst those leaving treatment incomplete, and 50% amongst those who had no treatment at all.

Exact data are not practicable in the present day fast-changing pattern, but picture at the end of one year's treatment and follow-up will be roughly as under:—

1. 60 % will be made fit to return to a light job;
2. 15% will remain as chronic invalids;
3. 20% will need training for a new job;
4. 35% including 20% from (3) above and about 15% from amongst (1) who are not likely to get a light job will need rehabilitation service.

If the above figures are applicable to all- areas in Delhi a rough estimate would suggest that at least 600 from amongst the known male patients would need help of the rehabilitation service every year. These figures -are so rough that one feels hesitant to guess on all-India figures. But whatever the level of true figures it is certainly going to be high and challenging to the extreme, revealing, a story of widespread misery and want. Poverty begets tuberculosis and tuberculosis begets poverty. Those concerned with the control of disease must provide more than the mere therapeutic facilities.

A Practical Approach

With the background of the general requirements of Rehabilitation programmes and the difficulties of the situation as enumerated above, we have to endeavour to search out for something immediate and practical, which is also consistent with the social and economic needs of the patients and of our financial resources.

With the few sanatoria beds (on an all-India average only one out of 200 patients gets admission in a sanatoria-bed), our consequential approach to the tuberculosis problem is to emphasize the control of the disease through domiciliary treatment organised through the tuberculosis clinics. Our problems of treatment and consequently of rehabilitation as well, are naturally concentrated around the homes and not around the sanatoria. Due to the large demand for sanatoria beds, there is a quick turnover, and patients are returned early to home-care and treatment under the nearest tuberculosis clinics. What to say of a very long period required for a colonisation, stay in the sanatoria long enough to allow even a reasonable arrest of the disease is at present not a practicable proposition. Without in any way minimising the value of in-sanatoria programmes, a scheme of training and rehabilitation which will help the large majority of tuberculous patients, who are at present being treated in their homes, becomes the priority requirement of our situation. Such a scheme will be cheaper, apart from being more realistic in catering to the needs of the much larger segment of the tuberculous patients, as compared to schemes developed round sanatoria.

On account of large-scale general unemployment, poor education, and economic want of a large section amongst the tuberculous patients, and the lack of organised social help, there is an urgent need for providing some light remunerative occupation even during the long medical treatment, after the toxemia is controlled and the man is fit for some light job. Instead of a subsidy during the long convalescence, a scholarship during the training period for some handicraft of the cottage industry type (suitable to

the man's capacity, aptitude and educational background) cannot only meet some immediate needs of care but will also provide a psychological security as regards the future and serve as the beginning of an independent living after full training. Such a scheme should cover the phase of retraining for effort and also the stage of re-education and readaptation for new job, if the original job is unsuitable. With this approach we can, so to speak, provide a 'Therapeutic Occupation' and a prophylactic Job' as well. A sheltered workshop in the highly technical surroundings of the West has to be replaced by a simpler organisation like a 'Work Centre' in our present context. We are now familiar with the term 'Work Centre', as these organisations have played an important part in the rehabilitation of a large number of our displaced countrymen. These centres are designed to impart training to enable the persons to start some cottage industry of their own. The course and the training are planned according to education and the aptitude of the individuals.

Such an organisation when suitably placed in the city near the homes of the patients, can also help to develop some home-bound programmes for those who cannot attend such centres due to physical handicap or for social difficulties, which is a special problem in the case of women. Opportunity to earn, and the feeling of being able to contribute to society, and the acceptance rather than rejection by one's fellowmen, would reduce the number of those non-cooperating and terminating treatment too early. Work can thus become the stimulus for recovery, but removal of obstruction to work is essential.

One cannot, however, forget that people can do the work which they know or for which they are trained with less expenditure of energy than something which entails complete change of life. A broadened approach by the employers (Government, industries and business) brought about by the pressure of public opinion or ultimately by legislation not only will reduce the number to be trained and rehabilitated afresh, but offers a natural and effective way of rehabilitating those employed before illness and not damaged irrevocably by disease. The small risk to industry in employing ex-patients is a part of the debt that industry owes to society. The big task for various associations that combat tuberculosis is to restore those who have been saved from death to a place in life, and public has to be organised to this great task. Except for the pioneer effort of a small colony in Arogyavaram which on account of its being isolated from the Centres of population has not caught the public eye, our ideas on rehabilitation have so far remained in the air with many people paying only lip sympathy. When our ideas take concrete shape in the work centres near the centres of population they will become the meeting ground for medical and social workers. These contacts will be useful in improving, augmenting and canalising this activity in several useful directions. One can even visualise the development ultimately of a specialised agency consisting of tuberculosis experts, social workers, industrialists and administrators to which adequate financial asistance from public and private sources can be made available. It will be the function of such an agency to plan and advise on the expansion of rehabilitation programmes at the State or all-India level.

Functions of the Works Centre

1. A vocational training Centre.
2. Work and production Centre for those who have been trained and are not yet fully employed, or not yet fully consolidated.
3. A centre to organise occupational therapy in the patient's homes, while they are unfit to attend such a Centre.
4. Councilling Centre for the families of the tuberculous patients, while they are sick, and need help to complete their treatment,

With modern antibiotics, a large majority of patients can, no doubt, return to their original employment and can complete the long period of medical and social convalescence under the clinics OPD care, but this facility is not available to following categories of patients:

(i) Those who are initially unemployed or where on occasional or daily wages;

(ii) Those whose working conditions were originally unsatisfactory;

(iii) Those who complete treatment with some physical incapacity which does not render them fit for return to full work or to original work;

(iv) Those who became unemployed because of termination of service due to long absence from work or to the unhelpful attitude of the employer;

(v) Those who are still infectious and cannot be safely employed, unless working under protected and controlled conditions.

Location, Management & Control of Work Centres

The Centre to be useful must be located within easy reach of the patients in the city, and to facilitate cheak-up, be not far off from a tuberculosis clinic to which it is attached. The clinic will be responsible for (i) judging the functional capacity of the trainee; (ii) deciding the nature of the vocation in consultation with the vocational instructors and social workers; (iii) advising on the periodic medical check-up and working capacity; and (iv) controlling infection in the work centre.

A number of work centres located in different parts of a big city and easily accessible to a majority of patients, will be the good beginning of a rehabilitation scheme for ex-patients in a big city, and will cater to the needs of the poorer section of tuberculous patients, whose needs are urgent and uppermost.

The physician is in a most favourable position to study the human mechanism in its entirety both as a living mechanism and as a social being. The actual administration of the work centre has, no doubt, to be delegated to the other professional staff.

A seperate managing committee for such a unit, will be desirable on which would be represented the members of the manging committee of the Government of India experts on cottage industries and marketing, social workers and care Committees, and patient-workers' representatives and other persons interested in social welfare. The Secretary of the committee should be the chief of the clinic to which it is attached.

Suggested Vocations in the Work Centres

The final selection of vocations may have to be left to those having experience of industry and business. The vast experience of successful organisation of 'Work Centres' for the rehabilitation of the displaced persons should be available for advice. Medically, the trades chosen should avoid heavy effort or exposure to dust and dampness, should bring maximum wages with minimum labour while throwing least responsibility on the worker, and finally, maintain good hygiene in the Centre. Economically, the work should not be seasonal, should not need too much technical skill or large investment, the raw material should be easily available and the market should be within easy reach.

Vocations suggested for the present are:

1. Tailoring.
2. Cloth Printing.
3. Book Binding.
4. Leather Embossing and Stitching etc.
5. Card-Board Box making.
6. Fret-Work.
7. Paper Printing.
8. Brush & Spray Painting.

These vocations have been suggested because they are light, the training is likely to be of short duration, and cost of establishment after training comparatively low, and also because these crafts can be developed as small cottage handicrafts. Further, they do not need much educational background, and some would be suitable even for members of the patients' families, including ladies, if the bred-winner cannot take the training himself due to sickness.

Additional trades and crafts can be added as the demands crystalise. Highly technical trades have intentionally been kept out, because they may not be able to draw the educated persons on the present limited stipends to be offered, because they get light employment otherwise on a better remuneration than this stipend, without long period of training. Some of the trades *e.g.* tailoring and printing can ultimately, if so desired, be turned into production trades, whereby work can be organised on a large production basis. The tailoring department, for example, can be enlarged to produce finished products, *e.g.* hospital garments etc. and run on an industrial scale.

It is clear that immediately after the training, these persons will not be able to compete in the open market and make competitive living, against experienced standard workers. It is however, anticipated that such a trained person would be able to earn any thing from Rs. 60/- to Rs. 90/- a month and thus keep starvation off his door and get some protection from a relapse. With experience and stabilisation he can, in course of time, be reasonably expected to come up to the level of an average worker in his own vocation.

Number & Type of People for Training

The people to be taken for training will be:

1. Those who have had sufficient treatment to make them afebrile, and stabilised to the extent of being able to work at least three hours a day. With modern antibiotics this can be expected with about six to nine months' treatment in most cases.
2. For the present only non-infectious cases would be taken for training. Possibility of training and employing chronic sputum positive cases can can be considered as an appendage to such a Centre in due course. They will for the present, however, be helped through home bound programme in their own homes, but organised by the Work Centre.
3. Family members of tuberculous patients should be eligible to such training, if space is available.

Till other centres are developed, allowing dispersal of patients area-wise, patients in the beginning will be drawn to one centre from all areas of a city, provided they are under the supervision of a tuberculosis clinic in the city. Preference should be given to those who are referred by the ward care and aftercare committee.

Staff, equipment and accommodation should in the beginning be arranged to provide for training of 100 persons at a time, and if the centre works in two shifts of three hours each, as proposed at present it can accommodate 200 persons at one time.

Period of Training

The period of training can be fixed as from six months to one year, depending on- the nature of the vocation and efficiency achieved by the individual. It would, therefore, be possible to turn out 200 to 250 persons every year in a Work Centre of the size suggested at present.

Scholarships & Rehabilitation Grants

The scheme should provide for scholarships at least of Rs. 40 per months to 100 persons (trainees) during each year. This provision is not made merely as an attraction for the people to take advantage of the training and the rehabilitation facilities offered by this scheme, but is really provided on the clear understanding that most of the people likely to take advantage of the training, will be already financially crippled. They would need some subsistence help from somewhere. Some of them, at present, do get occasional help from the Care Committees or other sources, but this is neither consistent nor prolonged enough to provide for the period of instability and unemployment. If the economic status of the family so warrants, the scholarship may, however, also be made available to trainees drawn from the family members of tuberculous patients. This will be an indirect help both in the immediate treatment, and for the future of the tuberculous persons, as the family secures a measure of self-sufficiency through one of its members trained under this scheme.

As long as the trainee is under training, he will not be entitled to any financial return for the work done, but when employed after the training is completed, his remuneration will depend on the amount of work turned out and calculated on the usual tradewages basis.

A rehabilitation grant of Rs. 200 per trainee may be provided. It is obvious that these patients will not only have to be trained but have to be put back in a position to earn a living. Nearly all the trainees, therefore, would need some sort of initial equipment—outfit or material—before they can be expected to start earning. Average cost of this has been computed at Rs. 200 for each individual. Such a grant in ordinary circumstances should be recoverable in easy instalments over a period of two to three years. The local Care Committees could be expected to take a hand in such arrangements. It may, however not be possible to visualise beforehand as to how much of this will be returnable, and ultimately in most cases, whole of it may have to be written off. Therefore it is expedient to provide for it outright and include it in the cost of training and rehabilitation.

Cost of Establishing the Centre

In the beginning 'Work Centres' providing training, to about 100 persons be set up, but these should be capable of expansion as the scheme progresses. As the experiment will need a long period for full establishment and assessment of its social

value, an initial provision must be made for at least five years. The figures given are only provisional:

Capital

Building	——	——	Rs 1,00,000
Equipment, Furniture, Installations			1,00,000
Land			Free

Running Costs:

	One year	*Five years*
(a) Technical Training Staff	Rs 20,000	1,00,000
(b) Administrative staff	20,000	1,00,000
(c) Scholarships to 100 pupils Rs. 40/-p.m.	40,000	2,00,000
(d) Materials for training	10,000	50,000
(e) Rehabilitation grant Rs. 200/- per pt. to 100 pts. in one year.	20,000	1,00,000
(f) Unforeseen	10,000	50,000
	1,20,000	6,00,000

Following is the minimum requirement of the staff:

1 Executive Officer
8 Technical Instructors
1 Social Worker
1 Accountant-cum-Head Clerk
1 Storekeeper and Production Officer
1 Clerk
8 Peons, Cleaners, Chowkidars and Sweepers.

Assessment

The scheme provides for training 100 to 150 persons a year, on an annual running expenditure of Rs. 1,20,000. The cost of training and rehabilitating each individual comes to Rs. 800 to Rs. 1,200 including subsistence allowance during the period of training. At the end of his training, he will not only be an economically self-sufficient individual, but will be saved from the danger of relapse. If this amount was given over as a dole, covering a period of two to three years, it would leave the patient and the family with no new skill and return to the origianal heavy and unsuitable work would again precipitate a breakdown. A dole, therefore, would be no substitute for a scheme of training like this, though the scheme may look heavily subsidised and may appear to cost as much as three years' dole. The expenditure involved in the scheme is equivalent to the cost of running some 50 to 60 sanatoria beds. The scheme certainly can stop relapses to a greater extent, and save the necessity of any equivalent number of sanatoria beds. Apart from its preventive value, it has humanitarian, social and economic advantages over an equivalent scheme of sanatoria beds. It is, in short, from many of points of view a good and necessary social investment.

.This is in no way a complete scheme of rehabilitation, but to me, it seems to be a beginning of a rehabilitation programme for the tuberculous patients in the present context of our financial and technical difficulties—something which would properly dovetail with our present national tuberculosis control programme, and which appears practicable and likely to succeed.

The Future

The shape and scope of future rehabilitation activities, will depend not only on the success of the present experiment, but also on the development of our tuberculosis Control Programmes and their social appeal. Varrier Jones once remarked that "the delay in developing rehabilitation of the tuberculosis is due first to public apathy and second to fear of the fit of competition from the unfit." That rehabilitation is a social investment is also a point of essential public education. In countries where these programmes are working successfully one hears the remarks that "Rehabilitation makes Tax Payers out of Tax Consumers." Whether the tax-payer realises it or not, he pays the bill all the same. The public in any case has to be educated to appreciate the fact, that in any plan of rehabilitation, subsidisation of the tuberculous patients to bring them on par with healthy workers, is essential.

It is obvious that only with a comprehensive national health and a broadened social welfare policy, can our schemes for rehabilitation be diversified and help to the patients liberalised. We can then one day hope to have an enlightened legislation like the 'Displaced Persons Act of England' which includes the tuberculous patients in its benefits. This provides social and financial help during treatment, convalescence, retraining and finally in placement in a suitable job. One can always conjure up pleasant visions of the future, but in practical human affairs all beginnings are small. Therefore, a plan of "Meeting Some Needs of Some People" through a stage of 'Meeting All Needs of Some People", one can, one day hope to reach the target of 'Meeting All Needs of All People'. The 'Work Centre' plan can at least claim to be the first foundation stone of the edifice of our future rehabilitation programmes.

The Place of BCG Vaccination in the Control of Tuberculosis in India

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In discussing a particular preventive method against a disease two important points have to be taken into consideration. They are:

(1) What the measure was expected to achieve; and

(2) The circumstances under which it was adopted.

The role of B.C.G. Vaccination in the control of tuberculosis in India has to be examined in the light of these two factors.

It must be mentioned at the very outset that none of the sponsors of B.C.G. vaccination ever claimed that it alone would solve the problem of tuberculosis in India. It was meant to serve only as an adjunct—a valuable adjunct at that, to the more important and universally accepted measures for the control of this disease. This will be very clear if we are to examine the circumstances under which B.C.G. Vaccination was introduced and widely practised in India.

1. The Problem

What was the tuberculosis problem in the country? Defective recording of vital statistics did not permit a correct appraisal of the mortality rate, let alone the morbidity rate. Stray surveys were conducted by different workers at different places and at different periods. "And these surveys have shown that the morbidity rate varied from 1 to 2.5% in the urban areas and the only survey in a rural area showed a rate of 0.42 %. The average morbidity rate for urban areas, weighted according to the number surveyed is 1.5%" (Nair, 1955). These findings have shown that the estimate made by the tuberculosis workers in India *viz;* about 500,000 persons died of tuberculosis and 2,500,000 suffered from it per year, was more or less correct. If the interim analysis of the available figures of the National Tuberculosis Survey now going on in the country is any guide, the number of tuberculous cases in the country is likely to be more.

That the infection is widely prevalent has been confirmed by the results of tuberculin tests in the mass BCG Campaign. The figures in the following table (Benjamin, 1951) are self-revealing:

TABLE I

Average Percentage of Reactors at Certain Ages

State	5 *years*	10 *years*	15 *years*	20 *years*	21-25 *years*
Assam	10.3	33.8	54.2	67.2	73.3
Bengal	23.0	50.4	67.7	77.9	82.1
Bihar	17.9	40.6	56.8	67.1	72.0
Bombay	32.2	59.9	75.2	83.2	87.5
Punjab	14.0	35.0	51.2	61.6	66.9
Travancore-Cochin	11.1	47.1	53.7	71.8	80.8
Uttar Pradesh	27.4	51.8	69.9	74.5	84.9

It would be noted that the percentage of reactors increases steeply with the age upto 25 years.

Thus it is clear that the position was serious indeed. India lost one person every minute of the day to tuberculosis. The conditions for the rapid spread of the disease were ever present. Malnutrition, overcrowding especially in urban areas, unhygienic living conditions and ignorance were so rampant that it is not surprising that practically everyone of the population is exposed to infection. The impact of technology on an agrarian rural population resulting in rapid industrialisation and improvements in communications narrowed down the difference between the urban and rural population with the consequence that the risk of infection was universal. The preliminary analysis of figures for accessible villages in the National Tuberculosis Survey strongly supports this view.

India was confronted with the same problem which Europe faced 75 years ago. While the Western countries crossed the peak of mortality (from tuberculosis) somewhere between the 4th decade and the close of the last century, the curve seemed still rising in India. The Western nations were able to achieve this by establishing clinics, institutions for treatment, isolation and after-care, and above all by raising the standard of living of the people. India could bring about the same changes if only she too had the wherewithals the European countries could command.

2. Control Measures

What was to be done then to meet the swift-growing menace?

Theoretically speaking three courses were open to India:

(1) Adoption of measures calculated to build up the non-specific resistance of the people against disease in general by raising the standard of living;

(2) Adoption of definite anti-tuberculosis measures, *viz.* clinics, hospitals for treatment and isolation, and after-care colonies; and

(3) Building up of specific resistance of the people, if possible.

Let us examine these three courses in some detail:

Raising the standard of living is undoubtedly the most effective measure to combat tuberculosis. It is easier said than done, because the changes involved can only be brought about in the course of one or two generations. Improvement of housing conditions and the nutritional level of the people are prime factors in raising the standard of living.

3. Economics of Orthodox Control Measures

It is estimated that to improve housing condition India may need Rs. 100,000 millions and to improve nutrition, another 3,000 millions per year. Through her Five Year Plans India is making gallant efforts to better the condition of her people, but as indicated already it will take time for her plans to fruition. We cannot afford to wait till this period and allow the terrible leakage of man power by death and suffering from tuberculosis and the consequent economic loss to the country.

The cost of establishing institutional facilities for diagnosis, treatment, isolation and after-care is still more staggering. We need about 4,000 clinics estimated to cost Rs. 400 millions. The 500,000 beds we need may cost us Rs. 4,000 millions more.

If these two items are planned for over a period of 15 years we may require an yearly expenditure of about Rs. 300 millions. The running cost when all these institutions are working will be about Rs. 600 millions per year. If to this is added the yearly sum needed for the improvement of housing and nutrition, calculated on 15 years' basis, will be Rs. 6,600 millions and Rs. 2,000 millions respectively. (Benjamin, 1949).

Thus if we are to follow in the footsteps of the West in tackling the tuberculosis problem successfully, India would immediately require about Rs. 9,000 millions per year. No more than 20 millions per year are now spent in the whole of the country on this score.

The plain fact is that India cannot afford to find this money in any foreseable future; and when the shortage of technical personnel to manage tuberculosis services, *viz.* 15,000 doctors, 50,000 nurses and 12,000 health visitors, is taken into consideration, one is obliged to throw up the hands in despair.

Were we then to resign ourselves to the situation? Was there no effective method that we could immediately adopt within our limited resources? Was there no measure that would bring tuberculosis within manageable limits and that would give us some breathing time till all our various schemes in our Five Year Plans mature ?

4. BCG : Only Practical Alternative

Fortunately for India B.C.G. vaccination provided just the answer and this fits in with the third and last course open to us, *viz:* building up of specific resistance of the people against tuberculosis. The accumulated experiences in the various countries of the world which had adopted this immunisation showed us that we too can by adopting it bring down the incidence of tuberculosis to about l/5th of what it is today within, say, 15 to 20 years.

To cite only one Asian country which has benefitted by B.C.G. vaccination, Japan's example is worth quoting. In Japan where a mortality rate of 282 per 100,000 population in 1943 was brought down to 82 in 1951, mainly due to BCG vaccination (American Journal of Public Health, July, 1954).

B.C.G. vaccination had attracted the attention of some tuberculosis workers in India even as early as 1936, long before international bodies thought of launching campaigns in the war-devastated countries of Europe. Worried about the growing menace of tuberculosis in India and realising the utter impossibility of controlling it on orthodox lines, Dr. Ukil (Calcutta) and others had plans to start B.C.G. vaccination. However, the World War II intervened and the plan fell through.

It is not necessary at all in this article to discuss the efficacy of B.C.G. vaccination in any detail. The Public Health Department of the London County Council puts down the utility of B.C.G. vaccination succinctly thus: "It is the best way known to medical science at present of protecting any one against any but the most severe exposure to tuberculosis."

There is sufficient evidence that the vaccination is safe and efficacious and that the harmful effects, if any, are no more serious than in any other preventive inoculation. The results of the most recent and the most painstaking investigations conducted by the British Medical Research Council on the subject have only confirmed this view and have left no doubt as to the utility of this measure.

5. Dr. Palmer's Views—New and Old

It has been recently reported that Dr. Palmer has now expressed the vj£w that vaccinating tuberculin negatives will not influence the epidemiology of tuberculosis and that he prefers, giving anti-biotics to the tuberculin positives who are the precursors of active tuberculosis cases. This is somewhat contrary to his own findings on studies carried out much earlier in colloboration with Arnson in America (U.S. A. Public Health Report, 1946) and is in conflict with his published opinion on the subject when he was the Head of the WHO/TRO*. Suffice it to say that the studies on which he has based his recent observations were not as thorough as those of the British Medical Research Council. In one important respect at least Palmer's studies lacked the scientific precision which the B.M.R.C, scrupulously observed, *viz:* proper screening of the subjects before the experiments were begun and also in detecting fresh cases in the course of the experiment. This has an important bearing on the results in as much as one could not be certain that all the vaccinatad persons were absolutely free from infection prior to vaccination and the comparisons made by him were free from bias. Therefore, his interim conclusion that there was only 8.5% against B.M.R.C.'s 55 % reduction in the incidence of tuberculosis as a result of vaccination can not be wholly acceptable. Moreover, Palmer has also not made any mention of the long term effects of the BCG Campaign which his study under reference has indicated. The incidence of tuberculosis among his vaccinated group, is only l/5th of that among the naturally infected, and this in fact confirms the earlier belief that the cumulative effect of BCG vaccination is to reduce the morbidity by about 80 %.

According to Dr. Palmer it is more profitable to give anti-biotics to the natural reactors and sterilise them than give BCG vacciniation to non-reactors. Surely he may be thinking of countries where the total number of reactors are much smaller than the non-reactors. India's overall percentage of reactors is about 55 and we have to give anti-biotics to over 200 million people if we are to follow Palmer's advice. The cost of anti-biotics alone would then come to about Rs. 5,000 millions at a modest estimate of Rs. 25 per head. Apart from the colossal nature of the task, the personnel required for this purpose, the difficulty of making normal persons to take drug treatment regularly, the serious complications attendant on prolonged treatment and the possibility of bringing into existence dangerous drug-resistant bacilli, and above all the uncertainty of achieving the desired results will surely preclude the trial of Palmer's method in our country. Palmer's idea is to deal with the pool of natural reactors from which group by far the largest number of active tuberculosis occurs; and this pool can be effectively reduced by the systematic vaccination of the non-reactors who ultimately come to constitute this potentially dangerous group. Here also, therefore, the policy of BCG vaccination stands vindicated.

6. Introduction of BCG in India

Following the advice of the Technical Committee of the Tuberculosis Association of India and on the recommendations of the Expert Committee of the World Health Organisation, the Planning Commission of the Government India decided to introduce BCG vaccination in the country on a mass scale and gave it top priority over all anti-tuberculosis measures. After a modest beginning in 1948 when only the school population was attempted to be protected, it was soon realised that if the epidemiology of tuberculosis was to be favourably influenced, the vaccination should be carried out

*"I think we can safely believe in the ultimate efficiency of tuberculosis immunisation. We can also, I think, unhesitatingly support the mass BCG Vaccination Programme in many countries hi the world where vaccination is almost all that can be done today to control tuberculosis. B.C.G. is certainly the best known, the most promising and the most acceptable immunising agent at our disposal". (CARROL E., PALMER, 1952).

on a mass cale. Mass vaccination was the only rational step in as much as the exposure to infection was so universal as not to make any distinction between exposed and unexposed groups.

In a country like England, where the tuberculosis mortality is only about 40 per 100,000, it is not absolutely necessary that BCG vaccination should be carried out on a mass scale, because the changes of the spread of infection are necessarily limited; and besides the standard of general health and the native resistance of people are high to withstand any random infection. But in the case of a country like India where the death rate (about 200 per 100,000) is dangerously high and the standard of living dismally low, the chances of practically every one of the population getting infected are vast indeed. Therefore, mass vaccination is the only remedy. Even in England there is a strong body of opinion that BCG vaccination should not be confined to exposed groups and to the school leavers (14 to 15 years old) alone and that it should be offered to younger children as well.

7. Mass Campaign

According to the decision taken by the Planning Commission the countrywide campaign was started in 1951 and at present all the states in India have full-fledged BCG Organisations. The table given below shows the progress of BCG vaccination in India from its inception in 1948 up to the end of 1955-56, end of the First Five Year Plan period:

TABLE II

Year	*Tested (Millions)*	*Vaccinated (Millions)*	*Mass Campaign Units*	*National Expenditure Rs. (in millions)*
*1949-50	0.53	0.18	No Mass Campaign	0.70
1950-51	2.07	0.68	Units formed.	0.98
1951-52	2.72	1.12	15	1.45
1952-53	8.62	2.14	48	2.02
1953-54	12.49	3.86	85	2.48
1954-55	18.78	6.56	119	2.80
1955-56	25.37	10.04	131	3.03
	71.58	24.58	131	13.46

It is estimated that about 170 million persons are likely to be tuberculin negative in the country and needing vaccination. These will be found mostly in the age group below 25. It is hoped, with the increased number of mass campaign units that are coming into position in 1957 at least 80% of these can be vaccinated by the end of the Second Five Year Plan period; and there are plans to test and vaccinate the succeeding generations thereafter. If this is achieved it is reasonable to expect a reduction in the tuberculosis incidence every year in India. In the mass campaign in India about 28 million persons have been vaccinated in a group of about 80 million persons tested so far. Ordinarily tubreculosis would have manifested in about 1.2 millions in this group. As a result of vaccination, even according to the reduction of 8.5 % calculated by Dr. Palmer, there would be a saving of tuberculosis in this group to the extent of 100,000 cases during a period of four to five years. The long-term advantage of the campaign *(i.e.* in the course of 15 to 20 years) will be considerably more. However, if we can reduce the morbidity rate in 15 years' time to about l/5th of what it is now, then the annual incidence of the disease will be brought down to 500,000 (from 2,500,000) and the huge

* This includes tests and vaccinations done in 1948 also.

amount that would otherwise have been required to combact the disease will be available for other useful purposes.

8. Economics of BCG Vaccination

Now let us look at the economics of BCG vaccination. From the table given above (Table II) it will be seen that a sum of Rs. 13.46 million has so far been spent on BCG vaccination by the Government of India and the State Governments, and on the basis of the 1956-57 budget in the coming years, the total expenditure by the end of 1960-61 will only be Rs. 40 millions. When we contract this entire sum required for a period of 12 years to the Rs. 9,000 millions that will be required for one year for the orthodox methods of control, or Rs. 5,000 millions (the cost of the drugs alone) required for controlling the disease by anti-biotics, the wisdom of adopting the BCG vaccination will be fully appreciated.

It will, therefore, be seen that the role of BCG vaccination in the control of tuberculosis is vital and rational. Its effectiveness is enhanced when practiced along with other methods against the disease which India is adopting at present. As already mentioned even in countries where standard of living is high and the incidence of the disease is low as in England, the expert opinion seems to favour the idea of vaccinating all children. Even if India could afford to have all the acknowledged methods straight away, it would still be desirable to vaccinate our children.

9. Other Achievements of BCG Campaign

Apart from building up the specific bodily resistance, the mass BCG vaccination campaign in India, which is the biggest of its kind in the world, and the largest single preventive measure carried out in the country has had certain salutary side-effects also. It has focussed country-wide attention on India's major public health problem: Tuberculosis. Tuberculosis used to be the sole preserve of the clinicians and its public health and preventive aspects were largely neglected. The mass campaign retrieved it from the hands of the clinicians and flood-lighted the preventive side. One of the immediate results was the increassing public demand for more measures to combat the -disease.

Another contribution BCG campaign made was the public health education that naturally followed in its wake. The frequent visits of BCG workers, with cinema and public address equipments, to the remotest corners of the vast sub-continent were a unique feature unheard of or unseen before. The BCG staff did not only educate the people on the causation and prevention of tuberculosis alone, but they also availed of the opportunity to appraise them on prevention of other diseases as well.

Some people in this country and abroad doubted if mass vaccination could be carried out in India. As a matter of fact, in the course of seven years we have tested over 80 millions and vaccinated over 28 millions upto the end of September, 1956 and we are confident that by 1960-61, we may be able to cover at least 80% of the vulnerable population in the country. We have achieved more. The India BCG Project demonstrated that any public health problem can be tackled in a big way; besides it has provided each state with a band of workers specially trained in public relationship and experienced in fighting not only tuberculosis but other communicable diseases as well.

CONCLUSION

The mass BCG programme in India evoked some controversy in the country. It was not at all surprising that this immunisation was the subject of some heated discussion in this country also. There is much in medicine that is controversial and

tuberculosis is no expection. Most of the opposition in India was wholly uniformed and largely based on out-of-date views of some tuberculosis workers. Though the anti-propaganda caused some slackening of the progress of the campaign in certain parts of the country for a time, it served some other useful purpose. It has made thinking people to study the subject in all its aspects and clear their doubts if they had any. It has also brought about an increased awareness of the tuberculosis problem of the country and gave an incentive to adopt measures to solve it. When the history of the conquest of- tuberculosis in India comes to be written the contribution of BCG vaccination in controlling the disease will surely be recorded as something substantial.

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2. U.S.A. Public Health Report, (1946)
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NEWS AND NOTES

PROGRAMME OF XIVth INTERNATIONAL TUBERCULOSIS CONFERENCE

Saturday Jan. 5, 1957

9.30. A.M.- 1 P.M. Meeting of Committee of Secretaries (Conference of Executive Directors). Chairman: Shri B. M. Cariappa.

3.00. P.M. - 6 P.M. Meeting of the Programme Committee, (Chairman: Prof. Etienne Bernard) and of the Budget & Finance Committee.

Sunday Jan. 6, 1957

10.00. A.M. - 1 P.M. Meeting of the Executive Committee. Chairman : Dr. P. V. Benjamin.

3.00. P.M. - 6 P.M. First Meeting of the Council (Chairman: Dr. P. V. Benjamin) (Members of the Council or their deputies will be supplied with identity cards).

Manday Jan. 7, 1957

11.00A.M.-12.15P.M. INAUGURAL SESSION OF THE CONFERENCE to be opened by Dr. RAJENDRA PRASAD, the President of India.

12. 45 P.M. Buffet Lunch (by invitation) by the Tuberculosis Association of India.

2.30. P.M. - 3.45 P.M. Second Meeting of the Council.

4.15 P.M. -5. 15 P.M. Reception in Rashtrapati Bhavan.

5.30 P.M. - 7.00 P.M. Film Show in Rashtrapati Bhavan.

Tuesday Jan. 8, 1957

8.30 A.M – 1.00P.M
3.00 P.M.- 5.00P.M } Scientific Sessions

5.45 P.M. - 7.15 P.M. Film Show “Life of Buddha” at Sapru House.

Wednesday Jan. 9, 1957

9.30 A.M.-1.00P.M
3.00 P.M – 5.00 P.M. } Scientific Sessions

5.30 P.M. - 6.30 P.M. Receptions.

7.15P.M. - 8.15 P.M. Ballet by Mrinalini Sarabhai and Troupe at AIFACS Auditorium.

Thursday Jan. 10, 1957

9.30 A.M. - 1.00 P.M.
3.00 P.M. - 5.00 P.M.) } Scientific Sessions

5.30 P.M. - 6.30 P.M. Receptions.

7.15 P.M. - 8.15 P.M. Variety Entertainment at AIFACS Auditorium.

Friday Jan. 11, 1957

9.00 A.M. - 11.00. A.M. Symposia on :

(1) The value of tuberculin reactions for the Selection of cases for B.C.G. Vaccination and significance of post-vaccination allergy.

(2) The importance of nutritional factors in tuberculosis.

11.00 A.M. -1.00 P.M. Symposia on

(1) Cortisone in the treatment of tuberculosis.

(2) Role of Voluntary Tuberculosis Associations in tuberculosis control programmes.

3.00 P.M. - 4.30 P.M. Meeting of the Eastern Regional Committee of the International Union Against Tuberculosis.

5.00 P.M. - 6.00 P.M. Closing Session of the Conference.

8.00 P.M. Banquet (invitation on payment of Rs. 25/- per person) at Asoka Hotel.

RESULT OF 1956 HEALTH VISITORS EXAMINATION

The following candidates have been declared as qualified tuberculosis health visitors at the examination held in New Delhi in September:

Shri Rajeshwar Nath, Punjab; Miss Annama Varghese and Miss Aleyamma Varghese, Hyderabad; Miss Nirmal Kumari Jagota, Pepsu; Shri Ram Prasad Sharma, Madhya Bharat; Shri Mohanlal Varma, Uttar Pradesh; Roderick V. Booth, Ajmer; Premananda Sharma, Assam. Halandhar Durrah, Assam & O. P. Saxena, Madhya Bharat of 1955 course also qualified.

POST-GRADUATE REFRESHER COURSE

Thirteen candidates attended the post-graduate refresher course held in Madras from November 3 to 17, 1956.

SEVENTH SEAL SALE CAMPAIGN

The Seventh Tuberculosis Seal Sale Campaign will terminate on January 26, 1957.

WORK OF THE P.E.P.S.U. ASSOCIATION

The Tuberculosis Association of Patiala, formed in 1939 was one of the oldest Tuberculosis Associations in India. It became the Association of PEPSU with the first reogranisation of States after independence and since its inception it successfully presented the case of tuberculosis to the Government and public alike, Dr. Khushdeva Singh was Secretary of the PEPSU Association.

The Association spent more than Rs. 5,00,000 for buildings and equipment alone and also contributed a sum of Rs. 1,000 for the production of a film on tuberculosis by the Tuberculosis Association of India.

The PEPSU Association had to face the problem of beds and institutions in the area. In 1947 there was only one institution with 20 beds but due to the sustained efforts of the Association there are now seven tuberculosis institutions with 250 beds. The Tuberculosis Centre, Patiala, is an achievement. It cost Rs. 4,25,000 and serves as a training institution, being recognised for the DTD course of the University of the Punjab. The efforts for the upgrading of existing clinics in the former PEPSU are continuing and the Tuberculosis Centre, Patiala, is to be upgraded as a teaching and demonstration Centre.

As part of its training activities the PEPSU Association conducted post-graduate refresher courses for medical practitioners under the auspices of the Tuberculosis Association of India and moved for the starting of health visitors course in the State. This course will begin in 1957. Besides, the PEPSU Association has trained BCG technicians. Out of funds available the PEPSU Association, helped 150 tuberculous patients with financial aid besides donating Rs. 300 to the Lady Linlithgow Sanatorium, Kasauli. The Association spent Rs. 3,000 yearly for purchase of antibiotics for free distribution amongst tuberculosis institutions.

The PEPSU Association undertook the BCG Vaccination Programme in the State with the co-operation of the State Government. It did much by way educating the public. PEPSU was the first State in India to complete the Mass BCG Vaccination programme.

As an important activity the PEPSU Association organised the Seal Sale Campaign in the State under the auspices of the Tuberculosis Association of India. During the last six campaigns it collected a sum of Rs. 1,35,000.

PEPSU as a State has now merged in Punjab but the work the PEPSU Association has done bears eloquent testimony to the planning and execution of programmes with sincerity of purpose and devotion. The PEPSU Association has done a good job and on the eve of its merger with Punjab deserves to be congratulated on a difficult task well done.

The Indian Journal of Tuberculosis

ABSTRACTS

Vol. IV **DECEMBER, 1956** **Abst. No. 1**

Treatment of Tuberculous Meningitis—The object of treatment of tuberculous meningitis is twofold, firstly, to eradicate meningeal infection and secondly, to promote resolution of the basal exudate, before it leads to the development of gross hydrocephalus and destruction of brain tissue.

The principles underlying the treatment are:

Firstly: Early institution of appropriate chemotherapy.

Secondly: Free access of chosen antibiotics to all sites of infection.

Thirdly: Maintenance of an adequate concentration of antibiotic, to all sites of infection.

Early Institution of Appropriate Chemotherpy .

Earlier the treatment started, better the results. Streptomycin and Isoniazid have been recommended as the drugs of choice.

The results of treatment of 223 consecutive cases at Oxford have been presented. The cases were classified according to the stage of disease at the time of treatment.

Group \. Consists of cases, who were conscious and rational and without neurological signs.

Group 2. Consists of cases, who were comatose or delerious.

Group 3. Includes the rest, who could neither be included in Group I nor Group II.

Of the group I having 52 patients, only 3 died, while of the group III having 67 patients, barely a third survived.

Diagnosis

The classical clinical findings are fever, obvious meningism cloudiness of consciousness, low grade papilloedema, separation of sutures, focal neurological signs such as squints hemi-paresis, positive mantoux and presence of systemic tuberculosis.

But the early involvement of meningis is difficult to detect. The cardinal sign in infantis not stiffness of neck, but fullness of fontanelle. Obstinate constipation is perhaps the commonest single symptom. Abdominal pain is frequently

Present in children.

For the diagnosis of early meningitis, the use of lumber puncture is recommended, which should be done for any unexplained ill health accompanied by fever, that fails to resolve after a few days' observation and particularly so, if there is history of recent contact and of systemic tuberculosis.

The characteristic changes in the C.S.F. in tuberculous meningitis are the characteristic cobweb clot, higher cell count range from 50-500 per C.M.M., raised protein content between 80-400 mgm. per 100 ml., mononuclear pleocytosis, lowered sugar content below 40 mgm. per ml. The fall in chloride content is a late phenomenon.

The finding of M. Tuberculosis in the C.S.F. by smear examination settles the diagnosis in doubtful cases and also differentiates other conditions such as virus infection, spirocheactal infection brain abscess, tumours, etc.

X-ray of the chest and examination of gastric content for M. Tuberculosis are invaluable aids to diagnosis. Other special methods of diagnosing are, encephalography and study of partition of bromide between blood and the C.S.F.

Even still in doubtful cases, it is recommended that the treatment should be started.

Free Access of Chosen Antibiotics

To achieve this the two important points are: firstly, the use of intrathecal medication and secondly, whether any adjuvant to chemotherapy such as hormones, cortisone, A.C.T.H. and tuberculin should be given or not.

The author recommends the administration of drugs intrathecally as well as systemically. For adults and adolescents interathecal dose is 50 mgm of both streptomycin and isoniazid and systemetic dose is 1 gm. of streptomycin by **I.M.** and 300 mgm. of isoniazid orally. This is continued till, (1) patient is apyrexial and is gaining weight, (2) spontaneous fluctuations in all cell counts of the C.S.F. have disappeared, (3) protein content of C.S.F. has been falling steadily and (4) at least eight weeks have elapsed since tubercle bacilli were last identified on daily examination of C.S.F.

After the intrathecal injections have stopped, the systemetic treatment is continued for another two months or for a total period of six months, whichever is longer.

For associated miliary spread, treatment may be continued for one year. For intrathecal injections, lumber route is the best but in cases with spinal block, ventricular or cisternal puncture should be done,

Intrathecal Tuberculin

Promotes the resolution of basal tuberculous exeudate and potentiates the action of chemotherpy.

Mifiute doses of P.P.D. (0.00375-0.0075 mg.) are give'h by lumber puncture every four days. The dose is gradually increased until reaction is obtained as shown by rise in the cells and protein content of C.S.F. Once reaction is obtained the same dose is repeated, once a week.

When the effect begins to wear off, P.P.D. is withheld and intrathecal chemotherapy continued for at least another ten days or longer; if previous improvement not maintained P.P.D. is only used; if the diagnosis is confirmed either bacteriologically or by demonstration of miliary spread or if Mantoux is positive to 1/100 O.T.

In case Mantoux is negative, P.P.D. is withheld.

Mantoux test is repeated weekly and when it is positive, P.P.D. may be given.

P.P.D. lumber injections are dangerous, if there are signs of compression of the spinal cord. *e.'g.* in incepient Potts paraplegia. If P.P.D. is requirled in such cases, it should be given by ventricuar or cisternal injections.

Thf limitations of such prolonged methods of treatment are:

1. Introduction of secondary infection in case of interathecal treatment.

2. Trauma by the lumber puncture needle.

3. Associated vascular changes and consequent infection.

4. Accurate daily cell counts and protein examination impose a heavy burden on the laboratory. The dangers with P'P.D. regarding dosage and the reaction.

Maintenance of adequate concentration of the antibiotics in the C.S.F. for a sufficient length of time.

As it is difficult to determine when the infection is overcome hence it is better to treat the patient little too long than to allow him to relapse.

Treatment of Systemic Infection

Associated primary complex with or without miliary disease generally heals by the time meningitis is controlled. Chronic pthisis or Pott's disease, if present should be treated according to their own requirements.

General Measures

Such as good nursing care, adequate high caloric or high protein diet with full vitamin supplement is to be given, even by nasal route if necessary. Blood transfusion may be required in few cases. Cortisone or A.C.T.H. produce dramatic decrease in the abnormalities of C.S.F., but there is not enough. evidence that they promote resolution of tuberculous exudate already present.

(Treatment of Tuberculous Meningitis: Honour Smith: Tuber. (1956), *Vol. XXXVII, No.* 4).

Bacteriological! Studies of Resected Pulmonary Tuberculous Lesions.—Bacteriological studies were carried out on materials obtained from excised solid cavitary tuberculous lesions including bronchial and pneumonic secretions in 60 cases.

43% had cavitary lesions. Positive smears were obtained in 80% and positive cultures in 62%.

Lesions showing breakdown has positive smears in 63% and positive cultures in 35%.

The number of positive smears with negative cultures was 33 % and this included 65 solid and 6 cavity cases.

The number with negative smears and positive cultures was 6%, which included 10 solid lesions and 2 cavities.

In 178 samples from solid lesions, 60% were positive by smear and 28 % by culture.

In samples from cavities 79% were positive by smear and 66% by culture.

This difference may be due to the fact that tubercle bacillus has been altered in biochemical mechanism and viability depending on the type of lesion, natural defence and ability to adapt (Mutation).

These alterations vary in degrees from death to viability. This is responsible for different findings by pathological and bacteriological examination. The action of antibiotics is primarily bacterio-static but the process is slow and gradual.

The histopathological changes can be produced by the products of tubercle bacillus, without viable bacilli.

(Bacteriological Studies Of Resected Pulmonary Tuberculous Lesions: Johnson. B.H.., Sagar. F. Dis. of Chest (1956), *Vol. XXX, November).*

An Experience with Segmental Resection in the Treatment of Pulmonary Tuberculosis.—The results of 182 consecutive segmental resections in pulmonary tuberculosis done during the year 1951-54 have been presented.

By segmental resection, the author means anatomical dissection alongwith the broncho-vascular pattern as against wedge resection, which is an excision from the periphery with dissection towards the hilum without regard for anatomical landmark.

Age: 16 (9%) were under age of 20; 116 (64%) were between 20-40 and 50 (27%) were 40 or over.

Sex: 92 were females and 90 were male patients.

Of these 182 cases, one (0.3%) had minimal disease, 105 (58%) had moderately advanced disease, 76 (41.7%) had far advanced pulmonary tuberculosis.

161 (89%) had positive sputum for A.F.B. and 21 (11%) were negative.

14 (77%) had some collapse treatment and 41 (23%) were without collapse.

161 (89%) had received antimicrobial drugs prepperatively and 21 (11%) had more. 90 patients had received less than six months of antimicrobial drugs while 92 had received them over six months.

147 (80%) had less than a lobe removed, of these 40 had a wedge or a subsegment removed, 28 had a segment only, 79 had more than one segment, but less than a lobe, the rest 39 (20%) had lobectomy plus smaller portions of an additional lobe removed. Of the 183 surgical specimen, from these 182 patients 148 (80%) were positive to direct a smear and 67 (36 %) revealed positive culture.

One hundred fortysix (80%), of these patients are entirely uneventful post-operative course, 36 (20%) had a complicated course, 2 (01.1%) died as a result of surgical therapy.

Nearly half the patients had air leaks in the post-operative period. 22, who had residual air pockets, required further treatment.

These cases had broncho-pleural fistula and one had empyema.

In four cases, there were severe postoperative hemorrhages and these required exploratory thoracotomy. One had transfusin reaction, four wound infections, one pleurisy, one paralytic ilius, one retention of secretions without atelectasis, one post-operative asthma, two post-operative atelectasis and one severe dysponea and cyanosis.

Of the 130 patients discharged, one hundred and twenty five had disease, three had active disease and two were dead, both from cardiac arrest. Of these three discharged with active disease, one (discharged against medical advice) had positive culture with a contralateral lesion, the other two discharged with consent and advice.

Fiftytwo are still hospitalized. 49 of these are negative to culture, three are positive, one has a contralateral lesion, one has atypical acid fast organism.

Of the 130 patients discharged, follow up is available on 107 for over a period of 12.3 months. These were followed from the stand point of physical activity, sputum status and x-ray.

56 have returned to full activity and 50 of these are still having daily rest periods. One committed suicide.

The use of segmental resection is recommen-andded as it is safe, and mortality and morbidity is low. The disease is removed with the Conservation of maximum amount of lung tissue.

(An Experience with Segmental Resection in the Treatment of Pulmonarry Tuberculosis: R.F. Shek. J.L; Cope. J.A. ; Dis. of Chest (1956) *Vol. XXXIX No.* 2).

Three Phases of A Tuberculosis Control Programme for Student Nurses.—Tuberculosis has been recognized as an occupational hazard for student nurses, medical students, interns and other hospital personnel.

A report has been presented of 19-year study of the incidence, morbidity and control of tuberculosis at the Lincoln School for Nurses.

Investigations have been done to find out the difference in the incidence of active tuberculosis in the students with positive mantoux reactions on admission to Nursing School as compared with negative reactors. In addition the effectiveness of a programme aimed at controlling tuberculosis is evaluated.

The total number of students followed during the period between 1936 through 1954 was 906.

The survey has been divided into three phases.

Group I. Comprises of students who entered and graduated between 1936 and 1942.

Group II. In 1942 because of high incidence of tuberculin conversion and high morbidity ratz among students, a rigid tuberculosis programme was instituted. This covers the period between 1942 and 1949.

Group III. In 1950 B.C.G. vaccination was added to the control programme and it covers the period between 1949 to 1954.

Group I: More than 70% of the young

women, who were negative tuberculin reactors on entering nurses training became positive reactors prior to graduation. 12 cases (5.2%) developed active pulmonary tuberculosis, of this one had indiopathic pulmonary effusion and without any evidence of parenchymal disease, the rest 11 had minimal parenchymal lesions. All except one were asymptomatic.

Regarding the incidence of the development of tuberculosis amongs the students with positive mantoux reaction at admission, of the 141, four (3 %) developed active tuberculosis, while amongst the 87 students with negative mantoux, reaction at admission, 8 (9%) developed active tuberculous disease.

Group II. The students were followed under health programme. Of the 340, five girls (1.4%) developed active pulmonary tuberculosis and one a tuberculous adenites.

Out of these one had a high positive mantoux and was an attendant at Sea View Tuberculosis Hospital. Similarly the one with tuberculous adenitis had also a high mantoux.

Two of the 5 girls, who developed active disease in this group were negative reactors to tuberculin on entering training. The other 3 were positive on admission.

Group III. Of 3 38 students, 159 were negative reactors and of these 149 were given B.C.G. vaccine. 9.5% developed a positive mantoux. In the third group only one girl developed active tuberculosis.

Hence following the institution of the programme, there was a drop in incidence of tuberculin conversion from 73 to 21 %. The incidence of active tuberculosis dropped from 4.3 to 0.88%. Following the institution of B.C.G. vaccination, the incidence of disease dropped to zero.

(Three Phases of a Tuberculosis Control Programme for Student Nurses: Henry Young: Am. Rev. Tub. (1956) 73 : 6, *June) 1956.*

Does Haemorrhagic Tendency Exist in Patients under Isoniazid-Streptomycin Treatment.—287 unselected cases of pulmonary tuberculosis, who received streptomycin isoniazid were studied.

Streptomycin was given 1 gm. twice weekly (with few exceptions where daily streptomycin was given) and Isoniazid with average of 4 mgm. per kilogram daily.

The duration of treatment varied from three months to as long as two-year and five months, the average duration being ten months.

The clotting time, bleeding time, prothrombin time, platlet count and in 24 patients capillary fragility tests were done. These tests bere done before the beginning of treatment, after 5, 10 and 15 weeks.

Eight per cent of the patients developed haemoptysis or streaking. Of these 5.2% had haemoptic episodes before initiation of treatment 2.8% for the first time.

In these 2.8 % (8 cases), who had haemoptysis for the first time, bleeding could have occurred due to the nature of disease, or could be due to unusual activity, drinking etc. and was not necessarily due to the action of isoniazid. All cases were far advanced, and three had silico-tuberculosis.

In none of the cases under review, there was any tendency for other bleeding such as renal, rectal, etc. In those cases, who had to undergo resectional surgery, thoracoplasty or pneumonolysis, bleeding was normal. The laboratory studies of clotting, bleeding and prothrombin time and of platlet count before and during treatment showed the usual variations within the physiolo- gical limits.

The capillary fragility test was normal in 79.2 percent and increased in 20.8 percent. However, only in 12.5 percent, the increased fragility test had no definite explanation and this cou\d have been due to chemotherapy.

(Does a Haemorrahagic Tendency Exist in Patients under Isoniazid-Streptomycin treatment-C.V. Vishnevsky: Dis. of Chest (1956). *Vol. XXIX, No.* 5).

Cortisone and Chemotherapy in Pulmonary Tuberculosis.—Results of treatment of 19 patients with pulmonary tuberculosis by cortisone alongwith standard chemotherapy are presented with the object:

Firstly: Can cortisone be safely administered to the tuberculous subject alongwith anti-tuberculous drugs.

Secondly: Will cortisone by its lysing and inhibiting effect on granulation tissue bring the tubercle bacilli into more direct contact with the anti-tuberculous drugs and thus enhance chemotherapeutic action.

The main criterion of cortisone administration was a radiological assessment that the disease had been static.

It was given orally for two months in doses of 12.5 mgms. to 100 mgms. daily alongwith chemomotherapy.

The routine observations made were, twice daily rectal temperature and pulse rate, a weekly clinical examination including weight and B.S.R. (Westergren), fortnightly chest x-rays and sputum

examination by direct smear and culture.

There was an early and progressive increase in weight. After stopping cortisone, the gain in weight is maintained

There is prompt and dramatic fail in the B.S.R., but on stopping the drug it returned to its previous level.

Cortisone had little or no effect on the bacteriology of the sputum.

Significant although not dramatic radiological improvement can be expected in over 50 % of the patients. It is helpful in relieving bronchial stenosis primary disease. It has no effect in the indolent infiltration or tuberculomatous lesion.

(Cortisone and Chemotherapy in Pulmonary Tuberculosis: Cochrane J. B. Hislop J. P. Clay son Christopher: Br: J: Tub. (1956) *Vol. L. No.* 3, *July).*

Vaccination Against Tuberculosis in Childhood.—According to the findings of the Medical Research Council about the prophylactic effect of B.C.G. and vole bacillus, if all the previously uninfected adolescents in Britain were vaccinated, the incidence of the disease in young people between the age of 15-17 years and probably upto 19 years might be reduced by about one-half.

Mass investigation in adolescence showed that nearly forty per cent are already tuberculin positive and this being the largest group, in whom tuberculosis can not be prevented, hence it is to be decided whether protection should not be offered at birth.

Unfortunately it is not yet known as to how long the protection afforded by B.C.G. vaccination in infancy will last, nor it is certain, that the degree of protection is the same in young children as it is in adolescents.

he incidence of tuberculous pulmonary lesions in the vaccinated group was about two-fifth of that in the tuberculin negative unvaccinated group at age under 5 compared with one-quarter for those aged 5-9 and 10-14 and one sixth for those aged 15-19 years. According to findings of the Medical Research Council, the protection lasts for at least four years, though according to American enquiry, it has lasted for 10 years.

Hence in children, revaccination would probably be needed.

Local complications after B.C.G. vaccination are more common in infancy. Hence mass vaccination of children at the age of 5 has been recommended for those, who are tuberculin negative as it avoids many of these difficulties, though it would miss the period of maximum risk of tuberculosis meningitis.

Doubts about the length of time protection lasts are not as important as the fact that vaccination has now been proved to prevent tuberculosis. Further revaccination is neither difficult nor dangerous.

(Vaccination Against Tuberculosis in Childhood: Leading Article: Br. Med. J. (1956) *June* 30, 1534).

The Pleural Test as a Simultaneous Tailoring Procedure in Continuation with Pulmonary Resection.—Tailoring of the thorax after pulmonary resection by thoracoplasty was practiced to prevent over distension of the residual lung after resection as it is associated with high exacerbation rate and causes impairment of cardiopulmonary function.

Pleural space which is not filled by pulmonary tissue may cause empyema with or without bronchopleural fistula. A review has been presented of pleural test done in 100 cases.

The advantages of such a procedure over the the others such as thoracoplasty, extra-pleural plombage are :

(a) It can be used alongwith resection without additional shock.

(b) In cases where thoracoplasty cannot be done, because of poor cardiopulmonary reserve.

(c) Accurate fitting of the pleura to the re-expanded lung leads to early and effective closure of pleural space and even over the segments, when pleura is sucked down into them by intra-pleural negative pressure.

(d) The expansion and function of the residual pulmonary tissue can be easily controlled either by injection or aspiration of fluid or air or both.

(e) The integrity of the thoracic cage is maintained, thus there is no scoliosis nor there is mediastinal shift.

(f) There is prompt sealing of pulmonary surface and bronchial stump and hence less chances of empyema and bronchopleural fistula.

Even if the empyema develops, its management is easier by drainage and it is less hazardous than the post-operative intra-pleural empyema.

(The Pleural Test as a Simultaneous Tailoring Procedure in Continuation with Pulmonary Resection Miscall, Laurance; Duffy R. W., Nolan: R B., Klopstock Robert: Am. Rev. Tub. (June 1956), 73 : 6:

A Study of Tuberculous Round Foci.—The significance of tuberculous round foci has been studied in 124 cases.

Of these 98 (79 %) were cases of single round lesion and 26 (21 %) with multiple round lesions.

Of these 41.1 % cases came with symptoms for diagnosis, 10.5% were discovered on contact examination and 48.4% were discovered on routine mass miniature roentgenography.

No statistical difference was found regarding age and sex between the two groups. Of the 98 cases with solitary foci, 49 (50%) had no evidence of disease elsewhere. 21 (21.4%) had associated healed or unhealed disease elsewhere in the lung. 28 (28.6%) had adjacent infiltration.

71 (72.4%) were more than 1 cm. in diameter, 27 (27.6%) were 1 cm. or less in diameter, 73 (74.5%) were homogenous, 25 (25.5%) were heterogenous, 24 (24.5%) showed tubercle bacilli, the rest 74 (75.5%) were negative.

In 31 (31.6%) cases of single round foci, the foci were derived from infiltration and in 8 cases from blocked cavities. In 84 (67.7%) the round foci were present initially.

In the multiple round foci, 18 round foci appeared spontaneously in areas of lung previously unaffected by disease, this being due to tuberculous endarterites occuluding arterioles supplying the involved lung.

There was progression of disease in 20.4 % at some stage. 29 (28.6%) showed progression of disease, who had infiltration adjacent to the round foci, while 19.0% showed progression, who had disease elsewhere and 16.3% showed progression who had no disease at all. Thus there are greater chances of progression in those with adjacent disease around and in those situated in upper zone compared with middle and lower zones.

Greater number of foci regressed or disappeared particularly those who showed breakdown after they were given chemotherapeutic drugs compared with those were not given any chemotherapy. Cases of round foci larger than 1 cm. should be treated with chemotherapy but those less than 1 cm. should be kept under observation. The chemotherapy has to be kept for 6 months to one year.

Even after the chemotherapy, if there is progression of round foci, a further course of chemotherapy should be given.

Surgery should be employed in a small proportion of cases, in whom chemotherapy failed to produce satisfactory healing after breakdown.

Other causes, which lead to round foci *e.g.* bronchogenic, carcinoma, neoplastic metastasis, lung abscess, pneumonia, encapsulated pleural effusion or empyema, cysts, hipoma, gumma, haemengioma, hamartoma, neurofibroma, coccidiodiomycosis.

(A Study of Tuberculous Round Foci: Black. J.M. and Poole Graham: Am. Rev. Tub. (1956) 73: 6).

Liver Biopsy in a Tuberculosis Hospital.—To determine the value of the liver biopsy in a tuberculosis hospital, liver bioposis on 128 patients have been reviewed.

These were done in patients between the age of 15 to 77 years.

In some, biopsy was done fairly early during the treatment, but some had treatment for as long as four months before it was done.

The various biochemical determinations such as a serum albumin globulin tubidometric gamma globulin cholestrol-cepehalin flocculation thymol turbidity and alkaline phosphatase were done.

Histologically the lesions were divided into five categories; (1). Miliary granulomas; (2). Histiocytic nodules, (3). Non specific reactive hepatitis; (4). Amyloid infiltration: and (5). Non-tuberculous lesions.

Tuberculous granulomas in liver tissue mean hematogenous dissemination at least to the liver, but these are not necessarily diagnostic of acute miliary tuberculosis, but are frequently seen in extra-pulmonary tuberculosis and tuberculous pleural effusions.

Such dissemination, if present are not diagnostic but are important for prognosis and therapy in pulmonary tuberculosis, more so in extra-pulmonary forms.

The presence and extent of non specific reactive hepatitis indicates a hepatic reaction to systemic toxicity.

Liver biopsy may be helpful in finding associated diseases such as cirrihosis or hepatitis and it is more helpful in finding out the presence and extent of amyloid deposition than by Congo red test.

(Liver biopsy in a Tuberculosis Hospital, Buckingham W.B.; Turner G.C.; Knapp W.B.; Young Q.D.; Schaffner Fenton; Dis. Chest (1956). *Vol. XXIX, No.* 6).

Bilateral Symmetrical Diffuse Nodular Pulmonary Tuberculosis and Intestinal Tuberculosis.— To assess any possible relationship between the type and distribution of pulmonary tuberculous lesions and the presence of intestinal tuberculosis, an analysis was made of 1,504 patients with active pulmonary tuberculosis admitted to the Trudeau Sanatorium between 1930-1939.

The cases were followed to death or upto year 1953—1954.

All the cases had a routine admission examination with barium motor meal and as such were classified in two additional ways.

1. Presence or absence on admission of bilateral symmetrical nodular shadows on roengenographic examination of the lungs.

2. Presence or absence of roengenographic evidence of intestinal tuberculosis.

Of these 1,504 cases, 67 patients have been excluded because some died from non 'tuberculous causes and some lost contact in less than five years.

Of the 118 patients with intestinal tuberculosis, 19 (16.1 %) were found to have bilateral symmetrical diffuse nodular distribution of pulmonary lesions compared with 1,311 patients without intistinal tuberculosis. Only 25 (1.9%) had pulmonary tuberculosis of this nodular distribution.

Further follow up showed that patients with intestinal tuberculosis fared slightly less favourably than those without complications.

Patients with bilateral symmetrical diffuse nodular pulmonary tuberculosis regardless of co-existence of intestinal tuberculosis fared less well and had poor long term prognosis than those with other forms of pulmonary tuberculosis.

Bilateral symmetrical diffuse nodular pulmonary tuberculosis probably represents a non-miliary haemotogenous dissemination of disease frequently originating from drainage of M. tuberculosis into thoracic duct from a tuberculous infection.

(The Prognosis of Bilateral Symmetrical Diffuse Nodular Pulmonary Tuberculosis and its Possible Relationship of Intestinal Tuberculosis: Mitchell, Rogers. S.: Dis. of Chest (1956) *Vol. XXIX, No.* 6).

Influence of Various Dusts on Reaction of Guineapigs Against B.C.G. Inoculation: I: Inf luence of Quartz Dust.—Silica dust has a tendency to promote the progress of tuberculous lesions in animals. Similarly some investigators have shown that B.C.G. could also produce progressive and fatal pulmonary tuberculosis in guineapigs, which had inhaled quartz dust.

The results of experiments have been presented by combined inoculation of B.C.G. and quartz dust into guineapigs to see how quartz dust influences tuberculous lesions caused by B.C.G. and survival and distribution of B.C.G. in animal bodies and also to see how B.C.G. affects the silicotic lesions.

Sixty healthy guineapigs, which were negative to 1:10 diluted old tuberculin were divided into three groups and received the following subcutaneous inoculation on each side of the abdomen.

Group A: 1 mgm. of B.C.G. culture (16. 6x10 viable units) plus 0.05 gm of quartz dust suspended in 0.5 c. cm. of saline solution.

Croup B: 1 mgm. of B.C.G. culture (16.6 x 10 viable units) suspended in 0.5 c. cm. of saline solution.

Group C: 0.05 gm. of quartz dust suspended in 0.5 cm. of saline solution.

After inoculation, three or four animals in each group were sacrificed and dissected on the 1st day, 3rd day, 1st week, 2nd week, 5th week and 10th week.

Viable units of B.C.G. in the injection site, regional lymphnodes, portal lymphnodes, lung, liver and spleen were counted by quantitative cultivation and histological examination of these organs.

Results: Existence and distribution of B.C.G. in the injection site and internal organs.

1. Guineapigs of groups A showed large number of viable units of B.C.G. in the injection site for a fairly long period of time than those of Group B, which received B.C.G. alone.

2. Guineapigs of Group B showed large number of B.C.G. units in the regional lymphnodes, portal lymphnodes, lung, liver and spleen on the first day and thereafter sudden decrease except in regional lymphnodes.

3. Animal of Group A, which received B.C.G. together with quartz dust showed a few viable units of B.C.G. except in the injection site on the first day after inoculation and no organism was found in portal lymphnodes spleen and lung.

2. *Results of Tuberculin Test*

(a) Animals of Group C, which received quartz dust alone showed a negative reaction.

(b) Animals of Group A, were converted to positive earlier and stronger than those of Group B.

Histological Findings

1. Animals in group A and C showed a stronger swelling at the injection site, and even in some abscess formed in group A and it drained out five weeks following inoculation.

2. Histological findings on the specimens from group C were the same as those observed in the reaction caused by the intra-peritoneal injection of quartz dust, infiltration of polymorphonuclear leucocytis around aggregate of quartz dus*. Infiltration of polymorphonuclear leucocytes

around aggregate of quartz dust was seen at the beginning, but the nuclei of leucocytes were destroyed rapidly.

3. Fundamental mode of reaction was same in Groups A and C, but animals of Group A showed stronger infiltration of polymorphonuclear leucocytes than those of group C and formation of giant cell was less active.

(Influence of Various Dusts on Reactions of Guineapigs Against B.C.G. Inoculation: h Influence of Quartz Dust. Someyer; Shri; Kusama, Hideo; Sakabe, Hiroyuki; Ohi, Testsuo; Annual Rep: Japanese: Asso: Tuber. (1956) *April).*

II. Influence of Alumina Diatomaceous Earth. Acid Clay and Titanium Dioxide Dust.—Results ofvexperiments done after inoculation of B.C.G. combined with one of such inorganic substance as alumina, diatomaceous earth, acid clay and titanium dioxide to show whether it gives rise to similar reactions as observed in a combined inoculation of B.C.G. and quartz dust are presented.

For each dust five male guineapigs weighing about 300 gms. were inoculated subcutaneously into one side of the abdomen with 0.5 cm. of saline solution containing 2. gm. of the dust and 1 mgm. of B.C.G. culture (11.9x10 viable units) and on the other side of abdomen with 0.5 c.cm. of saline solution containing the same amount of dust alone.

An additional group of five guineapigs was inoculated with 1 mgm. of B.C.G. culture as the control.

Similar observation following inoculation such as body weight, tuberculin test with 1 : 10 or 1 : 100 diluted old tuberculin and changes in the injection site and regional lymphnodes were made every week. At the end of fifth week, all the animals were sacrificed.

1. *Changes Observed at the Site oj Injection*

No changes were seen in the B.C.G. group, while group which got acid clay showed a strong reaction, while titanium oxide did not show any reaction as it is but a very strong reaction when combined with B.C.G.

Results of Tuberculin Test

All showed an earlier and stronger development of tuberculin sensitivity than those in control group given B.C.G.

Histological Findings

In the injection site, when B.C.G. and each of the four dusts were introduced intense abscess formation, which soon drained outside were observed.

(Influence of Various Dusts on Reactions of Guineapigs Against B.C.G. Inoculation. II. Influence of Alumina Diatomaceous Earth, Acid Clay and Titanium Diaoxide Dust, So-Meya, Shri; Hayashi; Samu; Kusama, Hido; Sakabe; Hiroyuki and Ohi Tetsuo : Ann; Rep. Jap. Asso. For Tub. 1956 *April).*

Ill: Reactions of Guineapigs Inoculated with Titanium Diaoxide and Dead B.C.G.—Results about the ability of various dusts when, combined with dead B.C.G. organism are presented.

Animals were divided into three goups:

Group A: had subcutaneous inoculation of 0.5 c.cm. of saline suspension containing 20 mgm. of titanium dioxide dust.

Group B. 0.5 c.cm. of saline suspension containing 10 mgm. of dead B.C.G.

Group C: 0.05 c.cm. of saline suspension containing 20 mgm of titanium dioxide and 10 mgm. of dead B.C.G. Organism.

Animals were tested for their tuberculin sensitivity with 1 : 10 old tuberculin after 16, 23, and 33 days of inoculation. The reaction was read 24 hours after inoculation. One guineapig in each group at 53 days was sacrificed.

1. Abscess formation was observed only at site of inoculation in group C which received inoculation of titaneceous diaoxide dust plus dead B.C.G.

2. Group C developed tuberculin sensitivity, which appeared earlier and more intense than in group B.

Histological examination in group B given dead B.C.G. showed haemorragic reaction degeneration and necrosis and less degree of infiltration with polymorphonuclear leucocytic infiltration.

In group A inoculated with titaneceous diaoxide, local reaction was slight with slight proliferation of mononuclear cells and giant cells.

In group C inoculated with titanium oxide and dead B.C.G. showed strong hemorrhage and remarkable poly-morphonuclear leucocytic infiltration. Hence simultaneous inoculation of insoluble dust and B.C.G. given subcutaneously into guineapigs developed extensive necrosis at the site of injection.

(Influence of Various Dusts on Reaction of Guineapigs Against B.C.G. Inoculation. HI: Reaction of Guineapigs Inoculated with Titanium Diaoxide Dust Over Dead B.C.G. Sakabe, Hiroyuki; Naka Ganda, Masura; Soneya, Shri, Hayashi, Osanin; Amm: Rep: Jap: Ass: For Tuber. (1956) *No.* 1: *April).*