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OUTLINE OF A DISTRICT TUBERCULOSIS PROGRAMME*

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INTRODUCTION

The present paper outlines the organization of rural tuberculosis control within the framework of the National Tuberculosis Programme. As such it does not deal only with the problem of bringing relief to individual patients' suffering, but with an attempt at controlling tuberculosis as a communicable disease in the social context of today's India. By tuberculosis control is meant the reduction, over a span of years, of the problem of tuberculosis, as expressed by the prevalence of the disease. A reasonable target for control might be a 50 per cent reduction in prevalence of excretors of tubercle bacilli over a period of 20 years. How far the suggested programme may lead to control in the above terms would have to be assessed by use of epidemiological-mathematical methods.

In defining the organizational approach to rural control one has to consider the medical aspects of the programme against the background of the socio-economic development of the country, and to strike a balance between what is technically desirable and what is operationally (including financially) feasible. The programme is conceived in successive developmental stages, each of them in harmony with the other developmental activities under way in the rural areas (under the Community Development Scheme). Stress is laid on the organization, throughout the District, of drug distribution and treatment follow-up agencies as the first and foremost responsibility of the programme; it is argued that the awareness of TB as observed today in individuals and in the community provides an adequate basis for case-finding, if all the rural medical facilities, hither-to unused, are put to contribution. Immediate, general use of microscopy as a diagnostic tool is emphasized; X-ray referral is considered a subsequent development. The important elements of the plan are thought to be (*a*) the highest possible degree of integration of the tuberculosis programme into the general public health services (especially the Primary Health Units) and (*b*) the maximum participation of the local Government (Panchayats) and of the Community Development Department. This implies a changed pattern in the tuberculosis specialists' field of action from the clinical level to essentially advisory, co-ordinating and supervisory functions.

FACTS AND FIGURES ABOUT THE DISTRICT

The present outline is drawn with an average Indian district in mind. The programme defined below is dealing with a population of 12 lakhs, of which at least 10 lakhs live in some 2000 villages.

The National Sample Survey has shown that the prevalence of tuberculosis as defined by the proportion of radiologically active on the one hand, and of bacteriologically confirmed on the other hand, average 1.8 per cent and 0.4 per cent respectively. This is the best estimate of the prevalence of tuberculosis in any Indian district. Based on these prevalence figures, the caseload in a district may be estimated to be at least 20,000 radiologically active cases, of whom nearly 5000 are confirmed bacteriologically *at any point of time*. Of these, over 80 per cent are to be found in the district's villages, another 5-10 per cent in the district headquarters town and the rest in taluk headquarters.

The rate at which new cases occur is not known but the yearly incidence could be estimated to be in the order of 1/5 of the total existing at one point of time. This would mean that over 4000 new radiological cases occur every year of whom nearly 1000 would be confirmed bacteriologically.

The facilities available in the District

Most districts are in a fairly advanced stage of development under the National Extension Scheme: the figure of 8-10 blocks already available in 1961 would be representative of most districts. This number is to be increased during the Third Five Year Plan, thus bringing every district to full development stage within

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1965. It may be estimated therefore that at present 10 Primary Health Units are available and that this number will increase to the ultimate target of 16-18 within the forthcoming years.

Prior to the National Extension Scheme, health services had been developed on the basis of taluks/tehsils. The present day districts run on an average 10 taluk/tehsils hospitals and a District headquarters' hospital, frequently with a limited number of TB beds attached. Taking rural dispensaries into account there are often 30 medical institutions with a M.O. in attendance.

The tuberculosis centre envisaged under the National Tuberculosis Programme is now added to these facilities. Its buildings, staff and equipment pattern have been defined in the Second Five Year Plan as follows:

Staff:

Coordinating Unit

1 Director, Senior Medical Officer
1 Senior Clerk
1 Statistical Clerk

Diagnostic Unit

1 Assistant Medical Officer
1 X-ray Technician
2 Laboratory Technicians

Treatment Unit

1 Supervisor of Treatment Organization
3 Home Visitors (Treatment Organizers)
1 Dispenser
1 Driver

Equipment

1 X-ray unit (transportable type but, at present, without generator or vehicle)
1 Laboratory equipment (Microscopy only)
2 Tuberculin testing and BCG vaccination kits
1 Motorized tricycle
1 Regular motorcycle
1 Public address unit

Finally, one BCG team consisting of 6 technicians and of one non-medical supervisor with equipment and transport are now being stationed in each district in connection with the National Tuberculosis Programme.

The total facilities thus available today to deal with the tuberculosis problem as defined above are therefore some 30 non-specialised agencies which so far have not dealt with tuberculosis, and one specialised agency viz., the TB centre now being implemented, to which TB beds, if any, and BCG teams will be attached.

The Treatment of Tuberculosis

The number of persons to be catered for at any point of time has to be judged from that proportion of the existing caseload that are known to seek medical relief at present plus that proportion that would do so if facilities were available. The sociological studies conducted at the National Tuberculosis Institute indicate that *at present* 1/3 of the radiologically active cases (including one half of those confirmed on smear) take action under the pressure of symptoms: they receive mostly symptomatic treatment; furthermore, another 1/3 of the radiologically active (including an additional quarter of the bacteriologically confirmed) are sufficiently motivated by their symptoms to seek advice, but do not come into contact with medical facilities. In absolute figures this means that in a district over 2500 bacteriologically active cases of TB can—and must—be dealt with immediately. Another 1250 only require information about the developing facilities to seek their services. This puts the immediate yearly target of a district programme at a caseload of 3750 symptomatic infectious patients. As the programme adequately deals with these the yearly target will not change substantially in size, but the composition of the symptomatic group would gradually change until it reflects closely the overall ratio of 1/5 between bacteriological and radiological cases. Of course at all times some patients will seek treatment outside Government agencies, and, if given adequate therapy, will reduce the target caseload.

The size of the patients' population to be catered for makes it mandatory that treatment of tuberculosis should be based on self-administration of drug. The two major implications of such treatment are: (*a*) the constant supply of drug by the Health Services and (*b*) the regular intake of drug by the patients.

(*a*) Since rural TB *control* is the objective the supply of the drugs required is essentially the government's responsibility. The distribution of the drugs to the patients is the responsibility of all existing health facilities;

the allocation of drugs to the existing health facilities (P.H.U.s and taluk hospitals) is the responsibility of the Medical Officer of the District Tuberculosis Centre.

(*b*) The regular intake of drug by the patient, comprising monthly drug collection and daily drug consumption for one full year, is the most important aspect of the whole programme. This can only be achieved if the general health and medical staff, guided by the district TB centre, record and supervise the patients' drug consumption and enlist the co-operation of such non-medical agencies as Community Development and Gram Panchayats for the purpose of retrieving treatment defaulters.

The Drugs

It has been well established that in the treatment of tuberculosis, combined therapy is more efficient in converting sputum and in reducing the risk of resistance. However, considering that all patients coming forward must not be denied treatment—in any year, their number could be several thousands—the choice of the drugs is to be made after due reference to the cost and other operational factors.

Any treatment schedule should, in any case, include INH. Of the 5,000 infectious cases in a district, 2,500 being aware of the disease, may come forward in the course of any year: The cost of INH alone for these patients would amount to Rs 20,000. A further group of radiologically diagnosed cases would presumably be given INH to the tune of Rs 15,000 in addition, making Rs 35,000. Combined Therapy: Addition of the, at present, only drug available for self administration to all sputum positive (PAS) would increase this cost by 550 per cent to Rs 235,000 In order, therefore, to provide treatment only to those who may come forward for it all the money budgeted for anti-tuberculosis drugs for each centre in the Third Five Year Plan must be, of necessity, spent on INH. Funds for an additional drug could be sought from other sources—through reallocation of unspent balances—or through an increase in budget, but the cost of a programme based on combined therapy, however desirable, remains today prohibitive, unless another cheap, effective oral drug becomes available as a companion drug. In this connection it is to be hoped that the association INH-TSC (Thiosemicarbzone), which has shown very promising results in a B.M.R.C. trial in Africa and is now under trial at the Madras Chemotherapy Centre, will prove suitable under Indian conditions. Such association would appear to achieve all the advantages of PAS-INH over INH alone in terms of sputum conversion (90 per cent vs 60 per cent) and of emergence of resistant strains (8 per cent vs 32 per cent) at a cost not exceeding one and a half times that of INH alone. In order to prepare for this eventuality an adequate treatment organisation capable of ensuring in 2,000 villages a high proportion of completed treatment has to be evolved—and this cannot be done without at least the first drug.

DIAGNOSIS OF TUBERCULOSIS

The above philosophy of treatment has been based on the knowledge that as much as 1/3 of the existing patients are actually taking action on their own initiative and that another 1/3 of the existing caseload would do so as soon as means of diagnosis are made available to them. The implication of this knowledge with respect to case finding is that the Health Services, whether specialised or general, must be enabled to cope with this load within the available means. Obviously the classical TB clinic approach cannot do it alone.

Diagnosis by General Health Services

Every primary health unit that qualifies for international assistance receives, amongst others, one microscope. Taluk hospitals commonly also possess one. The other health facilities that are found capable of dealing with the treatment of tuberculosis could be given a microscope within the framework of the present Tuberculosis District Programme. This means that in the district, the use of a microscope for diagnosis of tuberculosis can rapidly be expanded to cover the entire district area. Of the above mentioned facilities, the primary health unit is the most promising one, as it has its own ramifications in the village in the form of M.C.W. centres, weekly clinics, rural dispensaries and so on. In these places sputum can be collected for further processing at the P.H.U. itself by regular primary health unit staff (specially trained for the purpose by the TB centre personnel). When 10 taluk hospitals and 10 P.H.U s-with their 50 sub-centres of any kinds—are all contributing to bacteriological diagnosis of tuberculosis, one may expect that the entire portion of those cases who were

stated above to take action spontaneously would be dealt with on a continuous basis. This would be made possible merely by bringing the diagnostic facility (sputum collection centre or sputum examination centre) within a few miles from any village.

As the pool of such cases gets diagnosed, an increasing proportion of symptomatic persons may not be found bacteriologically positive. This justifies the introduction of referral procedures as the second development stage of the diagnostic facilities in the district. Where the only X-ray plant is situated at the district centre, such referral must naturally be made to the centre. Where other X-ray facilities exist (such as screening plants in taluk hospitals), those facilities would naturally become of use for referring bacteriologically inactive, symptomatic cases. In the eventuality that a transportable X-ray unit is made available instead of a static one, the organization of referral can be based on all taluk hospitals periodically (fortnightly) thus making the development of the programme even in all its area.

Where referral facilities at the taluk level are not available and in the case of sputum negative persons who are beyond doubt genuine cases of tuberculosis from the clinical and history data, diagnosis should be made on this basis alone, especially in case of indigent patients who cannot afford the bus fares involved in referral to the District Centre.

Diagnosis of Tuberculosis at the District Centre

Whether patients report by themselves from the district headquarters town or elsewhere, or whether they are referred for further examination by peripheral units, the diagnosis of tuberculosis rests on the classical association of the tuberculin test, the X-ray and sputum examination, often qualified by clinical examination. The tuberculin test serves the purpose of pre-vaccination test for contacts in addition to qualifying the type of radiological picture in some cases. The miniature X-ray picture defines the type of pathology and helps forecasting the probability of its being active tuberculosis. The sputum examination by direct smear (for all cases with X-ray pathology likely to be active tuberculosis and those others in whom history and clinical investigation cast a doubt on the radiological diagnosis) would essentially serve the purpose of allocating patients to various types of treatment; in the absence of a second drug, it would be justified for the purpose of assessment of treatment results.

With such diagnostic means available at the district centre 50 per cent of the infectious caseload in district headquarters town may have been diagnosed within a few months from starting of operations. In addition, a small fraction of cases belonging to the periphery would also be diagnosed there.

BCG Vaccination

The posting of the BCG team with the district tuberculosis programme will achieve the desirable objective of integrating the preventive and curative aspects of tuberculosis control. It also achieves a certain amount of administrative integration. On the other hand the policies prevailing in respect of the mass BCG campaign conducted in the First and Second Plans should remain basically unaltered. The BCG teams would operate with a view to cover systematically the entire district. Areas should be taken up in the same sequence as in the previous campaign(s). Work should be confined to age-group 0-39, with a view to achieve a maximum coverage. For this purpose some technical changes are needed: systematic house to house registration of individuals is essential; otherwise tuberculin test is given as usual to all under 40 and BCG vaccination to all reacting with 10 mm. and less.

Where the BCG campaign goes on, the BCG team may provide a useful additional function namely that of questioning adults for the possible presence of symptoms and of referring the symptomatics to the nearest diagnostic facility (P.H.U. or taluk hospital).

Co-ordination of the District TB Programme

The co-ordination of the entire scheme rests in the hands of the medical officer in charge of the district centre with the assistance of the district medical officer and district health officer in their respective fields. At the planning stage the medical officer in charge of the district TB programme submits his development plan through D M.O./D.H O. to A D M S. (TB) for approval. At the implementation stage the medical officer deploys the technical staff under his supervision for training the non-specialised personnel in P.H.U.s and

taluk hospitals in their respective techniques (microscopy, treatment organization). Together with the D.M.O. and D.H.O., he initiates the various stages in the selected block areas or taluks. This should always be presented as a normal responsibility of the general health services, not as a specialised programme. For ensuring mass support, especially in connection with the treatment aspect, the medical officer of the Centre, together with the medical officer of the P.H.U. or Taluk Hospital always establish contact with the Panchayat Samitis and Block Development Department with a view to using Gram Sevaks and Panchayat Members as the essential communication channels between the general public on the one hand and the P.H.U., the Taluk Hospitals and the TB Centre on the other hand (for publicity as well as for treatment follow-up).

Proper co-ordination of the scheme implies the continuous assessment of its achievement. This is done by means of a district case register maintained at the TB centre, in which all newly found cases from the beginning of operations are entered. At regular intervals the case register—which is based on the village as a geographical unit—will be used for establishing the proportion of the estimated caseload dealt with.

Timing

The whole process of expanding anti-tuberculosis facilities throughout the district may take 1-2 years. The timing of the expansion essentially depends on what facilities are available at the onset of the programme and on the pace of development of suitable new ones. The general principle implied in the above chapters viz., 'that it is not justified to diagnose cases before a proper organization exists that is capable of ensuring the continuation of their treatment for one full year in the vast majority of cases', should determine the general trend of development.

In the first phase presumably lasting 2-3 months, the District Centre is established and the District Programme planned; Treatment facilities are also established.

The Medical Officer and his staff conduct a complete survey of existing health and development facilities in the district, and draw comprehensive maps of each area covered by such facilities. In the course of the survey, the programme is explained and a detailed account of the methods applied is given to all health and development units. The Medical Officer and Health visitors prepare a priority scheme for implementation of the expansion of services on the basis of the best utilisation of the available means (personnel and equipment) as found in the survey.

The treatment organization section of the district centre is then built up with a view to being able to conduct treatment operations (drug procurement, drug distribution and defaulter follow-up system operating anywhere in the district) P.H.U.s or taluk hospitals are encouraged to treat cases of TB coming to their knowledge. Treatment facilities (drug and briefing of staff) are provided to such units notifying cases. Treatment Organizers are deputed to brief their local counterparts and initiate action.

In the second phase, the case finding activities are started both at the periphery and in the headquarters' clinic.

The district centres' laboratory is built up and geared to process material from various sources, and to train non-specialised personnel in the peripheral unit. Such peripheral units which satisfy to treatment requirements should be given first priority for sputum case finding: Lab technicians are deputed there to initiate action and train their local counterparts.

The X-ray department of the district centre is then established and geared to cater to peripheral patients as well as to local ones. The organization of referral to X-ray from the periphery, and the feed back of information to the periphery is expanded as peripheral units demonstrate their efficiency in sputum case finding. Simultaneously, with the completion of the X-ray department, the district headquarters clinic is also ready to function.

Lastly, as cases are diagnosed and put under treatment, the system for notification from the peripheral units is developed and the district register is built up. The development of the register completes the building up of a District Tuberculosis Centre fit to deal with the Tuberculosis problem in the District.

Assessment of the Programme

The achievement of an applied programme such as the one outlined above depends on the technical efficiency of its tools and on the operational efficiency of its methods. The technical efficiency of the tools (for instance

the sputum conversion achieved by domiciliary chemotherapy, or the protection achieved by BCG vaccination etc.) has been estimated in clinical trials of the highest quality. It follows therefore that not much effort need be spent in the programme on technical assessment of results in individuals, because the mere observation would not often lead to any feasible corrective action. On the other hand the operational factors involved in the programme are far less known but probably many times more relevant to control work; health workers are familiar with the critical coverage required for making a vaccination campaign epidemiologically successful; clinicians appreciate the importance of regularity and continuity of drug intake for the sterilization of infection. The assessment of the programme must therefore be concerned with measuring these operational factors as often as these observations can lead to some corrective action. The reporting procedures, though simple must lay stress on output and coverage, the most important of all being the proportion of cases completing treatment. Outputs and coverages are compared, at every step in each area with the estimated caseload, and this comparison indicates the type of action required to improve the achievement. The district register should not merely record the cases found, their relapses and deaths, but should accumulate operational information in addition to social and epidemiological factors, as so to make long term adjustments of the programme possible.

As for the assessment of the ability of the programme to achieve a problem reduction, it is unfortunate that no direct observation method is at present feasible to measure such achievement. The present techniques of longitudinal survey cannot, within reasonable running costs, demonstrate *trends* in prevalence of disease. The only alternative is to calculate reasonable estimates of the achievement of the programme by making use of all the available data: Given the initial prevalence of disease, the coverage of the estimated caseload in terms of completed treatment and the technical efficiency of the drugs used, it is possible to estimate fairly accurately the long term reduction in number of cases achieved by the programme.

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EPIDEMIOLOGY

TUBERCULIN SENSITIVITY IN YOUNG CHILDREN (0-4 YEARS) AS AN INDEX OF TUBERCULOSIS IN THE COMMUNITY

Bordia N.L., Geser A., Mclary J., Mundt I. & Kul Bhushan

The purpose of this study was to find out whether the prevalence of infection in young children might be used as an index of the tuberculosis problem in a population. Tuberculin testing was done in a random sample of 2,883 children (0-4 years) in Bangalore city and 2,589 of nearby villages. Tuberculin test reading was done in over 90% of the sample.

The results of the study showed that prevalence of infection in 0-4 years age group of cantonment area was 1.6% and that in the crowded city area was 4.1% at 14 mm induration level. In the rural population the prevalence of tuberculosis infection was 2%. In the city, a positive correlation between tuberculosis infection and socio-economic condition was obtained while it was not seen in rural area. It was not possible to establish any correlation between tuberculosis disease and infection either in rural or urban area - as the population was not examined for the prevalence of tuberculosis disease.

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RESURVEY OF 15 VILLAGES FROM THE MADANAPALLE ZONE OF THE NATIONAL SAMPLE SURVEY ON TUBERCULOSIS

Raj Narain, Jambunathan M.V. & Subramanian M.

A study was undertaken with the following objectives:

1) To estimate the proportion of population that would be available for resurvey after 5 years

2) To ascertain five years later the fate of persons with X-ray pathology.

3) To compare the prevalence of tuberculosis in the villages at an interval of 5 years.

Population of 15 of the 31 villages from the Madanapalle zone, was selected for this study. About 9,500 persons were registered and 7,200 were x-rayed at the initial survey. Five years later the same population was re-x-rayed. Sputa were collected from persons with abnormal X-ray shadows interpreted as such by either of the two readers. Two spot samples were collected within 1-3 days of each other and were examined by direct smear and by culture. Analysis of the data showed that:

1) Nearly 70% were available for examination after 5 years.

2) There was no significant difference in the prevalence rates at the two points of time.

3) During the interval, 30% of active cases had died and 20% were still active at the end of 5 years

4) There was almost a complete turn over of the bacillary cases during the 5 year interval.

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LIMITATIONS OF SINGLE PICTURE INTERPRETATION IN MASS RADIOGRAPHY

Raj Narain & Subramanian M.

Surveys with MMR remains one of the most important methods available for measuring the size and extent of tuberculosis problem in developing countries. Its value in case-finding programmes is well recognised. Nevertheless mass miniature radiography with a single picture of the chest has a fiarly wide margin of error owing to the intra and inter-individual differences in x-ray reading. A study was undertaken to know the errors involved by repeating an x-ray picture after an interval of 3 to 4 months and judging the first picture in the light of a comparative reading of the two pictures. It is postulated that two pictures taken at an interval may afford better judgement regarding the assessment of a case than a single picture only. A total of 8,000 persons were registered, 5,300 of them were x-rayed and re-read by two readers. Photofluorograms were repeated after three and a half months after the first picture. At the time of repeat x-ray, a spot sample of sputum was collected from persons with abnormal shadows. Briefly the findings of the study were:

1) About 20% of bacillary cases were among those with inactive or non-tubercular shadows on the basis of a single x-ray film.

2) Inter-individual agreement for x-ray active cases was of the order of 50%.

3) Intra-individual agreement for x-ray active cases was 52% and 69% for the two readers.

4) Mass miniature radiography with a single film, inspite of its inherent limitations is the best available method both for surveys as well as for case-finding programmes due to its ability to find cases as well as potential cases in a short time.

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SOME ASPECTS OF A TUBERCULOSIS PREVALENCE SURVEY IN A SOUTH INDIAN DISTRICT

Raj Narain, Ceasar A, Jambunathan M.V., & Subramanian M.

The objective was to establish the prevalence rates for tuberculosis infection, radiological evidence suggestive of pulmonary tuberculosis ("radiologically active disease") and bacteriologically confirmed disease for different age and sex groups.

Tumkur District in Mysore State consists of 2,392 villages, 10 towns and the district headquarters town of Tumkur. A district headquarter town Tumkur was excluded from the survey. Random sample of 62 villages and 4 town blocks having a population of 34,746 person constituted the study population. All the individuals available in the registered population were given a Mantoux test with 1 TU PT 23 with Tween 80. Longitudinal diameter of induration was read 3-4 days after the test. At the time of tuberculin test, all persons aged 10 years and above were offered a single 70 mm photofluorogram. For each picture read as abnormal including those with non-tubercular pathology and for each technically inadequate picture where the x-ray exam could not be repeated, a "spot specimen of sputum" of the individual concerned was collected at the time of reading the tuberculin test. Various parameters concerning the prevalence of infection and disease in the community were reported. Age and sex distribution of infection and disease were studied.

Prevalence of infection in all ages and both sexes was found to be 38.3%, radiologically active tubercular disease was in 1.86% of the population and 0.41% had sputum positive disease. The infection and disease increased with age; of the total disease half were in age group 40 years and more and about 2/3 among males.

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A COMPARISON OF THE RELATIVE VALUE OF SINGLE AND DOUBLE PICTURE TECHNIQUES IN TUBERCULOSIS PREVALENCE SURVEYS

Raj Narain, Nair S.S., & Chandrasekhar P.

Limitations of a single x-ray picture for locating and interpreting shadows in the chest had been studied earlier. In order to reduce these limitations, it was suggested that two picture of each person be taken where the second picture was to be taken after a vertical displacement of x-ray tube, up or down by about 4 to 5 cms. The advantages of taking two pictures simultaneously as compared to a single picture have not been studied systematically.

Two mobile x-ray units each with an odelca camera were alternated for the single

and double picture examinations. A total of about 2,000 persons were x-rayed and were read independently by 3 readers. A spot sample of sputum was collected 3-4 days later from persons with abnormal x-ray shadows and was examined by direct smear microscopy.

Comparison of the readings of the two sets of picture did not show a better agreement between different (inter-individual) readers or between two different readings of the same reader (intra-individual) when the two picture technique was used. The x-ray cases detected by double picture only by any one reader were not confirmed, more often than those detected by single picture only. The x-ray pictures of the bacillary cases were also, not interpreted more often as due to active tuberculosis by the two picture technique. It was concluded that the double picture technique does not offer any advantage over the single picture technique.

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PROBLEMS CONNECTED WITH THE ESTIMATION OF THE INCIDENCE OF TUBERCULOSIS INFECTION

Raj Narain, Nari S.S., Chandrasekhar P. & Ramanatha Rao G.

The incidence of new infection with mycobacterium tuberculosis is an index of the risk of infection to which a community is exposed. An accurate estimation of incidence rates is of considerable importance in understanding the epidemiology of tuberculosis and in organising control measures. Various methods have been adopted for the estimation of incidence of infection, indirectly from the age-specific prevalence rates of infection by Bogen (1957), Frimodt Moller (1960) and Raj Narain et al (1963). The incidence rate of infection can also be estimated directly by repeating tuberculin test at two points of time. This however, has the disadvantage that the reaction obtained at the second test tends to be high, mainly due to the boosting effect of the earlier test.

The present study is based on a survey of a random sample of 134 villages. No previous testing or BCG vaccination had been carried out in the area, but each person was examined for BCG scars in order to exclude persons vaccinated probably from other areas. After a complete census, a Mantoux test with I TU of PPD RT 23 plus Tween 80 was given on two occasions (Round I and II). Those with reaction of 13 mm or less at Round I were offered a test with 20 TU with Tween within a week of I TU test. The interval between the rounds was about 18 months. From the analysis of the data from the first 50 villages for which complete information for both rounds was available, it was seen that there was a general increase in the size of reactions elicited in the second round.

The data was also used to study variations in the technique of testing and reading. It was estimated that on an average inter and intra reader variations between the rounds were unlikely to exceed ± 6 mm in more than 5% of the observations. The reading errors and an equal chance of being positive or negative,

except at the extreme ends of the distribution, where zero readings at Round I could only show an increase, and the very large reactions had a greater chance of showing only a decrease at a subsequent round. The main study concerns the problem of estimating the incidence of tuberculous infection in a community. Calculations based on age-specific prevalence rates or on rates of tuberculin conversion are both subject to gross error, leading to unreliable epidemiological conclusions. For estimating the newly infected, a new approach has been suggested based on the drawing of a curve for the distribution of differences in reaction size from one round of tuberculin testing to another. It is assumed that if new infection causes a distinct rise in the degree of tuberculin sensitivity which is greater than the combined rise due to enhancement and reader variation, the distribution of difference between the rounds should indicate the newly infected, and the method used to identify the newly infected group has been described in detail.

It is shown that the newly infected probably constitute a homogenous group with an increase in mean reaction size of about 24 mm and standard deviation of 4 mm. Accordingly, 98% of the newly infected show an increase in reaction size of I6 mm or more. There are others who show similarly large increases in allergy on a retest, even in the absence of infection.

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ENHANCING OF TUBERCULIN ALLERGY BY PREVIOUS TUBERCULIN TESTS

Raj Narain, Nair S.S., Ramanatha Rao G., Chandrasekhar P. & Pyarelal

Tuberculin tests repeated after an interval of time, at a different site have been reported to elicit larger reactions than the first test. Magnus and Edwards (I955) suggested that intradermal testing in school children every year may prevent waning of BCG induced allergy. Magnus (I957) found that waning of allergy in BCG vaccinated guinea pigs can be substantially enhanced by an intradermal injection of PPD in a dose of 5 TU or more and by old tuberculin in a dose of I TU. Kul Bhushan (I958-59) studied this phenomena among the vaccinated and unvaccinated tuberculin positive and negative school children and reported enhancing of allergy among the negative vaccinated.

A study was undertaken where reactors of I3 mm or less to I TU have been tested with 20 TU for the study of low grade reactions. Study was carried out in a previously untested and unvaccinated rural population (Longitudinal Survey) where only about 25% of the population showed I4 mm or more to I TU and the remaining about 60% showed I0 mm or larger reactions to 20 TU. These results confirm the high prevalence of non-specific allergy in the area. It was found that a tuberculin test does enhance the allergy elicited by a subsequent test. The enhancing effect is associated with the initial allergy i.e., 8-I3 mm to I TU tuberculin, especially those elicited by a 20 TU test, increase being almost confined to those with I0 mm and large reactions to 20 TU. The enhancing effect increases with increase in age especially among those with I0 mm or

bigger reactions to 20 TU. It is possible that the enhancing effect is more in communities with high prevalence of non-specific allergy.

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DISTRIBUTION OF TUBERCULOUS INFECTION AND DISEASE AMONG HOUSEHOLDS IN A RURAL COMMUNITY

Raj Narain, Nair S.S., Ramanatha Rao G. & Chandrasekhar P.

Studies on the distribution of tuberculous infection and disease in households have mostly been restricted to the examination of contacts of known cases. Clinical experience has lead to a strong belief that tuberculosis is a family disease and contact examination is a "must" for case-finding programmes. A representative picture of the distribution of infection and disease in households can be obtained only from a tuberculosis prevalence survey.

This paper reports such an investigation, based on a prevalence survey in a rural community in South India. The survey techniques and study population have been described in an earlier report, briefly, the *defacto* population was given a tuberculin test with I TU of PPD RT 23 with Tween 80 and those aged I0 years and over were examined by 70 mm photofluorography. All the x-ray pictures were read by two independent readers. Those with any abnormal shadows by either of the two readers were eligible for examination of a single spot specimen of sputum by direct smear and by culture. The *defacto* population numbered 29,8I3 and tuberculin test results are available for 27,II5. After excluding BCG scars, the study population of 24,474 was distributed over 5,266 households which were further classified as bacillary case household with atleast one bacteriologically confirmed case, x-ray case household with at least one radiologically active case but with no bacillary cases and 'non-case household' with neither a bacillary nor an x-ray case. Total bacillary cases were 77 and were distributed in 75 households, 74 households had one case each and one household had 3 bacillary cases.

The findings of the study have thrown considerable doubt on the usefulness of contact examination in tuberculosis control. (I) over 80% of the total number of infected persons, in any age group, occurred in households without cases, (2) cases of tuberculosis occurred mostly singly in households, and the chance of finding an additional case by contact examination in the same household is extremely small, (3) a common belief has been that prevalence of infection in children in 0-4 age group is a good index of disease in households; but if this study a large population of households with cases of tuberculosis had no children in this age group, (4) in houses with bacteriologically confirmed case only I2% of the children showed evidence of infection, a possible explanation of such a low intensity of infection could be that there is resistance to infection. It is well known that some children even after repeated BCG vaccination do not become tuberculin positive. It is felt that a large number of children

? a matter of belief / interpretation
over pre-existing beliefs / influence diff. interpretations of the same data set by diff. people

do inhale tubercle bacilli, but a primary complex does not develop or even if it develops, the children remain tuberculin negative. Heaf (1957) stated that some children do get infected, but do not show evidence of infection. A hypothesis has been made out that in addition to resistance to infection, there is something known as "resistance to disease". Otherwise, it is difficult to explain why under conditions of heavy exposure to infection, only some individuals develop evidence of infection and very few develop disease thereafter. It is possible to test this hypothesis from the results of the longitudinal survey (Repeat Survey). If the results show that the incidence of new infection in "case" household is not higher than in non-case households, inspite of the higher risk, the hypothesis will be confirmed.

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PROBLEMS IN DEFINING A "CASE" OF PULMONARY TUBERCULOSIS IN PREVALENCE SURVEYS

Raj Narain, Nair S.S., Naganna K., Chandrasekhar P. Ramanatha Rao G. & Pyarelal

There is generally no acceptable definition of the term "case of pulmonary tuberculosis", although such a definition is of fundamental importance both in clinical medicine where results of various chemotherapeutic regimens are compared, as well as in the comparison of different epidemiological data. The main purpose of this paper is to focus attention on the difficulties of defining a case on the basis of bacteriological examination, x-ray examination and tuberculin test. Data from two successive prevalence surveys in a random sample of 134 villages with a population of 70,000 have been utilised to illustrate some of the difficulties in defining a "case" of pulmonary tuberculosis for reporting the prevalence or incidence of the disease. The entire population was tuberculin tested with I TU RT 23 with Tween 80 at both rounds and those 5 years of age and older were examined by 70 mm photofluorogram. Two sputum specimens (spot and overnight) were collected from those with any abnormality on x-ray as recorded by either of the two independent readers. Both the specimens were examined by fluorescence microscopy and Ziehl Neelsen technique and by culture.

Analysis of data has shown that the term "a case of pulmonary tuberculosis" does not represent a single uniform entity, but enbraces cases of several types, differing considerably in their tuberculin sensitivity, results of x-ray and sputum examination, in the reliability of their diagnosis and mortality experience. The status of cases found at initial and subsequent surveys showed changes with time, and such changes show considerable differences for the various types of cases. It was felt that a single straight-forward definition of a case was not possible to suit all situations. One has to use more than one definition. Although theoretically, finding a single bacillus in sputum should be adequate proof of pulmonary tuberculosis, it was shown that finding of

a few bacilli (3 or less) was very often due to artifacts and should not be the basis for a diagnosis. It has also been found that positive radiological finding in the absence of bacteriological confirmation indicates only a high risk of the disease and not necessarily pulmonary tuberculosis. Direct microscopy appears to be a consistent index of disease but in community surveys has the limitation of missing a substantial proportion of cases and of adding some false ones. In view of the difficulty of providing a single definition of a case of tuberculosis, 4 indices have been suggested.

I) Cases defintely positive by direct smear.

2) Cases definitely positive by culture

3) All cases by culture (including less than twenty colonies)

4) Sputum positive cases which are radiologically active.

Each of these could be used for different situations. However, it was concluded that, there seems to be no option but to use more than one definition for assessing the prevalence and incidence of disease.

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RESISTANT AND SENSITIVE STRAINS OF MYCOBACTERIUM TUBERCULOSIS FOUND IN REPEATED SURVEYS AMONG A SOUTH INDIAN RURAL POPULATION

Raj Narain, Chandrasekhar P., Satyanarayanachar R.A. & Pyarelal

The degree of the risk of infection and disease in man from drug resistant strains of mycobacterium tuberculosis is not clear. An increase in the prevalence of primary resistance indicates the extent of such a risk while an increase of secondary or acquired resistance could be considered as a problem of the individual patient and may reflect limitations of his treatment.

The present report describes the prevalence of strains with acquired or primary resistance or of sensitive strains found in 3 successive surveys in a sizeable random sample of villages in a South Indian district. Changes in the status of cases with such strains from one survey to another and their infectivity among household contacts are also described.

The prevalence of tuberculosis infection among household contacts of cases with acquired resistance to isoniazid was significantly higher than those with primary resistance or with sensitive culture. This was probably due to the longer duration of sputum positivity of isoniazid resistant strains at the time of diagnosis. But infectivity as judged by the incidence of new infection among household contacts was generally less for cases with acquired or primary resistance than for cases with sensitive cultures, though the difference observed was not statistically significant. A large number of culture positive cases especially those with primary resistance had no radiological evidence of active

pulmonary tuberculosis. The prevalence of primary resistance was high in certain categories of cases and the differences between cases with primary resistance and those with acquired resistance were many and large. It was suggested that this could be due to the primary resistant cultures being those of atypical mycobacteria, despite positivity in the niacin test. There was a significant increase in the number of cases with acquired resistance to isoniazid at the third survey owing to irregular treatment after the second round. The prevalence of primary resistance at the III Round was almost the same.

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EXAMINATION OF MULTIPLE SPUTUM SPECIMENS IN A TUBERCULOSIS SURVEY

Chandrasekhar P., Nair S.S., Rao K.P., Ramanatha Rao G. & Pyarelal

Prevalence surveys are useful for estimating the tuberculosis problem in different countries. Three techniques are commonly used in surveys, tuberculin test, mass miniature x-ray and sputum examination. Each has its own limitations. A limitation of sputum examination is that all the sputum positive cases in the community cannot be diagnosed when only one sample of sputum is examined from each eligible person. Barton (1958) reported addition of 10% positives through examination of a second specimen. Among a highly selected group of patients attending Tuberculosis Chemotherapy Centre, Madras, it was found that a second sample added about 4% to the culture positives detected by the first specimen (Andrews and Radhakrishna (1959). Multiple sputum examination are not often possible under field condition of surveys covering the whole community.

It would be worthwhile to have some idea of the extent of under-diagnosis in sputum examination. For this purpose, during an epidemiological survey, four specimens of sputum were collected within seven days of x-ray examination from each person with an abnormal chest x-ray in 30 villages of a district of South India. Each specimen was examined by fluorescence microscopy, Ziehl Neelsen technique and culture. There were 34 culture positives among 2,164 persons for whom all the four culture examinations were available. Out of these, on an average 21 (62%) were found from examination of one specimen only. An estimate of prevalence obtained from only one sputum specimen will have to be multiplied by 1.67 to get the prevalence that would be obtained from many specimens. Similarly, the correction factor for estimates based on two specimens will be 1.26.

Ziehl Neelsen positives not confirmed by culture (mostly with less than four bacilli reported in the smear) increased from 7 from the first specimen to 18 from all four specimens, while positives confirmed by culture method showed only a marginal increase from 13 to 15. Fluorescence microscopy did not have this disadvantage. More than 80% of the smear positives (confirmed by culture) could be found from the examination of one specimen only. Examination of two specimens by fluorescence microscopy detected about 95% of cases demonstrable by

this method. But with the Ziehl Neelsen technique additional specimens may add more "false positives". Multiple specimens are most rewarding for detecting cases found positive on culture only.

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SOME EPIDEMIOLOGICAL ASPECTS OF TUBERCULOUS DISEASE AND INFECTION IN THE PAEDIATRIC AGE GROUP IN A RURAL COMMUNITY

Gothi G.D., Nair S.S., & Pyarelal

The prevalence and incidence rates of tuberculous infection and disease in the community are known in the age group I0 years and above from several surveys carried out so far. The present paper provides various parameters of tuberculosis in the paediatric age group in particular.

A random sample of II9 villages in 3 taluks of Bangalore district were surveyed 4 times from May, I96I to July I968 at intervals of I8 months, 3 years and 5 years of the initial survey. Tuberculin test was done for the entire available population with I TU PPD RT 23 with Tween 80 and 70 mm x-ray was done for all available persons aged 5 years and above. Two samples of sputa were obtained from the x-ray abnormals, and examined by smear and culture.

It was found that prevalence of infection increased with age from 2.I% at 0-4 year age group to I6.5% at I0-I4 year age group compared to 47% at I5 and above age group. Prevalence of disease in 5-I4 year age group was considerably lower than in age I5 years or more. Tuberculosis morbidity increased with the size of tuberculin reaction and it was high among children with reaction 20 mm or more.

Incidence of infection increased with age from 0.9% per year in age group 0-4 to 2.8% per year among that of I5 years and above. Incidence of disease also showed the same phenomena, rising from 0.5% in age group 5-9 to 4% per year among I5 years and above. The fate on follow-up of cases of tuberculosis in this age was not serious.

The survey had no means of examining miliary and meningeal tuberculosis

The paper further presents the crude mortality rates in relation to tuberculin reaction size and thereafter discusses the role of National Tuberculosis Programme in relation to tuberculosis in the paediatric age group.

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DISTRIBUTION OF TUBERCULOUS INFECTION AND DISEASE IN CLUSTERS OF RURAL HOUSEHOLDS

Nair S.S., Ramanatha Rao G. & Chandrasekhar P.

Data from 62 randomly selected villages in a district of South India, which formed part of a prevalence survey carried out by the National Tuberculosis Institute, Bangalore, during I960-6I, has been made use of. The survey covered 29,8I3 persons in 5,266 households. There were 70 cases with bacilli demonstrable either in smear or culture and 300 suspect cases. Using the village map (prepared by survey staff), 'case clusters' were formed first, with each case household as nucleus and adjacent households within a maximum distance of about 20 meters on either side of the case households. Households closest to the nucleus household on either side have been called as Ist neighbourhood and those coming next in proximity on either side as a 2nd neighbourhood and so on. The case household and its four neighbourhood together was called a cluster. If another case household was found within 4th neighbourhood of the first case the cluster was extended by including the 4th neighbourhood of the new case also Such clusters are called composite case clusters and clusters with only one case household as simple case clusters.

Similarly, suspect case clusters were formed and differentiated as simple suspect clusters or composite suspect clusters. Further, to serve as a control group, non-case clusters were constituted from a systematic sample of I0% households that were not included in case or suspect case clusters.

Out of 60 case clusters formed, only 7 had multiple cases showing that there was no evidence of high concentration of disease in case clusters.

While the percentage of child contacts (0-I4 years) infected was considerably higher in case clusters (25.8%), there was not much difference between suspect case clusters (I4.9%) and non-case clusters (9.8%). Similarly, there was not much difference between simple and composite clusters.

Infection among child contacts was higher in case households as compared to their neighbourhoods. To get some idea of the zone of influence of a case or suspect case, prevalence of infection was studied for I0 neighbourhoods, in simple clusters to avoid the influence of multiple cases. It appeared that the zone of influence of a case may extend at least upto the I0th neighbourhood. It was also noted that there was very little difference between zones of influence of suspect cases and non-cases.

Case clusters in which the nucleus case had shown activity of lung lesion (evident on X-ray reading) or had cough showed significantly higher infection among child contacts. Clusters around cases positive on both smear and culture did not show higher infection than those around cases positive on culture only. (This may be due to sputum examination of single specimen only).

Out of the total infected persons in the community only 2% were in case households and 7% in suspect case households, over 90% being in non-case households. The zone of influence of a case extending at least upto the I0th neighbourhood and the overlapping of such zones of influence of cases, present and past, seems to be the most probable explanation for the wide scatter of infection in the community.

Prevalence of infection among child contacts was definitely higher in case clusters. But, the significance of this could be understood only from a study of the incidence of disease during subsequent years in different types of clusters. It is significant that only I0% of the total infected persons in the community were found in case clusters.

The case yield in general population, cluster contacts, household contacts and symptomatics attending general health institutions have been compared. The case yield in the last group(I0%) is much higher than the case yeild from both types of contacts (0.7% and 0.6%) which were only slightly higher than the case yield from the general population (0.4%).

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A COMPARISON BETWEEN LONGITUDINAL AND TRANSVERSE DIAMETERS OF TUBERCULIN TEST INDURATIONS

Kul Bhushan, Mukherjee M.N., Chattopadhya S.P. & Ganapathy K.T.

In the epidemiological surveys carried out by the National Tuberculosis Institute (NTI), Bangalore, instead of reading the tuberculin reactions (indurations) by measuring their transverse diameters as is done conventionally, the longitudinal diameters were read. Later on, as the longitudinal diameters were observed to be larger than the transferve diameters, an investigation was carried out to study whether this difference would affect the estimation of infection rates.

Out of I,240 tuberculin tested persons, for I,I89 both transverse and longitudinal diameters were read by each of two readers, one accustomed to read the longitudinal diameter and the other, the transverse diameter. All care was taken to avoid bias on the part of the readers.

All four readings were available for I,075 persons. It was found that longitudinal diameters were larger than the transverse diameters for all ranges (of sizes) of reactions when either diameter for each reader was taken as standard. The prevalence of infection, considering I0 mm+ reactions as the minimum level for those infected, were almost the same for both the diameters and for both the readers. Analysis according to age and sex gave similar results. Variations between the readers are known to be of much higher magnitude than those observed between the diameters in this study.

The levels of post-vaccination allergy calculated on the basis of longitudinal diameters, however, will be larger than those for transverse diameters.

In view of the above results, the findings of the NTI epidemiological survey wherein longitudinal diameters of tuberculin reactions are read, will not only be comparable with other studies conducted by NTI but also with studies done by other organisations - national or international.

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SOCIOLOGY

A STUDY OF MIGRATION IN FOUR TALUKS OF BANGALORE DISTRICT

Andersen S. & Banerji D.

The purpose of the study was to establish the rate of emigration in a random selection of villages, with a view to forecast the likely loss of population in a follow-up study on BCG vaccination in the area. The study was carried out in the total population 35 villages of Channapatna, Devanahalli, Magadi and Nelamangala taluks of Bangalore district. Demographic characteristics such as birth and death rates, immigration rates and proportion of persons temporarily absent, were also studied.

The head of the household or if absent, any other responsible adult was interviewed on a house-to-house basis, regarding the composition of the family according to the NTI manual for census takers. Estimation of migration was to be based on the registered population of the current day, the population of exactly one year ago and all relevant events during the intervening year. Each household member was listed as under :

A. Persons now in the household who also belonged to it one year ago.

B. Persons born during the past year.

C. Persons who immigrated during the past year.

D. Persons dead during the past year.

E. Persons emigrated during the past year.

The registration was as follows :

Total registered Population	I3,838
Category A	I3,I83
" B	470
" C	230
" D	200
" E	307
Temporarily absent	770

It was estimated that no more than 5% of the population would be lost by emigration over a period of two years. About 1/3 of the emigration is within the same taluk. Only a small portion of the emigrants are above 30 years of age. It is also found that a good proportion of women's migration is due to marriage.

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A SOCIOLOGICAL STUDY OF AWARENESS OF SYMPTOMS AMONG PERSONS WITH PULMONARY TUBERCULOSIS

Banerji D. & Andersen S.

This study was undertaken in 34 villages and 4 town blocks where a few weeks earlier an epidemiological survey was carried out. All persons above 20 years whose photofluorograms were read as inactive, probably active or active by at least one reader were age-sex matched with an equal number of x-ray normals to form the experimental and control groups respectively. Thus a total of 2,106 were eligible for social investigation.

Interview sheets, with particulars of the name and location of village, household number, and individual number and the identifiable data of the interviewees were made available to the social investigators at random for contacting and interviewing them at their homes. The interviews were non-suggestive in nature and deep-probing on the details of symptoms experienced by the respondent, which were fully recorded.

79% of the experimental group and 83% of the control group were satisfactorily interviewed, which constituted the data further analysed. Of the numerous symptoms recorded, only such that were associated with pulmonary tuberculosis were considered, of which cough occurring for one month or more, fever occurring for a month or more, pain in the chest, haemoptysis and all combination of these four symptoms were analysed statistically.

Cough was found to be the most important single symptom. It was not only the most frequent symptom alone or in combination in the experimental group but was less frequent in the control group in that 69% of sputum positive and 46% of radiological positive had cough while only 9% of the control group had it. Considerably fewer people had fever and pain in the chest. Pain in the chest appears to be non-specific, giving a ratio of only 2 : 1 along the experimental and control groups while fever was in the ratio of 6 : 1 and haemoptysis was 11 : 1. It was seen that 69% of the sputum positive cases, 52% of the x-ray active or probably active, 29% of the inactive and 15% of the normals (control group) had at least one of the above mentioned symptoms. In all the groups, the proportion of symptoms were higher among the males than among the females. In both males and females the prevalence of symptoms was higher in the middle age groups than among the younger or older groups. This age variation was more marked in the females.

The findings of the study were analysed further along with the data obtained

from a couple of minor investigations, conducted in the rest of the 28 villages which formed the total of the villages surveyed epidemiologically. This brought out further that 95% of bacteriologically positive cases are aware of symptoms, 72% experience 'worry awareness' and 52% form the action-taking group.

The above findings have been of considerable importance in planning further studies and in formulating the National Tuberculosis Programme.

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A SOCIOLOGICAL INQUIRY INTO AN URBAN TUBERCULOSIS CONTROL PROGRAMME IN INDIA

Andersen S. & Banerji D.

Under well supervised conditions and in clinical trials domicillary chemotherapy has proved successful in the treatment of cases of tuberculosis. It was however necessary to study the treatment programme of domiciliary chemotherapy on a large scale in respect of the patients' behaviour towards the programme during the treatment period.

Study Population

Study population consisted of 784 radiologically positive patients diagnosed at the Lady Willingdon Tuberculosis Demonstration & Training Centre between 13.3.1961 to 5.5.1961. As per the clinic procedure all persons attending the clinic were submitted to a tuberculin test and examination by a 70 mm photofluorogram. Those who were x-ray positive were given bacteriological examination of a spot sample of sputa by both smear and culture on their second visit scheduled on the third day after x-ray. All patients diagnosed by x-ray to be having active tuberculosis were put on a treatment regimen of 300 mg of isoniazid per day for a period of one year. During the course of the study a few of the sputum positive cases were given 10 gms of PAS in addition.

Monotherapy

The study population was interviewed initially at the clinic immediately after their diagnosis; defaulters at their homes within four weeks of their defaulting; and all patients after twelve months of treatment period; the coverage being 100%, 65% and 76% respectively.

Findings

The following Table summarises the findings :

Summary of Distribution of 784 Patients by their Administrative Status and their Initial Sputum Status

Administrative Status	Total	%	Initial Sputum Status			
			Sp. Neg.	Sp. not Produced	Sp. not Examined	Sp. Pos.
Persons who did not return to learn the result of their diagnosis	84	11	0	0	84	0
Patients whose houses could not be found	46	6	22	5	1	18
Patients resisiding outside the city	138	17	47	9	5	77
Patients who emigrated during the treatment period	48	6	17	6	0	25
Patients who took all or part of their treatment outside the clinic's control	173	22	61	11	5	96
Patients not completing the full 12 - months' treatment	139	18	70	28	1	40
Regular patients	156	20	53	35	6	62
Total	784	100	270	94	102	318

No attempt was made to follow-up the 84 (11%) of patients who defaulted initially. Accurate address taking will be helpful in following up this group as well as the 6% of those whose houses could not be found during follow-up. It is presumed that a few from outlying areas would have given fictitious city addresses. 17% who were diagnosed and put on treatment were residing outside the city limit. They were found to be irregular in treatment which points to the necessity of having diagnostic and treatment centres nearer to their homes. 22% is seen to have taken treatment from other health facilities also. This is a problem of urban areas where a large number and variety of health facilities are available. It poses essentially a problem of co-ordination to ensure that the patient does not resort to haphazard treatment but will receive adequate treatment. 18% did not complete the required treatment of twelve months Various reasons were given for defaults in drug collection, a sizeable proportion of which could have been avoided through better organisation and administrative procedures and good initial motivation at the clinic. Default is a complex behaviour pattern and this study did not bring out any co-relation between default and the economic, social, educational or other status of the patient. With changes in the system leading to a good treatment organisation, it should be possible to have a higher percentage of regular patients than the twenty percent as at present.

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A SOCIO-EPIDEMIOLOGICAL STUDY OF OUT-PATIENTS ATTENDING A CITY TUBERCULOSIS CLINIC IN INDIA TO JUDGE THE PLACE OF SPECIALIZED CENTRES IN A TUBERCULOSIS CONTROL PROGRAMME

Nagpaul D.R., Viswanath M.K. & Dwarakanath G.

The objectives of the study were to inquire into the epidemiological and socio-logical characteristics of patients attending a city tuberculosis clinic for the first time; to ascertain the reason for attendance and the nature of previous treatment if any. It was also to see whether there was a preference for seeking specialists and specialised services for alleviation of the symptoms experinced and whether there were any differences amongst the urban and rural attenders.

The study was based on the first day attenders at the Lady Willingdon Tuberculosis Demonstration and Training Centre, Bangalore, which functions as the District Tuberculosis Centre, and provides diagnostic services to several urban and rural peripheral health institutions. A fifty per cent sample of attenders during 61 working days, formed the study population. They were interviewed by using a questionnaire based on the above mentioned objectives.

2,658 was the random sample of attenders of whom 9% were below 5 years of age and hence eliminated from the study. A further 9% was excluded due to unsatisfactory and incomlete initial data. Of the remaining eligible 2,403 patients, 83% were from urban and 17% from rural areas. Sputum collection was made from 2,308. 179 (7.8%) were found to be positive by direct microscopy or culture or both and 169 were positive by culture (91% confirmation by culture). 131 (80%) were sensitive to isoniazid and 32 were isoniazid resistant.

It was observed that those between 20-30 years of age formed the largest age group of attenders and that 44% amongst the urban and 61% of the rural patients were wage earners.

Nearly 80% of out-patients in the urban and rural groups were aware of one or more symptoms suggestive of pulmonary tuberculosis and significantly 95% of all cases were found among them. Most of the patients with symptoms had 2 or 3 symptoms presumably because of delay in reporting or to the multi-symptom characteristic of the disease. There is no essential difference between the urban and rural patients in the prevalence of symptoms at the time of reporting. 61% of the urban patients and 42% of the rural attended within three months of the onset of their symptoms. The higher case yield in both urban and rural patients were found in the groups with symptom duration of 1-3 months.

Distance was a significant factor. Upto 4.8 km the number of new patients was large but the case yield was poor, while beyond that distance the number of out-patients decreased but the case yield was more, suggesting a selective process influenced by distance.

It was also found that 52% came to the centre on their own initiative, 31% were referred by other health institutions and 17% were those advised by BCG workers etc. A further analysis of urban attenders showed that of those who came on their own initiative, 82% of attenders within the 6.4 km zone and 79% from beyond had already contacted general institutions.

An analysis of the total attenders showed that 20% of the out-patients had contacted the centre directly on their own initiative without any prior contact with any other source of treatment. 61% of the 52% who claimed to have come of their own accord had had previous contact with other health institutions regarding their chest symptoms. 31% of the referred group had also been previously treated for their symptoms. Further analysis showed that of the 1,642 who had had previous contacts with health institutions 84% were at institutions of general medical services, 4% at indigenous practitioners 10% at specialised tuberculosis institutions and 2% were not able to recall the exact place.

Out of the 1,985 urban patients, 7% failed to return on the third day for ascertaining their sputum result and commencing of treatment if needed (initial default). 82% of those were contacted at home when reasons of failure to return were elicited. Some of them were as "travel inconveniences", "forgot" was "out of station", etc.

The data obtained suggests that attendance at a specialized tuberculosis centre is not necessarily a function of awareness of symptoms and of the knowledge that such specialized services exist. It also does not support the theory that people prefer specialized institutions in cities. It is also seen than urban and rural patients behave in almost the same way in that their first contact for symptoms suggestive of tuberculosis, is initially at the general medical services.

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CASE-FINDING

SOME OPERATIONAL FACTORS INFLUENCING THE RELATIVE UTILITY OF CULTURE METHOD OF DIAGNOSIS OF PULMONARY TUBERCULOSIS

Rao K.P., Nair S.S., Cobbold N. & Naganathan N.

Laboratory diagnosis of pulmonary tuberculosis is based on the presence of tubercle bacilli in sputum by direct microscopy, culture and/or animal inoculation. Culture examination, followed by tests for identifying the bacilli, is recognised as the most accurate and reliable method. Its efficacy depends on the laboratory techniques employed and its use in different practical situations such as epidemiological surveys, active community case-finding, organisation of diagnostic services and evaluation of diagnosis and treatment in tuberculosis control programmes. But the practicability of culture method in developing countries must be studied. The present paper deals with a systematic study of data from four investigations designed to elucidate the influence of certain operational factors on the utility of the culture method.

Study I: is a longitudinal survey in a randomly selected population in 134 villages in the three sub-divisions (Taluks) of Bangalore district. The analysis is based on the material from the first round, when two samples of sputa, spot and overnight were collected at intervals of 24-48 hours from persons aged 5 years and above having abnormal x-ray shadows. The specimens were collected in house-to-house visits, stored after collection in insulated box with ice

container and transported to the main laboratory at the National Tuberculosis Institute. The interval between collection of specimens in the field and culture in the laboratory was 1-7 days. A smear was stained and examined first by fluorescence microscopy and then by Ziehl Neelsen method. Each specimen was cultured on two slopes of Lowenstein-Jensen medium. All positive cultures were submitted to further identification tests; like growth at room temperature, rate of growth at 37% C, pigment production in the dark and exposure to light, catalase and peroxidase reactions, niacin production, sensitivity to INH, SM and PAS.

Study II: relates to a mass case-finding programme in Tumkur district when two specimens (spot and overnight) were collected from individuals aged 20 years and over with symptoms suggestive of pulmonary tuberculosis and from positive tuberculin reactors below 20 years voluntarily reporting with symptoms. The specimens were then treated in the same way as in Study I.

Study III: pertains to the technical assessment of microscopy using Ziehl-Neelsen method performed by the auxiliary health staff of peripheral health institutions in Bangalore district. A spot specimen was collected daily by auxiliary staff at each health facility from patients who were symptomatics. All smears examined by Ziehl-Neelsen method at each centre and the corresponding specimens were collected twice a week and tranported to NTI laboratory for re-examination and examination of a fresh duplicate smear. All positive culture were identified as in Study I. No refrigeration facilities are available in these centres and specimens were not transported in an insulated box. Rest of the procedures and the interval are same as in previous studies.

Study IV: is connected with operational and technical assessment of the district tuberculosis programme in Anantapur district one year after its commencement. A sample was taken from all patiants who started treatment during a particular period but did not collect their drugs. Spot specimens were collected in the field, stored without any refrigeration and transported to NTI laboratory, thereafter the same procedure followed as in other studies.

An analysis of these four studies brought out certain operational factors affecting the culture method. (1) The results showed that an interval of 7 days between collection of sputum in the field and its processing in the laboratory did not affect the yield of positive cultures, even though the specimens were stored and transported under field conditions. (2) A higher proportion of positive cases was detected by culture than by direct microscopy but the magnitude of additional yield was dependent upon the procedure of selecting persons for sputum examination. (3) In service programmes restricted to persons with symptoms who attend diagnostic centres, the increased yield is too small to justify the introduction of culture examination.

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POTENTIAL YIELD OF PULMONARY TUBERCULOSIS CASES BY DIRECT MICROSCOPY OF SPUTUM IN A DISTRICT OF SOUTH INDIA

Baily G.V.J., Savic D., Gothi G.D., Naidu V.B. & Nair S.S.

The objectiveso of the study were to understand some operational aspects of case-finding in the peripheral health institutions (PHI) in an integrated programme. (1) What is the frequency of persons showing symptoms suggestive of pulmonary tuberculosis among the normal out-patient (OP) attendance, (2) how many cases can be found by direct microscopy of sputum of those symptomatics, (3) what will be the workload of TB case-finding at a PHI and, what proportion of symptomatics will be willing to and will actually attend the District TB Centre (DTC) when referred there for X-ray examination.

The study was conducted in a district (population 1.5 million) having one DTC and 55 PHIs. 15 PHIs were selected on the basis of stratified random sampling. At each PHI an NTI investigator worked for a period of one month. All new out-patients were questioned for symptoms (non-suggestive and suggestive) and any patient with defined symptoms (mainly cough for more than one week) was subjected to a sputum examination and also referred for x-ray examination at the DTC.

It was found that 3.5% of the total new out-patients aged 10 years or more complained of cough for more than 2 weeks and of those symptomatics, 11% were new cases of pulmonary tuberculosis. When the symptomatics were referred for x-ray examination, only 66% agreed to go for x-ray to DTC while only 16% (of the total referred) actually went for x-ray. Each PHI had to examine only one or two sputa per working day.

As the study was conducted in a representative sample of PHIs for a representative duration of time, the material permits the estimation of the potential yield of cases in a DTP during a period of time (say one year). It was estimated that about 45% of the total estimated prevalence of cases in a district can be diagnosed in a DTP during a period of one year, if all PHIs function according to the programme recommendations. The workload due to tuberculosis case-finding is small and can be managed with the existing staff of a PHI. Referral in a DTP plays a very modest role in case-finding and case-finding by direct smear examination of sputum at the PHI has to be relied upon.

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B BACTERIOLOGICAL DIAGNOSIS OF PULMONARY TUBERCULOSIS - SPUTUM MICROSCOPY

Rao K.P. & Nagpaul D.R.

Bacteriological method is the most reliable of all available methods for the diagnosis of pulmonary tuberculosis. Bacteriological diagnosis of pulmonary tuberculosis is chiefly by sputum microscopy and culture. This paper discusses sputum microscopy from various points of view. Sputum, which forms the basis of bacteriological diagnosis, is a variable source material. The type of speci-

men, its quality, quantity, bacterial content and viability of bacteria considerably influence the sensitivity and the specificity; and these in turn would vary under different diagnostic situations. One of the reasons for the observed variations could be the different criteria adopted for examination; another might be due to the observed range of diagnostic situations from an epidemiological survey at the one extreme to the cases seeking treatment in a comparatively backward community with poor tuberculosis diagnostic services.

In epidemiological community survey (ICMR 1968), it has been found that culture positives that were also smear positives varied from 73% to 87%; whereass among patients attending rural general health institutions for diagnosis, about 82% of the infectious cases found by culture could also be discovered by microscopy of single spot specimens (Rao et al 1966). Sikand (1965) from New Delhi Tuberculosis Centre, could get 67% of culture positives by microscopy, whereas Mitchison (1967) found that 35% were smear positive among the sputum positive patients reporting for the first time. In the Longitudinal Epidemiological Study in the Bangalore area, it was found that about 40% - 48% were positive by direct smear and the rest positive by culture only. One of the reasons for these variations could be the different criteria adopted for examination and the different situations from where the sputum specimens are collected.

Another factor affecting the sensitivity and specificity of sputum microscopy is the staining technique adopted and also the experience of the trained technician. It has been found that over diagnosis by auxiliary staff (trained) in the general health institutions (1.9%) compares favourably with the over-diagnosis (1.3%) by experienced technicians. Besides these aspects, other factors like the quality of sputum smear, time spent on examination, type of sputum specimen, the use of multiple smears, etc., affecting the sputum microscopy have been discussed in great detail in the paper.

The cost of bacteriological examination have also been studied and mentioned in the paper, and the cost ratio between microscopy and culture have been worked out to be 1 : 6.6. Cost can become an important factor in deciding the suitability of bacteriological methods for diagnosis of pulmonary tuberculosis in various countries and in different diagnostic situations.

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CASES OF PULMONARY TUBERCULOSIS AMONG OUT-PATIENTS ATTENDING GENERAL HEALTH INSTITUTIONS IN AN INDIAN CITY

Gothi G.D., Savic D., Baily G.V.J. & Samuel R.

The study was undertaken to investigate the proportion of persons with chest symptoms (cough, fever, pain in chest and haemoptysis) among out-patients attending the general city dispensaries, and the proportion of pulmonary tuberculosis cases among them.

The findings of this study are based on examination of one day's attendance at each of the 19 general dispensaries of Bangalore city, consisting of 2,506 persons aged 10 years or more who had attended the dispensaries for the relief of any ailment. The investigation consisted of symptom questioning, examination of spot sputum sample and 70 mm chest photofluorogram. Sputa were examined by direct smear and culture. Study duration was 19 days, spread over three months.

The study showed that about 47% of the out-patients had visited dispensaries primarily for relief of chest symptoms. Of these, 2% had evidence of active or probably active pulmonary tuberculosis and 0.8% were sputum positive cases. It is concluded that even though there are special tuberculosis institutions in the city, a fair number of new and old tuberculosis patients contact general dispensaries. These dispansaries can therefpre contribute considerably to tuberculosis case-finding in the city.

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ASSESSMENT OF DIAGNOSIS OF PULMONARY TUBERCULOSIS BY SPUTUM MICROSCOPY IN A DISTRICT TUBERCULOSIS PROGRAMME

Rao K.P., Nair S.S., Naganathan N. & Rajalakshmi R.

In the District Tuberculosis Programme (DTP) the diagnosis is based on sputum microscopy. Majority of health institutions in the district are provided with microscopes for this purpose. In the peripheral health institutions the programme activities have to be carried out by its staff after a short period of training given by DTC personnel on the spot. So the microscopy work in the PHIs is likely to be carried out by any paramedical personnel and not necessarily by a qualified laboratory technician. It is therefore, necessary to know whether the standard of microscopy carried out by these paramedical personnel after a short training will be upto the mark.

To assess the efficiency of smear examination done by these individuals, a study was conducted in Bangalore district covering nine microscopy centres in various types of health institutions, a few months after the implementation of the programme.

Under the DTP a single spot specimen of sputum is collected from every chest symptomatic attending the health institutions and a smear is made and examined for tubercle bacilli and all positive cases are put under treatment.

The sputum specimens and the smears examined in these nine centres were brought to NTI laboratory. The smears were examined by an experienced laboratory technician. Duplicate smears were also prepared from these specimens and their results compared with results of re-examination and centre's examination. All specimens were cultured by swab method and all positive cultures were subjected to sensitivity and identification tests.

Analysis of the results based on culture showed that barring a few centres whe the performance was poor, the standard of examination was fairly good. The under and over-diagnosis based on culture were 38.2% and 2.6% respectively, and these were within the limits observed generally. Comparison of results on re-examination of centre smears and duplicate smears indicated that both reading variation and defective smear preparations and staining could have influenced under diagnosis in these centres. The study has also thrown some light on methodology of assessment of sputum examination that could be adopted wherever a tuberculosis control programme is functioning.

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TREATMENT

PROBLEMS OF TREATMENT OF TUBERCULOUS PATIENTS IN RURAL AREAS

Gothi G.D. & Baily G.V.J.

The paper is a discussion on the problems of treatment of tuberculosis in the rural areas. As suggested therein, an integrated programme, and not the specialized anti-tuberculosis service, is the only suitable method to reach India's vast rural areas.

The problem of treatment in rural areas were listed as technical, organisational and personnel. Under the technical problems, the choice of anti-microbials was considered. The anti-microbials should be effective, cheap and acceptable to the patient. INH-PAS, INH alone or INH-Thiacetazone were considered suitable. Streptomycin containing drug regimens were difficult for the health services to deliver to the patients in rural areas. The other technical limitation of treatment mentioned in the paper was the probability of increase in drug resistance due to the wide application of drug treatment which might be irregular. This hasnnot been considered as enough justification for with-holding treatment to the vast majority of patients, as its epidemiological and clinical significance in India are yet to be fully understood.

The organisational problems listed were: (1) irregularity of drug intake and drug collection; their identification, (ii) default at drug collection, intake and remedial action, (iii) maintenance of records, (iv) check up while on treatment and follow-up after completion of treatment. The paper suggests that regular collection could be taken as an index of regular drug intake. Identification of initial and subsequent defaults had to be from records. Corrective actions could retrieve about 30% of the defaulters. Check up during treatment as well as follow-up after treatment were found to be not acceptable to the patients due to a number of reasons.

Training of staff to render services was also highlighted as one of the major problems and its remedial measures discussed.

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INTERMITTENT TREATMENT WITH STREPTOMYCIN AND ISONIAZID IN RURAL AREA

Govindaswamy V. & Savic D.

This paper studied the acceptability and applicability of the drug regimen streptomycine 1 gm and INH 650 mgm once a week in a rural area as well as the regularity with which the rural folk took this treatment. Association between the observed regularity and factors like age, sex , etc., was also to be studied.

107 rural patients of tuberculosis, diagnosed at 5 taluk hospitals in Anantapur district of Andhra Pradesh on the basis of sputum examination by direct smear and/or x-ray examination with the help of mobile x-rays, consented to treatment with intermittent regimen mentioned above. About half of them were new patients and the rest were old patients who were mostly regular on an earlier oral regimen. 94 of the above were available for analysis.

The regimen was found quite practicable in the sense that at no centre was the study interrupted or discontinued because of the inability of the health centre staff to give injection. However, its initial acceptability to the patient and subsequent regularity of those accepting the regimen were quite low. There was very steep fall in regularity during the first 10 weeks of treatment, nearly a half of the total cases became irregular during the first 6 weeks. Beyond 4 months of treatment, patients who continued to attend centres regularly for treatment became negligible, thus pointing, that injection was not a key variable in the treatment regularity of tuberculosis.

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SOME OBSERVATIONS ON THE DRUG COMBINATION OF INH+THIACETAZONE UNDER THE CONDITIONS OF DISTRICT TUBERCULOSIS PROGRAMME

Gothi G.D., O'Rourke J.O. & Baily G.V.J.

The study reported the applicability of INH-Thiacetazone combination with reference to acceptability and toxicity.

150 patients from Tumkur town and some nearby villages were discovered during a mass case-finding programme, of whom 127 including 43 sputum positives were given chemotherapy with 300 mgm INH and 150 mgm thiacetazone (TH), in a single tablet to be taken once a day. All but one of them had the treatment on an ambulatory basis, Results of treatment in respect of 103 patients are presented in the paper.

The overall death rate was of the order of 15%. About twice the number of deaths occurred among the sputum positive patients than among the negative ones. About 40% of death occurred during the first quarter. In all, 23 patients developed side effects, in 18 of whom thiacetazone had to be withdrawn. Serious side effects occured among 5 (about 4%) patients. These patients did not report to the treatment centre and could not have been detected, if not

home visits were made, thus giving an erroneous impression about side effects with TH.

The sputum conversion at the end of one year was of the order of 50% among all survivors. Among those who were drug sensitive and examined at one year, conversion rate was 63%. Favourable radiological response was seen in 74%.

Thus, though cheap and clinically effective, TH in combination with INH was found to produce serious and significant side effects. Hence givigilance by the treatment centres were though to be necessary when the patients are on this regimen.

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COLLECTION AND CONSUMPTION OF SELF-ADMINISTERED ANTI-TUBERCULOSIS DRUGS UNDER PROGRAMME CONDITION

Gothi G.D., Savic D., Baily G.V.J., Rao K.P., Nair S.S. & Samuel R.

This investigation was to find out the drug consumption among tuberculosis patients put on domiciliary self-administered chemotherapy, in terms of proportion of patients that make various levels of drug collections and proportion among them that consume drugs at different points of time during the course of treatment.

In all, 816 tuberculosis patients aged 5 years and above residing in Bangalore city were admitted to the study. They were randomly divided into 6 groups at the time of inclusion into the study, for examination of urine samples. One surprise urine sample was collected from each patient at the pre-determined time after the drug collection. The samples of urine were collected from one group at first month, another at second month, third at fourth month, fourtth at sixth month, fifth at nineth month and six at twelveth month of treatment. Urine samples were collected within 33 days of drug collection for the month because the drugs were supplied at a time for the said period. Urine specimens were examined for the presence of drug or their metabolites. The drug collection was judged on the basis of treatment record and its consumption on the basis of results of urine examination.

Of the total patients included in the study, 54% made 10 or more drug collections over a period of 15 months. The initial radiological or bacteriological status or severity of disease did not influence the drug collection; however smaller proportion of old persons in both sexes collected the drugs for 10 months or more. Urine specimens of 71% of patients who had collected drugs were positive for INH on any one day. Bacteriological quiesence was obtained among the 82% INH sensitive patients who had made 10 or more collections.

The above findings suggest that the patients who collect drugs also consume with fair amount of regularity and achieve a high degree of bacteriological quiesence.

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B.C.G

ASSESSMENT OF BCG VACCINATION IN INDIA - 3RD REPORT

Kul Bhushan

In the period 1955 to 1958 the All India BCG Assessment Team carried out an appraisal of post-vaccination tuberculin sensitivity in mass campaign BCG vaccinated 262 schools in 159 different localities with 91 different batches of vaccine produced in Madras. The interval between vaccination and retest varied from 1½ to 42 months. Tuberculin test was given with 5 TU RT 22.

The mean size of reactions varied from 8.3 to 16.6 with overall mean of 12.5 mm. Less than 10% of the mean values were under 10 mm and less than 10% over 15 mm. Analysis also showed that BCG vaccination was responsible for an increase of 6-7 mm in the mean size of reaction over the pre-vaccination level of the non-infected or 6-7 mm less than that of the naturally infected children.

1/3 of the groups had their sensitivity increased upto 6mm and 2/3 by 7-11 mm. Comparing with the highest attainable degree of tuberculin sensitivity in the infected 1/3 of the vaccinated group fell short of it by 5-9 mm whereas 2/3 were within 4 mm of this level

Increase in allergising capacity of the BCG vaccine after introduction of modifications in the production procedures in 1955 and again in 1956 in the Madras Laboratory were seen. Waning of allergy upto 20 months after vaccination and boosting thereafter probably dueto supeinfection was also observed.

In view of the variable and low levels of allergy in many groups switching over to production and use of Freeze Dried BCG was suggested.

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ALLERGY PRODUCING CAPACITY OF MADRAS AND DANISH BCG VACCINES AS SEEN AMONG SCHOOL CHILDREN IN BANGALORE

Raj Narain, Kul Bhushan & Subramanian M.

In all, 1,259 students aged 11-19 years from three boys High School of Bangalore, formed the study group. They were tuberculin tested with 1 TU RT 23 containing Tween 80. Boys with a reaction of 13 mm or less to tuberculin test and willing for BCG vaccination were allocated in 3 groups: (i) to be vaccinated with Madras vaccine (211), (ii) to be vaccinated with Danish Vaccine (236), (iii) control (no vaccination) saline injection (231). Strength of Madras and Danish vaccines used was same, 0.75 mg per dose. After 3 months of vaccination, second tuberculin test with 1 TU RT 23 with Tween 80 was given to 575 boys included in both the vaccinated groups and in the control group. A follow-up at one year after vaccination was done among 328 boys, who were again tuberculin tested.

The analysis of data shows that the mean size of post-vaccination tuberculin

test induration among Madras BCG vaccinated group was 11.8 mm and among Danish BCG vaccinated group, it was 11.9 mm, the standard deviation were 3.8 and 4.5 mm respectively. The above differences between the 2 vaccinated groups were not statistically significant. Similarly, the post-vaccination allergy in the 2 BCG vaccinated group at one year was not significantly different. The mean size of the scar produced by 2 vaccines were also smaller. The post-vaccination allergy among persons whose pre-vaccination tuberculin induration was 9 mm or more to 1 TU RT 23 with Tween, did not increase by more than 4 mm after vaccination. While the group whose pre-vaccination tuberculin induration was below 9 mm, had an increase of post-vaccination allergy of a little over 8 mm. It is concluded that the allergy producing capacity of the Danish and Madras vaccines was not different.

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ALLERGY AFTER BCG VACCINATION

Kul Bhushan

In view of the variable and low levels of post-vaccination allergy elicited in the Indian Mass BCG Campaign vaccinated groups by WHO and Indian BCG Assessment Teams, some studies were carried out to investigate if some of the factors considered influenced the levels of post-vaccination allergy. They are described below :

In the neighbouring un-vaccinated areas five groups of villages BCG vaccinated by five different mass BCG campaign teams in Tamil Nadu State, the BCG Assessment Team personnel vaccinated tuberculin non-reactors with the same batch of BCG vaccine as used by the mass campaign teams, in two consequtive weeks. Half of the eligibles selected randomly in each area, were vaccinated with vaccine stored by the assessment team and the other half by the one stored by mass campaign team. The post-vaccination allergy was elicited three months later.

The level of post-vaccination allergy was higher in all the five groups vaccinated by assessment team with vaccine stored by them than in those vaccinated with vaccine stored by the mass campaign teams. It was further seen that the groups vaccinated in the first week had higher level of allergy than those vaccinated in the subsequent week.

The post-vaccination allergy was higher in two groups (out of 5) vaccinated by assessment teams and in other two by the Mass Campaign Teams. In one group it was similar for both the teams. The mean size of five groups combined, however, was higher in the case of assessment team.

In another study where three technicians each were selected at random from four different States for comparison of techniques of tuberculin testing, reading and vaccination with the assessment team, it was found that the efficiency of the mass campaign technicians in tuberculin testing and reading differed significantly from each other and from the assessment team personnel. No differences, however, were noticed in regard to the post-vaccination allergy.

In another study wherein a large group of BCG vaccinated children was randomly divided into three small groups, to avoid any boosting due to the repeat tuberculin tests, post-vaccination allergy in these was elicited separately at interval of one year for three years.

The results show that the mean of reactions at 1 year and 2 years were similar. In those re-tested after 2 years, however, one-third of persons had smaller reactions, and one-third had very big reactions. While the former could be the result of waning of allergy with time, the latter was perhaps due to a natural super-infection.

In the third year (not included in the paper) greater proportion of people had bigger reactions and the level of post-vaccination allergy was higher.

The findings of these studies indicate (1) that the liquid BCG vaccine was not stored properly by the mass campaign teams, (2) that it easily lost its potency with time even when stored properly, (3) that tuberculin testing and reading techniques of mass campaign personnel though inferior, their vaccination techniques could give comparable post-vaccination allergy and (4) that post-vaccination allergy not only waned with time, but also perhaps was influnced by natural super-infection with time making it necessary to elicit post-vaccination allergy soon after vaccination and at more or less a fixed time e.g., between 3-6 months after vaccination.

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DOOR TO DOOR BCG VACCINATION

Baily G.V.J.

The objectives of the presentation were to understand the operational efficiency of the centre type of BCG mass campaign in India and how the efficiency especially the BCG vaccination coverages could be improved through adopting a house-to-house (or door to door) approach.

The material from three different sources are examined. Firstly, the reports from the mass capaign showing the reported coverages in different age groups; secondly, the presence of BCG scards (as an evidence of vaccination) as seen in an epidemiological survey done shortly afterwards and finally the coverages as obtained in an operational study of door to door BCG vaccination.

While the mass campaign reported that 35% of the total population was tuberculin tested (vaccination coverage reports were not available) the epidemiological survey showed that shortly after the mass campaign only about 10% of the total population had BCG scars, while 60% were tuberculin negative and eligible for vaccination. On the other hand in the house-to-house campaign 80% of the eligibles could be vaccinated. The presentation also highlights the disadvantage of a house-to-house programme i.e., that it is slower than the centre type of mass campaign.

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SIMULTANEOUS SMALLPOX AND BCG VACCINATION

Kul Bhushan, Baily G.V.J. & Naidu V.B.

The objectives of the study were as follows: when BCG vaccination is administered simultaneously with primary smallpox vaccination to infants, whether any immunological interferences take place as indicated by the development of vaccination lesion and post-vaccination allergy due to BCG vaccination and the development of the local lesion (take rate) of smallpox vaccination; whether the incidence of complications are higher among those simultaneously vaccinated and, whether the population will accept a procedure involving two vaccinations.

789 children aged below one year were admitted to the study. 315 were vaccinated simultaneously with BCG and smallpox vaccines (BCG in left arm and smallpox in right arm), while 255 were vaccinated with smallpox vaccine only and 219 with BCG vaccine only. All 789 children were followed-up on the 5th and the 21st day of vaccination or vaccinations to study the development of lesions at the site of vaccination. A post-vaccination tuberculin test was done for the BCG vaccinated children on the 90th day after vaccination, and the results read 72 hours later.

from surface evidence.

It was found that there was no evidence of immunological interference between the two vaccines when administered simultaneously i.e., the development of lesion of smallpox vaccination among the simultaneously vaccinated group was similar to the development of the smallpox vaccination lesion among the only smallpox vaccinated group and, the post-vaccination allergy due to BCG among the simultaneously vaccinated group was similar to the post-vaccination allergy among the only BCG vaccinated group. The complications due to vaccinations were very few and similar among the simultaneously vaccinated as compared to the other respective group. The acceptability of simultaneous vaccination was high.

The above study has demonstrated that BCG and smallpox vaccinations can be administered simultaneously.

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ASSESSMENT OF POST-VACCINATION ALLERGY AMONG THOSE BCG VACCINATED WITHOUT PRE-VACCINATION TUBERCULIN TEST

Kul Bhushan, Nair S.S. & Ganapathy K.T.

The conventional methods of assessment of post vaccination allergy are inapplicable in case of BCG vaccination without prior tuberculin test. Because of obvious advantages of direct vaccination a search for a method of Technical Assessment of BCG vaccination is important. Following methods were tried in this study:

1. Four groups of directly BCG vaccinated persons aged 0-19 years were divided into infected and non-infected by a tuberculin test done within 24 hours of the vaccination. 12 weeks later post-vaccination allergy was elicited only in the non-infected. Varying levels of allergy were seen for the four groups. This constituted the reference method against which technical and operational efficiency of other methods was compared.

2. 0-4 years age group being predominently non-infected when tested after 12 weeks of direct vaccination showed differences from reference test. Thus, not technically suitable. Moreover, for sufficient children to give valid results, coverages of very large population was needed.

3. Having found a positive correlation between tuberculin non-reactor (0-9 mm tuberculin induration) with 0-13 mm local vaccination reactions on the 4th day, when the latter were tuberculin tested after 12 weeks they showed comparative levels of post-vaccination allergy with the reference method. Operationally however, this method only gave a marginal advantage since 3 instead of 4 visits were required.

4. Induration size at the site of vaccination after 21 days were not found compararable with the post-vaccination allergy in the reference method. Operationally, this method would have been most useful as it involved only one visit to the group.

5. Difference between mean size of post-vaccination tuberculin reaction among directly BCG vaccinated and in the reactors in the neighbouring unvaccinated areas as index of adequate post-vaccination allergy in the former group, was found to be reasonable method. Though it needed lesser number of visits (two only) to the area but involved greater amount of work. Further investigations on this are necessary.

6. Tuberculin testing of all directly BCG vaccinated persons including the natural reactors about 12 weeks after vaccination compared favourably, with the reference method, as the tuberculin reactors contributed less than 1 mm over (and above) the allergy in the vaccinated non-reactors. This method would be useful when rate of tuberculin reactors is less 20% in 0-19 years age group and their mean size is less than 20 mm. Operationally, it is a simpler method next only to No.4 above. Further investigations are considered necessary for final selection of this or any of other method.

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BCG WITHOUT TUBERCULIN TEST

Gothi G.D., Kul Bhushan, Nair S.S. & Baily G.V.J.

Considering that in the BCG Mass Campaign low outputs and coverages of BCG vaccination, done after tuberculin test were due to slowness of the campaign because of two visits to an area, the fear of two pricks and tuberculin tested absenting themselves from reading of the test it was thought that if BCG

The interests of the State balanced by the interests of the individual

vaccination could be given without prior tuberculin test without causing any complications then the speed of work and outputs could be more than doubled and coverages appreciably improved. For this, the following three studies were carried out :

In the first study a rural population of 1,891 was randomly divided into four groups (i) those tuberculin tested and vaccinated, (ii) tested but not vaccinated, (iii) not tested but vaccinated, and (iv) neither tested nor vaccinated. Induration site of tuberculin test and vaccination were read on the 3rd, 6th and 90th days. Later on, another tuberculin test was done on the 90th day. Both axillae were examined on 0, 14th and 90th day and x-ray pictures were taken on 0 day, 90th day and after one year.

The results showed that though slightly accelerated and exaggerated reactions occurred locally at the site of vaccination among the reactors, they were also present among those classified as the non-reactors (to the extent of 45%). There were no differences as regards the size of lymph nodes (regional reactions) between reactors and non-reactors neither was there any evidence of exacerbation of existing disease nor any flaring up of dormant focii (Primary complex) in the form of new disease.

Does not the tested

In the second study out of 1,520 population from 4 villages, 1,186 were both tuberculin tested and simultaneously vaccinated. Examination of local reactions daily from one to nine days, on 19th and the 29th day confirmed theffindings of first study in regard to the local reactions. In this study axillae were not examined nor x-ray pictures taken.

In thid third study because of large local reactions in the BCG vaccinated reactors its acceptability by the public was investigated. For this, direct BCG vaccination was given in one central village followed by similar vaccination in a group of villages at a distance of 1 to 2 kilometers from the first one and from one another at an interval of 1, 2 and 4 weeks. The large local reactions showed no adverse effect on the acceptability of BCG vaccination in the neighbouring villages, rather a slight improvement in BCG vaccination coverages with time was seen.

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A COMPARISON OF THE COPENHAGEN AND MADRAS LIQUID BCG VACCINE

Kul Bhushan, Nair S.S., Ganapathy K.T. & Vijay Singh

Indian BCG vaccine which was initially weak was subsequently so improved that its potency was adjudged as equivalent to Danish BCG vaccine. Later on, observations of its decreasing potency it was compared against with Danish vaccine in terms of the potency of the strains, production efficiency of the laboratory and stability on storage.

On a predetermined date in each of four consecutive months both laboratories

supplied to the Research Team one week old and fresh vaccines from their respective BCG strains and only fresh vaccine out of strains borrowed from the other laboratory. Vaccinations were given by these six vaccines every month, in two consecutive weeks randomly, to 2,978 tuberculin non-reactors. Post-vaccination allergy was elicited 10 weeks later when size of BCG lesion was also noted. Viable counts on all vaccines were done by Madras Laboratory.

Though the Indian and Danish BCG vaccines induced similar levels of allergy, on further analysis it was found that Madras BCG strain was inferior to the Danish strain and that Madras Laboratory produced better vaccine than Copenhagen Laboratory. The vaccine produced from Copenhagen strain in Madras Laboratory induced the highest level of allergy. The stability of vaccines produced from Madras strain was found to be unsatisfactory. Results according to vaccination lesion size more or less confirmed the above findings. They, however, were not corroborated in terms of viable counts.

Considering that the inferior quality of Madras BCG strain was due to mutation over time, seed lots of suitable BCG strain would ensure uniformly potent vaccine from Madras Laboratory.

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BACTERIOLOGY

AN INVITRO STUDY ON SENSITIVITY OF TUBERCLE BACILLI TO THIACETAZONE (TB1)

Rao K.P., Nair S.S., Naganathan N. & Ramanatha Rao G.

This report is based on the study of 735 cultures of tubercle bacilli identified as human type. Sputum specimens were collected from patients attending the Tuberculosis Demonstration and Training Centre, Bangalore, and from the mass case-finding studies in semi-urban areas. Drug sensitivity tests for Streptomycin, Isoniazid, PAS and Thiacetazone with different drug concentrations, different size of inoculum and for various length of incubation were carried out.

No difference was observed in the duration of growth between sensitive and resistant cultures in their first appearance on primary diagnostic cultures or sub-cultures on drug free slopes when innoculated with standard suspension. The primary cultures take about 3 weeks and sub-cultures 2 weeks for the growth to appear on drug free media. Large sensitive bacillary population required higher concentration of thiacetazone to inhibit the growth, suggesting standardization of inoculum size for sensitivity tests. Prolonged incubation period on drug slopes showed profound influence on the level of drug inhibiting concentration of thiacetazone; with the increase in incubation period, fall in growth of sensitive culture was observed even on high drug concentration. The reproducibility of this observation on duplicate specimens from the same patients after shorter intervals excluded the possibility of experimental error. A reduction in the inhibition of growth of sensitive organisms on drug media with time is presumed to be due to either deterioration of the drugs in the media or due to adaptation by the micro-organisms.

Because of the inhibition of growth even sensitive organisms may be classified as resistant if reading of culture for drug sensitivity is prolonged beyond 3 weeks of the inoculation period. It is suggested that a standard inoculum size and maximum limit of 3 weeks incubation period should be adopted for finding out the sensitivity to thiacetazone.

Cultures classified sensitive to the three first line drugs or resistant to one or more, showed no different in the pattern of sensitivity to TB1.

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A COMPARATIVE STUDY OF PREVALENCE OF DRUG RESISTANCE TO MAJOR ANTI-TUBERCULOSIS DRUGS

Rao K.P.

This report brings out the fact that prevalence of drug resistance among tuberculosis patients varies in different situations. The situations considered are: (i) Sanatoria, (ii) Urban Tuberculosis Clinic, (iii) Rural General Health Dispensaries, (iv) the mass case-finding among selected group of population and (v) survey of general population.

The prevalence of drug resistance (INH, Streptomycin and PAS) is found to be highest (53% to INH) among patients under situation (i) and lowest (11%) among patients discovered in tuberculosis surveys. Among newly diagnosed culture positive tuberculosis patients of urban tuberculosis clinic, rural general health institutions and selected case-finding programmes, proportion of patients with INH resistant organisms were 26%, 33% and 16% respectively. The resistant rates were generally highest in age group 25 to 44 in all 5 situations, case-wise rates were not significantly different. The prevalence of INH, Streptomycin resistance among patients found in special mass case-finding tuberculosis programme, were significantly lower than among patients attending special tuberculosis services or general health institutions.

This paper highlights the fact that prevalence of drug resistance among patients attending tuberculosis services and general health institutions is not a true index of the prevalence of drug resistance in the community.

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A COLD STAINING METHOD FOR TUBERCLE BACILLI USING CHLOROFORM

Rao K.P., Naganathan N. & Nair S.S.

The difficulty in staining tubercle bacilli is believed to be related to the complex surface structure containing a large amount of unsaponifiable wax. Any staining technique which can counteract the influence of this wax could therefore be expected to give better results. The standard method in vogue is by the application of heat which renders the bacilli permeable to aqueous dyes.

Several attempts have been made to develop a cold staining method for tubercle bacilli as for other organisms. Since this wax is soluble in chloroform, a cold staining method using carbol fuchsin containing chloroform was developed and the results of staining by this new method have been compared with the conventional ZN method in the present study.

Triplicate smears were made from 186 specimens and smears of each were stained by ZN, CS and FM methods. The results of examination of duplicate smears by ZN and CS methods show a higher degree of correlation with 75% showing identical grading and only 8% were positive by one and negative by the other method. The reliability of these methods was judged on the basis of culture results and agreement among themselves. The cold staining method was found to be as efficient as ZN method in detecting different gradings of culture positives. False positives with this method were significantly lower than by ZN or FM microscopy. Some possible explanations for the relatively less number of false positives under CS method have been discussed in the paper.

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GENERAL

DISTRICT TUBERCULOSIS CONTROL PROGRAMME IN CONCEPT AND OUTLINE

Nagpaul D.R.

This is a conceptual account of the District Tuberculosis Control Programme. The district Tuberculosis Programme was formulated by the National Tuberculosis Institute in 1962 to form the basis of a community-wide programme to deal with the challenge of a large, predominantly rural tuberculosis problem in this country. The limited resources in the form of funds, trained personnel and equipment, made it necessary that the programme be simple, easy to apply and widely acceptable.

The DTP includes provision for tuberculosis case-finding, treatment and prevention throughout the district from the health institutions in an integrated manner. Case-finding is carried out among the symptomatics attending the health institutions primarily by sputum examination and treatment is offered on ambulatory domiciliary basis.

District Tuberculosis Centre (DTC) represents the pivot around which the integrated DTP revolves. DTC takes up all the responsibilities in respect of the programme on behalf of the District Health Authority. It undertakes planning, implementation, coordination and supervision of the DTP in the entire district besides offering the usual diagnosis and treatment service to the population, under its direct care. Health institutions other than DTC which participate in the DTP are called "Periperal Centres". These are categorised into "Microscopy Centres" and "Referring Centres" depending upon possession of microscope or otherwise. Both categories are full-fledged "Treatment Centres". Sputum examination is offered to all symptomatics reporting at "Peripheral Microscopic Centres" and if found positive for AFB the patient is motivated and put on treatment immediately. DTC maintains the important "District TB Case

Index" and offers "referral" x-ray examination to the sputum smear negative symptomatics referred by the "Referring Centres". One BCG Vaccination Team also works under DTC. There is one DTC in a district and the already existing TB clinics become just "Sub-Centres" under one DTC.

Key staff consisting of a Tuberculosis Officer, a Treatment Organiser (TO), a Laboratory Technician (LT), an X-ray Technician, BCG Team Leader and a Statistical Assistant is required to provide service from the DTC and to organise the programme of case-finding and treatment in integrated manner throughout the district from all available institutions of General Health Services.

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PROBLEMS OF MAINTENANCE OF HOSPITAL EQUIPMENT

Menon V.A.

In an investigation carried out at the instance of Government of India, Mr Ernbourg, W.H.O. X-ray Technician, in 1960-61 found that between 40% and 50% X-ray equipment are idle in Government and quasi-government medical institutions all over the country. This paper deals with reasons and suggests a remedy for improving the situation because when society creates an institution for delivering health care to the community, it expects the institution to give fair returns on the investment of resources. When facilities made available to such an institution are not put to use, when required, then the community loses. This paper also suggests a method of evaluation of the lose incurred by the community and deals with reasons for such a loss.

One of the main reasons for non-utilisation of available facilities is the unserviceable condition of equipment. The main cause for this state of affairs is poor distribution and paucity of maintenance facilities available. These two reasons make servicing of equipment very expensive. Administrative constraints under which the institution delivering health care works makes the costly service inaccessible to them or creates considerable delay in its availability.

On the basis of experience of x-ray equipment maintenance in NTI during the preceding period, the average cost per maintenance or repair serviceisis worked out. By comparing it with cost of smsimilar service available to an average institution it is shown that to effectively cover institutions over a wide area, a cheap service organization which has units distributed very widely in the country is required.

Comparing the loss to the community due to idle equipment and cost of creating and running a cheap service organisation it is shown that investment in such a service organisation is profitable to the community as the estimated loss of Rs.71 million, can be brought down to 11 million with annual expenditure of only 7 million. Thus, a community can gain to the extent of 53 million every year by way of better facilities. For this purpose an investment of 3.5 million is requ8ired on capital account for creating a training centre for maintenance personnel and 0.8 million for running it. Such a Centre can provide the manpower required for running a country wide organisation.

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ASSESSMENT AND MONITORING OF NATIONAL TUBERCULOSIS PROGRAMME (NTP)

Nair S.S.

Assessment of a programme is the measurement of the extent to which its objectives have been fulfilled. This may be called assessment of efficacy. For this the objectives have to be defined in quantifiable terms which is yet to be done for the National Tuberculosis Programme. In particular to what extent the tuberculosis problem has to be reduced and within what period of time, has to be stated as the main objective.

However, assessment of efficacy is difficult as the impact of a Tuberculosis Programme is felt only after a fairly long period of time during which other socio-economic factors etc., also influence the problem. Any early assessment of problem reduction will only be a very costly attempt at proving the obvious and will possibly lead to frustration. Hence, a different methodology of assessment has to be adopted.

Measurement of the extent to which the expectations for various activities under the programme are being fulfilled is referred to as assessment of efficiency. Such assessment seems to be a practicable solution to the problem of assessment of National Tuberculosis Programme.

For this purpose, certain stages of the programme with quantifiable objectives (expectations) should be formulated and assessment of efficiency of programmes in different stages should be considered separately.

Use of monitoring or assessment based on reports has been illustrated. It is stressed that monitoring could give useful information about the working of the programme provided:

i) the efficiency of reporting from peripheral health institutions to the district level and from districts to State and Central levels is improved, and

ii) such assessment is done separately for districts under different stages of development

Assessment becomes a mere exercise if the corrective actions indicated are not taken. Assessment should be objective enough to inspire confidence and its findings should be accepted or at least appreciated by the persons incharge of the actual functioning of the programmes. For this, a proper climate for assessment should be created so that assessment is welcomed by programme organisers and corrective actions are taken soon after completion of assessment.

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OPERATIONS RESEARCH IN PUBLIC HEALTH

BY
STIG ANDERSEN*

1. Introduction

The spectacular progress of public health in certain parts of the world during the last century, and notably in the last half century, was a result of a cumulative interaction between a large number of factors, chief among which are two broad groups of factors: economic progress and the development of science. The gradually richer society could afford to buy more and more Public Health Services, improved public health in its turn accelerated economic progress, but also—and this is the crux in the present context—the technical means of the Public Health Services became invented and developed more or less at the time when the increasingly prosperous society could afford to apply them. The research that was needed during this process was mainly inventive and experimental.

The situation in the under-developed countries by mid-twentieth century corresponds in some respects to the situation a hundred years earlier in the rich countries; economies that cannot afford to buy an adequate Public Health Service and a state of national health which hampers economic progress. However, the decisive difference is that a very large part of the inventions and experience in techniques are now available to apply in logical systems as and when the economic position permits—and forces—the authorities to develop the public health service. This relative preponderance of technical knowledge over economic capacity is the social fact which necessitates a new type of research. The research which is foremostly needed in the poor countries of the world is not inventive and experimental research; the demand of these societies is no longer for new techniques and new inventions to improve their human material to a level they can now afford; their demand is for systems composed of largely known techniques which give the optimal utilisation of scarce economic resources. Research that satisfies this demand can be called application research or, borrowing an expression from certain other fields: Operations Research

2. Operations Research

The techniques of Operations Research have mainly been developed, after a start in the military field during and after the Second World War, in the field of industrial management. There is little likelihood that operations research in public health can reach a stage, for many years to come, where it can utilise directly many of the mathematical programming techniques which have been developed for military and industrial purposes. However the basic concept of research into total systems which, in principle, can be translated into mathematical models, can and should be adapted to the needs of public health services research. The name operations research implies that it involves research into some or all aspects of conducting or operating a system, a business, a service, and treating the system as a living organism in its proper environment; thus it distinguishes itself from laboratory research.

The following are the major phases in operations research, adapted by the author from

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Churchman, Ackoff and Arnoff (1957) and *Houlden* (1962):

1. Formulating the problem, including definition of the objectives.
2. Collection of data relevant to the problem.
3. Analysis of data to produce a hypothesis and a mathematical model to represent the system under study.
4. Deriving solutions from the model.
5. Choosing the optimal solution and forecasting results.
6. Testing out the optimal combination of interventions, with controls in-built in the system to keep continuous check on the hypotheses
7. Recommending implementation of the solution, including the control system.

The concept of an operations research team is an important aspect of operations research. No one single person possesses all the necessary skills and experience to conduct worthwhile operations research. Usually a team in industry comprises scientists in the fields of mathematics, statistics, economics and engineering, in addition to experts in the special field under study. Sometimes the team also includes a professional logician or a specialist in the science of scientific methods.

3. Operations Research Applied to Public Health Services

The need for applying an operations research approach to public health problems has during the last few years been recognized by a few foresighted public health administrators particularly in the United States and in the United Kingdom, see e.g. *Committee of Enquiry* (1956) and *Bailey* (1962). One of the problems that has particularly had the attention of operations researchers in these countries is hospital planning, see *Bailey* (1957).

There is no doubt that many public health administrators in the poor nations of the world are solving problems in ways implicitly akin to operations research. However, it is the contention of this paper that a more explicit adoption of an operations research approach would be of the greatest benefit to the Public Health Services of these nations. Moreover, operations research should be applied not only for solution of detailed problems within the services, but, more importantly, to larger systems within them, as well as to the entire system of the Public Health Service in the nation. A modest attempt to apply operations research to one system within India's Public Health Service is being made by India's National Tuberculosis Institute in respect of the developing National Tuberculosis Programme. The Institute is only at the beginning of its efforts, and only a few aspects have been dealt with in published papers. *Andersen & Piot* (1962) gives a summary of the operations research approach of the NTI. *Raj Narain* (1962) summarizes the extent of the problem to be dealt with, *Waaler, Geser & Andersen* (1962) attempt a first formulation of an epidemetric model, and *Banerji & Andersen* (1963) and *Andersen* (1962) deal with certain sociological and economic aspects. A provisional "optimal combination of interventions" is suggested in *Piot* (1962). The present paper suggests that operations research be applied to the whole system of a Public Health Service and attempts to foresee some of the types of problems which an operations research team would be faced with, divided into the seven major phases of operations research listed above. In principle the problems outlined would be common to a good number of countries in Asia, Africa and Latin America, but here and there it may be apparent that India's Public Health Service has been consciously or unconsciously in the author's mind.

3.1 The Phases of Operations Research

3.1.1 Formulation of the problem

The first and perhaps one of the most formidable challenges to the operations research team is the precise and explicit formulation of the problem. What is the system under study? Does it comprise the entire health field of the nation? Or can the team at least confine itself to that part which is under direct public control? How does the team define the boundaries of its field towards other public undertakings the expenditure on which can be considered alternative to expenditure on public health? Can it evaluate public health outputs without comparisons with results of alternative investments? It is not unlikely that it may be found necessary to confine the first stages of a systems analysis to one or a few local areas, and perhaps even, to begin with, to a given total budget so as to reduce the total number of variables.

Even if, by this and other means, the system under study is brought down to manageable proportions, the team is left with an equally arduous task: the definition of objectives. At first glance it may appear puzzling that this should be part of the researchers' function. It

is usually, and rightly considered outside the province of the scientist, as a scientist, to decide or interfere with the objectives of a service, which are determined by the executive and ultimately by the people and its elected assemblies. However, in modern complex societies the popular will and even the executive's objectives are not necessarily very transparent and they are usually difficult to translate into scientific terms. Conceivably, the administrative and political heads of the Public Health Service could be assumed to want "the maximum utilization of the given resources towards the promotion of health among the people", but the operations research team would require far more specific objectives than that. A major obligation of the team in the first stages of its work is to guide the executive towards very specific definitions of objectives. (If the team never achieved anything else this would in fact be an extraordinarily valuable contribution).

The team must stimulate the executive to define the objectives by putting to him the logical alternative: what is meant by "given resources"? Cannot the resources planned to be expended on public health services be increased or reduced, if the expenditure can be shown to be more or less profitable than assumed? What is meant by "promotion of health"? One might particularly wish to emphasise one of the two entirely different aspects: 1) the state of health itself, in a certain distribution in the population, which again might be viewed under a) absence of ill-health and b) presence of positive health, *or* 2) existence, in reasonable proximity of the thus distributed population, of a confidence-inspiring health service. Again, "among the people" must be far more sharply defined; assuming that equality is a guiding principle, are qualifications to the general equality principle to be considered permissible, e.g. emphasis on highly productive groups, or children versus old people? Among the most difficult problems are those of the dynamics of the objectives: Should there be date-target-setting? Or should the formulations be more dynamic and relate to the development over a period? If so, which period? and should they be related to the concomitant economic, demographic and other social development?

Already at this stage the team will have to start considering the terms of the solutions, particularly on the output side. When the team—and the executive—have agreed on a set of general objectives, they have to be specified, perhaps in the form of indices, some of which probably can only be formulated in the course of the data collection process. The demands in these respects will become clearer, when the data collection and model construction are dealt with, below.

3.1.2 Collection of data

The collection of data is inextricably related to the formulation of objectives, above, and the formulation of the hypothesis, below. Data collection, no doubt, is bound to be extensive, but it must also be strictly economical, and strictly relevant to the objectives and the hypothesis. It can perhaps be said that data collection, in present day public health services research, is relatively over-developed. A wealth of material, no end of official reports, quite a bit of scientific data, become available every year, but this material is rarely, if ever, related to clearly formulated objectives and hypotheses, and it is therefore of far too little value for decision making. For this very reason, the operations research team will have to supplement existing data considerably; but it should only collect data that are strictly necessary for its other functions and it should not be hesitant about making "informed guesses" when it finds that data collection on a particular subject is out of proportion in cost to the importance the data will have in the total system. Naturally, the team will rely extensively on sampling techniques. This is particularly true for a large part of the output functions, where a good deal of the information is to be collected among the general population. On the input side, cost of services, training of personnel, medical stores handling, administrative and technical operations, data collection will largely be "total", since the number of units to be observed will often be too small for sampling. The major part of the data to be collected under this phase will be on the system as it now works and the results that are now obtained. But under many circumstances it will probably be found necessary to supplement these data with a limited amount of data of a more experimental type. Such public health "experiments" have for example been found useful by India's National Tuberculosis Institute which is conducting a series of comparisons of organizational approaches to tuberculosis control in a number of primary health unit blocks in South India. The detailed protocols for these so-called operational investigations are available (*National Tuberculosis Institute* (1961).

For its data collection functions the operations research team will have to employ special investigators. Depending on the fields in which data are particularly lacking, they may need medical officers, various kinds of paramedical technicians, accountants, social investigators, demographic investigators. Most of these categories must be given special courses in interviewing techniques.

One phenomenon must be mentioned in this context: the effect of observation on that which is observed. That is a difficult factor to deal with in all scientific enquiry, but it is particularly disturbing in operations research where "experimental conditions" cannot, in fact shall not, be established. This observer-effect must be kept constantly in view, partly in the data collection and the test runs (see below) themselves, where all devices must be employed to minimise its influence, partly in the analysis where the effect which nevertheless remains must be accounted for.

3.1.3 Analysis and hypothesis formulation

The formulation of the hypothesis or the construction of the model to represent the system under study may be considered the pivotal procedure of operations research in the fields where it is now relatively highly developed. By far the largest part of existing literature on operations research deals with the mathematical and statistical problems involved in this phase of operations research (an exception is the very useful book by *Eddison, Pennycuick and Rivett* (1962), which gives an overall review of operations research in industrial management in largely non-mathematical terms). There is also no doubt that the pioneers in operations research in public health must strive, within a few years, to reach the stage where at least simple models depicting a public health service can be constructed. Such models will probably be input-output models of the type which are particularly employed in econometric research. However, with a system as complex as a whole national health service, with inputs that can only with the greatest difficulty be translated into common terms and, particularly, with outputs the units of which vary from, say, average nutritional status of a population to, say, average health service consumer satisfaction, it must be considered unlikely that comprehensive and useful models strictly mathemetically formulated, will result from the first few years of the operations research team's efforts. This does not by any means defeat the purpose of adopting operations research techniques in public health. Firstly, for quite some time, invaluable contributions can be made by the other phases of the research: the careful formulation of the problem and the objectives, the purposeful, economical collection of data, the precisely formulated and carefully evaluated test runs (see below).

Secondly, while it may not be possible to formulate the model or the hypotheses wholly mathematically to begin with, the operations research team can very well, and will, think mathematically, i.e. logically, in making the formulations under this phase; they will think in terms of hypotheses, assumptions, parameters and prognoses precisely expressed and systematized—committing themselves so that they expose themselves to the test of verification.

The model is a simplified explicit description of the existing Public Health Services, the elements and factors of which it consists and relationships between them. It comprises the input of resources, in terms of money, material, personnel training, in terms of preventive, curative and educational services, in terms of administrative, decision-making and evaluating machinery, in terms of geographical and functional distribution of resources. It comprises output partly in terms of operational achievement, public participation in services, numbers of relevant health personnel actions, again geographically and functionally distributed, partly in terms of fulfilment of declared objectives, including disease control, health promotion, demographic change, consumer satisfaction and economic effects. The construction of such a model, even if vastly simplified, is in itself a complex affair. However, the operations research team cannot be satisfied before it has at least broadly outlined the relationships of this model to the whole social system, i.e. the interactions of the public health system with the rest of the system and the partly supplementary, partly competitive relationships between investments in public health and alternative investments.

The operations research team will, certainly in the first phases of its work, severely limit the scope of their model in order to keep it within a reasonable degree of simplicity. Firstly and foremostly, it would no doubt find itself forced to disregard other sectors in the social system to begin with. As already mentioned, under definition of objectives above, the team would perhaps also start with the assumption that present resource allocation to the total public health service is an unchangeable para-

meter. Furthermore, it would restrict the inclusion of objective fulfilment in the model to a very few simple indices. Finally, but not least, the team would attempt to construct the whole sysem in terms of a manageable number of *key variables*.

One of the central functions of the team is the selection of what is to be considered, at least provisionally, the key variables of the system. In such a complex system as a health service, no model or hypothesis can ever be expected to comprise all the innumerable interdependent variables of which the system consists. Among them, the team must choose the key variables, i.e. the variables the changes of which bring about the largest effect in the total system. Though observation plays its considerable role when this choice is made, there can be no doubt that insight and more or less intuitive understanding of the system will be of decisive importance. This is the situation where all team members, with wisdom and patience, even humility, must sort out what is true insight from what is mere prejudice.

It is in the formulation of these hypotheses that the *team work* is put to its acid test. There can be no strict delimitations of the functions of each team member; everyone must contribute his insight, skills, experience—and his tolerance and patience. The logistics and and methodology may well be largely contributed by the mathematician and the statistician, and the material knowledge by the public health administrator, the epidemiologist, the economist and the sociologist, but unless they gradually all get a considerable grasp of each others' subjects they will be unable to make their full contribution.

Examples of factors and relationships which would beyond doubt be part of the model are: Input: the total health budget, its geographical and functional breakdown, inflow and outflow of personnel, quantity and quality of training, inflow, storage and consumption of durable and non-durable goods, distribution of all types of health services and institutions; output: operational achievements seen from the side of the services, including for example, participation and attendance, vaccinations performed, number of child births assisted, wells constructed, drugs distributed; otherwise the output part of the model can probably afford to be rather sketchy and give four or five indices, as mentioned above e.g.—demographic: crude or age-specific death-rates and birth-rates, epidemiological: prevalence of two or three major diseases, educational: at least one index of health educational status.

3.1.4 Deriving solutions from the model

The solving of the model consists in a long continuous series of theoretical input changes in the model and calculation of the probable output changes. Input changes range from, for example, replacement of female health visitors with male or simplification of procedure for indenting supplies, to, for example, major shift of emphasis from curative to preventive services or radical reforms in the organizational machinery or in the training of health personnel. The solutions theoretically carried out—on paper and in digital computers —will have the form of combinations of interventions in the existing system. The number of possible combinations of interventions, naturally, is virtually infinite.

However, two factors will contribute to restricting the number of combinations to be deemed worthy of study: Firstly, the team's choice of key variables in the system (which may, admittedly, be revised in the course of the process of deriving solutions) will limit the number of even theoretically possible solutions. Secondly, the economist will constantly keep the team in check in respect of what is economically feasible; the public health administrator will have a similar function on administrative subjects; the epidemiologist will restrain enthusiasm, for example, concerning the possibilities of "eradication" of specific diseases; the sociologist will no doubt often have to remind the team of what is socially, psychologically and politically acceptable, and the statistician and the mathematician will, among other tasks, certainly see that the imagination of the team does not transgress reasonable limits of calculability. Finally, and most importantly, the common sense of all team members will restrict the field of theoretical study to sufficiently few combinations to make it possible to derive solutions before the administrators become too impatient about the results.

When this is said, however, one should not forget that it is exactly in the play of the creative imagination of the team—together with its scientific restraint—that the hope lie of considerable improvement of the system under study. Within reasonable limits of realism and practicability, the team should play a very free game with the multiple factors and relationships involved, combine and re combine until theoretically optimal combinations are approached. This "game" will consist of an iterative process of varying the value of a small number of variables while keeping the remaining variables constant. In th

process, a number of, at least apparently, virtually equally good intervention combinations will be pursued, until the team ends up with, perhaps, five or ten combinations the output results of which appear to be of comparable magnitude.

3.1.5 Choosing the optimal solution and forecasting results :

With a limited number of intervention combinations thus arrived at, the team faces the choice of one of these solutions to be put to a test (under some circumstances the team may find it desirable and possible to put more than one solution to a test).

Before making this choice the team should consult the executive. The various intervention combination are likely to differ from each other particularly in two major respects: firstly, there will be a variation in regard to the degree of departure from the existing system, secondly, the solutions will differ in respect of the degree to which they are calculated to fulfil each of the three, four or five major objectives.

The team is now in a position to present the executive with a set of specified proposals for interventions with details of changes needed in the system and consequences of these changes. The choice should be a collective choice of the executive and the team, but no doubt with a final veto-power vested with the executive.

Once the choice is made (and this could be of two or three combinations of interventions, as mentioned above), the team proceeds to working out the details of implementation of input changes and details of the prognosis of results, operational as well as in terms of fulfilment of objectives.

These details should in the first instance be worked out only for the test run area; and they should specify not least the exact timetable of implementation. One would hazard to guess that a good deal of the intervention would lay major emphasis on training changes and, again a guess, would comprise a series of manuals laying down the functions, in greatest possible detail, of all personnel engaged in the public health services in the area.

A crucial part of the solution is the prognosis. This prognosis will partly forecast the change in operational achievements, partly the change in results (mostly in indices) in terms of the declared objectives. In this prognosis the team is to prove its worth. Their task is, at least in principle, relatively simple as far as operational achievements are concerned: for example, this and that change in attendance to out-patients departments, this change in turnover of such and such drugs in the medical stores depot, so many new closed and chlorinated wells in so many villages thus distributed over the area; though even in these forecasts their skill, not least in judging human frailty, will come to a severe test. But more difficult by far, both principally and practically, is the team's task of forecasting the results proper in terms of the objectives, so much more so as they cannot afford to omit any of the major aspects of health and disease in their forecast. For example, while incidence of small-pox may not necessarily be comprised in the model describing the existing situation, the forecast should probably include an opinion on the likelihood of small-pox outbreaks in three and five years' time.

One of the most important obstacles for the output forecast relates to the relative slowness with which health status, health consciousness, health action, health habits, etc. develop. Even rather radical changes in several aspects are not observable in less than five or ten years' time, because the variation within the material is so huge. The team will therefore probably have to select a range of indices with varying reliability and varying sensitivity, so that changes in at least some of them are observable after a rather short time, say, two years, and if these indices are then, as one would expect, relatively unreliable, one must await their gradual confirmation by more reliable, but less sensitive, indices during the following years.

The form of the prognosis will largely be statistical and conditional, where the results, for example, are expressed in terms of 19 in 20 chances of this or that value being within such and such limits, provided the operational achievement atttains such value, and within such other limits if the operational achievement attains such other value.

3.1.6 The test run and the control system

The test run is not a central part of operations research in industrial management, but it is likely that it should play a key role in the application of operations research to public health services. The first operations research teams will not only have no experience, at least in this particular field, but they will also, on the whole, have far less operational knowledge and less epidemiological, sociological and psychological data, compared with the knowledge and data available to

their colleagues in industry. Their system will not be vastly more complex than the systems in industry, and it will be rather less complex than econometric systems, but in comparison with industrial researchers the team will be confronted with a larger number of factors which would not be within their ambit of control (though the demand for health services is probably just as foreseeable as the demand for, say, nylon stockings). Under these circumstances it would seem advisable to give rather heavy emphasis to the test run. Operations research in public health has, in the practicability of test runs, a considerable advantage over econometrics, where test runs are virtually out of the question.

The most important characteristic of the test run is that, while limited geographically, it is true to life in every possible aspect. It is true that the observer-effect mentioned above will play a role; it is also inevitable that the personnel executing the test will know that they participate in a special programme and that this will influence their behaviour. These factors must be rigorously controlled, and in the evaluation of the test run they must, as far as possible, be taken into consideration. Risking to state the obvious, it may perhaps be mentioned that the test run is in no way spectacular, a showpiece: the test run operators are, with as little fuss as possible, quietly told to follow such and such new instructions which, in many cases, may not be strikingly different from existing ones, though probably often more explicit. The test run area should be of manageable size, but it should be sufficiently large to provide observations for proper statistical inference. Thus, it would seem necessary to have no less than 60-100 basic health units (centres, dispensaries) in the test run area, so that their operational achievements can be analysed as proper distributions.

The major difference between the test run and the final national implementation is that the former has a more intensive control system. Even the final implementation will have, of course, a carefully planned control system, but for the operations research team to derive full benefit of the test run they require a particularly good apparatus through which information on all aspects of the operations and their results are fed back to them. This feed-back information will continuously be analysed and compared with the prognosis and whenever key variables attain values outside the pre-determined limits of variation these new values must be fed into the model and the hypotheses and the model solved anew. The question will soon arise as to what extent to allow change to be made in the test run programmes, if and when they turn out to run wide of the mark. In principle, the test run should no doubt be allowed to run itself out without modification, and new test runs in new areas implemented if need be, but the team may have to find compromises between this principle and practical necessities.

Although the control system should largely be in-built, i.e. the operators and operations report themselves on their performance, the test run will need additional investigations staff to conduct sample investigations of the results (mainly interviews of population) and even local statistical assistance to cope with the very large material which the team will require.

3.1.7 Recommending implementation

The last link in the chain of operations research is implementation of the solution in the whole system, and establishment of a total control system, i.e. an evaluation machinery with an apparatus for new decision making when the key variables change beyond predetermined limits. In industry (and in the military field) such implementation follows more or less automatically after the final solution has been arrived at and tested, though even here the stock-holders may insist on having their last say. In a public service there may well be considerable obstacles before the rational solution is put to work.

This rationality may in the first place be questioned by the executive and by the public, and even when the rationality is recognized the solution may be deemed politically unacceptable to special groups or certain political parties including the party in power. However, in principle even such factors should already have been taken into consideration by the research team—this is one of several justifications for the inclusion of a sociologist —and in the case of failure to have the scheme implemented it can rightly be blamed on the team that it did not appreciate the political climate in which it worked. For example, it is of little use if the team arrives at a major conclusion that the whole health service, including general practitioners, should be nationalised, if the feelings and power of the medical profession and/or the public are

such that this part of their solution is not feasible.

The recommendation for national implementation would probably in many cases, notwithstanding a successful test run, be in the form of a recommendation for gradual extension, with a large pilot area to begin with, where the realism of the test-run-modified solution is put to a final test.

3.2 Minor Uses of Operations Research Techniques in Public Health Services

Operations research is wholistic, it treats a system as a whole. However, whole systems usually consist of many smaller ones. A national public health service is itself a sector only of a whole economic-social system, and the public health service in its turn comprises a large number of smaller and bigger sectors and units within many of which one can well visualize good use being made of operations research techniques. Such work has, it would seem, far lower priority than the efforts described in the preceding paragraphs, but a team working in a country on such a major effort might find it worthwhile to gain experience from solving such smaller systems problems. One example of a sub-system which would no doubt be fertile ground in many countries is the medical stores system. Considerable loss in operational efficiency is sustained in some countries because the Medical Stores take months, even years, to expedite indents; and this often occurs at the same time as the Stores have to dispose of, occasionally destroy, items which have become obsolete because of technical developments.

The team might also try to solve part-problems within the main system before, or as part of, the solution of the overall systems problem. Examples of such part-problems are: optimal size of area and population to be covered by midwife, smallpox vaccinator, basic health unit; ideal vehicle for local health workers; administrative management solutions leaving maximum time for technical personnel to utilize their skills; architectural design of hospitals and health centres; queueing problems in out-patients departments and hospital waiting lists; solutions to integration problems where specialized services have developed on emergency basis outside the general health services. For the methodology of some of the above problems the team could rely heavily on techniques developed in industry, the parallel often being quite obvious with industrial management problems.

3.3 The Operations Research Team

Operations research can be a more or less continuous process, or it can be a valuable one time effort. Once a team has gone through the full seven-phased procedure, described above, the service will presumably have been considerably improved, and the task of the team can be considered accomplished. For a smaller national service such a procedure or perhaps gradually a more simplified one, could be repeated with intervals of, for example, 10 years. For a large country, for example the three or four largest in Asia, it would seem justified to make operations research a permanent feature of the national health service. The team would here be employed, perhaps equally much, in the overall systems research and in work on part-systems and specific local and functional problems. With such a variation in the requirements it is difficult to suggest general rules for the size and composition of the operations research team. However, some features would be more or less common to all such teams:

The minimum composition is probably a public health administrator, an epidemiologist, a mathematician, a statistician and a social scientist. Larger teams should probably also comprise an engineer (sanitary), an educationist, and the general social scientist should be replaced by an economist and a sociologist. To this must be added, because the team must have its own data collection apparatus and test run evaluation system, a number of investigators of various categories, perhaps 10 or 20 more, and a group of junior statisticians and statistical clerks, numbering perhaps equally many. Finally, if they cannot rely on outside assistance in computer programming, they must have their own personnel for this purpose. They must have full-time disposal of statistical processing machinery, for example of the IBM 101 type, and part-time disposal of a digital computer, e.g., of the type IBM 1620. Mention has already been made above of the extraordinarily strict discipline and dedicated loyalty that must govern the behaviour of the team. Such a team spirit can only be expected, if each individual member is very carefully selected, but another condition is no doubt that the team is headed by a man of outstanding competence. He must partly command complete respect and loyalty among his team members, partly possess all the diplo-

natic skill which is required to secure the ecessary cordial relationships with the scores f top men operating the system which the eam reviews—and sets about to change.

.4 A note to two kinds of sceptics

3.4.1 "This is just common sense—with a superstructure of fine new words"

Operations research *is* very little but common sense. This is perhaps even more true when it is admitted that in the first stages of applying operations research in public health services mathematical models may be of rather limited relevance. The essence of operations research *is* that logical thought, combined with careful observation and methodological analysis, should form the basis for decision making. Adoption of such a principle may not appear very revolutionary, but in an irrational world the public health service that carries it out to it its full logical consequence, abiding by its sometimes exacting commands, would be likely to find itself a vastly better service. The methodological study of alternative courses of action can of course be given many names; much the same kind of activity has variously been called Work Study, Cybernetics, Systems Engineering, or simply Planning—and probably most operations researchers would be quite proud to have their science known as the Science of Common Sense.

3.4.2 "Operations Research can never replace experience"

Human experience is a more or less unconscious collection of data and analysis of data by an individual or a group of individuals. But experience is often unreliable, is often narrow-based and tends to be biased in the selection of data. Scientific methods can remove the bias and ensure that data are properly systematized to give a truer picture of the past and a more reliable forecast of the future, including the probable outcome of intended executive action; and they can give a measure of the so-called imponderables by calculating probabilities of occurrences. However, the operations researcher still needs the "experienced" man who helps in the selection of key variables and in estimating their value if they cannot be directly assessed, and in these processes intuition and inspired guesswork are indispensable. But intuition and guesswork will play only their planned part and should not be allowed to govern the whole or the larger part in the decision making.

4. Proposal for a Project to Study the Methodology of Public Health Services Research

It will be obvious from the above that there exists a great need for the development of methodology of public health services research, with special reference to the poor countries. Some ways to tackle the methodology problems have been suggested, but they are all very tentative. It would appear that the stage reached is one where a project is required, which could attempt simultaneously to conduct methodology research and action research; a project which is foremostly aimed at developing methodology of public health services research, but which, for this purpose, goes through the motions of doing this research, thus conceivably achieving material results for the country in which it works.

The difficulties in implementing such a project are momentous. But the possible dividends of carrying it out with an acceptable degree of success would seem to justify a certain risk of failure—provided one takes cognizance of the difficulties in formulating the plans for the project.

4.1 Location

If even moderately successful, this project may be considered the first in a series to be planned and implemented in many countries in all regions of the world. It is therefore important that it should be located in a country which can provide an example for the situation which may *become* reasonably typical of other countries in some years' time. This condition points towards India in Asia and the comparatively developed countries in Africa, for example, Nigeria and Ghana. India has an advantage in its very size; India's huge area and population would provide the necessary testing ground both for data collection, test runs and pilot application, and the variation in conditions from one part of India to the other would constitute a smaller problem than the variation between, for example, the various sovereign states of Africa. India's major disadvantage is probably the federal structure of its government and health service. National plans are formulated, but in the final analysis the individual state has complete autonomy in health matters. In fact, however, there is considerable and increasing uniformity in structure between state health services.

In favour of India speaks also the availability of personnel. This is true both for senior personnel—India's fine traditions in statistics are well-known—and for the indispensable medium-level personnel. It is not fortuitous that India has also pioneered in applying an operations research approach to problems of national economic planning, see *Mahalanobis* (1955).

4.2 Plan of Action

It is to a degree a self-contradiction to propose any details of the project's plan of action, since it should be clearly understood, as one of the basic principles of the project, that the team should have complete freedom to choose and develop its own methods. Even the frame outlined in the above seven phased programme should in no way be binding on the team. However, it is of course necessary for planning and budgetting the project to have a vision of the probable physical set-up. Below, therefore, is an outline of this set-up, which would have to be reviewed by the team as and when they begin to decide on their methodology. The team proper should comprise the following specialists: a public health administrator, an epidemiologist, a mathematician, a statistician, a social scientist (sociologist), an engineer (sanitary) an educationist, an economist. This team is headed by a team-leader who can be either one of the above if one is suited or a ninth person who could then devote himself entirely to the coordination of the work and the external relationships.

In addition to its foremost duty, namely thinking, the team will have certain executive functions, managing (1) data collection which will probably mainly be under two heads (1.1) epidemiological and related data and (1.2) social, economic, organizational and related data, (2) test runs, and (3) statistical processing, including computor programming.

4.2.1 Data Collection

The data collection activity will, to begin with, mainly be related to the model construction or hypothesis formulation. In later phases data will have to be collected in the test run areas to supplement the information fed back through the in-built control system. It is possible that the team will find it necessary to carry out a limited amount of experimentation in small scale operations. If this is the case a third unit should probably be added to the two suggested below.

4.2.1.1 Epidemiological Unit

The epidemiologist should head a unit collecting data of epidemiological and related nature. It is difficult to foresee the need of personnel in such a unit. Some data are collected from existing reports and other literature; for this probably two or more research assistants are necessary. Some data are collected in the field, and it is only when starting his work that the epidemiologist can begin deciding the kind and amount of staff he needs. One may guess that he will need at least one or two medical officers, one or more laboratory technicians, quite a number of interviewers, who might be medical social workers. He would probably also need a statistician in his own unit to do the sampling in the field and to check and control records from the field investigators.

4.2.1.2 Social Science Unit

The social scientist should head a unit collecting data of social and related nature. This unit again would need several research assistants to sift existing recorded data, among whom probably a professional accountant or budget analyst. Field data collection will also be considerable, and certainly half a dozen perhaps a dozen social investigators will be needed.

4.2.2 Test Runs

It is visualized that the test runs will play a very dominant role at least in this first project. If the project is located in India the team might conduct as much as two, three or four test runs, each probably covering a full district, the average population of which is 1.3 million, with an average number of health institutions of 40 to 60. For managing each test run the team should probably have a special team on the spot, consisting for example of a medical officer, a public health nurse and a statistician. Each such team should have clerical assistance to the tune of one stenographer and four statistical clerks. Since it is envisaged that one of the main proposals from the operations research solution will be improved and extended pre-service and in-service training of health personnel, the test run sub-team could probably

undertake training functions in addition to their main function as local evaluation unit; though there may be a danger in combining an executive function and evaluation in the same persons. The head of the unit directing and coordinating the two, later perhaps three or four teams would presumably be the public health administrator of the operations research team.

4.2.3 Statistical Processing

The statistician of the team will head a rather large statistical unit. The unit should probably comprise two additonal statisticians and about a dozen statistical assistants and clerks. To this must be added the operators required for the computer and other statistical machinery. With the exception of a good deal of transport, virtually the only type of equipment needed for this project is the statistical machinery. It is likely that part-time service of a machine of the IMB 1620 type would be required in addition to punch-card processing machines, but it is essential that the statistician and the mathematician of the team should make this important decision themselves.

4.2.4 Internal Administration Unit

In order that the team should have minimal problems of internal administration an adequate administrative and accounts unit should be established, headed by a high-powered administrative officer. In summary, the Operations Research Team, itself numbering 8 or 9 persons, might need the assistance of as many as 75 to 100 professional and semi-professional people.

4.3 Recruitment of Personnel

It is not an exaggeration to say that the personnel for such a project do not exist; it must be created, or it must gradually create itself. A group of, probably relatively young, scientists must be collected who are prepared to dedicate themselves for a good deal of their life-time to what amounts to creating a new branch of research. It would no doubt be an advantage if one or more of the group had experience in operations research in industry, failing which one or more should have experience in programming techniques in national economic planning.

If the project is partly financed from international sources, a number of the members of the team might be internationally recruited, to the extent that naional staff is not available.

4.4 Finance

A project as the one outlined above might cost between 10 and 20 lakhs rupees per year. Though it is likely that the project would soon be able to effect savings of a considerably higher order than this, it is also true that the project's purpose of developing methods could be hampered if too early material results were expected from the team. Under these circumstances, it would seem natural if a good deal of the financial burden were to rest with international agencies.

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PROCEEDINGS

OF THE TWENTYSIXTH

NATIONAL CONFERENCE ON TUBERCULOSIS AND CHEST DISEASES

HELD IN

BANGALORE

JANUARY 1971

★

UNDER THE AUSPICES OF

penetrate down to the rural areas. Their mission should pervade every section of the community and permeate every strata of society. For this purpose they should have a net-work of efficient district and taluk associations with programmes to involve the community in their working. I am afraid our Associations have not yet reached this stage. Many of the State Associations no doubt stimulate the formation and working of District Associations and some of them do operate direct services to demonstrate the benefits of official programmes. The mass contact programme organised by the Maharashtra Association and lately by Kerala and Andhra are noteworthy and if extensively adopted can be an effective programme to stimulate and supplement Government work.

15. I am happy to say that the Tuberculosis Association of India is considered as one of the best voluntary Associations. It has a regular programme of which organising the National Conference yearly is only one. Through its highpower Technical Committee it endeavours to evolve the *modus operandi* for tuberculosis control work in India. The publication of the Blue-Print, revision of Classification, compilation of the Text-Book, publication of the Journal and the Hand Book on Tuberculosis are some of its outstanding contributions. It has recently established a Research Committee with distinguished workers as members. Its outstanding contribution in the international sphere relates to the initiation of the formation of the Eastern wing of the International Union which today is said to be the most active Regional Body of the Union. Credit for reaching this stage of excellence is entirely due to Shri B.M. Cariappa, the Secretary-General, the Executive and Technical Committees with the cooperation of all of you. We all recognise Shri Cariappa's dedicated services and great contributions. In appreciation of his personal qualities and spirit of dedication the Executive Committee have awarded a prize of Rs. 5,000/- to him on behalf of the Association. The Tuberculosis Association has great opportunities to be the harbinger of the health development of the people by showing that tuberculosis control is a community effort and with the cooperation of the government, the profession and the voluntary organisations the disease can be controlled with the participation of the people. It has been my privilege to have been closely associated with the Tuberculosis Association of India for over two decades now. I take this opportunity to record my high appreciatton of its work and wish it and its affiliates all success. I thank you for the honour given to me.

Shri B.M. Cariappa then read out the citation on Dr. A.K. Sil before the Governor presented the "T.A.I. cash prize" of Rs. 500/- to Dr. Sil whose article on "Status of the Disease compared in urban and rural areas in the newly diagnosed pulmonary TB cases" was adjudged best for the prize. The citation read as follows :

DR. A.K. SIL

After graduating from the R.G. Kar Medical College, Calcutta, Dr. A.K. Sil passed his M.B.B.S. in 1954 from the Calcutta University and T.D.D. in 1958 from the same University. He has been admitted to Ph. D. (Medicine) of the Calcutta University in 1970 and is now working as a Medical Officer in charge, TB Unit, Urban Health Centre, Chetla and Rural Health Centre, Singur, under the All-India Institute of Hygiene and Public Health, Calcutta, since 1961. He has held other positions since 1955. He has published several medical and scientific papers and educative handbooks.

Dr. K. Somayya, President of the Conference, in his address said :

Introduction

Twentyfive distinguished predecessors from this august platform have given their valuable advice on these occasions. During this quarter century tuberculosis control measures have become revolutionalised, the old order having changed yielding place to new. Naturally therefore the presidential addresses would have been viewed from different angles and appropriate emphasis made on several and various stages of the development in this specialised field. It will be better therefore, to think of a consensus than add to their multiplicity.

However, most of the suggestions common to these addresses remain unimplemented to this day. Let us therefore get to the grass-roots, rather than adoptivory tower platitudes.

Time is both an asset as well as a challenge. We have been in the anti-biotic era for quarter of a century now and the Five Year Plan period for well over two decades. Formerly we had no anti-TB drugs and no national programme. We have both these now. But our failure to implement the national programme throws additional challenges and creates fresh problems. We must search our hearts and find out why, if we have failed at all. However, it is obvious that the tuberculous bacillus is spreading by 'mercifully' sparing the lives of its victims for a few more years. The 'wonder-drugs' seem to be losing their edge on the bacillus due to the imperfect and incomplete treatment given to the patient. Treatment can be imperfect if the doctor does not keep abreast of the developments : it can be incomplete if the sufferer does not fully cooperate. Both will result in the emergence of the resistant bacilll which offer dangerous prospects of a terrible set back and reversion to the pre-drug status of the patient viz., prolonged suffering. These are unwelcome developments, certainly avoidable with the proper education and infusion of a sense of dedication to the profession, administration and the people themselves. Because, today we can even think of eradication of tuberculosis provided we have the will and the nation gives the problem the priority it deserves.

A war is on, ever since the discovery and application of modern drugs—a glorious war on this age-long enemy : but we are not yet waging a TOTAL WAR, a determined war though the situation demands it and several other countries have done so. Hence, we have to heed the warning signal and gird our loins to fall in line with them.

Men, Munition, and Money are the three essential requisites to wage a war. The fight against TB also requires these. When the specialist has given place to the generalist, the professional tends to become an unwilling worker, a half willing organiser and less responsible crusader. Hence, our cadres have become depleted and dispirited. Drugs are our munition. We hear they are in plenty and yet it is common to hear of shortage. At least there seems to be no shortage of the 2nd item—Money—on paper. How much of it is actually allotted and spent is not known. As funds were being thus diverted in the last minute by the State Governments the centre has taken up this responsibility and TB control has become a centrally sponsored programme. But the release of funds by the centre involves a lengthy procedure and waste of time. Assistance from International Organisations is said to be progressively declining. The picture therefore does not look to be rosy. It is against such a background that workers in the field of TB and Chest Diseases are meeting annually.

Before I proceed with my stray thoughts on various aspects of the problem, I wish to thank the Chairman and Secretary-General of the Tuberculosis Association of India and Members of Standing Technical Committee for nominating me as Chairman of the Committee and President of this Conference—I consider this as an honour to my profession-public health of whom I had been a solitary representative. I am also aware that in choosing me, you are recognising the contribution made by the Andhra Pradesh State Tuberculosis Association which I have the privilege to serve as its Official Secretary almost since its inception.

I began my career as a Medical Officer in the army during the Second World War. Later I was selected for the State Health Service. I was assigned the charge of BCG Vaccination Campaign when it was facing great opposition. At the same time I was also given the opportunity to form the Andhra Pradesh TB Association and step up its activities including the Seal Sale Campaign for fund-raising as well as Health Education. Thanks to the French Government, I had the opportunity to study the well organised Anti-TB services in Europe and the role played by their excellent Social Security System, which greatly enhanced the value of the control measure. My association with the Technical Committee of the Tuberculosis Association of India for years enabled me to study the growth and development of the National TB Control Programme. With the integration of Preventive and Curative services in Andhra Pradesh I had first-hand knowledge of the implementation of this

programme in my State. I shall naturally be leaning on the experiences and knowledge gained by me therefrom. I request you therefore, to share my thoughts. My address may not take you into the visionary heights of research of Dr. Viswanathan, Professor and Emeritus Scientist, nor be comprehensive as that of Dr. K.N. Rao, former Director General and noted TB Specialist. It will not be a marathon effort like that of Dr. Bordia, who fully justified his Advisorship, nor can it be so sweet and appealing as that of the indefatigable worker Dr. Deshmukh who is creating history with his Anti-TB Shibirs. It can be only a simple address like that of my immediate predecessor, late Dr. Umesha Rao. May God bless his soul ! But being an administrator and essentially a health worker, I also see the 'failing side of the wave' and be critical of the values attributed to our programme. If my remarks are depressing at times I request you to please bear with me, as my intention is only to alert the audience, wake up the Associations and request the organisers of National Programme to come to grips with the problems.

I have to submit that these are my personal views and do not represent those of my government.

The Problem

As you know the problem is vast and is spread out evenly among the six lakhs villages and 3,000 cities and towns with about seven million active cases of which nearly two million are infectious. With the increase in the population every year, more number of cases seem to be added than being controlled under the programme. Therefore it is likely that the gains made are neutralised, or even the provisions currenly available become inadequate. As several health problems are to be tackled simultaneously, an integrated approach has been adopted. Happily today there are 95,000 doctors working in more than 12,000 institutions all over the country in 5,200 community development blocks covering about 75,000 population each but all of them are not involved in tuberculosis work. As against a general bed-strength of 2.5 lakhs, about 35,000 beds are devoted to TB in 92 Hospitals and 68 Sanatoria and some of these beds are lying vacant for want of finances which formerly were used by the paying patients. Today patients claim the privilege of getting free treatment and brought down the cost. However, since the direct and indirect costs of treatment of TB cases are estimated at 2,000 crores of rupees. no effort should be spared to reduce this colossal waste of funds on illness and premature death, and to increase economic production and ensure better health to our people (Dr. K.N. Rao).

In several countries TB was fairly well controlled even before the advent of drugs with the traditional concepts of prolonged rest, fresh air and good food, backed by excellent social security measures. In the post-war Europe, especially the East European countries—Bulgaria, Hungary. Poland and Czeckoslovakia—put up an all-out

effort and brought the problem under control within a decade, making use of the modern drugs, mass Miniature X-ray and mass preventive campaign with BCG. Therefore, we can now control the problem even with the known drugs and BCG without waiting for the discovery of better drugs provided we make an all out effort.

National TB Programme

At the very outset let me pay my warm tribute—one of admiration—to the great men who started the NATIONAL TB INSTITUTE and worked with a missionary zeal to find out ways and means to control this most difficult and multi-facetted problem. I had the privilege of being in the first batch of Senior TB workers. I was one of those who were completely convinced of the new philosophy.

A comprehensive programme based on the experience gained in the projects and test runs conducted around Bangalore has shown the way for the developing countries in Asia and Africa. Based on the successful demonstration by the Madras Chemotherapy Centre of the value of domiciliary treatment as against institutional, and social approach based on the 'felt-need' of TB patients, it has the advantage of being within the means and resources of the country. Our control units if established in all the districts and function effectively can make a deep dent on the problem. They should all be staffed properly and provided with drugs. At present there are 200 teams functioning in districts after getting 12 weeks training in the NTI. Peripheral centres are organised in about 8000 rural clinics, where microscopic examination is undertaken. Reliance is placed on sputum smears, as 'culture' facilities are available only at a few places in the country. The previous emphasis on X-ray has shifted to the microscope, as there are many fleeting shadows due to viral and other infections which cause confusion. As even the symptomatic patients visiting the existing facilities do not get diagnosed properly, the case for mass case-finding except in pilot projects has been given up. But this has robbed the educative value for the campaign and its tempo has come down very much. "Implementation at 'Grass-root' level has not been very satisfactory and as it is being implemented to-day it cannot be expected to achieve the control of TB in the near future". (Dr. Bordia)

Consequent upon the change in the strategy, fresh problems are cropping up viz., widely spread out services, maintainance of continuous supplies of drugs etc. and apparent shortages due to procedural difficulties and other bottle-necks—creating headaches to the Administrator. There seems also to be a certain dampening of the earlier enthusiasm both among the workers and administrators which is really to be guarded against. "New programmes have been stealing the limelight enjoyed during the Mass Campaign phase of BCG Vaccination."

'The present steady but not very spectacular progress made by

the National TB programme raises several doubts. Have we reached a blind end, where the incidence of fresh disease is equal to those temporarily cured, maintaining or even increasing the backlog of cases with each year ? Have we gained during the ten-year interval epidemiologically, to have the assurance that we are proceeding on right lines and that victory is in sight ? Are we sure how long the valuable drugs will continue to be so, in view of the resistance to drugs which may nullify its value like DDT in malaria control ? Having been wedded to the general principle of integrated approach, has the programme been accepted by the general practitioners fully as to drive the specialist away from the field ? How do the patients and public react to this changed picture in Tuberculosis Control ? As already mentioned, our commitment to an ideal—the integration of TB control programme with General Health Services—has, to my mind, led to several disadvantages, The lustre of a specialised programme is fading and the campaign approach of the hay days of BCG Vaccination more or less halted. This was quickly followed by an anonymous existence, leaving the front stage to other prestigious programmes."

The District Medical and Health Officer—a busy person—is pressurised to attend to crash programmes and usually forgets the existence of this programme. Similarly the Director at State level is hard pressed for time. Even the TB Adviser, who is the programme executive, is not a master of his show. A decade ago he had a complete control over the closely knit anti-TB services. He is now drawn into a wider organisation without freedom to act decisively in the interests of the programme. Have we shown the white flag of surrender or can we co-exist honourably with other major health programmes ? "When funds could be found for so many other programmes and infra-structure created at Block level, how is it that a major health problem with its still considerable death toll and vast suffering has been relegated to the background ?

None could be held responsible for these unwelcome changes except the doctrinaire flair for integration, which was taken by the other health programmes as surrender. As this must have demoralised the TB services, the immediate task to be undertaken in responsible quarters is to restore the individuality of this immense programme. We should now get our due by making the other health programmes serve the TB cases and the TB patients. "We have to claim our share in the funds allotted for several campaigns and get them earmarked, as we are allotted a mere subsistence dole only. Like the poor victim of TB, the programme should not also suffer."

This is what Dr. N.L. Bordia said in his address: "I would like to caution and sound a note of warning to those who are over enthusiatic for integration of tuberculosis services with the general health services with the aim of control of disease. Our experience on integration of tuberculosis work so far has not been very encouraging. Some times integration is taken so far as to disintegrate even what has been achieved. No major communicable disease

in this country has been successfully controlled entirely by the integrated approach. Efforts in measures like case-finding and treatment will be diluted to such a great extent that control of disease will never be achieved. The policy on integrated tuberculosis services therefore needs careful thinking before integration can be effected at any level. It can be tried only at the periphery, at the block level but even there specialised para-medical personnel will have to be provided at the Primary Health Centre or taluk hospitals etc. for tuberculosis work, as have been provided for maternity and child welfare, family planning, small pox, malaria etc. *To-day Tuberculosis is nobody's child and has therefore remained neglected.* This is an important reason why casefinding and treatment supervision has not satisfactorily developed at the periphery."

Probably sociological approach with its 'felt need' theory has contributed unwittingly to this grim situation. Earlier TB commanded the sympathy of the community as a great social problem and on account of the economic and human suffering caused thereby. However, the felt-need approach, which was meant to stream-line the services and deliver the goods effectively, narrowed down the concept of the problem. Measured against such colossal needs of protected water supply and environmental sanitation, which are impractical with our financial resources for a long time to come, TB problem has become only one of the 'felt-needs' of the country and cut down artificially. It is said that a casual daily TB case at the Health Centre does not merit the services of a specialist. But what of the vast number of persons who need immunisation against TB ?

Thus while due to the decline in the mortality, the problem of TB has lost its 'horror', the 'felt-need' sociological approach has bred complaceney in the attitude of the administrator. There is therefore an urgent need to restore the real image of the problem. Dr. Deshmukh has repeatedly pleaded "let us make it clear to the authorities that this is not a measure for cutting down expenses ; that we need adequately equipped and staffed TB clinics and sufficient drugs to give adequate treatment to all the active cases. Now that we have a detailed National Plan for Control of Tuberculosis, *let us not be satisfied with just a 'service programme' but press on 'case finding programme'* as well' and again "*Let us put this fight on a real war-footing*. Surely, the *Commander-in-Chief must be in constant touch with his various Generals* in the field in every phase of the battle ; then only correctives can be applied when things seem to go wrong". He compared the Adviser in TB to Commander-in-Chief and the State TB Officers to his Generals.

But we are trying to develop it on the excellent lines of Madanapalle or Madras Project studies, although there is a great disparity and lack of uniformity of programmes in different parts of the country. Therefore a common planned approach, though essential, will not be adequate. At the rate of upgrading one District TB Clinic per State, when will the programme be completed ?

How much more population and with this growth to what extent will the TB problem increase ? By the time the country is fully covered the programme as at present worked may become inadequate. It is certainly not clear, whether we are gaining control of the 'head end' of the problem or drifting towards its 'tail end'. We can only guess in the absence of uptodate facts. Complacency in our own minds based on a decade old data, will be unjustified and the programme needs to be evaluated thoroughly.

Meanwhile I wish to appeal that the programme should be given the necessary acceleration and a forward direction. The ninefold intensification of the programme spelt out by Dr. Bordia in his address viz., Intensive Health Education. Intensification of case detection drive, increasing BCG teams, more intensive supervision in the field, financial support to patients for checkup visits as well as social assistance, organisation of voluntary efforts, incentives to District TB Centre staff and a better understanding and improved patient doctor relationship—are worthy of implementation. Let us remove the cobwebs of complacency that "all is well with the programme" and satisfy ourselves that all is really going well.

Community Programme—Lack of a Proper Climate

In a sense, the defects noted above in the implementation of National TB programme are largely inherent in the community approach, and the lack of a proper climate for the development of community Health Programme. Till the Social Welfare Services are well developed, Health check-ups, surveys and the community programme have no prestige value either in the minds of the profession or the public. An epidemiologist does as grand a job as a pathologist in a General Hospital. But in practice the work turned out is different.

Similarly the para-medical worker who forms the backbone of the community pragramme, is not given the importance or the real encouragement he or she deserves. He is often made to sit at the desk or the compounding table. His work is not supervised and when looked into, lacks the enquiry that is needed. This is due to the lack of interest by his immediate officer who is not oriented. He has no conception of team work and is unaware that his presence in the field will add immense prestige to the drab work of the paramedical worker. He has absolutely no concept of field research and not even the elementary ideas of planning and evaluation. Hence there is no direction given to the field work, which therefore strays away with the whims and fancies of the field workers like "the driverless cart"

Health Education

Lack of, Health Education is also glaring. There may be bundles of posters, some journals and odd press features or some ill-adapted audio-visual material. These do not constitute real Health

Education, which should lead to health action by the community. The workers are mostly tongue-tied. Hence lack of communication is the basic defect in extention services and knowledge gets bottled up. It is sad to note that the volume and tempo of Health Education carried out during early phase of Mass BCG Vaccination Campaign has come down almost to a stand-still. The equipment and vehicles are either under repair or idle. I consider personal communication to be of the utmost value in field work and reluctance or resistance is generally overcome by proper motivation. There will be far less defaulting by patients if the treatment organiser adopts a friendly approach, ably supported by the medical officer through initial motivation.

Everyone will admit that public institutions differ from private hospitals—specially in one essential viz., the lack of doctor-patient relationship. Pleasing the patient is of utmost importance and here lies the art of private practice. Even a quack is able to command the confidence of his patient by this personal behaviour and communication. But that is entirely absent in the Government-run clinics and hospitals. *When will it be realised that Hospitality is the basic equipment of a hospital ?* It is quite common for the patient who has taken all the trouble to get examined, to disappear after taking one or two instalments of drugs. Therefore the doctor-patient relationship has to be developed in the community programme as the community programme needs this factor in even much larger a dose than the curative practice. When the para-medical worker knows his patient, the programme will be successful.

BCG Vaccination Programme

Due to the above mentioned factors, great damage has been done to the preventive limb of the National Programme and Prevention is one of the three main pillars of the control programme. According to W.H.O. schedule and even otherwise, BCG is the first immunisation a new-born child deserves. But the small team of six BCG technicians cannot be present everywhere to protect these babies ! Due to the lack of emphasis on the programme, a BCG Vaccinator was not provided during the IVth Plan for every Primary Health Centre which would have filled the void of infra-structure for TB Services. It should be noted that BCG is both a general immunisation programme as also a part TB control programme. But without adequate preparation, the mass campaign was terminated and the teams were attached to the District TB Clinics, which are yet to develop. No wonder the campaign reached a new low ! About 50% of the mass campaign output remains fairly constant although the staff remained the same or even increased slightly. Even the indiscriminate vaccination—though it created bottle-necks in the vaccine production and supply due to the large quantity of vaccine required to vaccinate even Mantoux positives—has not 'covered' the population with BCG, as it was expected to. Besides, the very slow pace of the campaign, many other insurmountable difficulties like the immobilized transport etc, have also contributed to the neglect

of the campaign. It is not uncommon that the UNICEF donated BCG vehicles are used in other programmes or lie in workshops unattended for, especially after the special transport organisation merged forming the nucleus of general Health Transport. At the present rate and tempo of the programme, only a very small percentage of the population will be covered. "By door-to-door work, hardly 21½% of the population can be vaccinated every year which is almost the yearly population growth. We have not vaccinated even one fourth of the population in 20 years" as commented by Dr. Bordia in his presidential address.

Need for dialogue

Therefore the programme has to be extended as a general immunisation measure and all the knowledge gained in recent years in the field applied to spread out the Campaign wherever there is necessity. We have still to make use of the simultaneous BCG Vaccination programme with small-pox. Doubts linger in the minds of the Health Administrators whether such a procedure is effective. The N.S.E.P. staff have been increased recently. It is quite easy for the inclusion of simultaneous BCG programmes also at least in Child Welfare Centres and Hospitals. We have not made it obligatory for the Local Bodies to carry out this preventive measure. Supply of portable kits with equipment poses problem. It is also necessary to fill the felt-need of the preventive measures. Several General Practitioners will be willing to carry out this work, along with triple antigen. in their paediatric practice. Unless all such steps are taken to popularise the programme, the preventive pillar will not be strengthened. In Andhra Pradesh BCG vaccination is carried out by 19 Local Bodies since a long time covering a sizeable number of the newborn in those municipalities. But these programmmes have not been expanded or taken up in all States. There is need to bring out a legislation or issue a directive at least to the local bodies.

Drugs—Uninterrupted Supply

There are other difficulties facing the programme. Our Munition—Drugs—are in short supply. Even though we produce standard anti-tuberculosis drugs we are not yet self-sufficient. Raw-materials are still being imported. According to Dr. K.N. Rao, we consume at present about 100 tons of Isoniazid, 30 tons of Streptomycin. 425 tons of PAS and 5 tons of Thiacetazone. Second line drugs like Ethionamide have been introduced, but Pyraxinamide and Cycloserine have not been allowed to be imported freely due to high cost and shortage of foreign exchange. Ethambutol has just been introduced in the country. Without an adequate supply of second line drugs it is not possible to take up surgery and treat drug-resistant cases. Even the National drug bill for treating 1.5 million infectious cases with PAS. INH and Thiacetazone in a year would be about Rs. 250 million. The total quantity of drugs available in the country will be adequate enough to treat only 8,00,000 to one million cases, but due to misuse of drugs and organisational difficulties, a larger section of infectious cases are not getting the needed drugs.

ie 25% ssuccessfully treated

Further, it is unfortunate that there are too many defaulters inspite of the various methods used to motivate them by personal contacts and through correspondence." The success of the programme will depend entirely upon the availability of adequate number of trained personnel and of anti-tuberculosis drugs in sufficient quantities. More than anything else, proper machinery is to be evolved to see that the drugs are taken by patients consistently and continuously. That constitutes the whole crux of the problem" (Blue Print). It is here that TB Associations have to step in. They should have well meaning volunteers to supervise regular drug taking by patients and prevent default.

Cadres of Willing Workers

A few words about the men that man our programme ! During the last two decades revolutionary change have taken place in the control of TB, but our specialists have not realised the full significance and impact on their careers as many look helpless and are unable to find their place in this rapidly moving picture of TB control. What is his role today ? Has he been sufficiently equipped and financed to hospitalise only those cases which need admission and render surgical aid or second-line drug therapy'? Or, for want of facilities has he been simply competing with the Domiciliary Services and treating out-patients as in-patients ? How is his line of speciality ensured of its continuity and are sufficient number of young doctors enthused to take up this branch of the profession, as it was the case in the pre-chemotherapy era ?

What is the standing of a diploma holder before the full-fledged Post-Graduates possessing a Doctorate in General Medicine ? How does he compete with Chest Surgeon who developed a speciality with a wider field ? Is the TDD, who formed the back-bone of the TB services, a specialist or an organiser ? As a specialist what is his place in a Teaching Institution ? For an organiser there has been no significant change in the TDD curriculum. Except for the longer duration of the course and probably some community orientation, the emphasis still remains mainly clinical. In some States a general duty doctor is usually the District TB Officer. How will the complexion of the services change, when at the district level also a general duty doctor replaces the TB Specialist ? Sometimes the Medical Officer in charge of the TB Ward deals with advanced cases, while the TDD specialist is organising the progrgmme in the villages ; he is prohibited from ward work. Thus the poor diploma holder is squeezed from both the sides—from the generalist at the periphery and the full fledged post-graduate at the District level. In fact several general M.Ds feel quite insulted to refer their cases to the Diploma holder.

The programme has also resulted in a separation of the TB clinics. It is not uncommon for the District TB Officer to cast longing eyes for a job in the TB hospital/sanatorium and wait for the earliest opportunity to get posted there. What is the fate of the

community programme if such aspirations continue to divert their attention ? These attitudes are revealed in connection with the training in the National Tuberculosis Institute as a deputation for the purpose to NTI is resisted from the day the orders are issued. A time has come when every one has to seriously think of the damage done to the programme by taking in unwilling or indifferent workers. I have sufficient evidence of such damage. Better remuneration and early prospects for promotions are some of the measures to overcome this lack of attraction. Thereby the waning prestige of the diploma holder will be restored. As it is, very few candidates are joining the diploma course for the above reasons and majority of the vacancies are filled by general doctors. Dr. Deshmukh has rightly pointed this in his address "General Medicine practice and other specialities appear to keep our young medical men away from Tuberculosis. Even for those who are willing to go in for full time service, there are other attractive and better paid set-ups. Flourishing pharmaceutical concerns appear to spirit away our laboratory technicians by means of their ability to pay higher wages. It is high time we give sufficient thought to this problem and make the salaries and aliowances at various levels attractive enough to attract and retain our staff". Dr. Bordia has also pleaded for better incentives to those toiling hard in anti-TB services. It is time that the senior District TB Officer is given the rank of a Civil Surgeon and a junior selection grade, because he has to inspect the work of Medical Officers of Primary Health Centres, which cannot be done by an equal grade Officer.

D.T.C.D—Community Orientation

It is often said that the training in TB (DTCD) should be oriented to community approach. His attention however still largely remains clinical and there is practically no participation by him in the work of his para-medical staff. Whether it is due to a deficiency in training or the contents of the syllabus needs examination. It is well-known that the Professor of Social and Preventive Medicine is not much involved in the training programme and although a large content of SPM might have been taken into DTCD, there is no evidence, of such orientation. It is probably due to such a difficiency, the NTI started orientation courses for the medical officers and staff. A properly integrated syllabus and course will prepare the DTCD much better for shouldering the tasks of National TB Programme. It may also be remembered that not all DTCDs will be engaged in the NTP and receive NTI orientation. Hence this aspect needs to be urgently looked into and the Professor of Social and Preventive Medicine involved in the undergraduate and post-graduate training. I would suggest that the Technical Committee should examine this question.

Institutions

I have already mentioned that about 35,000 beds are distributed in 82 hospitals and 68 sanatoria for indoor treatment of TB. They form even today an important segment for scientific management of

our inpatients. Without these specialised institutions, the art of diagnosis and management of cases may give place to quackery. It is a sad irony that despite this fact most of the beds are lying vacant for want of official subsidy. I am in agreement with Dr. Deshmukh when he deplored about the "lack of attention" and even complete neglect, of the TB departments in Medical Colleges and pleaded against over-simplification of case finding methods and management of cases. He appealed for provision for culture facilities and additional X-ray facilities at important centres.

I hope and pray that our institutions will soon receive the attention that they deserve. I appeal to our brethern holding charge of these institutes to develop them to the very best standards. Finally there should be a spirit of harmony prevailing between the hospitals and the clinics rendering ambulatory treatment or domiciliary service.

In the pre-antimicrobial era, the successful management of pulmonary tuberculosis was carried on in hospitals, with clinics, as adjuncts to them for diagnasis and preventive work. With successful chemotherapy the clinic is the pivot for the management of pulmonary tuberculosis and the hospital where patients are admitted for short periods according to their particular needs and only for as long as that need lasts, should be adjuncts to the clinics. (Blue Print).

Role of other Health Agencies

There is a great scope for improving the programme performanc by making proper use of the large number of health staff employed in the Health Centres. The Basic Health Worker in fact is visiting every household but he may not stop a TB patient. How simple will it be, if he is given that information and can make an enquiry about the regularity of the intake of drugs ? But the basic health services are not sufficiently oriented and have not taken up various other functions, which include Tuberculosis Programme. Experts directing the Malaria Eradication Programme are wary in allowing the staff to be used as Basic Health personnel and apprehend 'revision' of the problem in case of diversion of their staff to other duties. This situation can also be met both by official and non-governmental agencies.

Similarly Regional Family Planning institutions offer wide training facilities and can help in the orientation of the different strata of society. Liaison with these centres is necessary and active participation in their programme is very much needed. Thus there is a great scope to co-ordinate TB and Family Planning activities. Government may encourage such activities so as to reach all the members of the community and improve coverage. Special groups-like TB and Leprosy patients and their families could easily be advised on Family Planning by our workers. Instead of being pushed aside by these massive programmes, there should be integration of these facilities. The entire picture can be changed, provided the

District Officer mixes with the fellow officers in a spirit of service and draws the attention of his 'boss' to his programme.

General Practitioner :

Our army of workers will not be complete without the Private Practitioner and the voluntary agency coming into the picture in a big way. Whether we like it or not the general practitioner has a major role in the control of TB—probably not so much publicised ! Time and again it is emphasised that we should seek his co-operation. But he has his handicaps. He must have the facilities to treat his patients with the drugs. He must cultivate 'service' mentality and listen to the advice given to him to make use of service facilities. Have we got sufficient drugs to dump every practitioner with the 'Munition'? If so, is it wise to follow such a policy, because of the possible and irregular use of the drugs ? If not, should we not supply drugs to him ? Torn by such doubts and vaccillation, we have not followed an active policy of "Trust begets Trust". Drugs cannot be misused probably as it is being done, or reported to be done at the moment. There are therefore the two camps—the general practitioner and the services, and the gap between them will be most unfortunate. Due to this thousands of patients go to Hakims and Vaids and languish at their mercy. I understand that in a place like Amritsar about 40% of the patients go to these unqualified practioners ? The number of cases that get lost for proper treatment in this way, to their ultimate detriment, is high and makes it difficult to tackle the pool of infection in a scientific manner. Dr. Deshmukh in his address says "The E.S.I.S. set up in the city of Bombay suggests that if the population is divided amongst the general practitioners on payment per head, and if diagnostic and treatment facilities are fully available at the Central Clinic, the general practitioner will be only too keen to make an early diagnosis for pulmonary tuberculosis, *for late diagnosis only means more work for them.* Let us have a panel of willing doctors even for rural areas on reasonable payment for each case of tuberculosis referred and treated by them under guidance from the District Clinic". He appealed for the additional expenditure to be provided in the 4th Five Year Plan. If Government does not do, the TB Associations should. Without strengthening our army by the inclusion judiciously of qualified General Practitioners, the fight cannot be won and the enemy cannot be liquidated.

Voluntary Effort

Volunteers and voluntary services have a great role to play in strengthening the official programme. All TB Associations all over the world have done this. We in India are endeavouring to do this. But many of the TB Associations are manned by Government Officials, who are accustomed to look at matters with "Government eyes". TB Associations should be guided by public men and women who have no inhibitions of "red-tape or yellow lines". My predecessor, Dr. Umesh Rao, was a pioneer in organising such work

in his district. It is time that all the major Associations in the country make a note of this and start activities to enthuse officials, patients, general practitioners and the public.

But there is dangerous aspect of 'make-belief'. The official circles give the impression that they are an isolated group and that other's co-cperation is needed. They are also confident that the duties prescribed for them are carried out by the staff scrupulously and may not even care to supervise them adequately. This is the typical 'touch me not' attitude of the bureaucracy, which is detrimental to the success of a community programme like the National TB Programme. As years roll by, there is a back-log of cases which cannot be followed up by the programme staff. In a district with ten-year old programme only 2,000 of 20,000 cases —just 10 percent are attending the service programme. In Tumkur district the volunteers have done a good job and the TB Association of India is trying to prepare a feature film of this project. Such dovetailing of voluntary and official organisation in the field is very necessary as their activities are essentially complementary in nature. State branches may come forward and take up this activity, as this is True Health Education—which should lead to community action. Mere follow-up activity by the volunteers will not improve the programme, unless the defaulters are not only motivated, but retrieved. All these require the co-operation of voluntary bodies and their appreciation by the official sector. Hence their doors should be thrown open to volunteer activity.

After much thought and deliberations, the Association has released a "Blue Print' for TB control in our country. This should become a bible for action by the voluntary agencies. Unless the voluntary sector covers the entire area, programme will not make an impact. It is the duty of one and all of us to see that the contents of the Blue-Print are digested by the official and voluntary agencies.

There is another useful field of activity for the TB Association to play. Maharashtra has set a fine example of conducting 'Shibirs' or camps to stimulate public enthusiasm and fill a gap where necessary. Such mobile camps are quite essential in India and should be recognised for giving medical relief while the community is no doubt systematically being covered by the regular health services. It will be a great help and the programme gets accelerated by such camps.

Seminars have been initiated by the Association, but the co-operation of the Teaching Institution is necessary and a joint partnership has to be built between them. In this, the role of State TB Centres is very great indeed. At present the State TB Centres have not developed the activity to any appreciable extent—although their earlier name clearly emphasised these activities e.g. TB Training and Demonstration Centres. These activities should not be

merely confined to undergraduate and post-graduate education but embrace the wider public and para-medical staff.

TB Association of India

As with my predecessors. I am bound to say a few words about the parent Association of voluntary TB effort. We are all aware of the monumental work turned out by our All India body started just before the 2nd World War. She soon spread her long arms not only throughout the country but even abroad. Thanks to Sri B.M. Cariapppa, our Secretary-General and Dr. P.V. Benjamin, the first TB Adviser, due to whose partnership there was a harmonious blending of non-official and official effort, the Association could become a model for developing nations and their services are recognised. It is this recognition which prompted the International Union in 1956 to entrust Dr. Benjamin and Sri Cariappa with the task of organising the Eastern Regional Wing of the Union. Both of them did a remarkable job and this Regional Wing has now become the most active one among the regional bodies. The Association has become a model for other voluntary bodies for organising conferences, seminars etc. There are other stalwarts like Drs. Sen, Viswanathan, K.N. Rao, Sikand, Frimodt-Moller and Bordia who added lustre by their services in the various committees and achieved the international distinction. The younger guards have stepped in with Drs. Pamra, Menon, Nagpaul, Dingley, Singh etc. who are no less enthusiastic.

Times have changed. So also our fighting strategy. The need is now for developing mass organisation. Unfortunately our affiliated bodies are suffering from limited membership, probably due to a policy of isolation. The Association should enlist every citizen as members. Health propaganda must be carried on from every platform, besides the medical forum. They must enlist the cooperation of the film world, cultural field, educational institutions, temples, churches, mosques, synogogues and every conceivable forum.

As we are getting funds through the Seal Sale Campaigns, it seems to work as disincentive for raising more membership. The Health Education aspect of Seal Sale Campaign has to be accelerated to compensate for the small element of voluntary coercion inherent in the Seals Sale Organisation. But the campaign has been generating tremendous enthusiasm among the public and the organisers, wherever it has been handled properly. Let me pay my compliments, as one who knows something about the difficulties involved in building up this campaign. on the brilliant efforts put up by our Tamil Nadu Association for winning the All-India Shield successfully. I, take pride, though I do not claim to know their secret yet, that Andhra part of the Association was once part of the parent body—the Madras TB Association.

As suggested by Dr. Umesha Rao, we may also encourage the

institutional treatment of middle class patients by subsidising a few vacant beds in the private TB sanatoria and see that the bed strength is effectively utilised. Refresher courses are very useful, now that General Practitioner is becoming aware of his responsibilities for treating tuberculosis in a big way. The co-operation of State TB Centres is very necessary and direction may be given to that effect by State Governments and Government of India to provide facilities and incentives to the Association, as given to the College of General Practitioners. It is not always possible to arrange the subject of TB in their curriculum and unless experts are invited, the interest of General Practitioners is not maintained, which involves additional expenditure. Further, the College of General Practitioners pays daily allowance and travel expenses to the refresher course trainees. Hence the need for subsidy to TB Associations.

The celebration of annual 'TB Week' is a 'must' for the organisation, now that several such weeks and fortnights are being run in the country. Success lies in the extensive campaigns conducted all over the State by the district branches. During this week excellent contact with public and co-operation with the services should be aimed at.

National Conferences

I have been attending almost regularly several conferences and since my first attendance as a BCG Worker, I was pestered by one thought—How far do these help to create favourable climate in the battle against this fell disease; besides its social and educative aspects, and how many of the workers are seized with the programme that is being developed and how closely the efforts of the voluntary and official sectors integrated? I leave these questions to be answered by you. But the successful conduct of these conferences—comparable to the 'Yagna' of the olden days—requires no mean effort. As one who knows, let me thank the Mysore State Association for the wonderful organisation made by them. Our veteran Secretary-General carries on with his indefatigable energy using all the devices that he can employ in getting the maximum turn-over of effort from the Association playing the host. Naturally these conferences are bound to generate a tremendous amount of enthusiasm among the delegates and camaraderie besides its educative value. But the full use of the conference will be in evidence when we can forge a fighting front against the enemy—the mycobacterium Tuberculosis!

Before concluding my address there are a few more items—some of which bear repetition and thanks-giving.

Legislation

Notification of TB is very necessary and has been emphasised by almost all the Presidents in their addresses. But a legislation to

the effect has not been effected yet. This may be urgently considered.

Insurance

The difficulties of patients are well realised in developed countries. In France the Social Security Scheme permits financial relief by giving 3 years leave on full pay and 2 more years on half average pay. It is difficult to expect that every patient can support himself and his family while undergoing the prolonged treatment. As in France, the disease should be considered as a disease of long duration and leave given. Insurance companies should be prevailed upon to cover TB risk, as pointed out by my predecessor late Dr. Umesh Rao.

There are some 'protected' groups of people who receive free medical services in India. Government employees and industrial workers who come under compulsory health insurance scheme, Railway employees, and Posts and Telegraphs employees are some of these fortunate persons. The vast majority of TB patients are found among the general poorer public, agriculturists, farm labourers, workers in smaller establishments and who do not have the benefit of free medical attention except those available in the Government institutions. Most of these establishments are found in urban areas where TB services are fairly available. Tuberculosis being an infectious disease it is of paramount importance for its prevention and control that as many unknown cases as possible should be detected as quickly as possible. (Dr. S. Chandrasekhar).

Research

We are grateful to the excellent research work being done in the country and in particular in the Madras Chemotherapy Centre, Madanapalle Tuberculosis Research Centre and the U.S. Public Health Service. A number of co-operative studies also are undertaken. You will be very happy to know that the Tuberculosis Association of India has just established its Research Committee and is trying to build up a strong Research fund. Their attempts, I believe, will be to find out if and how the period of treatment of the tuberculous can be shortened. We might also expect as a result of world-wide studies that are being made, better drugs which will treat the disease in a shorter period and also find out the secret as to why only a very small percent of the infected persons develop the disease.

International Organisation

I will be failing in my duty if I do not express my thanks as well as the gratitude for the large hearted and unfailing assistance given to the national programme by the WHO, UNICEF and other

international agencies right from the beginning. As already mentioned any sudden switching off the assistance will tell upon the programme adversely. It can only be tapered off when the programme in every respect can be carried through. We should be particularly grateful and happy for recognising our programme as the model for all developing countries.

Conclusion

We are yet a long way from achievement. The desired objectives of reducing the pool of infection one percent prevalence of natural reactors to Tuberculin among children below 14 years of age, has eluded even the developed countries with their every advanced control programmes. With the present infection rate of about 50%, it will take a long time and so long Tuberculosis "will be permanently with us and the control measures hence should be made permanent". As we might have crossed the crest of epidemic wave its decline may be uneventful, though slow. After the control of malaria, Tuberculosis has become a major public health menace and its conquest imperative. In view of the individual focus given to the disease over several decades, community approach recently developed has to catch the imagination of one and all. Education of the public as well as the Administrators is very essential on these aspects. It has not been possible to make ideal treatment available to all patients due to shortage of drugs, lack of facilities for injections, treatment, treatment over a prolonged period, high rate of default in regular drug intake and lack of facilities for drug resistance test.

It has also been clearly pointed by my predecessors that only 50% of the cases at best that are detected could really be treated while the rest are likely to remain infectious to the community. Further, the capacity of all our clinics, hospitals, sanatoria put together can at best tackle a million patients. What about the remaining million of estimated infectious cases, who are at large without treatment ? These are disturbing thoughts and something has to be done. Again we have a paradox of scarcity of medical man-power in our country side. Only 20% of the doctors work in villages where 82% of population lives, while 80% of the doctors are in urban area where only 18% live ! How is this problem to be solved ? Again poverty breeds Tuberculosis and Tuberculosis in turn breeds poverty. So let us wage a war on poverty as advised by our esteemed President of the Republic and remove pockets of infection as well as vulnerable areas of infection.

Modern Tuberculosis control work is mainly organisational, administrative and financial. Though the disease is caused by a specific micro-organism, its development and spread are related to social and economic conditions. Efforts therefore ought to be made to improve these conditions in order to minimise the effect of environmental circumstances in the spread of the disease in the community. It is also necessary to improve the general resistance

of the individual by improvement of housing conditions, sanitation, water supply, drainage and nutrition. They are as important for the prevention of tuberculosis as they are for the prevention of other communicable diseases in general—a no mean gain !

Unless these long term measures are carried through no real conquest of TB is possible.

Lastly we should not hesitate to evaluate the programme in its entirety. If our drugs are not delivering the goods let us say so, if integration has retarded our pace let us say so and find a solution. If our services have become demoralised or filled with unwilling persons—square pegs in round holes or vice versa—let us weed them out and create attraction for real talent. If our hospitals are merely competing with Domiciliary Services and not playing their role effectively let us say so and find funds and staff to reorganise them. If the Campaign has lost its edge due to integration and consequently Health Education has suffered, let it be corrected. But let us not fight shy or shirk our duty.

It should be recognised that objective truth is the goal of operational research and field practice will become largely unproductive without such research. I have noted that essential elements like Planning and Evaluation—which are the beginning and the end of any activity—are lacking in the daily activities of countless number of field workers. I once again make a plea that the baseline data gathered 15 years ago can be misleading and upto date data be gathered making use of the 1971 census data as well as fresh studies conducted.

Let me conclude with well known invocation from the RIG VEDA

"May He protect us both	*"Sahana vauathu*
May He nourish us both	*Sahanau bhuuaktu*
May we both work together with great energy	*Sahaviryam kara vavahai Tejaswina vadithamastu*
May our study be thorough and fruitful"	*Mavidvishavahai"*
Om, Peace, Peace, Peace	*Om Santhi, Santhi, Santhi*

Let us work together to gather the fruits of collective endeavour in a team spirit. Let us be rid of hatred.

I wish my fellow workers a happy and useful conference and hundred percent success in their great efforts to root out this problem. I also thank you all for the patient hearing given to me.

OM TAT SAT

SUNDAY, 3rd January, 1971

MORNING SESSION

The conference re-assembled in the Auditorium of the Government Medical College, Fort, Bangalore with Dr. K. Somayya, President of the Conference, in the Chair. Dr. Somayya announced that the morning sessions will begin with a session on "Progress and Evaluation of National Tuberculosis Control Programme" under the moderatorship of Dr. K.N. Rao. He requested Dr. Rao to take his seat on the dias. Dr. N.M. Sinha acted as the rapporteur for the session.

Dr. Rao then requested the participants to come to the dias. The following persons participated in the session :

Dr. N.L. Bordia
Dr. M.D. Deshmukh
Dr. Raj Narain
Shri S.S. Nair
Dr. Jaswant Singh
Dr. T. Srinivasulu
Sri K.S. Sundareswara
Dr. G.D. Gothi

Dr. Rao requested Dr. Bordia to present his paper.

A BRIEF ASSESSMENT REPORT ON THE WORK OF A DISTRICT TUBERCULOSIS PROGRAMME

BY

DR. N.L. BORDIA, M.D.,
Indore (M.P.)

At the requestt of the TB Association of India the Director, Health Services, Government of M.P., very kindly authorised this reporter to look into the working of a district Tuberculosis programme (National Tuberculosls Programme). I am grateful to the

state director, health services and the TB Association of India for giving me this opportunity of evaluating the work of a district in M.P. The choice of the district to be evaluated was left at the pleasure of the Director, Health Services. Casually without any special reasons the choice fell on a district which was almost an average district of M.P. State.

In 1962 the Government of India had made certain recommendations to the State Governments as to how tuberculosis service should be organised in each district. The National Tuberculosis Institute have trained numerous teams in these years to implement these recommendations and the UNICEF had assisted these district centres with the necessary equipment including transport. So far State Governments have established nearly 200 such district centres throughout the country. The development of the district tuberculosis programme envisages establishment of a close net work of diagnostic and treatment services at the permanent health centres of different denominations in the entire country in an integrated manner so that the medical and paramedical personnel work there as multipurpose workers for all health services. The long term aim of the programme is to develop the service to the extent that it can have some impact on the problem of tuberculosis, and gradual reduction in prevalence could be expected in the future.

To achieve the objectives of control of disease which is a long term aim it was visualised that development can take place only slowly. In the first stage of development the teams would get trained and equipped. Then it will take two to three years for the programme to expand to the entire district. When the programme would be in good speed from the third year it could be expected that almost all symptomatic sputum positive patients would take action and report to the various peripheral health centres. Of these patients about 40% could be defected by careful microscopy at the peripheral centres and the district centres. A few patients would be taken care of by the general medical practitioners as well. Once the major proportion of sputum patients are detected and treated then the yearly detected cases would approximately be equivalent to the annual attack rates. It was then presumed that a quarter of the total cases were developing disease every year Coming to the treatment service it was presumed that if 80% will be the efficacy of chemotherapy and 80% patients will take drugs in their own homes on a domiciliary basis without supervision, then 65 to 70% will be rendered non-infectious. The fourth five year plan was therefore planned as early as 1963 on the above presumptions. Provision was made to cover every one of the districts out of the 335 districts existing then. 200 new integrated district TB centres were to be developed during the plan period. 15 to 20 lakhs of patients were to be provided with anti-TB drugs every year from the 12,000 peripheral health centres, dispensaries and other institutions under the National TB programme. While planning the Government was clearly told that anti-TB drugs must be freely supplied by the Government of India and that there can be no economy on this item of the

scheme. By that time it was observed that the most difficult problem will be to maintain long term treatment continuity. It was also feared that the paramedical personnel may not take sufficient interest and therefore one person was proposed for employment specially for Tuberculosis work at every primary health centre in the entire country. However, this provision was deleted from the plan at a later stage. Finally, the fourth five year plan was accepted as a centrally sponsored scheme. Against this background the district TB programmes which have formed the backbone of the National Tuberculosis Programme are developing for the last eight years.

This assessment had to be confined roughly to judging the efficacy of a few of the organisational, administrative, operational and technical performances and to form an idea as to how the expansion of the programme has taken place in the district and what were the shortcomings and how they can be mitigated.

A full working week was spent in the district. Much of the time was spent on looking into the work at the main centre specially analysis of the treatment and index cards of 1969. Some typical health facilities of different denominations were visited to judge the work in case detection and treatment organisation which was being undertaken there. During this period only a few aspects of the assessment relevant at the present stage of development of the National Programme could be looked into. If more time was spent more information could have been collected. This reporter had in mind specially to study how the diagnostic and treatment service was functioning in the district and what the difficulties were in the development of the programme at the periphery through different health centres like PHCS and dispensaries of various denominations.

A copy of the summary of assessment undertaken and analysed has been circulated to the delegates and which I narrate:—

Basic data of the district evaluated :

Population of State of M.P. estimated to be over 30 million. Total districts 43.

This district was an average district of M.P., partly hilly, partly plain. Height 1800 feet above sea level.

Population 490,000 aproximateiy (1961) now estimated 0.6 mil.

District Headquarters is a town of 100,000 (estimated 1970).

There are four Tehsils (Talukas) only.

75% population is rural, 25% urban.

Occupation: Mostly agriculture—no canals, little irrigation—people poor—partly tribal population, few industries.

District town is central and hub of railways and roads; other communications buses, poor road system. Villages 1,038.

Area 1727 sq. miles, density of population 346 per sq. mile.

District Administration: Two Senior Officers, (1) District Health Officer : controls PHCs, dispensaries, Public Health work and Family Planning. (2) Civil Surgeon : Controls Hospitals, Ayurvedic dispensaries and Tuberculosis Clinics.

State Health Administration: (1) Director of Public Health, Family Planning etc. is responsible for all PHCs, public health and family planning, (2) Director Health Services : controls all Hospitals, Ayurvedic Institutions, Tuberculosis clinics, (3) Deans for teaching and medical college hospitals.

District Health facilities: 13 grades dispensaries. Six PHCs, 5 upgraded dispensaries, 21 Ayurvedic (Indigenous) dispensaries, 6 sub-centres in each PHC area.

Tuberculosis Services

TB Control Officer (Status—Assistant Director in the Directorate of Health Services.)

TB Clinic was established at district headquarters in 1954 with 52 beds, upgraded as District TB Centre with UNICEF assistance in 1965 for District TB programme with standard equipment. BCG vaccination team integrated with District TB Centre; full team was in position. The district TB team has to organise programme in one more neighbouring district where there is no *DTC*.

District TB Team: Full team including 2 medical officers (one NTI trained), three health visitors (two of them trained as treatment organisers), one statistical clerk, x-ray technician, laboratory technician (no laboratory assistance, no dark room assistant).

Budget in 1969 Rs. 56,000/- (this does not include anti-TB drugs.)

System of working: according to standard NTI manuals.

Minor deviations

(i) Case register maintained separately in addition to case index and cross index cards.

(ii) Sputum examinations mostly by collection of over night sample.

Drug supply: In 1969 almost all through Government of India, UNICEF, little from State Government.

Evaluation of Treatment cards of all diagnosed patients in the whole of the calendar year 1969 has been undertaken that is from 1.1.1969 to 31.12.1969.

Technical Evaluation for 1969

Persons x-rayed 7,756 including case finding amongst factory workers.

Suspected tuberculosis 652—minimal 58, moderate 151, advanced 390 and others 53.

Whole district Total 454	Local	234	(120 males 114 females)
	District	220	(140 males 80 females)
	Migratory	198	(138 males 60 females) (Outside District cases)

Sputum Positive Cases

Whole district 151	Local 65 (35 males. 30 females)—65% of attack rate
	Rural 86 (61 males. 25 females)—20% of attack rate
	Migratory 85 (60 males, 25 females)

Total sputum positive 236 (out of 652 radiological suspects)

Not a single sputum positive detected at any PHC in the whole year under report

Sputum positivity rate in treated pulmonary cases—36 per cent.

Treatment given to 652 (DTC 577, PHC 75) (5 migratory transferred)

Regimens

SM+INH	*INH, SM, TZN*	*INH, TZN*	*INH alone*	*Other*
79	283	161	71	58

Regularity in 4 4 district patients

	Regular means.
Regular 12 per cent	(80% or more regularity)
Partly irregular 20 per cent	50 to 80% drug collection
Very irregular 42 per cent	Less than 50% collection
Initial defaulters 26 per cent	Collected once or not at all.

Post Treatment Evaluation of 1969 Patients

Sputum status of 652 patients

		District	*Migratory*
Sputum positive to negative	87	(61	26)
Sputum positive to positive	29	(19	10)
Sputum negative to negative	65	(51	14)
Sputum negative to positive	7	(6	1)
Sputum result not available	464	(317	147)
	652	454	198

X-ray Evaluation

Miniature x-ray same as before	102	(92	10)
Clearance of disease by less than 50%	55	(33	22)
Clearance more than 50%	119	(86	33)
Complete clearance	12	(3	9)
Worsening	8	(3	5)
	296		79

Results not available for the rest (356) 237 district cases and 119 migratory.

Defaulter action on district patients as recorded in Treatment Cards,

Post cards sent	30
Home visited	50
Message sent	14
No action on remaining defaulters	
Retrieved	18

Hospitalisation 52 beds (plus two private rooms)

Total admissions	707
Patients admitted	258

District:	84 males	54 females
Migratory:	86 males	34 females

Many patients admitted twice or thrice or more time in the same year.

Work at sub-centres

Participating Centres : PHCs 6, Dispensaries 3, general hospital 1. No programme at any other centres.

Diagnostic activity in 1969 only at Civil Hospital, 23 cases detected sputum positive.

Treatment cards 75 in all sub-centres.

There is not much of difference in sputum positivity, treatment regularity in district patients and migratory ones. Patients admitted to inpatients wards had very high defaulter rate in drug taking after discharge from wards.

Extra Pulmonary Tuberculosis

Main Findings :

Glandular disease	162	(males	70	females	92)
Abdominal	38	(,,	9	,,	29)
Bones & Joints	26	(,,	6	,,	20)
Pleurisy	17	(,,	7	,,	10)
Others	19	(,,	9	,,	10)
	262		104		158

Average age in males 1-15 years

Average age in females 1-44 years

Diagnosis of Extra Pulmonary Tuberculosis was questionable as they were mostly referred cases from main hospitals.

Females predominated in age group 15 to 44 and males predominated in age group 0 to 15.

General Observations and Recommendations

It is gratifying to observe that the system of record keeping in the national tuberculosis programme is efficient, meaningful at the same time, simple and easy to maintain. The system provides a good method of follow up of patients and provision for defaulter action. The system has stood the test inspite of shortfalls which are due mainly to human failure.

2. Inspite of having a well qualified trained and efficient district TB centre team in position for five years after the initiation of the programme from 1965, the diagnostic and treatment organisation has not developed in the district. Though the main clinic is run fairly satisfactorily with a few short-comings, common in most centres, the district team has failed to develop the programme to the periphery. They had all the required facilities of adequate staff, vehicle, budget, government orders for implementation of the programme, other equipment for peripheral centres and anti-TB drugs etc. etc. It must be stressed that the district team was well reputed and known to be well trained and consisted of willing

workers, even then the programme did not expand. The major responsibility is therefore mainly on the district team. Following reasons are responsible for failure of expansion of the programme:

I. The district TB Centre team had not toured the district PHCs and other centres as much as necessary. The vehicle had covered 152,60 kilometers in all but 8307 k.m. was for tuberculosis programme and the rest for other purposes.

II. There is complete apathy and lack of interest in most of the officers of PHCs and dispensaries in undertaking tuberculosis work both microscopy and treatment service. Paramedical workers are still worse. Medical Officers are unable to get work done. As there are no microscopists or laboratory technicians/assistants in Primary Health Centres and even in small civil hpspitals, no member of the staff is willing to do microscopy. Deterioration in discipline has gone to the stage that para-medicals concoct false record fearlessly. The district TB team felt disgusted with the lack of response and made no further attempts to establish microscopy centres at PHCs.

Without specific provision of microscopist at all PHCs sputum examination will not develop inspite of the fact that the present staff is generally not over worked.

Treatment organisation will also not succeed unless a person is specifically appointed for the purpose. If one tuberculosis worker is exclusively provided he can be responsible for both microscopy and treatment organisation.

III. There is lack of supervision from all levels, the DHO. Civil Surgeon, Assistant Director of Tuberculosis and the regional Tuberculosis Superintendent. They are also partly responsible for lack of expansion of the programme. Even though the Directorate had issued circular letters bringing to the notice of all health centres the short-falls, these have been ignored by sub-centres. Strict supervision, guidance and control is necessary at all levels. Senior officials must tour and supervise the work at health centres.

IV. Lack of timely and appropriate disciplinary action against defaulting employees has created indiscipline in the staff of PHCs. When disciplinary action is taken, interference by politicians nullified the action, creating a worse situation. Unless strict discipline is enforced, no programme can succeed.

V. Posts of Laboratory Technician and Laboratory Assistant are necessary at all DTCs so that senior person can tour the microscopy centres frequently and ensure that microscopy develops. At present there is only one person doing microscopy in the TB Centre who often remains tied down to the local clinic work and is unable to go out.

VI. Vehicles must be used exclusively for the purpose they are provided for. In this district in 1969 nearly 45% mileage was done by the DTC vehicle for purposes other than tuberculosis work. The *DTO* was unable to keep the vehicle in good condition. Even for repair of a punctured wheel. quotations have to be called and approved by the Civil Surgeon's office. Powers of the district officers for major repairs should be enhanced.

VII. Stress on other health programmes specially family planning need not deter personnel from undertaking tuberculosis work, as they were not over worked. Incentives provided by family planning programme has acted as deterrant to tuberculosis work.

VIII. Deafulter rate in drug taking is very high. This can create serious problem in the years to come. It will result in higher resistance rate and chronic infectious invalidism. All procedures laid down to prevent defaulters and retrieve them should be enforced throughout the district. Activities of the district TB Association should be developed to educate patients and the community.

IX. The DTC team should be more careful in completing all entries on the respective cards and forms so that some type of evaluation of the work is possible. I understood from DTO that more work had really been done than observed from cards as entries were not made in many cases.

X. The salary scale of the entire tuberculosis service is low. This deserves to be looked into. With the rising prices, families cannot sustain interest in work with present emoluments. They have to look other sources of income at the expense of work.

XI. There is need to develop human discipline in both patients and the services. Unless steps are taken to improve them, programme will not succeed.

XII. There is need to do more serious thinking on how tuberculosis will be controlled. Trends indicated by this evaluation are that problem of drug resistance and chronic invalidism may develop following high irregularity in drug taking and by ineffective chemotherapy. Every step should, therefore, be taken to ensure that detected patients take prolonged continuous effective anti-TB drugs therapy.

Dr. Rao : Thank you. I would now request Dr. Deshmukh to present his paper.

DISTRICT TUBERCULOSIS PROGRAMME IN MAHARASHTRA

By

Dr. M.D. Deshmukh

I must congratulate Dr. Bordia for his excellent report on the working of the District Tuberculosis Programme in Madhaya Pradesh. I was also asked to carry out similar work in my State but I have not yet been able to do it. The authorities in my State have not been as prompt in responding to my request as in M.P. My observations are based mostly on the official report I received late in December, 1970.

Progress of District Tuberculosis Programmes in Maharashtra

Figures from year to year are not available. It seems that since 1963 District Tuberculosis Programme has been established only in 11 out of 26 districts of Maharashtra viz. Thana, Dhulia, Nasik, Jalgaon, Aurangabad, Parabhani, Nanded, Latur (Dist. Osmanabad), Chandrapur, Wardha and Nagpur. It seems Poona had everything ready except the UNICEF vehicle for many years. Now that the vehicle has arrived, the new medical officer has to be sent to National Tuberculosis Institute for training, for the previous N.T.I. trained medical officers have been posted to Jalgaon.

Akola, Sholapur and Sangli have all the necessary requirements except the UNICEF equipment release of which is expected soon.

Satara and Ahmednagar TB Clinic buildings are stated to be nearing completion.

Plans for TB Clinic buildings are yet to be submitted by Civil Surgeon of Ratnagiri, Alibag, Bihar and Bhandara. The information about the remaining districts is not at hand.

The total number of TB clinics in the state is 27 but 3 of these are not for the Districts (J.J. Hospital, G.T. Hospital and Kalyan Camp) which means 2 districts (Kolhapur and Buldhana) are still without a TB Clinic.

II. Rise of District Tuberculosis Programmes as compared with rise in number of trained teams

The information given under this heading is rather confusing. It seems that the practice of sending a team as a whole to N.T.I. is

long abandoned. Odd persons in different categories are sent from different places and it is hoped that some teams would be made out of them.

It is stated that in the 21 courses conducted at N.T.I. from August 1962 to May 1970, the following were trained for our State :

Medical Officers	24
Treatment Organisers	36
X-Ray technicians	28
Lab. Technicians	22
B.C.G. Team leaders	16
Statistical Assistants	23

Rise in District Tuberculosis Programmes has not been consistent with training of personnel. Out of 24 medical officers trained so far, 9 are posted to District Tuberculosis Programme, 5 to TB Clinic awaiting upgrading to District Tuberculosis programme, 1 resigned, 2 promoted as Class I officer, I died, I to TB Hospital, 5 on general side. Of the paramedical personnel, most are stated to be working in District Tuberculosis Programmes or TB Clinics except a few—especially statistical clerks who are working on general side because of promotion as senior clerks.

III. Corelation of District Tuberculosis Programme with rise if any, in case finding, case holding, and B.C.G. coverage.

In 11 District Tuberculosis Programmes, 225 Peripheral centres have been so far established—104 Primary Health Centres, 69 Zilla Parishad dispensaries, 35 Municipal dispensaries and 16 other health agencies. A total of 6,391 patients are stated to be under treatment.

It is not stated how many are sputum positives. It is also not clear if this figure represents the total number under treatment in 11 District Tuberculosis Programmes or if the patients at District Headquarters are excluded. The average per peripheral centre works out at just over 28.

When we consider the load which the District Tuberculosis Programmes with its peripheral centre should carry, the figure seems pitiably low. For the average of expected TB cases per district should be 20.000 (5,000 sputum positives). 11 District Tuberculosis Programmes here are covering only 6,391 patients which work out as 3% of total cases. Even if we consider peripheral centres as responsible only for 80% of the total it is hardly one or two per cent higher.

Case Holding

It is stated that cases holding at district clinics is 60-70% but

at the peripheral centres it is 40 to 50%. There are no figures to prove or disprove this.

B.C.G.

Out of the total of 15 teams (1 team leader and 6 technicians) one is working in the city of Bombay and 14 in the districts.

Their performance is admittedly poor. We have details only for the months of August and September 1970.

Taking the better performance in September 1970 we find that only 80 technicians out of the available 98 (14×7) appeared to have worked for 20 days in that month. Out of just over 4 lac registrations they have vaccinated only 94,505, an average of 58-59 per technician per day (direct vaccination). At this rate just to cover the susceptibles in one district alone all 14 teams will have to work for nearly 12 months.

Bombay team is said to be averaging 98.7 vaccinations per each technician per day but in the programme of primary school vaccination in the month of August they could do only 1,140 total vaccinations in the whole month. In our camps, in one day, we can get 1,500 to 2,000 vaccinations done with 2 technicians. Training by B.C.G. Department appears to be at a very slow rate. From January to November 1970 only 31 candidates could be trained—an average of less than 3 per month.

Evaluation

I have no reliable information on these points but I venture my suggestions :

We propose to have a team to assess the programme in Maharashtra very soon.

I believe that the concept of evaluating efficiency by matching achievement against expectation is quite sound under our existing conditions.

Proportion of sputum povitives

Even in the best run programme in our State (Nagpur) the contribution of Peripheral Centres by way of sputum positives in total number under treatment appears to be less than 10% whereas the percentage of sputum positives is given as 10%. In many places the microscopes are not working and supervision on the work where it is done appears to be poor.

Respective role of city centres etc.

No figures are available. It appears that most of the cases are at present diagnosed at city centres.

Conclusion and suggestions

The D.T.P. in Maharashtra appears to be well behind schedule and unless taken up more seriously than at present will not be able to function effectively for many years to come.

Some of the fundamental things are not yet sorted out.

What grade and qualifications should an officer have to fill the post of State Tuberculosis Officer ? It seems the grade of Asistant Director is not sufficiently high to command respect from all TB Centres. It should be that of Deputy Director. What grade and qualifications should the District Tuberculosis Officer have to command respect and secure cooperation from Medical Officers-in-Charge of Peripheral Centres ? A fresh post-graduate with just 3 months training at N.T.I. does not appear to be well equipped to fill this important post. He should be on level with the Civil Surgeon and the District Health Officer.

What comes first—the type design building, the team, the training at N.T.I. or the equipment to the last detail ? Many programmes are held up for want of one of these. Surely any district TB Clinic can at least initiate the programme and improve it later after training, building and equipment. I do not see why Primary Health Centres cannot start functioning as Peripheral Centres even in the absence of District Programme. The training of teams for District Tuberculosis Programmes must be accelerated and losses after training avoided at any cost.

Talking about low output of work I am tempted to present here the average output in our 15 TB Camps, where in one day (Sunday) we get 30 to 40 cases of pulmonary tuberculosis out of which 7 to 8 are sputum positive, B.C.G. vaccination averages well over 1000 with 2 B.C.G. technicians. (Report of the work in 15 camps attached).

I have no doubt that voluntary efforts can bolster up our D.T.P. If every district centre undertakes TB Camps (with the help of other district officials and voluntary bodies) once a month for each Taluka place or Primary Health Centre, they will cover the entire district in about 12 months.

Talking about B.C.G. vaccination, even if B.C.G. team is integrated with the D.T P. in every district, at the present rate of vaccination, the whole year's output per team works out at as $20 \times 12 \times 60 \times 6 = 86400$, whereas the susceptible population is $\frac{1}{20}$ of 1.5 mil. viz. 7,50,000 which mean they will take 9 years to finish the 1st round.

I am convinced that it is high time that we change our B.C.G. policy. In addition to mass programme by our B.C.G. teams, the

District Tuberculosis Control Programme

TB Control & Training Centre, Nagpur

Yearwise analysis of centres cases in rural area

Year	No. of Centres	Micros-copic	No. of sputum exam	Pos. Diag-nosed	Total under treatment	Referral centres	Sp. exam	Diagnosed	Total under treatment	Total cases under treatment
April 1966	4	4	112	12	212	—	—	—	—	212
1967	9	7	500	56	509	2	—	—	123	632
1968	15	8	1226	55	613	7	—	—	322	935
1969	26	10	1742	89	879	16	—	—	549	1428
1970	34	12	2493	138	1197	—	—	—	—	—
Up to end of Nov. 70										

The Maharashtra State Anti-Tuberculosis Association

Total work done in fifteen Tuberculosis Camps in the year 1969 & 1970

Place of camp	No. of persons examined	No. of persons screened	No. of X-Ray positive	No. of sputum examined	No. of sputum positive	No. of BCG vaccinations	Oral polio	Triple vaccinations
1. Roha—Dist. Kolaba	321	321	69	30	12	1291	226	—
2. Murud-Janjira—Dist. Kolaba	350	276	37	37	5	1035	220	—
3. Gargoti—Dist. Kolhapur	490	113	31	56	16	237	—	—
4. Chinchani—Dist. Thana	404	125	17	25	8	214	169	—
5. Khopoli—Dist. Kolaba	194	154	37	75	3	349	204	—
6. Mahad—Dist. Kolaba	304	202	67	45	12	1138	211	—
7. Ashta—Dist. Sangli	426	132	32	32	7	1387	200	200
8. Alibag, Nagao, Revdanda—Dist. Kolaba	350	143	24	14	4	1729	190	180
9. Virar—Dist. Thana	96	96	35	24	7	253	—	—
10. Khed—Dist. Poona	174	50	9	8	3	1400	200	210
11. Ambarnath—Dist Thana	742	250	22	22	5	1449	—	430
12. Takli-Kazi—Dist. Ahmedabad	762	109	10	9	5	1437	100	450
13. Goregaon - Mangaon—Dist. Kolaba	324	171	86	28	12	1054	200	200
14. Khed—Dist. Ratnagiri	1124	171	41	41	13	1990	—	—
15. Panchgani—Dist. Satara	213	67	8	8	3	2200	273	321
Total	6265	2380	525	454	115	17163	2193	1991

vaccination should be released for general use like any other preventive inoculations. The training of B C.G. technicians should be accelerated by B.C.G. Department and should also be given by Department of Preventive Medicine in medical colleges and by local health authorities.

Thus we will have an army of technicians, medical men, nurses, health visitors and social workers to deal with this urgent problem.

In short, D.T.P. needs helping hand all round. Every one concerned must work with sincerity and zeal. Strict supervision is necessary at all levels.

Dr. Rao : Thank you. May I now request Dr. Raj Narain to present his paper.

TWO EPIDEMIOLOGICAL FACTORS RELEVANT TO NATIONAL TUBERCULOSIS PROGRAMMES*

By

Dr. Raj Narain

Tuberculosis Prevention Trial, Bangalore-20

I am grateful to the Chairman, Dr. K.N. Rao, for asking me to say a few words relevant to the National Tuberculosis Programme. One thing I hope to show you is that infection in children with Myco. tuberculosis in our country does not result in death or disease as often as one might expect from statements in standard text books on tuberculosis. I have chosen children to show the risk associated with infection as in children, not only the infected and uninfected can be separated with greater certainty but also that the risk is believed to be the greatest among them. Another factor I hope to show is that the Microscopy positive case of Pulmonary Tuberculosis is more likely to develop resistance to drugs than the case positive on culture only.

I shall use the data from 3 successive Tuberculosis Prevalence Surveys in 119 randomly selected villages in Bangalore District. Total de jure population at the first Survey was 61,688. At each survey testing with 1 TU of PPD RT 23 with Tween, X-ray examination of those 5 years or more of age, and sputum exami-

* Field work for the material was carried out by the National Tuberculosis Institute. Analysis has been carried out by the Tuberculosis Prevention Trial, Palace Guttahalli Circle, Bangalore-20. The latter is being conducted under the auspices of the Indian Council of Medical Research as a joint project sponsored by the Ministry of Health, Government of India, the National Communicable Disease Centre, United States Public Health Service and the World Health Organization and is financed by United States PL-480 funds and by a WHO grant-in-aid.

nation for those with definite or doubtful X-ray shadows were carried out. Interval between successive surveys was 18 months.

Risk associated with infection among Children :

Table 1 shows the prevalence of 15 mm or bigger tuberculin reactions at Survey I among children in 3 age groups. 15 mm or bigger tuberculin reactions, at least for children below 15 years, may be regarded as strong evidence of infection with Myco. tuberculosis. 1.8% of the children in age group (0-4) years, 7% for age group (5-9) years, 12.6% for age group (10-14) years had 15 mm or bigger reactions.

TABLE 1

Prevalence of infection at I survey

Age group	Total test read	Those with 15 mm or bigger reactions	
		Number	Percent
0—4	7976	148	1.8
5—9	7454	520	7.0
10—14	7242	915	12.6

Table 2 shows that during the next 3 years i.e., by the time Survey III was done, of the children below 5 years of age, 11 or 8.4% had died. 105 were X-rayed at Surveys II or III and none had developed bacteriologically confirmed pulmonary tuberculosis. For this report only sputum culture positive cases are regarded as cases of pulmonary tuberculosis. Such a definition has its weaknesses especially for children, but number of cases showing only X-ray evidence of disease is not at the moment available. Similarly of the 477 infected children of age (5-9) years, 9 or 1.9% had died ; of the 430 X-rayed at Surveys II or III only one had developed pulmonary tuberculosis. In age-group (10-14) years 1.4% had died and 4 out of 740 or 0.5% had developed pulmonary tuberculosis.

TABLE 2

Mortality and morbidity over a period of 3 years for children with 15 mm or bigger reactions at I survey

Age group	Number followed till Survey III	Number dead	%	Number x-rayed at Survey II or III	No. culture positive
0—4	131	11	8.4	105	0
5—9	477	9	1.9	430	1
10—14	741	10	1.4	740	4

The number of deaths shown in Table 2 is regardless of its cause. The proportion that died of tuberculosis is not known. Though all the 131 children in age-group (0-4) years had 15 mm or bigger reactions, only 8.4% died over a period of 3 years (1). Contrary to all present beliefs, this mortality rate for infected children is low and the rate for those that developed infectious pulmonary tuberculosis is lower still. Even if it is assumed that all the 8.4% died of tuberculosis, as only 1.8% were infected, deaths due to tuberculosis for children below 5 years would appear to be of the order of $\frac{8.4 \times 1.8}{100}$ or less than one sixth % of total population. It must be emphasised that these low rates are in the absence of any treatment worth the name. Possible interpretations of this low risk of infection could be :

(i) That even children in the area in spite of their tender age had pretty high resistance against tuberculosis.

(ii) Possibly that due to low virulence of the tubercle bacilli in the area, infection does not often lead to death or disease. Several reports, Tuberculosis Chemotherapy Centre, Madras (2), Frimodt-Moller (3), Balbir Singh (4) and last and most comprehensive Wijsmuller et al (5), show that a large proportion of the bacilli isolated from patients had very low virulence, often as low as that of BCG.

(iii) That infection is very slow acting and the three-year follow-up was too short to bring out the full risk associated with it. This assumption itself would be against the generally held belief that the greatest danger is soon after infection.

Whatever the cause of this low mortality be, it should be realised the lower the risk associated with infection, the greater is its value for producing immunity against tuberculosis. Also the possible low proportion of deaths due to tuberculosis among children would suggest that tuberculosis may not be as serious a problem as is generally made out.

Risk associated with new infection

This low risk associated with large reactions was also seen among the newly infected. New infection among children and young adolescents is believed to be very dangerous (6). Table III shows the number of children found to be newly infected at Survey II. As shown in our previous report (7), only an increase of 16 mm or more at Survey II over the size of induration at Survey I has been taken as evidence of new infection. At Survey II 85 children of age (0-4) years, uninfected at Survey I, were found newly infected. During the next 1½ years, i.e., by Survey III, only 2 of them had died : the cause of death is not known. None of those who could be X-rayed at Survey II or Survey III (only those who had attained

TABLE 3

Mortality and morbidity over a period of 18 months for newly infected children

Age group	Number found newly infected* at survey II	Number that died by survey III	%	Number who had pulmonary tuberculosis at survey II or III
0—4	85	2	2.4	0
5—14	229	—	—	4

* An increase of at least 16 mm in size of tuberculin reaction from Survey I to Survey II among those with 9 mm or smaller reactions at Survey I.

the age of 5 years were eligible for X-ray examination) were found to have bacteriologically confirmed pulmonary tuberculosis. In age-group (5-14) years, of the 259 newly infected at Round II, not one had died during the next 18 months and only 4 had developed pulmonary tuberculosis.

Thus the risk that new infection carries is also low in the area, confirming that tuberculosis infection in our context is not that dangerous as is generally made out. These findings suggest :

(i) Tuberculosis itself may not be as serious a problem as is usually made out.

(ii) If the risk associated with infection is low, BCG in our context may not offer as much protection against tuberculosis as it did in the British BCG Trial.

Development of drug resistance

The second factor relevant to National Tuberculosis Programme is shown in Table IV. Cases found at each of the 3 surveys have been divided into 2 categories—those that were positive both on Culture and Microscopy and others that were positive on Culture but negative on Microscopy. For the 2 categories number and percentage of those with cultures resistant to Isoniazid, either alone or in combination with other drugs, is shown in the table. At each of the 3 surveys the proportion of cases with resistant cultures was more for the group which was Microscopy Positive. Also at III Survey a marked, statistically significant, increase in the number of cases with resistant cultures for the Microscopy Positive cases only is noteworthy. At Survey I the cases found could not be offered treatment. They depended on the very few facilities for treatment that existed in the area. After Survey II most cases were offered treatment with isoniazid alone. This offer was not fully utilised by the patients from these far flung

villages resulting in great irregularity in treatment and consequently in the great and rapid increase in resistant cultures at Survey III.

TABLE 4

Proportion of resistant cultures at the three surveys

Survey	Culture+Microscopy cases			Culture+Microscopy cases		
	Total number	With cultures resistant to isoniazid+		Total number	With cultures resistant to isoniazid+	
		No.	%		No.	%
I	68	12	17.6	111	8	7.2
II	61	15	24.6	106	12	11.3
III	61	27	44.3	95	13	13.7

Thus the Microscopy Positive case which is the king pin in our control programmes appears much more likely to develop resistant cultures than the case positive on culture only. The latter type of case at the moment is beyond the reach of our National Programmes. Thus development of cases with resistant cultures is a risk which could result from our control programmes. The risk is there in any programme as shown by the study by Frimodt-Moller extending over 17 years in which seven Mass Miniature Radiographic surveys of the population of Madanapalle Town and surrounding villages were carried out. Facilities for treatment provided for admission of each case in a hospital and drug supply was more plentiful and regular than in the National Tuberculosis Programme. Yet, at the end of 17 years, the total pool of infection remained almost the same while the proportion of cases with cultures resistant to INH increased significantly (8). The risk of developing resistant cultures would appear to be much more in the National Tuberculosis Programme.

To sum up. :

(i) The risk of infection with Myco. tuberculosis is much lower in India than the described in text books of tuberculosis by European authors.

(ii) Risk of increasing the number of patients with resistant cultures with our present Control Programme is real.

Both factors point to the great necessity for assessing our Control Programmes. The eminently feasible National Control Programme forms only a beginning. Only by constant and realistic assessment can we improve the programme and also judge whether

it can lead us to our objective—namely—the Control of Tuberculosis in the country or to the degree to which it can do so.

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Dr. Rao : Thank you. I would now request Mr. Nair to present his paper.

ASSESSMENT AND MONITORING OF NATIONAL TUBERCULOSIS PROGRAMME (NTP)

BY

S.S. NAIR

The Approach

Assessment of a programme is the measurement of the extent to which its objectives have been fulfilled. Assessment may also include a study of factors that may influence the achievement. It is clear that the objectives have to be defined in quantifiable terms so that the extent of achievement can be measured.

In the past, control of tuberculosis defined as a systematic reduction of the problem of tuberculosis to an extent that it ceases to be a major public health problem had been accepted as the goal of the National Tuberculosis Programme. The difficulties arising from such a definition of the goal are :

1. What is a major public health problem ?
2. In what quantifiable terms—social and epidemiological—should the tuberculosis problem be defined ?
3. To what extent should the problem thus defined be reduced for it to be a major public health problem no longer, and
4. What should be a reasonable period of time required for achieving this reduction ?

A number of attempts have already been made to quantify the problem. But, more thinking and research has to be done before these and related considerations can form the basis of assessment. A clear definition of the goal in quantifiable terms has yet to be adopted.

Another serious difficulty for assessment arises from a lack of precise information on the period between infection and disease. If, as is commonly believed, most of the cases* occur among the already infected, then prevention, case-finding and treatment can have only a marginal effect, during the initial period of the programme. Thus, a sizeable reduction in the number of cases may not occur within a period of 10-15 years, or even more, unless the disease is already on the decline. Any early assessment of reduction in the

* Cases are those patients confirmed bacteriologically ; the rest are suspects.

number of cases will only be a very costly attempt at proving the obvious and will possibly lead to frustration. Nevertheless, it is necessary to know the gains from tuberculosis control measures involving sizeable amount of public funds. For this, a different methodology of assessment has to be adopted since it is almost impossible to provide a direct answer in terms of reduction of the problem.

It is true that based on the trend of the disease, before introduction of the programme, epidemetric models can be used to predict the size of the tuberculosis problem at future points of time. Comparing this with the actual size of the problem after the programme has been working for sometime, can provide a measure of the problem reduction due to the programme. But, even for this. the programme has to be on for a sufficiently long period so that a demonstrable reduction could be expected.

Assessment of efficiency

Measurement of the extent to which the objectives of the programme as a whole have been achieved may be called *assessment of efficacy*. Measurement of the extent to which the expectations for various activities under the programme are being fulfilled is referred to as *assessment of efficiency*. It is generally true that improving the efficiency of each activity under a programme will result in improvement in its efficacy, provided the improvements in one activity do not place restrictions on other activities. On the basis of this rationale, assessment of efficiency seems to be a practicable solution to the problem of assessment of a tuberculosis control programme.

Realistic expectations for outputs and coverages under different activities can be set up on the basis of potentiality studies on the one hand and programmes working with reasonable efficiency on the other. The former provides information on what could be achieved with a given staffing pattern and method of work. The latter on what normally is achieved in the environment in which the activity is performed. Achievements of the programme could then be matched against these expectations.

Need to define stages

One important consideration is that the programme can only be implemented in a few districts at a time and administrative and operational conditions may vary among those districts. Thus, different districts will have the programmes developed to different levels. Any overall assessment of such a heterogeneous programme situation may give a confusing picture. One way to avoid this is to define some stages of of development of the programme, with graded expectations, and to assess each district at suitable intervals to judge whether it qualifies to cross from one stage to the other. The number of districts which qualify to go from one stage to another at a

specified time will itself indicate the progress achieved. One advantage of this method is that after assessment, attention can be concentrated on the corrective actions required for fulfilling the expectations for that stage.

Monitoring

A detailed stage-by-stage assessment could be supplemented by monitoring i.e., a continuous watch on some key indices of the programme calculated from periodic reports. This requires a reasonably efficient reporting machinery. At present about 30% of the district programmes do not report on time. Within the reporting programmes more than 50% of the peripheral health institutions doing tuberculosis work do not report on time. Under these circumstances, monitoring or any assessment based on reports will underestimate the achievements and cannot be considered reliable. It would be better for assessment based on reports to be separate for programmes under different stages, as the expectations against which achievements are to be matched differ with the stages.

Comparison of performance against expectation

Some results of monitoring are given below mainly for illustrating the methodology and the type of conclusions that can be drawn. An average peripheral health institution in which tuberculosis programme is implemented could be expected to examine sputa from 75 "symptomatics" per quarter and diagnose about 7.5 cases. The achievements of the programme in the Southern Region generally are of the order of 30% of the expectation for examinations and 40% for cases diagnosed. On the average about 60% of the cases and suspects who are expected to collect their drugs do so i.e., about 63% of a fairly high target of 95% of patients on hand taking treatment at any time. For BCG vaccination, the all India average monthly performance per team is about 55% of the expectation of 8,000 vaccinations. Thus, comparatively, case-finding activity needs greater attention and improvement at present. Then comes BCG and lastly treatment.

Contribution from peripheral health institutions

Three indices help in assessing the contribution made by PHIs in the programme (Table 1).

(1) Only about 28% of the total cases diagnosed by an average DTP are found by peripheral institutions (about 50% in the Southern Region).

(2) Only about 23% of the total cases and suspects in an average DTP are diagnosed by peripheral health institutions, suspect cases diagnosed at DTC on referral being credited to the referring institutions.

TABLE 1

Indices showing contribution of peripheral health institutions (PHIs) (January 1967—March 1970)

	Percentage of total	
	Range	Mean
Diagnosed by PHIs		
(a) Cases	23.8—34.1	28.1
(b) Cases and suspects	18.4—27.9	22.9
(c) Treated by PHIs	9,1—34.9	26.2

N.B. : Figures are underestimates because of non-receipt of reports from peripheral health institutions.

(3) Only about 26% of the patients on treatment are treated by peripheral institutions (about 50% in the Southern Region).

After making allowances for non-receipt of some reports, it is likely that the combined performance of a large number of peripheral health institutions falls much short of that of the district tuberculosis centre. This can be improved if the case-finding efficiency of the peripheral health institutions can be increased, so that more and more cases who seek relief from these institutions could be diagnosed and treated there itself.

Comparison with case load in the community

An average district is expected to have about 5,000 cases at any point of time and an annual incidence of about 1.500 cases. The present rate of diagnosis in an average district programme is about 158 per quarter or 632 per year and is only about 40% of the rate at which new cases occur. This figure again may be an underestimate and is an average for districts under different stages of development. It is likely that this percentage will be quite high in some districts and a more correct picture could only be obtained by separately considering districts under different levels of development. However, it is significant that the diagnosis of only one more case per peripheral health institution per month will increase the number diagnosed by an average district with 30 peripheral institutions by 360 per year. And, this will result in more than 1.000 cases being

diagnosed every year in an average district i.e., about 70% of the rate at which new cases occur.

Range in performance of an average DTP

The quarterly reports prepared by the Directorate General of Health Services show an interesting feature. The average performance of a district tuberculosis programme has been fairly stable over the last four years with respect to the number of X-ray and sputum examinations, new cases diagnosed and cases under treatment (Table 2). It could be that these programmes have reached a particular

TABLE 2

Average quarterly output per district programme (April 1966—March 1970)

	Range	Mean
X-ray examinations	1559—2353	2085
Sputum examinations	1162—1512	1356
Cases diagnosed	143—190	158
Cases and suspects diagnosed	458—627	532
Cases and suspects under treatment	2092—2641	2366

N.B. : Figures are under estimates because of non-receipt of reports from peripheral health institutions.

level of performance within such a short time and that further improvements are not easily achieved. One possible reason for this may be that the situation is a true reflection of the overall efficiency of the general health services. In other words, the efficiency of participation of peripheral health institutions in tuberculosis control may not be much different from the achievements for other activities of these institutions and the problem cannot be considered to be peculiar to the tuberculosis programme alone. If so, concerted efforts will be necessary to increase the all round efficiency of the general health services. This is all the more important firstly because the available resources do not permit many parallel vertical health programmes and secondly because the performances under such special programmes viz., BCG, NSEP, Family Planning, etc., have not so far shown a much higher efficiency than the general health services.

Comparison of DTPs with Tuberculosis Clinics

Monitoring could also be used to compare the contributions from different components of NTP vis-a-vis the resources which have been spent on them. For instance, the case-finding output of an average DTP is about 260% that of District TB Clinics where the integrated programme has not yet been introduced (Table 3). This comparative performance may even be better (may be more than 3 times) if allowance is made for non-receipt of reports from some

TABLE 3

Average cases and suspects found by district programmes and district clinics (April 1966—March 1970*)

	Cases and suspects found per quarter per district	
	Range	Mean
District programmes	458**—627**	532**
District clinics (without integrated programme)	149 —305	203

* Based on the quarterly reports of the Directorate General of Health Services.

** These figures may be underestimates because non-receipt of reports from peripheral health institutions.

peripheral health institutions. This would indicate that establishment of district tuberculosis programmes could probably give better results than district clinics. On the other hand, the expenditure on a district programme will be more than that of a TB clinic and it has to be studied whether even this three fold increase in case-finding is commensurate with the additional expenditure involved. Similarly, data on treatment for these two components of the programme could also be compared.

Need for a proper climate for assessment

Assessment becomes a mere exercise if the indicated corrective actions are not taken. Assessment should be objective enough to inspire confidence and its findings should be accepted or at least appreciated by the persons in charge of the actual functioning of the

programmes. Assessement findings are generally acceptable when the assessment team has been authorised by the administrative authority concerned and has the necessary technical capacity and status. When assessment of a district programme is done without a favourable attitude on the part of the persons responsible for the actual working of the programme and/or that of the State Government concerned, the findings may not always be acceptable and may not be followed by effective corrective action. Developing a proper climate for assessment and authorising a suitable and competent agency to carry out assessment are extremely important if resources spent on assessment should not be wasted. This aspect has not so far been given the attention it deserves and may be one of the reasons for assessment being equated with fault finding and thereby inhibiting the progress of assessment activities which are essential for the healthy development of programmes and better utilization of resources.

In conclusion, the following points may be re-emphasised :

(1) Attempts should be made to define the goal of the programme in quantifiable terms—both epidemiological and social.

(2) It is almost impossible at present to calculate the extent of reduction of the tuberculosis problem. Assessment of efficiency is a practicable solution to this problem of assessment.

(3) Certain stages of the programme with quantifiable objectives should be formulated and assessment of programmes in different stages should be considered separately.

(4) Monitoring or assessment based on reports could give useful information about the working of the programme provided (i) the efficiency of reporting from peripheral health institutions to the district level and from districts to state and central levels is improved and (ii) such assessment is done separately for districts under different stages of development.

(5) A proper climate for assessment should be created so that assessment is welcomed by programme organisers at state, district and periperal levels and corrective actions are taken soon after completion of assessment, This very important aspect is not given the attention it deserves.

Dr. Rao : Thank you. May I now request Dr. Jaswant Singh to present his paper ?

SYMPOSIUM ON PROGRESS AND EVALUATION OF THE NATIONAL TUBERCULOSIS PROGRAMME

BY

DR. JASWANT SINGH

The National Tuberculosis Programme was introduced in the Punjab State in 1963 and its implementation in the Patiala District was commenced in the year 1965. Only the aspects of implementation, organisation and problems encountered with in this district under this programme will be discussed here. This incidently, would also reflect to the difficulties being encountered in the other districts as well.

As regards the establishment of diagnostic and treatment centers in the peripheral areas, almost every allopathic general health institution of every grade including one Ayurvedic Dispensary is participating in this programme. A few dispensaries resisted in black and white with a plea of being already overburdened with other programmes, but on constant pursuation the staff concerned was brought around to co-operate.

The number of participating institutions in the district, leaving aside a TB Clinic at Nabha, is 38. Out of these 38, 10 institutions are participating as diagnostic centres whereas the other as treatment and referal centres.

In the year 1965, this centre was upgraded to a Demostration and Training Centre and besides the training of doctors and nurses training of TB Health Visitors was also commenced in order to extend the benefit of this programme to the whole state.

Regarding organisation of this programme, one doctor has been visiting the participating centres regularly atleast once a month for pursuading the staff and to maintain a regular supply of drugs, laboratory sundries, forms and cards etc. There has been no shortage of drugs and laboratory sundries in the previous years although the forms and cards had to be managed on some occasions from certain other funds.

Under all such facilities, though the treatment side of all the diagnosed cases has been undertaken by the participating institutions satisfactorily, the diagnostic activity has been at a very low ebb. The major cause, according to the staff of the primary health centres was undue pressures from the administrative authorities for attaining the targets of some other public health programmes such as NMEP and FP. The fear complex amongst the workers during the

collection of sputa and its handling while staining has been another setback and remarked as a "Hazardous Task" with no incentive and extra allowance for this risk.

During the training of TB Health Visitors Course, the field training was also included in the curriculum.

Slide No. 1

This slide shows the number of sputum examinations done at the periphral institutions in the years 1965, 66 and 67 respectively. The vertical limb shows the number of sputa whereas the horizontal limb shows the years and the quaters. In 1965, in the 1st quarter the number of sputa examined was 56 and in the 2nd quarter, when according to the syllabus curriculum of TB Health Visitors, the batch under training at that time was sent to the Primary Health Centres; the number of sputa examined sprang to 431. After their coming back, the number again dropped to 244 and 190 in the subsequent quarters.

Again in the year 1966, in the 1st quarter, the number of sputa examined was 188 and in the subsequent quarters, due to the presence of under training health visitors, the number rose to 488 and 545 respectively, and after their withdrawl the number of sputa examined dropped to 107. The same thing happened in the year 1967. In its 1st quarter the number of sputa examined was 159 and when the health visitors were sent there it jumped to 397 but again dropped to 106 on their withdrawal. This constant experience of three years gave us the impression that the diagnostic activity of the peripheral health centres was boosted only when a special personnel was deputed there to help the staff in this programme. In the interest of this programme the matter was discussed with the administrative authorities and the State Directorate agreed in principle to depute one extra worker at each primary health centre as it was being done for other current public health programmes. Such a worker has been designated as a "Multipurpose Worker" and the training of these workers has been entrusted to this centre. This training was commenced in the year 1969.

Slide No. 2

The first column sums up the total number of sputa examined at 7 periphral diagnostic centres for the quarter ending on 31.12.69, without the presence of an extra personnel for this activity. The first posting of multipurpose workers was done in February, 1970 and though it was at a few centres to start with, the number of sputa examined rose from 155 in the preceding quarter to 423. In the 2nd quarter of this year another batch was trained and posted at the remaining primary health centres and the number of sputa examined jumped to 1018 and similarly in the 3rd quarter to 977. In the column of the 3rd quarter it is very clearly evident that when a worker was transferred from one primary health centre the number

of sputa examined in the whole quarter came down from 161 to 9. This is an infantile period of the posting of multipurpose workers, but the increase in the number of sputa examined is manifold and very significant. The boosting effect of these multipurpose workers on this programme is quite obvious.

It should also be mentioned at this juncture, that the organisation and pursuation tactics were handled by my epidemiologist, a senior collegue of mine, who studied the problems for about four months with personal visits to the diagnostic centres. A few diagnostic centres even after the posting of multipurpose workers the average sputum examination was less than one sputum a day and when the medical officer and the other anciliary staff was tackled by him then, their attitude of mind was changed.

To sum up in brief the following points, devices need proper attention.

1. Functional uniformity must be there.

2. Orientations for change of attitude of medical and paramedical members engaged in general health services in such a way that this programme is accepted and not repulsed.

3. From the administrative side :

   (a) The attention of state level authorities for this programme should go in parallel to the other top priorty programmes.

   (b) As being done for other programmes, targets should be fixed, and incentives offered as for family planning etc., Extra facilities should be allowed and annual confidential reports scrutinised.

   (c) Periodic check of district TB Centres by administrative heads and the difficulties and problems to be solved at spot.

   (d) There should be a decentralisation of administrative powers to overcome difficulties at the spot.

4. From the point of organisation there should be adequate arrangements of stocks, forms, drugs and laboratory sundries etc. and the supply should be regular and without any pitfall and break.

5. District level monthly meetings should be held to have open discussions on this programme with the same enthusiasm as for NMEP and FP.

6. There should be no dual administrative control of BCG teams in the districts.

7. Under the pressure of other priorty programmes, the activity of this programme should not suffer.

8. A very common observation is regarding the vehicle which is supposed to be allotted to the DTO. In almost all the district the CMO always requisits the vehicle on one pretext or the other. This results in the neglect of the control programme.

9. To maintain the records in the proper order the forms should be supplied by one agency may it be TAI or DGHS.

10. The personnel trained should not to be disturbed by the Government.

Dr. Rao : Thank you. I would now request Dr. Srinivasulu to present his paper.

OBSERVATIONS ON THE NATIONAL TUBEERCULOSIS PROGRAMME OF KURNOOL DISTRICT, ANDHRA PRADESH

By

Dr. T. Srinivasulu
Kurnool

I had the privilege of working in National T.B. Programme for a period of two years after my training in N.T.I., Bangalore.

The National Programme was started in Kurnool District in 1966 and the programme is in existence for 5 years. In this district, the DTP is functioning according to the recommendations of the N.T.I. The whole team is trained at N.T.I. The District Tuberculosis Officer is the drawing Officer and the District Medical and Health Officer is the controlling and coordinating officer between District Tuberculosis Officer (DTC) and the Peripheral Health Institutions (PHIs).

The BCG team is integrated with D.T.C. since 1967 and doing mass BCG Vaccination door to door type without mantoux among the eligibles i.e., 0-19 years age group There is a vehicle for the team but often the vehicle is being diverted for other programmes, which is interfering with the coverage of BCG. New born vaccinations and vaccinations in Municipal towns by BCG Vaccinators, the output and coverage is not upto the mark. The team is not working with full complement due to frequent transfers of BCG technicians to other national programmes and the posts are not filled up for a very long time in sufficient numbers. Since the liquid

BCG vaccine is supplied only a few days before the date of expiry, it is resulting in a lot of waste. In 1970, 6655 cc vaccine was supplied to Kurnool out of which 3275 cc was wasted. The wastage can be minimised if freeze-dried vaccine is supplied in large quantity. In 1968, the team registered 1,24,000 cases and vaccinated 42,000 cases and the performance is 50% of the expected.

Diagnostic activity by the DTC

From 1966 to 1970, the DTC has indexed round about 3,000 cases every year. By the end of 1970, the total cases indexed are 13,000. There is a steady rise in the participation of P.H.Is in D.T.P. In 1966, there were 10 peripheral health institutions participating in the programme. By the end of 1970. fifty PHIs are participating in the programme.

Drug supply : There was free supply of sufficient quantity of Anti-TB drugs by the DGHS all these years. Of late, there is a shortage in supply.

"X"-Ray : X-Ray machine has gone out of order very frequently causing setback in case-finding.

Laboratory : On an average, 3 thousand sputa were examined by the DTC, Laboratory, and on an average one thousand sputa were found positive every year.

General approach towards evaluation and why assessment of epidemiological impact has to be kept aside for the time-being

The distribution of Tuberculosis cases in rural as well as urban areas is equal among the general population as revealed by the surveys. Hence assessment of epidemiological impact of tuberculosis has to be kept aside for the time being for the following reasons. The problem of tuberculosis will be much reduced only when systematic case-finding and intense treatment is carried out for all T.B. patients through DTPs. Since Tuberculosis is a chronic disease the assessment of epidemiological impact cannot throw much light in a short period of time of existence of NTP. Further by our approach to the problem through NTP, we are tackling the problem uniformly throughout the country. A reasonable target will be 50% reduction in 20 years. Now the programme is in existence only for 5 years. This period is too short to assess the epidemiological impact in a chronic disease. Hence it has to be kept aside for the time being.

Concept of evaluation efficiency by matching achievements against evaluations

In a big district of Kurnool with a population of 20 lacs, the expected case load at 1.5% of the population will be 30 thousand and sputum positives at 0.4% will be 8,000. In a period of 5 years

10 thousand cases were indexed within the district and four thousand sputa were found to be positive. As the programme gains momentum due to the increasing awareness of the public and frequent visits by the DTC staff to the peripheral health institutions with regular supply of drugs nearest to the place of residence, increase in hospital beds and more trained team manning the programme and by enlisting the co-operation of the PHIs' staff, we can expect 3 to 4 thousand cases to be diagnosed every year by DTP. At this rate, in another 5 years 20 thousand (5 x 4 thousand) cases can be detected, provided the case load is constant, i.e., an equal number of cured cases are added to the "Pool" every year. While evaluating the efficiency we have to take into account new population added to the existing population minus total patients cured and died. Since births are more than deaths, we can expect total increase in population and also in the case load.

If the remaining 20 thousand cases are not diagnosed in five years from now, we have to conclude that either there is a recession in tempo of the programme or a substantial increase to the total 'pool' of cases than the number of cases cured and dead.

Therefore atleast 10 years period is required to evaluate the efficiency by matching achievements against expectations. A reasonable target will be 50% reduction in a period of 20 years Even if we are not able to achieve this end, the programme need not be considered a failure, since larger number of tuberculosis patients are receiving anti-TB treatment through DTP.

Proportion of sputum positives in the total casefinding yield and factors which determine its variability

The National T.B. survey has shown that about 1.8% of the general population are suffering from disease and ¼th of them are excreting bacilli (sputum positives). 50% of them are approaching for modern medical help. If these could be discovered forthwith as smear positive cases by a network of microscope centres by offering sputum examination, the PHIs can contribute a good proportion of sputum positives to the total case finding yield. Low yield of sputum positives is due to failure to use microscope by large number of microscope centres. Another cause of variability is that the annual incidence of the sputum positives of the district is likely to be 1,000 and therefore any gain in annual casefinding over and above thousand is likely to pay dividends towards TB control as it would lead to quicker draining of the pool of infectious cases leading to a receding risk of infection in the community.

Selection of patients for sputum examination among the symptomatics yields a high percentage of sputum positives when compared to the general population. A good microscope, fresh stains, a trained technician go a long way in detecting more positive cases. Examination of overnight collections, overspot collection yields better results in detecting positive cases. Above all, PHI

medical officers examining sputum of all symptomatics yields best results in detecting positive cases. In service training to all categories of Para-medical persons and reasonably good standards in microscopy after such a training can be expected. This goes a long way in detecting sputum positive cases.

The respective role of city centre (DTC) and rural centres (PHIs) in the case finding programme

The greatest stumbling block for the success of NTP are the PHIs In 1969, the DTC, Kurnool alone has diagnosed 2,600 cases whereas all the 50 PHIs (out of which 2 are T.B. Clinics) diagnosed only 360 cases working upto an average of 7 cases per PHI per year or one case in two months. If the two T.B. Clinics are excluded from the PHIs, the casefinding activity of general health institutions (PHIs) is negligible.

From this we can conclude that only specialised T.B. Clinics like the DTC and other T.B. Clinics in the district are doing case-finding of significance. In the light of these figures, we have to give a second thought on integrating NTP with general health services or find out other methods to enlist cooperation of PHI medical officers to offer sputum examinations for all the symptomatics that attend PHI. Inspite of supplying stains and slides from DTC and requesting the medical officers to cooperate for the success of programme the response is very poor. What is the remedy for this ?

What factors determine the treatment regularity as shown by assessment

Proper motivation, remotivation and prompt defaulter actions by letters or home visits, payment of conveyance charges for poor and deserving, sympathetic attitude even towards chronic defaulters. supply of drugs for two or three months in harvest and sowing seasons when the patient cannot attend for monthly collections, incentives in cash or kind for regular 12 or more collection of drugs make a large percentage of patients regular in their treatment. The stock of the drugs in the PHIs for not less than 3 months and uninterrupted supply of drugs without giving scope for exhaustion of the same gain the confidence of the patient to regularly attend for treatment. *Solving the distance problem from the patient's residence to the drug collecting centre (PHI) or the PHI of the patient's choice ensures the regularity of treatment as revealed by a study made.* The attitude of the PHI staff towards the patient goes a long way in treatment regularity. Administration of streptomycin for sputum positive cases for a considerable period and remotivating the patient for oral treatment at the end of the injections goes a long way in treatment regularity. Free availability of drugs, choice of drug regimen, case of drug administration, freedom from toxic manifestation and other side effects and availability of efficient treatment organisation play a great importance in treatment regularity.

Influence of changed BCG policy on BCG outputs and coverage

By the changed BCG policy, simultaneous coverage of the whole country through DTCs instead of some parts of each state as before, doubling the speed of work, cutting the cost proportionately and improving coverages by saving losses due to absenteeism and refusal at the time of second prick are achieved. Freeze-dried vaccine can be used for 6 months with a longer date of expiry and increase the coverage and output. There is a minimum wastage of vaccine. Changed BCG policy is definitely advantageous if carried out strictly as per the NTI manual.

Dr. Rao: Thank you. I would now request Mr. Sundareshwara to present his paper.

COMMUNITY LEADERSHIP IN NATIONAL TB CONTROL PROGRAMME—A CRITICAL STUDY OF TUMKUR PILOT PROJECT

BY

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The Author is glad to have this opportunity to participate in this Symposium under the leadership of Dr. K.N. Rao, whose name and fame in the medical field in general and tuberculosis work in particular, is well known all over the world. The observations that follow are based on his personal experience during the past 6 years having been closely associated with the non-official Pilot Project, the object of which is to bring out clearly and impersonally the merits and demerits of the National Tuberculosis Programme, both official and non-official.

The dynamics of society presupposes certain conditions which as a process itself divulges an analytical understanding about its structural relationships. It is essential always to make an attempt to study each social aspect in its entirety in relation to the functioning of the whole phenomena. This functional approach often tends to derivation of certain uniformities with the help of which one can build up meaningful course of social change; or accelerate the social planning on the direction envisaged. Therefore it would not be inappropriate if we subject the programme of National TB Control Programme, its implications to an explanation in relation to the existing and changing social order.

First of all, the National Tuberculosis Programme, emerging as a social concept, formulated into a fullfledged Health Programme taking into consideration its limitations as far as its scope in the light of the social, economic and other major health problems, especially in a developing country. The series of sociological and

other scientific investigations conducted by N.T.I. and Madras Chemotherapy Centre blended National Tuberculosis Programme into a hormonious social planning. The formulation ot National Tuberculosis Programme through an operational research has vividly characterised the quality of the participation of the community in the programme.

The understanding of the functional relationship between the programme and the community is a vast field of study for the social scientist and it has opened a new prospective particularly to the social ecologist whose scope of study can comparatively be enlarged with newer concepts of societal behaviour. These findings may help those who attempt to evaluate N.T.P. in its larger scope but do not at all by itself determine the indecies for evaluation or set standards for its progress.

It is essential to know what constituted the idea of implementation of a community participation programme like Tumkur Pilot Project hereinafter called as Voluntary Project. It was a modest and a scientific understanding that a felt-need oriented programme (National Tuberculosis Programme) necessitates "sustained effort over many decades and the effective application of new tools requires a very high level of community understanding and co-operation. Experience gained over the last few years in all parts of the world has clearly demonstrated the conflict between the basic efficiency of the control tools on one hand and human lethargy on the other. The assault on the human lethargy factor was expected to be launched effectively by the voluntary agencies". Whatever such other technical reasons prevailed, it was a measure of necessity to find out how a community can be mobilised as a strong social force to accelerate the achievements of N.T.P. in the alleviation of physical and mental suffering of TB patients and whether this objective can be effectively implemented through voluntary agencies, if so; how?.

In brief, the primary objective of the voluntary project implemented about six years ago in Tumkur district was to test the validity of the concept of supplementary assistance to N.T.P. in improving the communication between the patients and the existing TB Health facility where amongst the community, there is already a fair level of awareness of the pathological symptoms on the part of the patients. The defective communication between patients and the Health facilities was one of the main causes for the higher rate of defaulting or irregular treatment of the TB patients in the control programme. (The regularity of treatment was found to be in less than 50% of the patients).

With the help of these analyses a course of action was prepared and followed in the name of voluntary project in Tumkur District.

The examination of factors which the project implied cannot be arbitrarily summarised to any conclusions and correlated to the

functions of the National Tuberculosis Programme without a proper method of inquiry. This needs veritably an exhaustive study and repeated investigations. But one thing can be pointed out that this voluntary project by itself formed a hypothesis for a field operational test and the whole programme can be treated as a study.

Method of present inquiry

In order that a critical review is arrived, the entire functioning of the project since 1964 has been subjected to an investigation based on case studies recorded by the author as and when they were noticed. Hence it is admitted that while interpreting these case studies. there can be some amount of subjectivity being crept into the explanation of the facts. In a sociological study, like this. the treatment of the subject will be invariably both objective as well as subjective.

The case studies which are intrepreted here have not been described elaborately for want of space and time; only an analytical discussion on them has been stated. The analysis of these studies reveal themselves around two major subjects, firstly, the community represented by a volunteer and a patient and secondly the community welfare programme i.e. N.T.P. The inter communication between these two subjects forms the base on which the community behaviour is studied or understood in relation to a newer social situation, i.e. National Tuberculosis Programme.

Volunteer in N.T.P.

The definition of a volunteer calls for a close study of the social situation in which he functions. Here a volunteer is defined outside the general attributes of the formal leadership. This means a volunteer need not always be an existing leader but at the same time he may be projecting the qualities of leadership conducive to the promotion of knowledge about a particular programme in the community (National Tuberculosis Programme). In short, the leadership of a volunteer in a given situation (in a given community programme) is determined by the existing social values (of leadership) permeating to community itself; in order to invoke or locate such leadership in the community, it is imperative to study the community behaviour at its close quarters continuously over a long period of time. This is a time consuming process; but one cannot help oneself without doing that. This is the main realisation that the project achieved in its process of recruitment of volunteers to assist the National Tuberculosis Programme. Even without a project. such informal leaders supporting the programme may exist, but the project acted as a special social agent in a district to find such volunteers to assist the N.T.P. The influence of these congenial volunteers on the progress of N.T.P. is also not only natural but also indiscernible in character. The measurement or an assessment of such a social function cannot be gauged objectively; that is why it is

indicated that even this aspect may be taken up for a detailed socio. logical studies by the interested agencies.

Values determining the leadership in the programme

From the above discussion it is clear that all existing leadership may not be helpful for a given programme or situation. Then it becomes a task to locate the leadership or create such leadership in a village. This has led to the belief that is always unproductive to depend on the existing leadership in the village community for any kind of programme without properly recognising the attitude of such persons towards a particular programme or action.

The studies of the volunteer structure in the voluntary project indicate certain social differentiation on the character of volunteers in relation to their role they are playing in the programme. It ts true that many other social factors also play to make a person a volunteer in the programme, like his sympathy towards a sick person, his personal interest in a patient who might be a close blood relative, or a sense of appreciation or an understanding of the Programme, but what was prominently observed was the interplay of social attitudes and values, resulting in the acceptance of a function by a person in the education of a patient.

How values differentiate volunteers

(a)There are volunteers who have accepted the role of leadership in the programme because of an urge to gain their social status over others or to confirm their existing social status in the community. About 12-14 group leaders out of 59 or 60 can be grouped in this category; among the rest of 700 and odd volunteers 20% may belong to this group. The volunteers of this class normally exhibit their keen interest in the pragramme, since such a kind of participation will provide them with opportunity to come in closer contact with the officials of a Health Centre or D T.C., that will enable him to confirm his hold on the community. In short, his already existing social status is further recognised with confirmed actions done by him in the programme.

(b) The volunteers can be also grouped under another class of leadership who manifest a negative approach. For fear of losing the existing social status, they accept the responsibiiities in the programme. They accept the job because the community may not let them down in prestige. Generally, they constitute an older age group and the traditional leaders like village patels, castes heads etc.

(c) Some volunteers in the voluntary project feel that these programmes give them an opportunity to become important persons in the community. In this kind falls petty shop keepers, primary school teachers, students back at their villages.

(d) The other class of volunteers are those who are unwiiling to take up the work, but due to certain pressures they accept the job. The High School Teachers, Government Officials, including the community village level workers and leaders with political ambitions fall into the category.

Volunteers and the programme

The volunteers are generally trained by the project staff at their respective villages on the general aspects of the Control Programme; the process of training continues as long as the volunteer remains in the project. Therefore, it is hoped that he would pick up his work after he gets sufficient experience to deal with his patients over a sufficient long time. The main emphasis is given to create a situation wherein the volunteers conducts "Home Visits" to patients on cordial terms, constantly. This has resulted in establishing a regular process of social interaction between the patient and the volunteer inter linked with the purpose of the programme, i.e. the regular collection and intake of TB drugs by the patients.

The personal efficiency of a volunteer largely depends upon his attitudes towards his work. However it is also true that the exterior factors also qualify the work of a volunteer. As far as the volunteer's efficiency in his own area of function is concerned, it could be rated high to low from (a) to (d) as classified earlier. Generally the volunteers who have an urge to improve or to retain the social status in the community life form an active group of workers in the village. Such groups are intelligible to the training that is imparted to them. It should be noted here that formal and didactic Education of Volunteers through training sessions will not be effective since such measures cannot be sustained throughout the Programme. The personal interaction between the volunteers and the educator especially in the presence of a patient in a village is the dependable mean of education.

Interfering forces

There are specific areas in the programme where the volunteer cannot directly act in order to achieve his purpose. The attitude of Medical Officers and other health stafl. towards the Control Programme, the administrative aspects of distribution of TB drugs, and the frequent transfers of the Health Centre Staff are some such factors that may influence the performance of volunteers in either ways, they may increase the performance of volunteers in right direction if they are conducive, or may precipitate a slakening or disturb the entire voluntary structure in a given place. But, there are instances to show that even during such conflicting situations, volnnteers have been able to achieve conditions favourable to them. Such instances are very less. In the process of social interaction on a realm of common enterprise, it is always possible to find out uniformities on which a fair level of co-operation can be achieved. Even within the organisation of the cntrol programme, and voluntary

TB Association, the experience of the project indicated that it would be a persuasive task to achieve a cohesive commitment with the purpose and implementation of the volunrary project. This feed back education, though not realised in full, is a by-product of the project.

Health education, its widened prospects

In the final analysis, the entire functioning of the project can be treated as a programme of Health Education. The important contribution of this project has been able to give us is that a community can be effectively dealt with in aspects of a programme education or social education. through an organised leadership of the community—while other means of education being kept as supplementary or secondary. This interact method of Health Education can be co-ordinated effectively since it is formulated on the basis of study of interaction of various social aspects in relation to the functioning of a society as a whole.

The fact that the patients are found to be generally mixing freely with the other persons of the village. either gossiping in a country coffee shop or in the agricultural farm, poses a different problem for Health Education. Neither the patients nor the other villagers seen to have little concern over the possibility of infection. The so-called social stigma usually attached to a TB patient in a village is almost seem to be non-existing. The voluntary project had to meet this situation from a different angle. Any efforts through general propaganda like showing films on Tuberculosis and distribution of literature or conducting lectures had little impact on the community. Constant and persuasive talk with the villagers registered good success as probably the range of personal participation of a volunteer in such conversations with the villagers established necessary rapport.

The other important factor observed in the voluntary project was that the volunteers' influence has been of little effect on patients who become defaulters or irregular, because of their attitude of indifference towards their treatment owing to the presence of other economic problems, like, food, employment, etc. But the volunteers have successfully prevailed upon patients who default because of ignorance about the efficacy of the domiciliary TB treatment. The initial defaulters who discontinue the treatment within a few months after diagnosis do not set much difficulties to a volunteer. A doctor is always a deciding deity to a patient who looks to him with all hope and faith. A dialogue between them is so personal that any other force is almost feable desect it. If a volunteer as per the programme try to convince his patient friend that INH and PAS which are issued to him, (since injections are not made available in the hospital) are effective; and that he could get relief, his efforts may be futile, because the patient has already been told that injections are the 'must' drugs for his relief. Therefore, the Health Education

should start on a plane of common understanding of the programme implemented.

Evaluation

The question of assessing the contribution of the voluntary project to the overall progress of the Control Programme has been still engaging the minds of the members of the project committee. There have been some attempts to evaluate. to know whether the home visits to TB patients have led to more regularity of drug collection by patients. This is yet to be assessed, since no proper denominator is visible in the programme for the time being. However, it can be said, as stated by Dr M.D Deshmukh that the effectiveness of voluntary efforts would be, when the combined efforts of both the Government and the voluntary result in progressive control of TB. But again, it is very difficult to know in what degree and in what aspect each agency contributed to the progress of the control programme, since each social force does not act independently. Therefore it is modestly suggested that in such situation, two areas (DTPs), one with the project and the other without it, can be subjected to a comparative study.

Summary

(a) It is not impossible to locate leadership in the community to mobilise support in favour of a given community Welfare Programme.

(b) Health Education will be more effective if processed through social interaction between the volunteer-patients-and the National Tuberculosis Programme, the other modes of education being kept as supplementary.

(c) The assessment of such voluntary programme in relation to a Nation wide Programme cannot objectively be achieved, but such programme in general can help the major programme to achieve its purpose with more understanding of the community behaviour.

(d) The success of voluntary projects depends largely on the quality of guidance and leadership provided by the voluntary agencies. Commitment of faith in such programmes on the part of members of the voluntary agencies and Governmental agencies is an essential factor for the smooth implementation of such voluntary programmes. This may be noted by other Voluntary Agencies who are eager to implement such projects.

(e) It is suggested that some of observations made here in respect of leadership, and Health Education may be taken up again for a detailed sociological study to obtain a better and authentic understanding; hence it is reasonable

to hope for a better recognition of social scientists in N.T.P. and other connected programmes.

The author is greatly indebted to various authors whose work have been referred and specially to Dr. H. Shivalingappa. Dr. R Susai Mary, Dr Nagpaul, Dr. Raj Narin and Sri B.M. Cariappa, with whom the author had the privilege to discuss this paper. The author expresses his thanks to Dr. K.N. Rao. once again for giving an opportunity to present these observations in the symposium.

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6. Outline of Tumkur Project.

Dr. Rao: Thank you. May I now request Dr. Gothi to present his paper?

(Paper not received for publication)

Dr. Somayya, President of the conference, announced that the next item of the programme will be a session on "CHEMOTHERAPY" which has been separated into two parts, the first session consisting of the first seven papers mentioned in the printed programme to be under the Chairmanship of Dr. M. D. Deshmukh and the other four papers under the Chairmanship of Dr. R. Viswanathan in the afternoon. He then requested Dr. Deshmukh to take his chair on the dais. Dr. M.L. Mehrotra acted as the Rapporteur for the sessions. Dr. Deshmukh called upon the representative of the New Delhi TB Centre to present his paper.

CAUSES OF TREATMENT FAILURE

BY

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(New Delhi Tuberculosis Centre)

Chemotherapy makes it possible to achieve cent per cent conversion of sputum under ideal conditions. In routine practice, however, the conditions are seldom ideal and, therefore, the results usually fall short of the possible cent per cent. This shortfall is often associated with several factors which are supposed to be the cause of treatment failure. An attempt has been made in this paper to study these factors and to quantify their contribution to treatment failure. The paper is based on a retrospective analysis of 525 new pulmonary tuberculosis patients with positive sputum diagnosed in the New Delhi TB Centre in 1966 from the domiciliary service area of the Centre and treated on a domiciliary basis. Seventy four other patients who did not attend even for a single day after diagnosis and therefore took no treatment are excluded. Majority of these were not bonafide residents of the domiciliary service area.

A list of thirteen possible factors, some of which are present at the start of treatment and others appear during the course of treatment, was drawn up and the results of treatment were analysed in respect of these factors. For convenience of analysis, factors of similar nature present initially and likely to influence the results of treatment in an identical manner have been grouped together as follows :—

Group A—Disease involving 5 or 6 zones, large bilateral cavities and extremely poor general condition.

Group B—Tuberculosis or non-tuberculosis complications.

Table IV showing the results as compared with that of Andrew's series.

TABLE IV

Operation	Andrew's series		Present series	
	% cure	% death	% cure	% death
Drainage	10.7	7	6.2	6.7
Thoracoplasty	43.5	8.2	86.8	2.7
Resection	54.1	8.1	58.3	8.3
Decortication	63.6	9	96.4	Nil
Total	152 cases		212 cases	

Table V shows the overall mortality as compared with other authors.

TABLE V

	Gordon et al (1968)	Samson et al (1958)	Andrew (1965)	Present
Overall mortality	5%	2.9%	12.5%	8.9%

Cases were followed up for a minimum period of six months to a maximum of 4 years and 6 months. There was no case of recurrence of empyema. In six patients empyema is persisting though amount of discharge is much less and their general condition is much improved.

Summary

(1) 212 cases of empyema treated in a surgical unit have been analysed.

(2) Out of these 187 cases (88.2%) have been cured.

(3) Different surgical procedures were adopted and their results analysed. Decortication or decortication and lobectomy is undoubtedly the superior treatment where applicable. Of the collapse operation Grew's technique was found to be valuable.

(4) Nine cases required two major operations.

(5) Only three cases were fit for primary decortication.

(6) There was an overall mortality of 8.9%.

(7) In 6 patients empyema could not be cured though there was persistent improvement in their health and disease.

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Dr. Somayya, President of the conference, announced that the next item of the programme will be a series of papers on 'B.C.G.' under the Chairmanship of Dr. S.P. Pamra. He requested Dr. Pamra to take his chair on the dias and conduct the proceedings. Dr. P A. Deshmukh acted as the Rapporteur. Dr. Pamra requested Dr. Barua to present his paper.

BCG PROGRAMME IN INDIA—PRESENT POLICY AND FUTURE PLANS

BY

DR. B.N.M. BARUA

BCG vaccination was first introduced in India in 1948 and the mass BCG campaign was started in 1951. The target was to cover the entire susceptible population in a reasonable period of time, say 10 to 15 years. It was estimated at that time that 170

million persons were available in the young age group which need to be covered by the mass campaign and that 350 to 400 teams should be able to cover this population, as also addition because of new births, in about 10 to 15 years. By 1962, though a total of 178 million persons were tuberculin tested as against the 170 million estimated to be available in the younger age group in 1951, in fact the achievement was no where near the target. An analysis of the performance of the mass campaign in 13 years from 1951-62 showed that of the 178 million persons tested, only 112.7 million belonged to the 0 to 20 years age group and not more than 50 million of them were actually vaccinated, because 1) this population was covered over a period of 13 years with inadequate number of teams, 2) this population also included repeat coverages specially in urban and semi-urban areas, 3) during these 13 years large number of children were transferred to the next higher age group and 4) the vaccination coverage in the younger age groups was further diluted by addition of new births. The back-log of population to be covered at that point of time was estimated to be more than 90% in the 0 to 6 years age group, 50% in the 7 to 14 years age group and 38% in the 15 to 24 years age group.

It was realised that the figures in millions that we quote as the performance of the Campaign are not really that important unless a thorough and very speedy coverage of a given population can be ensured and maintained at a high level.

To ensure through coverage and proper record keeping, house to house vaccination was introduced in 1962. At the same time, endeavour was made to integrate BCG teams with the district TB Control Programme. Contrary to our expectations though house to house vaccination improved the coverage to a very small extent, the output per technician came down so sharply, that on an average not more than 30 to 40 persons were vaccinated by a technician per day. It was then realised that with the limited number of mass BCG campaign units the country, unless very speedy coverage of the population can be ensured, it will never be possible to achieve the target. As direct vaccination was by then found to be useful, this was introduced in the mass campaign at first in the 0 to 6 years age group and thereafter it was extended to the entire 0 to 20 years age group in 1965.

A further analysis was again done in 1968. Till then 112 million BCG vaccinations were performed from the inception of the campaign. It was established that about 84 million of these belonged to the age group 0 to 14. By working out the point coverage i.e. how many persons living in the age group 0 to 14 as on July, 1, 1968 have been vaccinated, it was estimated that of the total persons vaccinated, only 36.08 million survived and were in the age group 0 to 14 as on July 1, 1968, the others having died or crossed the age of 14 years. This gave a percentage coverage of only 16.53 of the total population in the 0 to 14 years age group estimated to be available at that point of time. This was beeause at this stage i.e.

during the period from 1965 to 1968, we had two distinct programmes. A large number of the teams were integrated with district TB clinics and these teams were doing mostly direct vaccination from house to house. Their increased out-put because of direct vaccination was offset by very poor out-put in house to house vaccination. The other teams, about a third of the total teams, were doing centre-wise tuberculin testing and vaccination, as a result of which the out-put continued to be poor.

Therefore, in 1969, it was decided to give precedence to school vaccinatian over house to house vaccination because in the meantime more than 70% children in the 5 to 11 years age group were known to be registered in schools and in any case even in the house to house programme and before that in the orthodox mass BCG campaign a large proportion of the figures reported were those of work done in schools.

The present policy of the BCG campaign is, therefore, the sum total of these changes, namely concentration in only to 0 to 20 years age group, only direct vaccination, precedence to school vaccination over house to house vaccination and integration of BCG teams with District TB Programmes, aiming at speedy and thorough coverage of the susceptible population. The procedure to be adopted by the mass campaign in respect of BCG vaccination in the country is that BCG vaccination will be restricted only to the 0 to 20 years age group. Unlike the mass campaign 0 to 1 year age group will also be covered. The entire population will be covered by direct BCG vaccination without any tuberculin test. If in the age group of 15 to 20 years the infection rate is known to be high from previous experience, this age group will also be ignored rather than being covered with tuberculin testing and BCG vaccination. As most of the children in the school going age group are now available in the schools, precedence should be given to vaccination in schools over house to house vaccination.

All these changes do not seem to have still improved the performance to any large extent though the number of vaccinations has gone up slightly high, being 109.53 million in 1969 and 112 million (estimated) in 1970 against 86.49 million in 1968. All the teams have not fallen in line with our recommendation of precedence to school vaccination yet, but the present indications are that school vaccination has improved the performance to some extent, being 117 vaccinations per technician day as against 42 vaccinations per technician day by the teams that are still working from house to house. In the meantime new born vaccination through maternity and other institutions is being further expanded and other agencies are being encouraged to offer BCG vaccinations.

The mass BCG campaign with special BCG teams has been in existence for more than 19 years now and more than one round of BCG operation has been conducted in almost all the areas, but it is doubtful whether in the initial mass campaign phase we have been

able to achieve a high population coverage because a huge proportion of the susceptible population still remains uncovered. At the present rate of coverage, the limited number of personnel available for BCG operation at present, will never be able to attain a satisfactory level of coverage. There are 237 sanctioned BCG teams now and by the end of the 4th plan, it is expected to rise to 330, giving one BCG team per district as part of District TB programme. It is not possible to expand the mass BCG campaign any further, nor is it possible to continue with the mass campaign for very long, as the ultimate aim of the BCG programme, and in fact of all other vertical programmes of today, is to integrate with the general health services. The strategy has, therefore, got to be a little different.

For ensuring effective coverage in BCG operation, the scope of activity of the programme has to be expanded further through all avenues possible, keeping in view the strategy that BCG should be offered atleast in three stages i.e. new borns, school entrants and school leavers, and at the same time the feasibility of integrating BCG services with other general health services has to be explored. The three main services through which BCG prngramme can be expanded further and with which BCG can also perhaps be integrated are the basic health service of the Primary Health centres, the School Health Service and the Maternity and Child Welfare service, which is now a part of the Family Planning programme.

So far as the basic health service in Primary Health Centres is concerned, this exists in only those Primary Health Centres that have entered into the Malaria maintenance phase. Of 5,044 Primary Health Centres at present, 2,462 (approximately 50%) are in Malaria Maintenance phase. In these areas, there is one basic health worker for a population of 10,000. The main duties of these basic health workers are, 1) Vigilance for Malaria, 2) vaccination for small-pox (mainly re-vaccination), 3) Health intelligence in respect of detection of communicable diseases, 4) recording of births, deaths and vital statistics, 5) information in respect of family planning. However, in practice they are doing only Malaria and family planning work and to a very small extent, small-pox vaccination. They are expected to visit every house once in a month, which means that there being about 2,000 houses in a population of 10,000, he is to visit about 100 houses per working day,—vigilance for Malaria being his main responsibility. As per norm fixed, for 2,462 PHC's, there should be 20,000 basic health workers, but in 1969, there were only 14,000. However, the picture is likely to improve considerably by the end of the 4th Plan when about 4,000 Primary Health Centres i.e. 75% of the total blocks are likely to go into Malaria Maintenance and thus there should be about 40,000 basic health workers.

Under Family Planning programme, the Primary Health Centres have been further strengthened due to re-organisation of family planning to public health approach. At the sub-centre level,

additional staff has been provided so as to have one Auxiliary nurse mide-wife for each 10,000 population and one health assistant for 20,000 population. They are primarily meant for family planning and maternity services. These additional staff for family planning have been provided in almost all the Primary Health Centres and at present there are about 19,000 A N.M.s and 10,000 dias in the sub-centres.

It thus appears that para-medical personnel are now available at the sub-centre level. However, they are meant for limited purpose at the present stage. Whether these workers will be made available for BCG vaccination, and, if available, whether they can be utilised for BCG vaccination of the new borns, infants and children in their areas aiming at thorough and periodical coverage, need to be studied.

Already there is a feeling that though para-medical personnel exist at the lowest level, at present they are mostly single purpose which is not in tune with the concept of basic health service, and therefore, a proposal to see if it is possible to pool all the para-medical personnel at the sub-centre level and utilise them as multi-purpose workers is under consideration. In that case para-medical personnel are likely to be available for a much smaller population than 10,000 as basic health workers to whom it may be possible to entrust the responsibility of BCG vaccination in due course.

So far as school health service is concerned, this is at different stages of development in different States. However, the present recommendation of the National School Health Council is that School health services should be recognised as an integral part of the Community Health service organisation. Therefore, the aim is to integrate school health service at the primary health centre level for which either an additional public health nurse or atleast an A.N.M. is to be provided. In absence of any special organisation for school health service, if BCG is to be integrated with school health service, the responsibility will have to be taken over by the additional public health nurse or A.N.M. provided for school health service at the Primary Health Centre level. How far this single school health nurse will be able to ensure thorough coverage of the entire school population in a Primary Health Centre area where about 100 to 150 Primary Schools are expected to be available, also requires to be studied.

On the whole, in the existing circumstances, integration of BCG to certain extent appears possible with either of the general health services discussed above, more so because freeze dried vaccine in increasing quantity will be available, but this has to be examined further by operational studies, specially to ascertain the best procedure for field work. changes that may be necessary in the working schedule of the different para-medical personnel, feasibility of combining BCG with small pox vaccination, the arrangement for supply, supervision, record keeping etc.

Technical and operational investigations to study the feasibility of integrating BCG work with the General Health Services through the Basic Health Workers are in progress at the NTI. Similar studiies for integration of BCG work with other services would be needed.

It, however, appears that unless the basic health services are further strengthened and many more basic health workers than at present are available and they are made multipurpose, any integration of BCG with these services cannot perhaps be in substitution of the existing BCG vaccination programme, but can only be as an expansion of the present services.

Dr. Pamra : Thank you. I would now request Miss Vasantha to present her paper.

FREEZE DRIED BCG VACCINATION (PRODUCTION, PROPERTIES AND USE)

BY

DR. J.C. SURI, SHRI A.V. OOMMEN, K. SUDHA and V. VASANTHA
(*BCG Vaccine Laboratory, Madras*)

Till the end of the year 1967, the BCG Laboratory at Guindy, Madras, was supplying only Liquid BCG Vaccine for use in the "BCG Vaccination Campaign". However, the use of Liquid BCG Vaccine in such Campaigns has great limitations because of certain inherent drawbacks in the vaccine such as :—

1. Liquid BCG Vaccine has a "short-life" of two weeks from the date of manufacture. Because of this, the vaccine has to be released for use, before completing many of the prescribed control tests.

   Also the Laboratory has to prepare a fresh batch of vaccine every week. Impairment in the production due to factors like scarcity of water, contamination, etc. has often resulted in short-supply of vaccine to many BCG Teams.

2. Liquid BCG Vaccine deteriorates rapidly even at room temperature and also on exposure to daylight. Therefore extreme care has to be taken at all stages of its production, storage and use.

Since BCG Vaccine in the lyophilized state is a more stable product, the use of Freeze Dried Vaccine in the Campaign was expected to give more satisfactory results. However, from the large number of enquiries received from the various BCG Teams it appears

that the superiority of the dry vaccine over the Liquid Vaccine has not been clearly appreciated.

The questions often asked have been :—

1. What is the 'life' of the dry vaccine and should it be protected from light and higher temperatures ?

2. What is the period upto which reconstituted freeze dried vaccine can be used, and should the vaccine be kept on ice during this period ?

3. In the field, when facilities for refrigeration are not available, within how many days should the vaccine be used ?

During the past two years, the Laboratory has done several experiments to assess the properties of the dry vaccine and thereby provide rational answers to these questions. In the process certain modifications were introduced in the production methods.

Materials and methods

Production of Freeze Dried BCG Vaccine

Freeze Dried BCG Vaccine is prepared from Liquid BCG Suspension. The BCG Strain used for vaccine production at the Madras Laboratory is the Danish strain (1331).

Surface cultures of BCG, after eight days' growth on Liquid Sauton medium, are harvested, using the Birkhaug's filter. A known quantity (8 to 9 gms) of the semi-dry BCG Cake, thus obtained, is ground into a homogenous mass and suspended in Sodium-glutamate solution, to a final concentration of 10 mg/ml.

About 0.5 ml of the concentrated suspension (5 mg of BCG) is filled in each ampoule and freeze-dried. The dry vaccine in one ampoule is reconstituted with 5 ml of the diluent to obtain a final concentration of 1 mg/ml.

Since BCG is a 'live' vaccine, its potency depends on the number of viable units contained in it. Therefore, in the experiments reported below, the "Viable Units Count" test has been used to estimate the loss in potency of the dry vaccine, under different experimental conditions.

Technique of the "Viable Units Count" test

Serial dilutions of the samples of vaccine are made in diluted Sauton (one part of Sauton medium diluted with three parts of distilled water). The last three dilutions are adjusted to obtain, for the middle dilution, an estimated optimum count of 50 colonies per bottle of medium, the first dilution 100 colonies and the third dilution, 25 colonies.

TABLE 3

Comparison of F.D. vaccine lots dried from the same suspension

Suspension	Viable Count of F.D. Vaccine lots
A	10.0 18.0 10.0 14.0 9.5
B	15.5 12.2 12.8 18.5 9.7
C	14.5 11.0 16.0

TABLE 4

Results of testing of F.D. vaccines—strain 1331—from Madras and Copenhagen

Average of the results from the three Laboratories

Tests	F.D. vaccine from Madras	F.D. vaccine from Copenhagen
Optical density	0.37	0.43
Viable units Millions/mg.	6.9	6.3
Oxygen uptake Microlitres/ Milligram hour	0.566	0.616
Germination Rate—72 hours	50—75	60—90

Dr. Pamra: Thank you. May I now request Dr. Somayya to present Dr. Umapathi Rao's paper since he has not come here?

B.C.G. AFTER INTEGRATION WITH TUBERCULOSIS SERVICES

A comparison with Mass and modified mass campaign phases

BY

DR. D UMAPATHAY RAO

Introduction

The problem of Tuberculosis is of immense magnitude affecting nearly 10 million population of which a quarter million are infectious and spreading the disease to the non-infected individuals. The control of Tuberculosis requires not only detection and treatment of the cases but also protection of the susceptible individuals by BCG Vaccination.

Objective

To make a retrospective study of the progress of BCG after integration with District Tuberculosis Programme and compare with the earlier Mass phase of the campaign. Factors for lack of progress will be identified though not studied in depth to asses the value of each fact.

The old set-up (Campaign approach)

B.C.G. Vaccination was introduced in the erstwhile Hyderabad state in 1948 and it is one of the few states to take up the programme quite early. B.C.G. Campaign was under the charge of the Assistant Director of Public Health (BCG) and there were five Units under the campaign—Warangal, Visakhapatnam, Guntur, Ananthapur and Hyderabad. The Warangal Unit consisted of Warangal. Adilabad, Khammam and Karimnagar Districts. The Visakhapatnam Unit consisted of Visakhapatnam, Srikakulam and East Godavari Districts. The Guntur Unit consisted of Guntur, Krishna and West Godavari and Nellore Districts. The Ananthapur Unit consisted of Ananthpur, Chittoor, Kurnool and Guddapah districts and the Hyderabad Unit consisted of Hyderabad Districts and City, Nizamabad, Medak, Mahaboobnagar and Nalgonda Districts. Each Unit consisted of one Team leader and Health Inspectors, driver and peon etc. Each Team had to cover a population of a District (10-20 lakhs), testing 3,000 and vaccinations 1000 a month. The reports were received and consolidated in the

office of the Asst. Director of Public Health and sent to the Director General of Health Services. The individuals were mantoux tested and Mx-negative people were offered BCG vaccination. In the year 1962 direct BCG Vaccination was introduced and in 1965 new born vaccination was taken up all over the state.

The present Set-up (Integrated approach)

The BCG campaign is now integrated with tuberculosis services through the District TB Programme as envisaged by the Government of India. In Andhra Pradesh 14 Districts were upgrated in this pattern and the teams are also integrated with tuberculosis services. In the remaining districts the TB Clinics were upgraded and BCG Teams are being supervised technically by District TB officers under the administrative control of the District Medical & Health Officer in each District. There are 31 BCG teams working in Andhra Pradesh one in each District and one in Hyderabad city (in the newly formed Ongole district separate tuberculosis services including BCG Teams are not functioning but are catered to by the neighbouring districts). In July 1967 with the integration of Medical and Health Services a separate post of Asst. Director of Medical & Health Services (BCG & TB) was created and he is also the state TB Control Officer. Under him there are two Supervisory Medical Officers exclusively for BCG Work. State TB Control Offieers supervises the District TB Programme including the BCG. District TB Programme provides for registration of the population visited and direct vaccination in the BCG Campaign for all the susceptible population in the age groups of 0-19 years which forms 49.2% of the entire population.

Advantages:Unified command for the curative and preventive parts of National TB Control Programme both at the State and District levels.

*Dis-advantages:*Unmanageable district and directorate offices. Consequent delays and inadequate provision of TA etc. , . District TB Officer's supervision is part time and superficial while that of the District Medical & Health Officer nominal.

Results

There were 3 phases of the campaign—Mass campaign upto 1962, modified mass campaign with direct vaccination of age-group 0-6 years, and the present phase of door-to-door vaccination campaign with registration and direct vaccination only upto 20 years of age. The figures shown are for 3 years periods during these phases.

Year	Phase of the campaign	Tested (in lakhs)	Read (in lakhs)	Vaccinations (in lakhs)
1954	Mass Campaign.	14.15	11.98	4.89
1955	,,	30.02	22.88	10.38
1956	,,	25.25	19.05	8.47
1963	Mass Campaign/Dvs (DTD.)	18.49/2 92*	10.98	10 23
1964	,,	19.16/4.99*	n a	12.38
1965	,,	21.20/6.44*	n.a	14.41
	(*Direct Vaccinations)			
1968	D.V.S. Alone (DTD)	1.06/14.80**	not done	5.55
	(**Regd. population)			
1969	,,	*41.862 (*thousands)/ 23.46.	,,	7.83
1970	(incomplete for Dec.)	7752/27.09	,,	7.59

As can be seen from the table, from the year 1964 onwards, the vaccinations figures doubled or trebled as compared to the previous years. This has been due to the introduction of direct vaccination due to which all those who were tested previously, were instead vaccinated in the earlier age-group. During 1968 and 1969 the figures are comparatively low because the BCG Teams were deputed on other duties like "Pushkeram" work at Rajahmundry and Vijayawada and suspended due to the Telangana agitation. Added to that most of the districts in Andhra and Telangana also suffered from inclemant weather such as Cyclone and floods etc. The complete figures for 1970 are also not available.

The following points are interesting to note :—

(i) During successive years the size of the positive induration was raised from 5 mm to 10 mm. Hence in 22.8 lakhs read in 1955, there should have been more negative than 10.38, as induration above 5 mm, were left out as positive and not vaccinated.

(ii) The number of Teams operating in Mass campaign phase were only 11, while they are 21 during the present direct vaccination period.

(iii) Vaccinations were given only on 12 days in a month in Mass Campaign. Now PVs can be given all the 24 days in the month, but there has been no increase in this respect. The out

put of technician was about 1000 vaccinations during mass campaign while it averages around 500 vaccinations at present.

Discussion

The administrative and technical difficulties were got over by the integration of BCG with TB Services and the creation of a single post of District TB Officer at District level and State TB Control Officer at State level. However progress depended primarily upon Technician output and technician days. All other factors like vehicles, ice, petrol, TA & DA etc., are woven around these two factors.

Technician output : Technique of campaign—TA (Prompt payment)—Kit condition and other equipment—Supervision—public cooperation and Health Education.

Technician Days :

i. No. of Teams and Technicians sanctioned.
No. in possession.
No. working.

ii. Diversion, disturbances, deputations—leave—transport

iii. Vaccine—availability - date of expiry—wastage—size of ampoule—difficulties in production (Some of these difficulties may be solved by the supply of Freeze dried vaccine).

iv. Vehiclee—age—on road and in garage—other duties.

v. Petrol—Ice—Budget for TA & DA.

These factors operated during the three phases.

For example the Technician days put up are as follows:-

Year.	Tech. Days.	Year.	Tech. Days.	Year.	Tech. Days.
1962	1149	1965	1594	1968	939
1963	1274	1966	1473	1969	1145
1964	1152	1967	1216	1970	—

Howevr during 64, 1152 Technician days gave an output of 12.38 lakhs of vaccinations, during 1969 for 1145 Technician days, the output was only 7.83 lakhs.

The mass campaign phase had certain disadvantages and soon deteriorated during the period 57-61. The modified mass campaign phase had certain advantages and revived the campaign, soon becoming one of the best organised in the country. New project like new-born vaccination, door-to-door approach with direct vaccination and simulteneous BCG and smallpox, were taken up by the State Organisation. The present policy envisages school vaccination—DTD, which is like modified campaign approach. This change in policy should be reflected in NTI teaching also. Only then the policy formulated by the All India BCG Officers will be implemented by the District TB Officer and their Team Leaders.

Conclusion

After integration this is what happened to an organisation which did creditable work for over a decade and earned good remarks of the TB adviser and the BCG Officers as one of the best organised campaigns in the country. The progress in the vaccination has come down to what it was in 1956. The number of the then Tuberculin tested have been covered by the Direct vaccination and the intensive coverage which was expected after the change over to form the mass campaign to door-to-door campaign did not materialise.

The paper does not refute the value of door-to-door vaccination, but that it should be limited in its application to earlier age-group only and also recommends retention of some of the aspects of Mass BCG Campaign, like publicity and health education for some time more in our country in view of the backwardness in education etc. From the past experience, a nucleus of special organisation is necessary to take care of the campaign from the the District to the National level, as very little supervision is exercised at the District level, as at present.

While there are about 260 million individuals today who require vaccination in 0-20 age-group, with the present set-up and the number of teams we are not able to touch even the fringe of the population. No. of teams have to be obviously raised especially in view of the door-to door vaccination policy. Sufficient budget should be made available for TA & DA for the personnel as also the timely supply of vaccine in adequate quantities and roadworthy vehicles.

If the freeze dried vaccine is made available as a routine supply, some of the operational difficulties can be solved.

Dr. Pamra : Thank you. Now I would request Dr. Bordia to present his paper.

HEAT KILLED BCG VACCINE AS A "TUBERCULIN TEST" COMPARED WITH PPD-RT-23 WITH TWEEN 80 AND OLD TUBERCULIN

BY

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Introduction

Tuberculin test is an important tool for the diagnosis of infection with the Mycobacterium tuberculosis especially in children. Various tuberculins have been used. At present 1 TU of PPD-RT-23 with Tween 80 is in common use. However in many instances it gives negative or weak reactions even among bacteriologically confirmed cases of Pulmonary tuberculosis (1). Stronger strengths of the tuberculin (PPD-RT-23 with Tween 80) are not commonly available in India. Supply of Old Tuberculin is irregular. Even PPD-RT-23 1 TU with tween is available only to specialised agencies.

Can heat killed BCG Vaccine be used in place of 1 TU PPD-RT-23 or Old Tuberculin ? Comparative response to Old Tuberculin and PPD-RT-23 with tween has been reported (2) but not in India. Similarly heat killed BCG Vaccine has not been used as a tuberculin in India though it has been reported elsewhere (3, 4, 5). Using heat killed BCG Vaccine in different dilution, Frappier and Guy (3) reported that it was more specific than the tuberculins in common use. In these studies (3, 4, 5) reaction to 'BCG Vaccination' was measured but BCG was not used for a Mantoux test. The present study was undertaken to see if BCG could be used as (an antigen for) a Mantoux test for detection of infection. If so, unused vaccine which is not thrown away, could become available for general use or for use to those who are unable to get any of the standard preparations of tuberculin.

Objective of the Study was to study the comparative sensitiveness of 1 TU of PPD-RT-23 with tween 80, 0.1 cc of Old Tuberculin (O.T.) 1/1000 and 0.1 cc of heat killed BCG vaccine (freeze-dried).

Methods and Material

Two consistent BCG technicians for testing and reading of the Mantoux tests were selected and were used for the entire study).

New syringes and needles were colour coded and used exclusively for the same preparation throughout the study. Four amber coloured similar bottles were filled with

(a) PPD-RT-23 with tween 80 in the strength of 1 TU in each 0.1 ml.

(b) O.T. 1/1000.

(c) Freeze-dried BCG, dissolved by solvent as done commonly in BCG programme and

(d) For dummy vaccination carbolised normal saline solution was used.

These four bottles were labelled with different colour codes. The corresponding syringes were given the same colour codes. The same syringe was used throughout the study for the same antigen and testers and readers had no access to the colour-code for the different antigens.

As far as possible, only fresh PPD-RT-23 with tween 80 1 TU and freeze dried BCG vaccine were used. Old Tuberculin (O.T.) was procured from 'Burrows Welcome', only fresh dilutions in carbolised normal saline were used. Freeze dried BCG diluted to standard strength vaccine, and boiled in a test tube for 15 minutes. To make up the water loss due to boiling more saline was added to the required level in the test tube. The boiled contents were emptied into the amber coloured bottle.

Bacteriological testing of the viability of heat killed BCG was not done, nor were the sterilization tests on their biologicals nor on carbolized saline for dummy vaccination. It was presumed that boiling the reconstituted vaccine for 15 minutes killed all the living BCG organisms.

The study was conducted between 28.7.1970 to 14.8.1970 in Indore City, M.P.

Four intradermal tests were given simultaneously two on the left and two on the right front forearms of 162 proved patients of tuberculosis or patients under investigations in the Tuberculosis hospital and sanatorium; for 161 patients test results are available.

271 patients of both sexes in a general hospital were also given four tests, 236 tests results are available.

School children were given only two tests each, with either PPD-RT-23-1 TU or heat killed BCG or O.T. 999 students aged between 6 and 16 years were tested but only 620 students are considered after excluding all those with previous BCG vaccination scar.

13. Smith, D.T., Use of steroids in conjunction with chemotherapy in selected cases of active tuberculosis, Trans. of 16th VA conference on chemotherapy of tuberculosis, 140, 1957.

14. Tuberculosis Society of Scotland, Research Committee : Prednisolone in the treatment of pulmonary tuberculosis : A controlled trial : *Brit. Med. J.*, **2**, 1751, 1960.

15. Weinstein, H.J. and Koklar, J.J., Adrenocorteroids in the treatment of tuberculosis, *New. Eng. J. Med.* **260**, 412, 1959.

MONDAY, 4th January, 1971

AFTERNOON SESSION

The conference reassembled in the auditorium of the Government Medical College, Bangalore at 2-30 p.m. with Dr. K. Somayya, President of the conference, in the chair. He announced that the afternoon sessions will begin with a session on "Social aspects of tuberculosis" under the chairmanship of Dr. Mohandas K. Pai. He requested Dr. Pai to take his chair on the dias. Dr. M.M. Singh acted as the rapporteur for the session. Dr. Pai called upon Dr. S.P. Pamra to present his paper.

Treatment taken prior to reporting at specialized Tuberculosis Institutions.

A MEDICAL-SOCIAL INVESTIGATION

BY

S.P. PAMRA,[1] S.H. PATHAK[2] & G.P. MATHUR[3]

The basic principle of tuberculosis control is to reduce the transmission of infection in the community. Many patients however do transmit infection for varying periods before they are diagnosed and rendered safe for the community by appropriate treatment. There could be many reasons for this time-lag. The patients may go on ignoring symptoms and take remedial action quite late. There may be no conveniently located health facility where they could go and seek relief. The facility they go to may not have the wherewithal of diagnosis. Lastly, tuberculosis may not be suspected at the facility where they report, thus delaying the diagnosis.

With a view to study this problem and to get an idea of the factors involved in late diagnosis, new patients attending the New Delhi Tuberculosis Centre were interrogated in respect of the duration of symptoms and remedial action taken by them before reporting at the Centre. Data thus collected were then correlated

1. Director, New Delhi Tuberculosis Centre, New Delhi.
2. Director of Field Work, Delhi School Work, Delhi.
3. Statistician, New Delhi Tuberculosis Centre, New Delhi,

with the clinical and bacteriological status of the patients with a view to ascertain the consequences of late diagnosis for the patient.

The investigation was entrusted to 4 students of the Delhi School of Social Work. The New Delhi Tuberculosis Centre, referred to as Centre hereafter, draws its patients from three different territorial entities viz domiciliary service area (DA), areas of Delhi served by other regional clinics (OA) and patients coming from outside Delhi (OS). DA, OA and OS cases are usually in the proportion of 2 : 1 : 1. The social workers interrogated . 00, 100 and 100 consecutive patients of the three categories respectively before they were examined clinically and entered the data according to a previously drawn out questionnaire. Patients discovered through contact examination and case-finding programmes, those referred for opinion or fitness for service or visa and those already diagnosed and treated for tuberculosis previously were excluded. The study started on May 18, 1970 and the requisite number of patients was completed on June, 6 1970.

Table 1 shows, category-wise, the distribution of pulmonary and non-pulmonary tuberculosis patients. The proportion of pulmonary tuberculosis patients is more or less the same in each category and furthermore, is similar to the percentage that is usually obtained in the Centre year by year. Two hundred and forty one of these patients were males and 159 females. Except for males, especially those above the age of 30 years, being somewhat more preponderant in OA and OS categories, there was no other appreciable difference in the age and sex composition of the three categories of patients. Amongst patients from outside Delhi, females are invariably fewer than males.

TABLE 1

Distribution of patients Included in the study*

	Pul. Tbc.	Non-Pul. Tbc.	Non TB	Total patients
D A.	97	13	90	200
O.A.	42	4	54	100
O.S.	44	5	51	100
Total	183	22	195	400

*D.A. Patients from domiciliary treatment area
O.A. Patients from other areas of Delhi
O S. Outsiders (patients not belonging to Delhi

Analysis was also made of the three categories of patients in respect of their presenting symptoms, especially cough. No differences were however found in the three categories. Nor was frequency of cough different in tuberculous and non-tuberculous patients.

Table 2 shows the number of remedial actions that the tuberculosis patients had taken prior to reporting at the Centre in each category separately. Nearly 15% of the DA patients came straight to the Centre without attending elsewhere. The percentage of similar patients in the OS category was, as expected, less. It is worth noting that even amongst DA patients, nearly 12% had attended at three or more places before attending at the Centre. Most of them had sought assistance from the general practitioners (GP) and general health institutions (GHI); nearly one fifth tried indigenous treatment. (Table 3). Amongst the OS patients, however, a much larger percentage of patients took indigenous treatment and this is understandable since general practitioners and GHIs are less easily available in the rural areas from which most of these patients came.

TABLE 2

Number of 'actions' taken by TB patients prior to reporting at a TB clinic

No. of actions before reporting at a TB clinic	D A.	O A.	O.S
None	16 14.5%	5 10.9%	4 8.2%
One	39 35.4%	34 73.9%	20 40.8%
Two	42 38.2%	7 15.2%	21 42.8%
Three ore more	13 11.8%	0 0.0%	4 8.2%
Total	110 100%	46 100%	49 100%

Table 4 is important and shows that, contrary to the usual belief, nearly 80% of the patients in each category took remedial action within one month of the appearance of the symptoms, most of them within about 10 days. Somewhat larger percentage of patients waited for over three months before taking action in OS category as compared to the DA. Table 5 shows the average duration of treatment under each 'action' taken by the patients prior to reporting at

TABLE 3

Nature of first action taken by TB patients

Nature of 1st Action	D.A.	C.A.	O.S.	Total
TB clinics	16	5	4	25 (12.2%)
General Health institutions	39	19	14	72 (.5 1%)
General practitioners	35	19	12	66 (32.2%)
Indigenous trearment	20	3	19	42 (20.5%)
Total	110	46	49	205 (100%)

TABLE 4

Interval between symptoms & 1st action (TB patients)

	D.A.	O.A	O.S	Total
<1 month	92 83.7%	35 76.1%	38 77.6%	165 80.5%
1—3 months	9 8.2%	5 10.9%	2 40.%	16 7.8%
>3 months	9 8.2%	6 13.0%	9 18 4%	24 11.7%
Total	110 100%	46 100%	49 100%	205 100%

the Centre. Patients in OA and OS categories preserved with the ineffective treatment, on the average, longer than the DA cases. To a certain extent it may be due to lack of adequate facilities for the OS cases but why there should be difference between DA and OA cases is not clear: since facilities for diagnosis and treatment of tuberculosis are available more or less to the same extent to OA patients as to the DA in Delhi.

Table 6 shows that the action was less prompt by the less educated patients. This was but expected. Only in 2 of the 22 with high school or higher education, the prior action/actions lasted for

TABLE 5

Average time lost per 'action' by TB patients

	D.A.	C.A.	O S	Total
<1 month	62	20	22	104 (50.7%)
1—3 months	18	6	11	35 (17 1%)
3—6 months	7	4	6	17 (8.3%)
>6 months	7	11	6	24 (11.7%)
Not applicable	16	5	4	25 (12.2%)
Total	110	46	49	205 (100 0%)

TABLE 6

Interval between symptoms & 1st action related to patients' educational level

	Uneducated	Below High School	High school or more	Total
<1 month	101 78.3%	44 81.5%	20 90.9%	165 80.5%
1-3 months	9 7.0%	5 9.2%	2 9 1%	16 7.8%
<3 months	19 14 7%	5 9 .%	— 0 0%	24 11.7%
Total	129 100%	54 100%	22 100%	205 100%

more than one month before coming to the Centre. Table 7 shows the approximate expenditure incurred by these patients on treatment elsewhere before reporting at the centre. Patients with lower income spent proportionately larger amounts of money on the previous ineffective treatment. This is in keeping with the earlier observation in relation to the educational status of the patients.

Table 8 shows the reason or reasons which ultimately prompted these patients to come to the Centre. It would be seen that a

TABLE 7

Money spent by TB patients prior to reporting at a TB clinic(all categories combined)

Patient's family income per month Rs.	Money spent on earlier treatment						Total	Average* expenditure Rs.
	None	Rs. 1—50	Rs. 51—100	Rs. 101—200	Rs. 201—300	Over Rs. 300		
0—50	7 38.9%	9	—	1	—	1	18 100.0%	66
51—100	29 33.0%	31	9	9	6	4	88 100.0%	97
101—150	19 32.2%	21	5	8	2	4	59 100.0%	109
151—200	6 35.3%	7	1	2	1	—	17 100.0%	73
201—300	4 44.4%	2	2	—	—	1	9 100.0%	110
Over 300	7 50.0%	4	—	2	1	—	14 100.0%	79
Total	72 35.1%	74 36.1%	17 8.3%	22 10.7%	10 4.9%	10 4.9%	205 100.0%	93

*Patients who did not spend any money have been excluded for purposes of this calculation.

TABLE 8

Reasons* which prompted TB patients to report at the Tuberculosis Centre

	D.A.	O.A.	O.S.	Total
Referred	84	42	22	148
Free treatment	17	1	18	36
Other reasons	37	19	27	83
Total patients	110	46	49	205

*Where more than one reason was mentioned entries were made under each head

large majority of these were referred by the persons who were then treating them This number is significantly less in OS cases than in DA or OA. In some cases the reasons were more than one e.g. they were referred by the treating institution and they also either knew of the existence of the Centre or were advised by someone else, a friend or an old patient etc. In the DA category 37 patients out of 110 ultimately came to the Centre either because they could not afford the previons treatment any longer, or failing to benefit, were prompted by some friend or relation or an old patient to do so. It is also significant that most of these 110 patients knew about the existence of the Centre but still did not come here in the first instance because they did not suspect that they were suffering from tuberculosis. In the case of OA patients, 10 out of 46 knew about the regional clinic in their area but did not care to go there. As for the OS cases, 46 out of 49 tuberculous patients had a GHI in their vicinity, only 6 out of them knew that they could get anti-tuberculous treatment at the institution, but even then only 4 out of the 6 attended there because they thought that the treatment there was, to use their own words, 'no good'.

Table 9 shows the extent of disease in the tuberculous patients according to whether their first action was attending at the Centre or they had attended at the some place earlier. For purposes of this table, DA, OA and OS cases have been combined since there was no significant difference amongst the patients in different categories. It would be seen that the patients who had taken the largest number of actions before reporting at the Centre had a higher percentage of advanced disease cases—a reflection of the time lost by them between appearance of symptoms and reporting at the Centre. Table 10 shows the sputum status of patients in the three categories according to the number of actions taken by them. It appears that the patients who came directly to the Centre, specially among DA cases, had more

TABLE 9

Extent of disease among pulmonary tuberculosis patients who took no, one, or more actions prior to reporting at the Tuberculosis Centre

	Minimal	Moderately advanced	Far advanced	Total
No action	8 34.8%	9 39.1%	6 26.1%	23 100.%
One action	17 22.7%	25 30.5%	40 48.8%	78 100.0%
Two or more action	12 15.4%	22 28.2%	44 56.4%	78 100.0%
Total	37	56	90	183

TABLE 10

Sputum positivity among PT patients who took no, one or more action/s prior to reporting at the Tuberculosis Centre

	D.A.			O.A.			O.S.		
	Sp Pos.	Sp. Neg	Total	Sp. Pos.	Sp. Neg.	Total	Sp. Pos.	Sp. Neg.	Total
No action	12	4	16	2	2	4	—	3	3
One action	17	15	32	12	19	31	8	11	19
Two or more actions	31	18	49	4	3	7	11	11	22
Total	60	37	97	18	24	42	19	25	44

sputum positive cases among them. This may appear to be anomalous but actually it is not so. Many general practitioners and GHIs prescribe anti-tuberculous treatment without labelling the patient as tuberculous. Inspite of proportionately more advanced disease, the lower percentage of sputum positives among those who had had treatment elsewhere before attending the Centre is probably due to some anti-tuberculous treatment they may have had earlier. It was also found that whether the previous treatment was indigenous or

with G.Ps or GHIs the proportion of sputum positives to sputum negatives in each category was more or less the same.

Conclusions

Before drawing conclusions from this study it may be mentioned these patients represent in a way a selected group. For every patient who did not get relief from the facility tried first, and, therefore, shifted elsewhere and finally to the TB clinic, there must have been many who would have been relieved of their symptoms and hence, even if tuberculous, felt no necessity to attend anywhere else. Further the conclusions that can be drawn from a material like this, based entirely on patients' version, which may not always be entirely correct, can only be general, indicating trends rather than precise quantitative differences. The study has shown that, contrary to the usual impression, patients by and large do not delay remedial action once the symptoms have appeared. However, a large majority of them do not suspect that the symptoms could be due to tuberculosis and hence their first action is not attendance at a tuberculosis clinic, even if it is within easy reach, but elsewhere, be it a GP or GHI or indigenous treatment. They take this treatment for a longer or shorter duration depending upon the available facilities, their educational and financial status and ultimately a large majority come to the specialised clinic when they are referred by the previous person who was treating them. It is obvious that if the person to whom they reported first had suspected the disease and taken steps to arrive at a diagnosis, or if that was not possible, had referred them to a clinic, much of this lost time could have been saved and many more could have been put on proper treatment at an earlier stage of disease. This would not only have improved the patients' prognosis but also reduced the transmission of infection in the community. Though there may be some justification for the earlier remedial actions being elsewhere in OS patients, (for want of a specialized clinic) that this can happen within a walking distance of a specialised clinic calls for more concerted effort to motivate not only the general public but more than that, the GPs and GHIs to suspect early and to take requisite steps for diagnosis or to refer early if the tentative remedial action is not successful.

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Dr. Pai : Thank you. I would now request Dr. S.U. Khan to present his paper.

THE RAILWAY AND THE SOCIAL ASPECTS OF TUBERCULOSIS

By

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Foreword

It is true that the disease "*Tuberculosis*" can never develop without the specific infection caused by the organism "*Mycobacterium Tuberculosis*", but at the same time it is also equally true that the social factors and economic stigmas existing in the community play a vital role in the pathogencsis and progress of disease. Moreover the close and constant impact of such decapacitating diseases in due course of time, particularly in cases of big industrial establishments, besides acting as a definite social evil in aggravating human sufferings, also bears a direct concern with the efficiency of work and output of production.

Object of study

With the above view point, the present study based upon the careful observations of the "Epidemiological trends of tuberculosis" as noticed amongst the railwaymen from years 1965 to 1969, is a sincere effort to find out the co-existing social factors of better called "*Sociological Tuberculogenic Factors*" that are really responsible for the development and spread of disease in the population.

Prevalence of disease

A sample survey of a few of our railway colonies done in

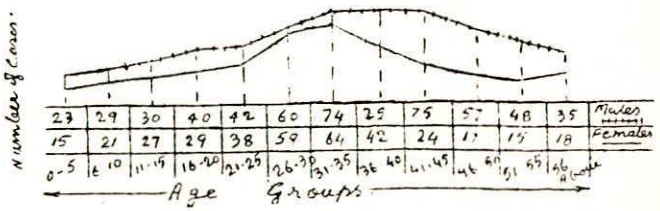
January-February, 1968, indicates the existence of 1.2% to 3.6% radiologically active cases out of which 25% to 30% are bacillary positive. This great variation is probably due to the seperate colonies built for the Officers. Upper subordinates and other categories of staff and the wide difference of social conditions prevailing in the relevant colonies.

Incidence of morbidity

1. *Age and Sex-wise incidence :* No age or sex is found to be exempted. Incidence in males is noticed to be highest between ages of 31—45 years (Fig. 1) whereas in females it is seen to be maximum

FIG. 1

Graph showing comparative incidence of P. T. Age and Sexwise during years 1965-1969

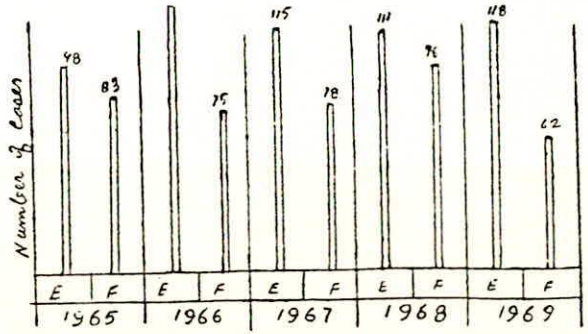


between 26—35 years of ages. Analysis of datas reveal that the males have 2.5 times greater preponderance over the females. The reason for this increased incidence in males is perhaps the inevitable free, frank and frequent contacts during the daily affairs of social and official engagements, and the cause of the above high incidence in females seems to be related to the physiological wear and tear phenomenon of the child-bearing period.

2. *Incidence amongst employee and family* : Further analysis of dates show that the incidence amongst employee (Fig. 2) is

FIG. 2

Graph showing yearly incidence of P. T. amongst employee and family from yeaas 1965-1969



nearly four times higher than the family. The cause behind this enormous increase again, appears to be the close and constant association with unknown cases and the bearance of far more social, familial and professional stress and strain that the employees, as active earning members, have to share and shoulder at almost all step of the usual work of life.

Incidence of mortality

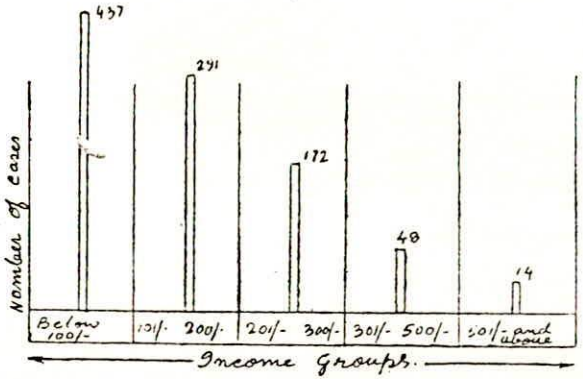
In this connection our study also shows that the incidence of mortality in the railways too is fairly low on the same grounds as attributed to the general mass of population.

Other co-relative factors

1. *Socio-economic conditions* : The study in regards to the trends and behaviour of disease in different socio-economic groups of railwaymen arbitrarily classed in accordance to their monthly incomes and the relevant standards of living (Fig. 3) discloses that the incidence of tuberculosis is more rampant amongst the low-paid categories and is inversely related to the groups of income.

FIG. 3

Graph showing comparative incidence of P T. amongst different Socio-economic groups during 1965-1969



2. *Working conditions ;* In this context it is observed (Table) that the incidence of tuberculosis amongst sedentary workers, workers doing medium physical labour and workers engaged in hard manual labour is 0.42%, 0.48% and 0.64% respectively. Further analysis of the total incidence of occurence shows that the percentage of distribution in the above three groups respectively, is as 28%, 32% and 40% approximately. This apparently indicates that the incidence increases with the increase of physical activities. But further careful social history of the patients gives a definite clue that the above difference of 4-5% in group 2 (Medium labour) and

TABLE 1

Showing average yearly incidence of P.T. according to the nature of workihg conditions as detected during year 1965—1969

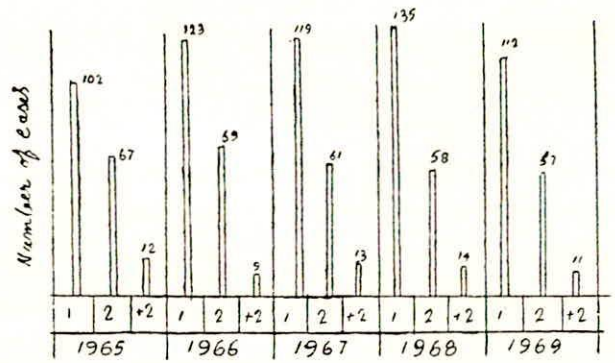
Nature of work	Strength of Staff	Average cases per year	Incidence of disease	Percentage in the category
Sedentary light works	4000 (App)	17	0.42%	28%
Medium physical labour	7000 ,,	33	0.48%	32%
Hard physical labour	9650 ,,	62	0.64%	40%

10-12% in group 3 (Hard labour) in comparison to the sedentary group is not the pure outcome of the nature of work entirely but is considerably co-influenced by the associated food and dietetic conditions also.

3. *Living conditions* : In this reference the graph (Fig 4) is self evident that the incidence is maximum in single-room quarters

FIG. 4

Graph showing yearly incidence of P. T. according to living conditions from years 1965-1969



and proportionately declines with the increase in the space of residential accommodations. Here the long house-hold or neighbourly contacts, the presence of reservoir of infection in the vicinity and the hygienic conditions existing in the locality appear to be the positive contributory factors.

4. *Food and Nutrition* : The lack of proper food and nutrition

resulting into poor health and general debility in all sphere of human life and work appears to be one of the important co-existing factors in the precipitation of disease.

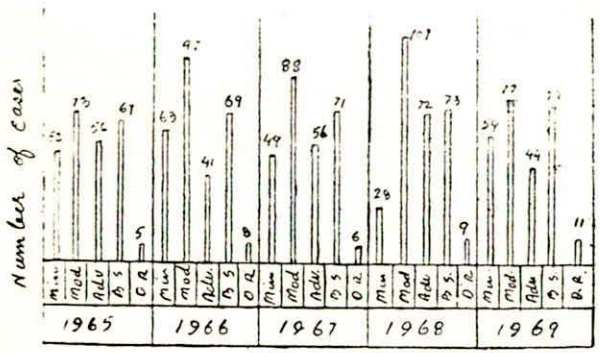
5. *Habits* : Personal unclean habits and certain social evils like heavy smoking particularly "Ganja" and excessive drinking specially without proper diet and performing hard physical work, have a definite reactivating effect in enhancing the incidence of disease.

Changes in pattern of disease

Our clinic records from the year 1965-1969 (Fig. 5) reveal that the majority of cases reporting for treatments are registered in

FIG. 5

Showing incidence of P. T. according to the nature of direase, Bacillary status and drug resistance during years 1965-1969



advanced stages and 35% to 40% out of them are detected to be bacillary positive by direct smears only. The number of "*Drug Resistant*" cases also are seen to be rising each year. The convincing reason for all these seems to be revolving round the false phobia of financial distress by employees, in case if detained for long under railway treatments, without any real realization about the social and familial damages, the therapeutic complications and the public health problems that usually creep in as a wanton social menace, due to the act of such deliberate hiding and haphazard irregular treatments of the disease.

Conclusion

The conclusive outcome of this study amongst railwaymen, which in all respects is a miniature form of the general stream of population, suggests that the following social factors or "Sociological

Tuberculogens" existing in a society, have a strong hand in the contribution and multiplication of disease :

1. Depressed socio-economic conditions.
2. Living conditions :
   - (i) Proximity to infectious cases.
   - (ii) Reservoir of infection in the vicinity.
   - (iii) Hygienic conditions of the locality.
3. Lack of proper food and nutrition specially with bad habits and hard physical labour.
4. Habits of excessive drinking and smoking particularly "Ganja" without proper diet.
5. Ignorance about contact and spread of infection.
6. Hidden cases and haphazard irregular treatment.

Suggestions

1. Attention towards correction of :
   - (a) Socio-economic and (b) living conditions.
2. Visuo-auditory education regarding contact and spread of infection.
3. Efforts to find out hidden cases :
   - (a) Periodical department-wise screening surveys.
   - (b) Screening of the families of infected members.
4. Some arrangement for the attendance and free medical treatment of non-railway population residing within the railway premises.

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