COVER SHEET

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Tuberculosis in South Africa - A Statement of the Problem.

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In spite of a climate which many believe to be specially favourable, easy procurability of food, and a life of much leisure, the incidence of tuberculosis in South Africa continues to be a very serious public health problem. Among Europeans there has been a considerable drop in incidence during recent years. This drop is to be associated with improving social conditions, in particular with the improvement in nutrition. We cannot flatter ourselves by supposing that the small amount of hospitalisation of cases can perceptibly have influenced the incidence. About the health conditions of our African population we know deplorably little, because of the absence of any system of recording vital statistics among them. We are, however, only too well aware of the fact that their nutritional state has in general deteriorated, and it is therefore more than probable that tuberculosis is increasing among them.

The Problem.

The number of Europeans in the Union who die annually from tuberculosis is approximately 750. The number of non-European deaths is estimated by the Central Health Department to be about 15,000. Notification of the disease even among the European population is very imperfect. We have, therefore, to work back from the death rate to arrive at an estimate of the number of active cases of tuberculosis in the country.

There is general agreement among authorities in other countries that there are at least nine cases of active disease for every annual death. Let us assume that even among our European sufferers malnutrition is worse and treatment facilities less satisfactory than elsewhere and that sufferers therefore live a shorter time. Assuming then that there are only six active cases for every European death, and only four for every non-European death annually, we find that there must be in the Union over 4,000 European and 60,000 non-European sufferers from the disease in an active form.

There we have our problem which this congress will study in its many aspects. We have, at least 64,000 persons who must be treated for obvious humanitarian reasons, if the State is to fulfil its obligation of providing happiness for all the people. They must be treated also with a view to lessening the amount of infective material in our midst. At the very least they must be isolated from their fellows, to whom they are a serious danger. We must also take steps to prevent more of the population succumbing to the disease. We now have the necessary knowledge to make this possible. We must implement this knowledge both to prevent needless suffering and to ensure the production of citizens of maximum value to the state.

The Solution.

We know sufficient about the pathology of tuberculosis to lay a plan for its eradication before our statesmen.

The disease in man is caused by one of two varieties of the tubercle bacillus, the human and the bovine. It would appear that the bovine variety is not of importance in South Africa. Our bacteriologists, in spite of careful research, have as yet recorded only three cases of bovine infection in human beings. Whether further investigation will show that this kind of infection is more common than we now imagine, need not seriously affect our national policy. Bovine tuberculosis here as elsewhere is a serious veterinary problem. Cows giving a positive tuberculin reaction sooner or later show clinical manifestations and die long before their time. Tuberculosis causes serious financial losses to dairy farmers. We can leave its elimination to Agriculture, which has at its disposal various well-tried methods such as those of Bang and Oster tag. Meanwhile, if we are concerned with the possible spread of tubercular infection to man via milk, we can completely obviate the risk by pasteurisation. To withhold milk from children, as some doctors are alleged to be doing, because of the possible risk of infection with tuberculosis, is indefensible. While it is doubtful whether any persons in South Africa have become infected with tuberculosis as the result of drinking milk; we cannot have the slightest doubt that thousands of children in the country have contracted the disease as the direct result of deprivation of milk.

There is still much investigation to be done in South Africa, but we can assume with reasonable certainty that infection commonly takes place through the breathing apparatus of children. The primary focus is usually in the right lung, served by the large and direct right main bronchus, with further foci in the mediastinal glands, to which bacilli are carried. These two foci, one in the lung, the other in the draining glands, constitute the primary complex. In the malnourished individual, particularly if he is subjected to sustained physical effort, this is soon followed by progressive primary disease and death. If there is little or no physical effort, the primary complex may remain for a while in an unstable state and the severe disease may be delayed. When infection occurs in a well nourished individual the primary complex heals, but continues to be a source of danger. Subsequent periods of malnutrition will render the primary complex unstable, and sustained physical effort with resultant fatigue will bring on delayed disease.

This brief outline of the pathology, which will be developed by subsequent contributors to our symposium, is given to indicate the points at which our attack on the problem must be directed. These have been clearly established. Infection can only occur if bacilli are being produced in the midst. Hence the need for the detection, isolation, and treatment of active sufferers of the disease. The further progress of the primary complex is dependent on the nutritional state of the patient and the degree to which he may be subjected to fatigue. These two factors can and must be controlled.
Detection of Cases.

If our preventive measures are to be effective we must detect the active cases of the disease, the sources of the infection, in their very earliest stages. For this the older diagnostic measures of peau d'orange and pulmonary are of little value. Some of our practitioners who devote all their time to chest examination doubtless develop very great skill in these procedures; but even they will admit that early stages of the disease cannot be detected thereby. All cases of active tuberculosis can, however, be detected by X-ray examination. This has in the past been a very costly procedure. The introduction by Collender and D'Abreau of miniature mass radiology has made such examination a practicable public health measure. Preliminary examination by means of the tuberculin tests of groups of the population whom we have any reason to suppose have been exposed to infection, or are about to engage in fatiguing operations, will reveal the infected persons who need to be further examined by means of the X-ray. The positive tuberculin reactors will include the potential sufferers and those among whom the disease is already active, even at its very earliest stage. The early active cases can then easily and cheaply be detected from among these by means of miniature mass radiology.

Although Collender's method of mass miniature radiography had been reported in the Lancet as early as June, 1939, it was not adopted in the British Army till much later. Had it been adopted earlier much breakdown of early lesions by strenuous army life would have been obviated. The individuals with such lesions would not have been recruited. They would have been saved much suffering and their countries vast sums in pensions. On our own gold mines the method was early introduced, with a consequent great reduction in the incidence, among the African labourers, of tuberculosis and miners' phthisis.

The Tuberculosis Research Committee set up jointly by the Government and the Transvaal Chamber of Mines to investigate the incidence of tuberculosis among our African population, reported in 1932 that 66 per cent. of Natives of all ages and both sexes examined were positive tuberculin reactors. It is fortunately not necessary to submit all of these to X-ray examination. In the leisureed life of the kraal the disease does not readily develop. It is only when these people come to our towns, to engage in strenuous industrial occupation, that the stable primary complex is liable to break down. These are the individuals who should be examined by mass radiography to detect the early active cases which should be eliminated and set aside for treatment. If they are not, the disease is likely to develop rapidly to their own great detriment and to the danger of their fellow workers. In any case, all positive reactors who are potential sufferers, whether the X-ray reveals active lesions or not, should undergo a course of physical training to fit them for strenuous work. It might seem surprising to emphasize the necessity for training before strenuous activity is to be undertaken. It is particularly necessary in the newly recruited African worker who has come from a life of leisureed ease and malnutrition in the Native reserves.

Isolation.

Having determined by tuberculin testing and X-ray examination which are the infective members of the population, we have to decide how to render them innocuous. This immediately presents us with almost insuperable difficulties.

We cannot pretend to believe that the small amount of hospitalisation that we have hitherto provided has perceptibly influenced the spread of tuberculosis. The Union Health Department has established, and is itself maintaining at the King George V Tuberculosis Hospital, Durban, at Nelson Sanatorium in the Karroo, and at the Rietfontein Hospital, Johannesburg, a total of 282 beds for Europeans and 355 for non-Europeans. At institutions established by itself but maintained by other public bodies there are a further 274 non-European tuberculosis beds. Seventeen local authorities have between them provided 149 European and 469 non-European beds. In addition, organisations have a total of 120 European and 162 non-European beds. This, with the Springbok Tuberculosis Hospital about to be opened, brings our total of beds for tuberculosis cases in the Union to 551 for Europeans and 1,756 for non-Europeans. In addition, arrangements have been made for a further 154 European and 854 non-European beds. Assuming these are provided we shall have a total bed accommodation in the Union of 3,315 (705 European and 2,610 non-European).

We have seen that at a low estimate we have among us some 64,000 persons among whom the disease is active and who are therefore a danger to their fellows. The 3,315 beds that may shortly be available cannot be expected to influence appreciably the risk from infection in the Union. Even if they are all occupied the great majority of sufferers giving off bacilli will still be at large.

The capital cost of tuberculosis beds in the Union works out at approximately £800 per bed for Europeans, through lessening amounts for Euraficans and Asiaties, to £100 per bed for the Bantu. This is not because of deplorable race discrimination, but because the African is not happy in the sumptuous surroundings demanded by civilized Europeans. He is most successfully treated in his own primitive home surroundings, provided with a diet to which he is accustomed. The maintenance of beds works out at 20/- a day for the European and 2/- a day for the African.

A small calculation will demonstrate the impracticability under our present socio-economic organisation of setting up and maintaining adequate beds for all the active cases of tuberculosis in the Union. But that need not deter us entirely from utilizing our hospitals in the campaign against the disease. Patients can have their conditions greatly improved by even a comparatively short spell in hospital. And, what is of even more importance for the public health, they can be educated against spreading infection. We have seen that inhalation is the commonest mode of infection. Adequate education of the patient can preclude his infecting others through this route. He is taught to cough into a paper handkerchief which is subsequently burnt, and to spit only into a receptacle of paper or into a sputum mug or bottle. The infective material can then again be easily destroyed. It is probably impracticable
under present conditions to attain isolation of all sufferers in hospital. We can, however, make very good use of existing hospitals, and by active education of sufferers, there could be isolation not only of the patient while he is actually in hospital, but also of his infective material after he leaves.

**Treatment.**

Treatment of sufferers is a humanitarian duty of the State. The disease occurs mostly among the very poor, who cannot afford to pay for their own treatment. The few well-off persons who have become sufferers, probably as a result of financial stress of their parents with consequent malnutrition of themselves during childhood, mostly do not remain well-off for long. Because of the chronic nature of the disease their financial resources soon become exhausted. We may assume, therefore, that private medical practice cannot be looked to for the provision of treatment of tuberculosis sufferers except in a very few instances.

Apart from humanitarian reasons, treatment on as large a scale as possible is desirable because some infection is removed this way. The patients in whom the disease is cured or arrested cease to be a danger to their fellows. This contribution to the public health will probably for a long time be very small but need not for that reason be neglected.

The details of modern treatment I shall again leave to other speakers, who have the necessary authority, to develop. Here it is only necessary to remind you that the basis of treatment is the same as that of prevention—rest and correct food; total rest of the patient and rest as far as practicable of the damaged tissues. The latter can often be effected by some form of surgical collapse: pneumothorax, phrenic neurectomy, pneumolysis, and thoracoplasty all aim at the partial or complete immobilization of the diseased lung.

The sulphonamides and penicillin have produced such remarkable results in the treatment of a number of infections, that one cannot resist looking hopefully to chemo-therapy in the case also of tuberculosis. Many of you are doubtless following with great interest the reports on the effects of various chemo-therapeutic agents in restraining tuberculosis in guinea-pigs. So far, however, we have little justification for the assumption that these agents will have similar effects in human sufferers. The authoritative Committee in Therapy of the American Trudeau Society (Medical Section of the National Tuberculosis Association) reviewing the available information on the effects of promin, dianol, promizole, diamino-diphenylsulfone and some related drugs upon previously established experimental tuberculosis in guinea pigs, taking into account the very limited amount of roentgenological and clinical data so far made available regarding patients treated with one of the drugs (dianol), expresses the following opinion:—

"Promin, dianol, promizole, and certain related compounds appear to possess in varying degree the striking ability to restrain the development of experimental tuberculosis in guinea pigs. It is recognized that experimentally induced tuberculosis in guinea pigs offers many contrasts with clinical tuberculosis in human beings, even though the causative organism is the same.

"It is the opinion of the Committee that the clinical and roentgenological data so far made available to the Committee on the action of dianol in human tuberculosis, is as yet inadequate both quantitatively and qualitatively to permit, even tentatively, a positive evaluation of its curative effects upon tuberculosis in humans. The Committee believes that there is at this time no adequate basis for the optimistic implications of the magazine articles, or of the releases to the press which are now so well known to both the profession and public. It is believed, on the contrary, that such implications are distinctly unwarranted, and not in accord with the clinical evidence which has been reviewed by the Committee. The Committee regrets exceedingly that the magazine articles mentioned previously, were published in spite of efforts on the part of both the Committee and the clinician quoted, to stop their publication.

"Until controlled studies of adequate scope have been reported, it is recommended that none of these drugs be used for treating tuberculosis patients except under conditions which will appreciably add to our knowledge of their clinical action, and in the presence of adequate facilities to protect patients effectively from their potentially serious toxic effects. Patients and physicians must also be reminded of the provisions of the federal regulations which prohibit the distribution of a drug in the experimental phase of development, to other than research institutions to which the material is assigned by the manufacturer for either laboratory or clinical investigation. The Committee is informed that other clinical investigations are now in progress, and it is the expressed opinion of the Committee that such further well-controlled clinical investigation is distinctly desirable."

**Combating Malnutrition.**

We come finally to a consideration of the fundamental reason for the prevalence of tuberculosis in South Africa—the malnourished state of a very large section of the population, particularly during the vulnerable years of infancy and childhood. We have seen that even if infection occurs it is very unlikely to develop if the individual is in a well-nourished condition. The stable primary complex is unlikely to break down if nutrition continues to be satisfactory, even if strenuous work is undertaken. All sufferers in the early stages have a good chance of recovery if they are supplied with good food. Tuberculosis authorities have in most cases come to the conclusion that race and climate have very little bearing on tuberculosis incidence. A racial group is only more vulnerable, if at all, compared with another racial group. The well-fed negro slaves of the southern states of America had no more tuberculosis among them than their masters. Ever since their release, the incidence among the negroes has been very much greater than among the whites, a fact directly related to their general low economic level.

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It appears reasonably certain that tuberculosis was unknown among the aborigines of South Africa. There are no records of its occurrence in the writings of early travellers and residents, including the missionaries who were intimately acquainted with the natives. It was introduced to the country by the European invaders and, though this is somewhat speculative, by the Arabs of the East Coast. Yet in the early days it was rare even among the Europeans. The first cut-clear reference to its occurrence is in an account by a ship's captain, Cornelis de Jong, of his journeys to the Cape in 1791-97. Lichtenstein—who was a Doctor of Medicine—in his "Travels in South Africa" (1803-06), describes the Xosas as a healthy people free from both syphilis and consumption. Moodie, twenty-five years later, says consumption was frequent among the Hottentots, and records a case of advanced phthisis in a young native near Grahamstown. But up to the time of Livingstone, who in his "Travels and Researches in South Africa," states categorically that tuberculosis did not exist among the tribes, there is no evidence that clinically recognisable tuberculosis among the Abantu was other than a rarity.

During the first half of the 19th century, however, the disease must have been materially on the increase among the Hottentots and the coloured peoples in the older parts of the Cape, possibly partly in consequence of the freeing of the slaves. By 1880, if not sooner, the disease had had a widespread distribution among the natives as well, although the number of active cases was still not very high. The factors accounting for this spread among the natives may be considered under two heads: contact with infection, and lowering of resistance.

Dr. Neil Macvicar, in his classic study of "Tuberculosis among the South African Natives" (1907), pointed out that probably the earliest significant contacts were by camp-followers of troops stationed on the Eastern Frontier during the Kaffir Wars. The phthisis death rate of the British Army at this time was nearly 800 per 100,000, so there must have been many tuberculosis among the troops. Somewhat later there were contacts with civilian consumptives who from 1880 onwards came to the Cape from Europe seeking the advantages of climate. Finally, there was the ever increasing flow of rural natives to the great labour centres, Kimberley and later the Reef and the coastal towns, where they came into contact with European consumptives under conditions which were usually extremely unhygienic.

The factors which lowered resistance included the great cattle-killing inspired by Nongqase in 1857, which drastically reduced milk supplies among the Xosas. The adoption of European clothing in place of greasy skins and blankets has been regarded by many authorities—including the Native Affairs Commission of 1905—as an important factor. Overcrowding, and overstrain due to unwonted study at mission educational institutions, probably also contributed some cases. Most important of all, the heavy work on the mines, unhygienic surroundings and an illbalanced diet—this was long before the legislative control of the housing and feeding of mine labourers—resulted in lowered resistance; as did also liquor and venereal disease.

In the light of findings to be described later, it appears that although many temporarily urbanised natives returned home to the rural areas with active tuberculosis and thus acquired infection to the purely rural natives, the latter merely became tuberculised, without developing active tuberculosis. Whatever the precise nature of the mechanism, the fact remains that by 1930 the adult male rural native population was tuberculised to the extent of two-thirds. From the epidemiological viewpoint it is most interesting to reflect that this had been achieved without high mortality from tuberculosis among this portion of the population. The reason probably was that up to this time the rural natives had been living under conditions which favoured resistance: excellent climate, adequate non-denatured food supplies, social security (thanks to tribal organisation), legislative protection from strong drink, and fairly light work. In contrast, the coloured population encountered tuberculosis under much less favourable conditions, and fared worse.

The starting point of any system of control of tuberculosis is of course the notification to the public health authorities of diagnosed cases. South Africa was ahead of Britain in this matter, for in 1904 all forms of tuberculosis were made notifiable in the Cape, and pulmonary tuberculosis was made notifiable in Natal (except in Pietermaritzburg, which opposed it). In 1907 the Free State introduced notification on an adoptive or voluntary basis at the will of local authorities, the