

CHAPTER VI.—INFERENCES DRAWN FROM THE FOREGOING
CHAPTERS IN REGARD TO TUBERCULOSIS IN
SOUTH AFRICAN NATIVES.

(WITH COMMENTARY BY PROFESSOR LYLE CUMMINS.)

NOTE.—In writing Chapters VI and VII the Committee has had the advantage of the co-operation and help of Professor Lyle Cummins, and after their final form was decided upon they were again submitted to him for his opinion. This he has expressed in the shape of comments which are printed as a running commentary throughout the text of the two Chapters. They are distinguished by being printed in heavier type.

The views of the Committee are therefore supplemented by the independent views of an outside observer of international repute.

Merely local observers are sometimes not unjustly accused of bias and their views are liable to suffer from the defects of the very advantages they possess—too much detailed knowledge or, as the popular phrase has it, inability to see the wood for the trees.

Professor Lyle Cummins has the advantage of having been sufficiently inside our wood to be aware of the density of its thickets but still remains outside and sufficiently far off to be able to see the wood as a whole unhampered by the details of its undergrowth.

In the absence of reliable vital statistics bearing on the general Native population of South Africa, it is very difficult to draw satisfactory comparisons between the incidence and mortality-rates of tuberculosis among Native mine workers and similar industrial groups in European countries. The Native mine population is not a relatively fixed community such as, for instance, the coal-mining population of England and Wales, in which the losses due to death and superannuation are made good by new entries from the adolescents of the districts concerned, but a kaleidoscopic population in which, apart from a small number of non-recruited Natives engaged locally, nothing approaches constancy except the "total strength" of round about 200,000 Native miners on the Rand. The wastage due to repatriation and death is made good by a constant stream of recruits from the "Native Territories" of the Union and of Portuguese East Africa, the periods of "contract" of these Natives varying from 9 months in the case of B.S.A. Natives to 12 months for the Natives of Portuguese territory, with a large and growing number of "voluntary" short-service Natives.

Thus it comes about that, although accurate records of deaths and repatriations are available, these refer not to a fixed population but to one changing continually at the rate of about 100 per cent. per annum.

But more eloquent than mere statistics are the actual cases of Native tuberculosis seen in the wards of the mine hospitals on the one hand or on the post-mortem table at the South African Institute for Medical Research on the other. To anyone accustomed to the slow and gradual course of tuberculosis in phthisical cases in European countries, and to the fibrotic state of many of the phthisical lungs seen at autopsy, this fulminating tuberculosis would be a new thing.

While slow and chronic cases do occur, it is common to encounter patients, who, having been at full work in the mines a week or so before, are now prostrate with all the signs and symptoms of generalized tuberculosis and, being too ill to allow of repatriation, are destined to die in a few weeks in the mine hospital to which they have been admitted.

About one-sixth of all the cases of tuberculosis in Natives on the mines are of the sort that die on the Rand, being too ill for the journey back to the Territories. But it must not be supposed that all those sent home are very different. About one-tenth of those repatriated die within two months of leaving the Rand, nearly half of them are dead within the year, and 60 per cent. within two years.

As to the type of the disease met with on the post-mortem table, the Pathological Section of this Report tells the same story. The outstanding features are the caseous nature of the lung and gland lesions, and the tendency to generalization of the disease with involvement of the liver and spleen. The type of tuberculosis, then, tends to be terribly severe.

Fortunately, there are other aspects of the question which are much less depressing.

The great majority of the Native miners escape tuberculosis and other bacterial diseases and gain in health and weight during their contracts. Nevertheless, the fact remains that this severe tuberculous disease is one of the outstanding features of the mining industry, as it concerns the Native, and one of the factors which introduce an element of risk into the association of Native and European workers in a "dusty" industry.

What, then, as to incidence? From the Chamber of Mines' Annual Summaries, we find, after deducting the incidence and deaths from simple silicosis, that the total tuberculosis-incidence was, for 1926-7, 6.81 per 1,000; for 1927-8, 7.53 per 1,000; and for 1928-9, 6.62 per 1,000; while for respiratory tuberculosis, the incidence-rates were 5.82, 5.68 and 4.93 per 1,000 respectively. These rates are, doubtless, under-estimates, since they take no account of cases which might be expected to occur later amongst Natives who had worked on the gold mines during the years in question and only developed the disease after return to their kraals; they are, however, considerably more correct than the estimates of tuberculosis-incidence based on notification in England.

The notifications for 1926 in England and Wales amounted to 1.45 per 1,000 for "respiratory tuberculosis"; in London to 1.62 per 1,000. But "notifications" in England are notoriously incomplete and cannot be regarded as anything approaching the true incidence of tuberculosis. Apart from the fact that numerous cases are wrongly diagnosed and escape recognition, many persons with more or less benign tuberculosis must remain at large and never consult a doctor at all.

It is safe to assume—so the Committee has been informed by Professor Lyle Cummins—that if the male population of England and Wales, in age-groups comparable to those of the mine Natives, were subjected, like the mine Natives, to monthly weighing and a careful clinical examination combined with observation in hospital for those falling short of normal weight, the incidence-rate from tuberculosis would at least approximate to that recorded on the Rand.

It comes to this, that, as regards the tuberculosis of England and Wales, we possess, through the Registrar-General's Annual Reports, a fairly accurate record of mortality-rates; but we have no real knowledge of the incidence-rates from the disease.

In the case of the Native gold-mine labourers, on the other hand, we have in the monthly tuberculosis returns a fairly correct approximation to the incidence of tuberculosis but no accurate figures as to the mortality; since the deaths recorded include only those of the very acute cases too ill to be repatriated and the returns give no information as to the number of cases which die after their return home.

As pointed out above, however, there is reason to believe that, while the incidence-rate in the Native, so far as it can be ascertained, is not much higher than what might be expected, the case mortality-rate in Native mine workers is very high.

For the comparison of the tuberculosis of the mine Natives and of a similarly-occupied community of European origin, an idea is obtained by contrasting the incidence and mortality of the gold-mine Natives with that of the White miners on the Rand; this being especially valuable because, owing to the periodical examination of all White miners, a true incidence-rate is available.

Such data as are available for this comparison are to be found in the Annual Reports of the Miners' Phthisis Medical Bureau, but it must be remembered that these Reports deal only with "tuberculosis under the Act" (for definition, see p. 116) and not with "tuberculosis, all forms." It is very necessary in considering statistics about tuberculosis on the Witwatersrand to be clear as to whether they deal with the "legal" disease or with the "clinical" disease. If the distinction be not made, fallacious inferences are liable to be drawn.

The comparison made in this instance, therefore, is one between the annual incidence of pulmonary tuberculosis on the European and Native labour forces respectively.

From Table 14 of the Report for the year ending 31st July, 1928, we learn that the "production-rate" of pulmonary tuberculosis for European miners for 1927-1928 was 2.19 per 1,000, while from Table 17 of the same Report we learn that of Native labourers coming to the notice of the Bureau the "production-rate" of pulmonary tuberculosis was 3.85 per 1,000. In other words, the annual pulmonary tuberculosis rate for Natives was nearly double that for Europeans.

Here, again, it is impossible to draw an accurate comparison between the tuberculosis *mortality*-rates of the two groups, since the Native cases are invariably repatriated if fit to travel, while the White miners are kept under observation, either at Springkell Sanatorium or elsewhere. We learn from Table 13 of the Report quoted that, of 390 cases in White miners, 117, or 30 per cent. had died within the first year after diagnosis.

Turning to the annual summaries of the monthly tuberculosis returns of Native miners (collected by the Chamber of Mines), we find that, during the three annual periods 1926-7, 1927-8 and 1928-9, a total of 4,120 cases of tuberculosis were recorded. Of these, 722 were so acute as to be unfit for repatriation and died in the mine hospitals, and 3,398 were repatriated. If we apply the findings of Allan during his three years of work in following up cases in the Transkei and assume that half of the cases repatriated died within the year, then we have to add 1,699 deaths to the 722 which occurred on the Reef, making 2,421 deaths in all, or about 59 per cent. of the cases.

It seems, therefore, probable that the case-mortality within the first year is about twice as high amongst Native as amongst White miners.

It is to be regretted that no adequate vital statistics exist as to the incidence and mortality from tuberculosis in the non-mining sections of the Native populations of the Union; but the above approximations suffice to show that, in the gold-mining industry, the Native miner is more liable to develop tuberculosis than the miner of European origin, and that the disease, when contracted, tends to run a much more rapid course with a marked tendency to a fatal termination.

This want of resistance to tuberculosis is, as pointed out in Part I, Chapter I, of the Committee's Report, a biological character of the African Native which can only disappear with the lapse of time and during many successive generations of industrial contact. This biological lack of resistance exists quite apart from any risk incurred in the mining industry or in other industries; but there can be no doubt that the concentration of Native industrial "recruits" under the conditions inseparable from practically all commercial developments in Africa, together with the unaccustomed hard work and the unfamiliar housing and diet conditions of a new environment, leads to a state of things in which this liability to tuberculosis ceases to be latent and becomes actively manifest.

If the Native tuberculosis cases, like the Whites, were to remain under observation at Johannesburg instead of being repatriated and lost sight of, the gross mortality from the disease would, doubtless, appear in the mine statistics at a much higher figure than that recorded under the present system.

It may be surmised, too, that if the Native miners were retained for observation and treatment in hospitals on the Reef, the mortality from tuberculosis would not only be more accurately appreciated statistically but would also be *actually* greater than at present, since

it appears certain that Native cases of a relatively favourable type tend to improve rapidly when they get back to their homes, their friends, the familiar Native diet as prepared under domestic conditions, and the "magnificent leisure" of the Bantu kraal—conditions which can hardly be realized in hospitals run by European staffs on "approved" lines.

The contrast between the tuberculosis of Native mine workers and that of Europeans, while fairly definite, is somewhat obscured by the grouping together of all forms of pulmonary tuberculosis occurring in Native miners. As a matter of fact, the tuberculosis of Native mine workers includes at least two sharply distinct types, one of which tends to approximate to the phthisis of civilized adults, while the other is highly characteristic of African Natives in general and finds its homologous type not in the phthisis of European adults but in that of European children and adolescents.

In the Chamber of Mines' tuberculosis returns, these types are roughly differentiated under the headings "Simple Tuberculosis" and "Tuberculo-Silicosis" respectively, although, of course, intermediate stages exist.

For a fuller discussion of these types, the reader is referred to the Statistical, Pathological and Clinical Sections of Chapter IV, but it may help towards a comprehension of the problem if the points of differentiation are given further consideration here. At the same time, the reservation must be made that no attempt at differentiation can do more than afford a general basis for discussion, nor must the distinctions made be accepted as too rigidly exact. The discussion aims at contrasting extreme types; but intermediate types are common and the most important fact, perhaps, is that the one type shades off by imperceptible stages into the other.

To the reader it may appear curious to introduce an extraneous element, such as silicosis, into a discussion on tuberculosis, but in the absence of any definite clue to the identity of the Native mine worker throughout the successive contract periods of his mine history, it is convenient to find, in the co-existence of silicotic changes in the lungs, a clear proof that such an individual has spent a considerable period of previous work in the gold-mining industry.

These silicotic changes stamp an "old" or "long-service" boy. Whether the silicosis greatly modifies the course of tuberculosis in the African Native is a question for further discussion, but there can be no doubt that the addition of tuberculosis acts as an "amplifier" to silicosis and, in the susceptible African Native, converts what might otherwise have remained a relatively benign peribronchial fibrosis into an active pulmonary phthisis.

THE TUBERCULOSIS OF "NEW RECRUITS."

Under this heading it is convenient to include both the "simple tuberculosis" of the Standardized Monthly Returns, which consist of cases regarded as pulmonary on clinical grounds, and also the "Other

Forms of Tuberculosis" of these Returns, since we know, from the pathological investigations that "simple tuberculosis" is seldom confined to the lungs, and that there are often pulmonary lesions in cases of "other forms of tuberculosis." It is significant that, of 3,046 cases recorded in the Returns for the three years 1926-7, 1927-8 and 1928-9, 610, or 20 per cent., died in the mine hospitals, and cases of this type must have constituted a large proportion of those found by Allan to die within a few months of repatriation.

[To the student of tuberculosis, it is extremely interesting to meet this highly fatal type of combined pulmonary and "generalized" tuberculosis in a community of Natives who are not "virgin soil," but arrive on the mines with a percentage of positive tuberculin reactions approaching 70 per cent.—S.L.C.]

The pathological findings in the fatal cases—that is to say, in the 20 per cent. of cases so severe as to be quite unfit for repatriation and dying within four or five weeks after admission to the mine hospitals—are almost exactly like those hitherto associated only with "virgin soil." There are, it is true, certain points of difference noted between the findings at Johannesburg and those of Borrel in the tuberculin-negative Senegalese soldiers imported into France during the European war, but the resemblances are great and the differences small. About one-fifth of the cases of "simple tuberculosis" arising in these usually tuberculin-positive mine Natives die on the Rand of a type of disease approximating closely to "natural" tuberculosis.

It appears evident that these Natives, infected during their childhood or adolescence in the kraals where, as shown in Part I, Chapter III, tuberculosis is now endemic, have, in many cases, developed only sufficient resistance to keep their initial lesions latent under the easy conditions of tribal life. For the new and strenuous conditions of life and work on the mines the resistance of at least a certain proportion of them is quite insufficient.

The degree of resistance developed under tribal conditions may perhaps serve, as in experimentally-infected guinea-pigs, to impede and retard the establishment of exogenous reinfections, but it does not, under the conditions of stress in the mines, suffice to keep within bounds the tendency to generalization of tubercle bacilli from the still active though clinically latent foci dating back to earlier years.

The result is that considerable numbers of these Natives, more especially the "new recruits," develop acute and fatal tuberculosis of what is, to all intents and purposes, the "natural" type, early in their mine service. A certain proportion of these cases is, in all probability, quite identical with the Borrel type, since it may be assumed that some, at least, of the "tuberculin-negatives," as classified according to tests with a five-thousand fold or still higher dilution, are really "virgin soil." There is reason to think that this was often true of "Tropicals" in past times and it may still be true of some of the Basutos, known to be so specially liable to tuberculosis. But, apart from the "virgin-soil" minority, there is reason to believe that most

of these "early cases" actually arrived on the Rand with definite but unrecognizable tuberculous lesions and that on starting the hard work of mining, they broke down into clinical disease through generalization of bacilli from these pre-existing foci.

[In a recent paper⁷ I have attempted to express my views on this phase of tuberculosis and have pointed out the analogies between the African Native in his comfortable village and the European child in its relatively sheltered environment.

Just as some of these infected but healthy European children break down into acute tuberculosis after intercurrent respiratory diseases or on quitting the leisure of childhood for the stress of wage-earning, so does a certain proportion of the young African mine recruits break down with acute disease shortly after starting work in the mines.

It would be a mistake to lay too much stress upon the minor differences between this acute type of tuberculosis of the Native mine worker and the secondary phase of tuberculosis described by Borrel in the Senegalese.

In the Senegalese soldiers, the first exposure to tuberculous contact and the "activating" stress of military service occurred at the same time. In the Native mine worker, the tuberculous contact occurs first, in the home-kraal or village, and under the easy conditions of life which permit all except the very heavy infections to become established as larval rather than progressive lesions. The "activating stress" comes later when the boy quits his kraal for Johannesburg. But, apart from the limited degree of enhanced resistance resulting from the longer duration of these quiescent lesions, the type of tuberculosis resulting from the "activation" is almost the same in the Native mine worker as in the Senegalese soldier.

Even where the "infection" and the "activating stress" were contemporaneous, Borrel noted that the "glandular stage," as he called it, lasted three or four months; the infected person remaining in fairly good health during this more or less prolonged latent period.

Exactly the same process initiates tuberculous infection in the European child; but, under the favourable conditions of home life and school life, the lesions usually remain "larval"; the minimal and successive re-infections of childhood and adolescence leading on, in a majority of individuals, to a stage of "compensated" sub-infection in which the resistance is so high that there is little risk of developing clinical tuberculosis. Thus, it comes about that, especially in the well-to-do and well-fed classes, the danger-period of adolescence is, as a rule, safely negotiated and the vast majority of the population remains healthy but tuberculin-sensitive and relatively tuberculo-resistant.

In the African Native, while the initial process of infection is the same, there is no equivalent opportunity for "acclimatization." The change from tribal life to the strain of work on the mines is abrupt; nor does the African Native yet appear to possess so efficient a mechanism for acquiring tuberculo-resistance as does the European adolescent.—S.L.C.]

In the Transkei it has been found that the more intense reactions to tuberculin occur in those persons found to be in actual contact with open cases. At Johannesburg it has been observed that the highest ratio of tuberculosis cases arises in persons who had given an intense tuberculin reaction on arrival. At post-mortem examinations it has been found that, in Native recruits dying of other than tuberculous diseases *before* starting work on the mines, a proportion of the cadavers contain tuberculous lesions in the tracheo-bronchial and other glands of such a nature as to be liable to "light up" under any severe stress. Finally, the proportion of "other forms of tuberculosis," as shown in the Monthly Tuberculosis Returns, is very high, no less than 30 per cent. of the tuberculosis, excluding tuberculo-silicosis, arising on the mines, and yet most of these "other forms of tuberculosis" must, almost of necessity, have been acquired previous to arrival at Johannesburg, since many of the lesions are of the so-called "secondary" types.

The conclusion seems inevitable that the greater part of the "simple tuberculosis" of the gold mines results from the recruiting of infected persons whose lesions are still so "larval" and so little "compensated" as to break down under the stress of life on the mines.

THE TUBERCULOSIS OF "LONG-SERVICE" BOYS.

The extreme type of "long-service" tuberculosis in Native miners is met with in the cases classified as "tuberculosis with silicosis" in the Monthly Tuberculosis Returns; and this group has, from the point of view of statistical examination, the added advantage of possessing a definite guarantee of long service as shown by the presence of silicotic changes in the lungs. In this group the proportion of cases dying in the mine hospitals is only half that noted in the "simple tuberculosis" group.

It appears, too, that, apart from the cases in which there is clinical or X-ray evidence of co-existent silicosis, a considerable number of the cases regarded as "simple tuberculosis" arising in Natives with several years of mine service should be differentiated from the "early" cases and included under the heading of "tuberculosis of 'old' or 'long-service' boys." The outstanding character of this group is the possession of an increased tolerance to tuberculosis.

Of 1,074 cases with tuberculosis and silicosis recorded in 1926-7, 1927-8 and 1928-9, 112, or just over 10 per cent., died in the mine hospitals; whereas 20 per cent. of the "simple tuberculosis" group died on the Reef.

Even when the recognized tuberculo-silicotic cases are left out of consideration, this tendency to increased tolerance is clearly seen in the enhanced power of the long-service cases to control their symptoms and retain a certain measure of good health in spite of clinically-evident tuberculosis. This was proved in a statistical report to the Committee, in which the average length of service of those cases found fit for repatriation was shown to be definitely greater than amongst the cases dying in the mine hospitals (see p. 181).

That a certain number of these cases go undetected owing to their being able to carry on at mine work in spite of their disease and without marked loss of weight is proved by the fact that a fair number are discovered annually at the clinical and X-ray examination of "long-service" Natives.

This tendency to *tolerance* of tuberculous lesions is also apparent in the fact brought to light during investigations into clinical types (see p. 180) that the Native phthisics with five years or more of mine service to their credit before the onset of clinically manifest tuberculosis show, in a fairly high proportion of cases, a power of maintaining their weight and keeping their temperature within normal limits in spite of marked pulmonary disease; a tendency which is slight or absent amongst the "short-service" cases with disease of equivalent extent.

In the Pathological Section of this Report (see p. 169) it is stated that tuberculo-silicosis is almost the only form of tuberculosis in this series of Natives which takes anything like a chronic form or, in other words, in which there is any appreciable amount of fibrous tissue, also, that in another respect these tuberculo-silicotic cases have some resemblance to the European-adult type of tuberculosis, viz., the comparative frequency with which the tuberculosis is limited to the lungs or, at all events, to the tuberculo-silicotic zone.

In this connexion, however, it must be borne in mind that tuberculosis itself, in its more chronic forms, leads to the formation of fibrous tissue and that the mere co-existence of carbon pigmentation along with fibrotic changes and chronic tuberculosis does not prove that silicosis is necessarily a dominant factor. While the presence of silicotic nodules affords an excellent basis for placing certain cases in the category of "long-service" boys, this does not take away from the undoubted fact that many long-service boys develop a chronic form of tuberculosis without showing definite evidence of silicosis. This comes out clearly if the "five years" and "over five years" groups of "simple tuberculosis" cases be compared with the "tuberculosis with silicosis" groups in the tables of clinical types already quoted (see p. 180). These tables show that, to all intents and purposes, the cases in these groups are identical in character so far as concerns maintenance of systemic condition and power of temperature control.

While this statement is correct in so far as it deals with clinical findings in the living, one must bear in mind autopsy experience to the effect that, in the absence of a silicotic element it is unusual for

lesions to be confined to the lungs, although these organs may show local attempts at repair. The comparative inability of the Native of any age to localize tuberculosis permanently is a much more important manifestation than his occasional ability to modify the course of the disease.

What matters is the time-factor. In these susceptible Natives, the co-existence of a certain amount of silicosis with their tuberculosis is chiefly important as a measure of the time spent in the industry. With each year passed in mining, the power of "confronting" a tuberculous process becomes greater. Whether this is due mainly to the early elimination of the more heavily infected or to the exaltation of acquired resistance in those longest exposed remains an open question. Probably both factors play a part.

The outstanding differences between these two types are here set forth briefly in tabular form:—

TABLE 56.

The Tuberculosis of "New Recruits."	The Tuberculosis of "Long-service" Boys.
Is associated with a high mortality rate.	Is associated with a lower mortality-rate.
Shows little or no tendency to fibrosis.	Shows definite fibrosis, in part due to silicosis.
Tends to generalization of lesions.	Tends to localization of lesions in the lungs.
Is seldom consistent with "working health."	Is often consistent for some time with "working health."
Appears to be due, in the main, to "break-down" of pre-existing lesions under stress of unfamiliar conditions of work on the mines.	Is probably due, in the main, to the gradual development of cumulative exogenous re-infections in the course of work in the mines.

The statistical differences between the tuberculosis of "new" boys and the tuberculosis, whether uncomplicated or combined with silicosis, of "old" boys are clearly brought out in the tables of the Section dealing with the incidence and mortality from tuberculosis on the Rand (see p. 154 *et seq.*, also Appendix 5).

Since, in this Report, the tuberculosis of the "new boy" has been compared to the tuberculosis of the European child, and the tuberculosis of the "long-service boy" has been compared to that of the European of middle-age, it may be of interest to give the characteristics of these types as presented by the National Tuberculosis Association.

TABLE 57.

Childhood Type.	Adult Type.
Usually occurs in children, but rarely in adults.	Usually occurs in adults, but rarely in children.
Result of primary infection.	Result of a reinfection.
May be localized in any part of the lung.	Localization is apical.
Tracheo-bronchial lymph-nodes always involved.	Tracheo-bronchial lymph-nodes not involved by this reinfection.
Caseous lesions usually become calcified.	Caseation of lesions followed by excavation and fibrosis.
Excavation very rare and but little tendency to fibrosis.	

If we turn to our own autopsy evidence and X-rays of the lungs after removal from the body we cannot say that, in the "new" boy excavation is very rare and calcification usual. If we turn to the "old" boy we find that the tracheo-bronchial lymph-nodes usually presented tuberculo-silicosis. The general comparison holds but much of our detail is *sui generis*.

One has greater confidence in associating the "chronic phthisis" of the "long-service" boy with exogenous re-infection than one has in minimizing the part played by this process in the tuberculosis of the "new" boy. The salient distinctions met with are apparently related to the fact that the "new" boy has been caught in a tuberculo-allergic state and also lacks the fibrous tissue barriers contributed by the silicosis factor. As bearing on the above, Myers⁷¹ writes:—

"I do not mean to leave the impression that every case of tuberculosis among young adults is due to direct spread of tubercle bacilli from old childhood lesions. Perhaps a large number, if not the majority, are due to re-infections from exogenous sources, but the childhood tuberculosis had prepared the way, as evidenced by the fact that it has left its indentities in more than 50 per cent. of the clinical cases of tuberculosis in young adults."

FACTORS UNDERLYING THE PREVALENCE OF ACUTE TUBERCULOSIS IN "SHORT-SERVICE" NATIVES.

(1) "Natural" and "Acquired" Liability to Generalized Infection.

On the one hand, the presence amongst new mine recruits of a certain proportion of previously uninfected boys may be expected to favour the occurrence of at least some cases of the "Borrel" type, the acute "natural" tuberculosis of virgin soil.

It is possible that, in the early days of the gold-mining industry, the proportion of cases of this type was fairly high, especially in those racial groups, such as the "Tropicals" and others, in which previous

contact with Europeans had been slight. When the step was taken of stopping all recruiting of Natives from north of latitude 22°S., a marked improvement followed in the health of the younger groups of Native miners.

This measure, and also the gradually increasing endemicity of tuberculosis in the kraals, has probably diminished the proportion of "virgin-soil" recruits; but, in view of the known liability of Basutos to contract acute tuberculosis on the Reef, together with the relatively low percentage of "positive" reactors to the tuberculin tests applied in the recent survey in Basutoland, it appears probable that a certain proportion of Natives, especially those from the less "Europeanized" districts, still arrive at Johannesburg with their "natural" liability unaltered by contact with infection.

On the other hand, the presence amongst mine recruits of a high percentage of young Natives from districts where tuberculosis is known to be endemic ensures the arrival of a large number of infected persons; and we know from the results of tuberculin tests that nearly all the mine boys are already infected on reaching Johannesburg.

Nor is it merely the percentage of positive tuberculin reactors which is high. A still more suggestive fact is that, as judged by tests with very dilute tuberculin, the degree of sensitivity is extreme (see p. 99).

[The tuberculin tests carried out under the Committee's auspices show that fully 50 per cent. of healthy Natives arriving at Johannesburg are capable of reacting to a 1/1,000,000 tuberculin dilution whereas, in tests carried out by me on clinically non-tuberculous adults in Wales, only about 25 per cent. were found to react positively to a dilution of 1/100,000.—S.L.C.]

Now it is known that a diminution in tuberculin sensitivity in infected persons may be due to gradual healing and inactivation of tuberculous lesions, with a corresponding reduction in specific auto-inoculations; or to a loss of the power to respond to specific auto-inoculations, such as accompanies failing health, whether due to the extension of the tuberculous process or to some intercurrent illness.* It may be inferred, then, that in persons with unusually intense tuberculin sensitivity, like these Native mine-recruits, the invasion of the virus producing this marked allergy must be recent and "active," and yet the resultant tissue changes must occur in such a position or else be of such a nature as to be consistent with good general health and the absence of signs and symptoms indicative of tuberculosis in the clinical sense.

We are able to exclude any significant amount of *active pulmonary* tuberculosis in these recruits, since this would be easily detected at the medical examination. Further, Professor Lyle Cummins examined at the W.N.L.A. hospital a series of 500 successive X-ray films from recruited boys without finding a single characteristic instance of active pulmonary infiltration, although some 30 per cent. of the films afforded

* Attention is directed to the possibility of there being two types of negative reactors as suggested in the last paragraph on p. 107.

evidence suggestive of the presence of inactive "primary foci" (see Appendix 9). We are thus in a position to infer that the "active" lesions proved, by the high tuberculin sensitivity, to be present somewhere in the body must be located, for the most part, in the tracheo-bronchial glands; one of the few situations in which active tuberculous processes may exist without seriously affecting the general health and without being clinically recognizable. We possess, indeed, in the observation that no less than 30 per cent. of healthy recruits have visible X-ray evidence of having passed through the stage of a primary lung focus, a proof that the lesions on which tracheo-bronchial glandular infection usually depends have actually occurred.

We find, then, in these "tuberculin-sensitive" boys, evidence that their condition represents, so to speak, a long-drawn-out phase of Borrel's "glandular stage," in which, owing to the favourable circumstances of life in the Native Territories, the process has not advanced any further towards generalization. In some of them, the process may, indeed, have gone a long way towards the healed and "compensated" tuberculosis that makes for resistance; in others the "larval" lesions may be close to breaking point. The more intense and the more recent the glandular infections, the greater will be the tuberculin sensitivity and the greater the risk of a breakdown into acute tuberculosis. The follow-up of the tuberculin-tested Natives on the Rand shows that there was, amongst the boys giving a "positive-plus" reaction, a decidedly greater liability to develop tuberculosis than was present in the "positive," "weakly-positive" and "negative" groups (see p. 100).

[Allan, in a private letter written to me from the Transkei, dated 25th November, 1929, reports about the more severe tuberculin reactions that "the cases with vesication came from families where tuberculosis is rampant."

Ukil⁷⁰, writing of his tests in Indian village communities, reports that "most of the cases giving +++ reactions were traced to a tubercular focus in the family."—S.L.C.]

This greater liability to develop tuberculosis, noted amongst those Natives whose extreme tuberculin sensitivity implies close and recent contact with infection and the existence of definitely "active" lesions, is what Professor Lyle Cummins terms "acquired liability," as opposed to the "natural liability" associated with virgin soil. This phase may be regarded as a dangerous defile at the very start of the road towards immunity.

The tuberculosis occurring in these new recruits, while approaching the "natural" tuberculosis of virgin soil, has been shown in the Pathological Section of the Report (see p. 160) to possess certain characters which differentiate it and indicate that it implies some degree, though only a very slight degree, of resistance to the tuberculous invasion.

[The Pathological Section of the Committee's Report, based on the pathological findings described by Pirie and Mavrogordato in Appendix 7 compares the descriptions of "primary"

and "natural" tuberculosis as given by Bushnell and Borrel, to illustrate the partial divergence of the local tuberculosis from the entirely "natural" type.

If we speak of the tuberculosis of virgin soil as the "Borrel" type and that of these tuberculin-sensitive Natives as the "Pirie-Mavrogordato type," we are in a position to appreciate this distinction; and it may be added that, while the Borrel type may still occur in a few uninfected Basutos and "Tropicals," the real problem of the tuberculosis of the "new mine Native" on the Rand at the present time is presented by the Pirie-Mavrogordato type.—S.L.C.]

(2) *Conditions in the Recruiting Areas.*

It has been shown that tuberculosis is now endemic in the Native Territories, both in the Union and in Portuguese East Africa, a fact which helps to explain the tuberculous infection underlying the prevalence of the type of disease found in the new recruits.

But the question arises as to whether any other factors exist in connexion with early life in the Native Territories which may help to explain the liability of young mine Natives to develop acute tuberculosis shortly after arrival on the Rand.

It was pointed out by Miss Delf⁷² that scurvy, an endemic disease in certain districts, "although rarely found potent and severe" among the Natives in their home surroundings, tended to become clinically obvious, in spite of the better diets, when work was started on the mines.

This observation on scurvy appears to fall into line with what has just been said about tuberculosis; and the close parallel between these two diseases in respect to latency under home conditions, and the tendency to activation on starting mining work, suggests that food deficiency in the Native Territories, which plays such a dominant rôle in scurvy, may enter into the tuberculosis picture as well.

[In this connexion, I think it advisable to quote some passages from my South African diary in which the results of enquiries and conversations during my visits to the Transkei were noted down at the time. These summaries of talks with persons possessing intimate knowledge of local conditions must be regarded as important in connexion with the present enquiry.

Dr. Roberts, F.R.S., at that time a Senator and a member of the Commission on Natives under the Union Government, interviewed at Queenstown on 28th August, 1928, expressed the opinion "that the Ciskei and Transkei Natives are deteriorating through diminution of stock and resultant loss of the traditional occupations of a pastoral people and a loss of milk from the dietary." He said that "when, in 1850, Sir Harry Smith exacted a fine of 50,000 head of cattle out of the Ciskei, this loss made little or no difference, so numerous were the

cattle then. Now it would be difficult or impossible to find 50,000 head of cattle in the same district. The custom of making and using "*amasi*" (sour milk) has almost ceased for want of milk."

Dr. Macvicar, of Lovedale, interviewed on the same date, "is struck with the amount of scurvy and xerosis in Native children." . . . On my asking as to breast-feeding, he stated that he had seen scurvy in a breast-fed infant at five months, suggesting insufficient or unsuitable feeding of the mother." Miss Macvicar, the daughter of Dr. Macvicar, herself a doctor on the staff of the hospital at Lovedale, "spoke of the frequency of acute tuberculous broncho-pneumonia in infants and young children, always fatal."

Mr. F. Brownlee, of Butterworth, gave it as his general impression that "there is less milk available and a larger population needing it, and a larger claim on the family purse for luxuries, than 25 years ago; with the result that the people are not so fit and not so well fed as they used to be. . . . There used to be a "milk-sack" in each kraal from which sour milk could always be had. Now this is seldom seen. . . . So poor are local resources that . . . we could not carry on for a twelve-month without the remittances from the miners."

Mr. C. Brownlee, formerly Chief Magistrate of the Transkei, told us, on the subject of fatty foods, "that the Natives do not make butter. Their fat is derived chiefly from sacrificial animals and is preserved in calabashes. They lay much stress on fat and each boy is told at circumcision 'never let your mother's calabash be dry.' . . . Now there is no game and they are averse from killing stock. Only the rich can afford to kill sheep or goats for their food. It is not so much that stock has diminished in number—the country is really over-stocked—but cattle have become concentrated in the hands of a few and in certain areas . . . so that there is no longer milk for all." —S.L.C.]

While the Natives of the Ciskei and Transkei still present, to the eye of a visitor, the appearance of good health and good humour so characteristic of African Natives in general, and while it would be clearly wrong to take an exaggerated view of their alleged deterioration, it seems that all is not well with them. Their numbers continue to increase without any corresponding increase in territory; and the lands they now occupy are very much less in extent than those over which they roamed with their flocks and herds before they encountered the advance of the White man from the Cape and from Natal.

They are in a difficult intermediate stage between a primitive state of society and a state of conformity to the standards of Western civilization and are not in a position to enjoy the advantages of either.

They have not yet lost the customs and traditions which belong to a pastoral and military community, and for which wide spaces for the grazing of cattle are a basic necessity, nor have they acquired the agricultural efficiency and the commercial sense needed for life in close proximity to European settlers and merchants.

The men have lost the hard discipline of warriors and hunters, and the women, with all the attractions of the trader's store close at hand, dream of short frocks and silk stockings and see the momentary advantages of tinned fruit and tinned milk over wild berries and herbs and the calabash of *amasi*.

As for the children, they are under-nourished ; and in seasons of drought, many of the Natives, both adults and children, approach the starvation line.

In these circumstances, it is not to be wondered at that latent tuberculous infection should tend to light-up into activity when a life of monotonous leisure is suddenly exchanged for one of strenuous and unfamiliar exertion.

So much for the Native Territories within the Union.

What, then, of the other great source of mine recruits, the Native Territories of Portuguese East Africa ?

The Committee has not had such detailed information laid before it in connexion with the life and economic conditions of the "East Coast" Natives, but a brief visit was paid to these Territories by Professor Lyle Cummins, and his impressions as laid before the Committee in a report dated 30th August, 1929, were much more favourable. The acquisition of land by White settlers appears to have been much less extensive, and the Native tribes seem still to enjoy a considerable amount of "elbow-room." A paragraph in his report runs as follows :—"We were struck, during our visit, by the plenty and variety of the foodstuffs available. . . . Mealie crops and crops of Kafir-corn and millet were reported to be excellent, and there was to be seen, on all sides, flourishing pineapple and mandioca cultivation. Ground-nuts, sweet potatoes and other vegetables were plentiful and many edible fruits grow wild for the plucking. To judge by the meals in preparation in various kraals visited by us, the Native women are excellent cooks and make a full use of the foodstuffs available."

In another part of the report there is mention of "the seemingly good conditions in which the Native population lives, conditions which appear to us much more favourable than those existing in the Transkei."

[To amplify this description of Portuguese East African conditions, I might again quote an entry from my diary, dated 12th August, 1929, at Zandamella. "We were much struck by the evident health and happiness of the Natives in this place ; they seem sleek and well fed and the country is rich" ; and, next day, "in the afternoon, a very good Native dance, at which we saw the whole population of the Zandamella area assembled ; and a fine lot of handsome, healthy people they appear to be."

This impression, as a set-off against which must, however, be placed the fact that 1929 was an unusually favourable year, appears to have been strongly fixed in my mind at the close of my visit to Portuguese East Africa, as the quotations made from my report already show.—S.L.C.]

Is this apparent relative superiority of Native life in Portuguese East Africa associated with any advantage in respect of the acute generalized type of tuberculosis? There appears to be some reason for thinking that it is. Thus, Pirie and Mavrogordato, in their report on the Pathological Anatomy of Tuberculosis in Mine Natives (see Appendix 7, p. 378) grouped the cases coming to autopsy according to the country of origin as follows:—

EAST COAST NATIVES :

Chronic Tuberculosis associated with Silicosis	...	...	117
Acute Lesions, Intra- and Extra-thoracic	...	...	146
TOTAL	...	...	<u>263</u>

BRITISH SOUTH AFRICAN NATIVES :

Chronic Tuberculosis associated with Silicosis	...	...	83
Acute Lesions, Intra- and Extra-thoracic	...	...	191
TOTAL	...	...	<u>274</u>

From this it appears that the East Coasters only produced 56 per cent. of "acute lesions," while British South Africans produced 70 per cent. of the acute type. When it is recalled that the Portuguese East Coast Natives come to the high level of Johannesburg from a warmer and more malarial climate than do the Transkei Natives and are, therefore, subjected to a sharper and more trying contrast in temperature than the latter, the fact that they produced 22 per cent. less of the acute types of tuberculosis appears very suggestive. It would appear that faulty conditions of life and diet before coming to the mines predispose to a danger of breaking down of "larval" tuberculous lesions into active ones under the stress of hard work.

(3) *The Journey to Johannesburg.*

There is also a further possible source of risk which, while antecedent to arrival at Johannesburg, might, under unfavourable circumstances, lead on to tuberculosis in those with "acquired liability" to the disease, viz., the long and arduous journey from the Territories to the Rand. In this journey, for the young recruit the first departure from adolescent ease to a new way of life, the Native ascends from the warm levels of the African coast to a point about 6,000 feet above the sea and to a climate which is, at least, in the winter months, very cold, dry and dusty. The journey is a slow one and, at least from the more northerly recruiting areas of Portuguese territory, a long one, including both sea and land transport.

The possibilities for risk in transit are too obvious to require more than mention at this stage, and all that need be said is that the warmth, diet, comfort and night-accommodation of Native mine recruits on the journey from their Territories to Johannesburg are matters of hygiene which deserve the closest consideration.

[I cannot speak with authority on this subject of the journey to Johannesburg, not having personal knowledge of the conditions of travel, but I remember my attention being drawn to it by Dr. Mavrogordato, so I presume the Committee has reason to believe that the conditions are capable of improvement.—S.L.C.]

The medical examination undergone by recruits at the W.N.L.A. compound is believed by the Committee to be such that few, if any, recruits with clinically-defined defects can be passed as fit for work. This fact makes still more suggestive the well-marked tendency of a certain percentage of the recruits to "break down" into generalized tuberculosis within the first few months after arrival. If the contention that the larval lesions underlying the characteristic acute tuberculosis of new recruits are situated, for the most part, in the tracheo-bronchial glands be correct, this failure of the careful medical examination to weed out all those with "acquired liability" to tuberculosis will be readily understood, since these tracheo-bronchial lesions defy accurate diagnosis nor are they often accompanied by general signs of ill-health.

[It has been my privilege to see a great deal of the medical examinations carried out at the Witwatersrand Native Labour Association's Compound to supplement the preliminary medical tests applied before departure from the Territories. These medical examinations are described in the body of the Committee's Report (p. 84), so need no elaboration here. It suffices to say that, in my opinion, the work is well and carefully carried out by an experienced staff of whole-time medical men, and that the physical examination is supplemented by facilities for "observation" in hospital and X-ray examination in the case of "doubtful" recruits. The examinations are thorough and may be said to ensure that no recruit with clinically-defined defects can possibly slip through the net.—S.L.C.]

(4) *Life in the Mine Compounds.*

When the Native mine recruit has passed the medical examination, he is posted to a mine and enters the new life which is to be his during the period of his contract. Here he becomes one of a community of workers, dwelling in large compounds close to the mines, accommodated in rooms, usually in batches of about 40 to each room, with an air-space of about 200 cubic feet per head, fed from the communal kitchen of the compound on rations based upon Native diets and regulated by a minimum scale of issue laid down by the Native Affairs Department. He is provided with communal bathing and sanitary arrangements, summoned to work each day between 4 and 6 a.m., and he gets back to the compound after the day's work at an hour which varies in the different mines, but is usually from about 3 p.m. to 4.30 p.m.

While in the compound his life is regulated by the compound manager, a European official selected for his knowledge of Native languages and customs and possessing, as a rule, long and sound experience of the administration of Natives under compound conditions. Under the compound manager there are usually a group of Native policemen or Native "boss boys," chosen from amongst the "long-service" boys on grounds of character, influence and tribal prestige.

He has few organized amusements in his leisure hours, but then the Native is not devoted to sports and his leisure hours, except at the week-end, are few. But the compound is full of Native musical instruments, there is the "club" life of the rooms, with its story-telling and gossip and the Native games, so well described by H. Junod,²⁶ which afford opportunities for mild gambling; and at the week-end there are "passes" to visit the towns and all the fun of visiting neighbouring compounds, or receiving visits from outside, for elaborate Native dances, which afford just as much exercise as a game of football.

This life in the compound is, in many ways, preferable to the idle life of the kraals which, now that wars have ceased and tribal wanderings have come to an end, may be described as "monotony interrupted by beer-drinks"; and there is no doubt but that, apart from the minority which contracts or develops bacterial disease, the Natives benefit in health and return home fitter as well as richer after their periods of service on the Rand. This is proved by the gain in weight which is found to occur in the majority of Natives and on most of the mines.

But there remains the minority, fated to contract or to develop bacterial diseases, and it is with these that we are now concerned.

What factors in compound life may be expected to have a bearing upon tuberculosis?

(5) *Compound Accommodation and Management.*

It has been pointed out in Chapter II, Part II (p. 66), that even to-day a few of the compounds do not come up to the standard laid down by the 1911 regulations, but it has also been made abundantly clear during the course of the Committee's investigations that neither the general sickness-rate nor the tuberculosis incidence-rate nor even the average gain or loss in weight of the Natives correspond with variations in the outward efficiency of the compounds or the type of room in use. Nevertheless, compound conditions may have their bearing upon the question at issue.

[I have never been able, during my three yearly visits to South Africa, to become quite reconciled to the outward appearance of the compounds and hutments as seen during occasional inspections; nor am I alone in this, since the Report of Surgeon-General Gorgas, in 1914, voices a similar unfavourable impression. Possibly the attitude of mind engendered by years of military hygiene may have something to say to this adverse reaction, since the life of a community of mine Natives hardly permits of the same standards of barrack-room cleanliness and

smartness exacted in Army life. Certain it is that neither the general sickness-rate nor the tuberculosis incidence-rate nor even the average gain or loss in weight of the Natives correspond with variations in the outward efficiency of the compounds or the type of hutments in use.

The anomaly of the maintenance of a high standard of health under apparently unfavourable compound conditions is well brought out in the following quotation, entered in my diary on the evening after a visit to a certain mine compound :—

“ Visited the compound, which is one of the ‘ rare old sort,’ very dirty and untidy, the rooms holding up to 40 (but some have only 10) boys, the windows stuffed or draped over with cloths, food cooked in the rooms, odds and ends of food scattered about, washing-water, urine, soap-suds, etc., constantly flushed away along open gutters. And yet the boys seem healthy and the proportion with tuberculosis is not unduly high. As a matter of fact, this mine shows the highest percentage gain in weight and the highest average gain (9·04 for the average Native during his contract) of any mine on the Reef. The ‘ production of tuberculosis ’ rate is of medium degree only and is falling.”

The Natives themselves like this particular mine, which attracts a considerable proportion of “ voluntary boys.” The greatest care is given to the feeding, a matter in which both the compound manager and the mine medical officer take a keen interest. But, so far as the state of the compound goes, no claim for special efficiency can possibly be made. Nor is this an isolated instance. It is the common experience that the health of the Natives is often as good or better in the “ obsolescent ” mines, where financial difficulties forbid modernization of the compounds, as in the more up-to-date and richer mines.

This being so, it is perhaps rash to criticize compound conditions, but the fact remains that morbidity and mortality statistics depend on a large number of varying factors and that, whatever the reason, there does remain to be explained the definite liability of the new mine Natives to acute tuberculosis. —S.L.C.]

The entry of a “ raw ” Native into a mine compound means, for him, close and intimate contact with a new community, and this contact is especially close and intimate in the crowded room in which he rests and sleeps. His companions include, perhaps, a few other recruits, often from remote areas, as well as “ old ” mine Natives who have learnt to tolerate the bacterial flora of the mines and compounds and some of whom may, indeed, be germ-carriers of one sort or another.

While carefully kept “ spot maps ” of tuberculosis incidence have failed to show any case-to-case association of this disease in the mine compounds, this, in view of the long latency of infection in tuberculosis,

does not exclude the possibility of re-infection from healthy carriers, nor does it bear upon the question of the lighting-up of old lesions, since cases so produced would be unassociated with previous cases.

The opportunities for the handing round of other respiratory infections must be considerable in rooms accommodating 40 or more persons with an air-space sometimes no more than 200 cubic feet for each.

Smaller rooms, with fewer persons per room, would certainly lessen this risk. The advice of General Gorgas, given in 1914, to "scatter" the Natives and thus diminish the chances of transmitting respiratory disease is undoubtedly sound in regard to tuberculosis also.

[In this connexion, it might be pointed out that influenza, pneumonia and cerebro-spinal meningitis are never entirely absent from the mines and often assume considerable proportions; and it is generally admitted that influenza, at least, is able to play a formidable rôle in lighting-up dormant tuberculous lesions. That this generalization applies in the compounds of the Rand appears probable, to judge by the close correspondence between the variations in incidence-rates of tuberculosis and influenza for the Rand Mines Group, recorded as graphs for the last twelve or more years by Dr. Orenstein, through whose kindness I was able to see the figures.]

The conditions in nearly all the compound hutments which I have visited appear calculated to facilitate the spread of influenza and other respiratory infections; and it is believed that, for those with "larval" tuberculous lesions, exposure to these respiratory infections involves a definite risk.—S.L.C.]

(6) *Feeding.*

The "Minimum Ration Scale for Native Labourers," as laid down by the Native Affairs Department, is quoted in Part II, Chapter II, p. 70, together with the calorific values and the presence or absence of vitamins A, B and C. Individual mines differ in their scale of provision; none of them fall below this minimum, but few of them exceed it to any considerable extent. Through Professor Lyle Cummins this minimum scale was submitted to the Medical Research Council, London, and through the kindness of Sir Walter Fletcher was reported on by Miss Harriette Chick, who writes: "The diet appears to be well supplied with vitamins B and C and to be low in vitamins A and D, and in mineral salts."

After a discussion on the values of the different constituents, she concludes, "if the labourers are exposed to sunshine the deficiency in vitamin D in the diet is unimportant, but the effect of sunshine in providing vitamin D is enhanced if the diet is well supplied with salts."

The Native miner, working underground, is not exposed to sunshine except during his week-end rest and during the short interval of daylight between his return from the mine in the late afternoon and the early African sunset.

It may be assumed, then, that the diet is deficient in both A and D vitamins, but there are numerous difficulties in the way of a more generous provision of fats. For one thing, the Native has his own ideas and preferences about food, and the diet, monotonous as it certainly is, meets his wishes and is based on his customs and habits. There is also the hard financial fact that even a very small increase in the daily ration for some 200,000 Natives mounts up into a very large sum and would involve an addition which some of the less prosperous mines might find impossible to face. At the same time, a more ample diet in respect to fats might be expected to yield some monetary return in the shape of a better output per man and in economics in hospital services and compensation claims for tuberculosis.

The Native diet in the kraal is based on the Native mode of life, an open-air life much less exacting from the point of view of metabolic waste than that of gold-mining. The diet on the mines is based to some extent, possibly too closely, on this kraal dietary. It may be added that milk is an important element in the diet of all cattle-owning tribes, whereas milk and butter are absent from the mine rations. While proof cannot be obtained except by trying, it is at least highly probable that an all-round increase in vitamins A and D to the Native mine rations would lead to a decrease in incidence and mortality from tuberculosis, just as attention to the provision and cooking of fresh vegetables has been followed by a fall in scurvy.

It is not, however, only in respect of diet constituents that the present arrangements are open to discussion. In respect of the intervals between meals, too, there is a problem difficult of solution and yet requiring close attention in relation to health.

Here, again, the arrangements in the mines are based on Native custom. The South African Native takes food twice daily; shortly after rising in the morning and again on return to his kraal in the late afternoon. The latter is the principal meal of the day. But the Native day starts with dawn and the amount of hard work included in the hours between dawn and dusk is not great. The Native miner's working day, on the other hand, starts as a rule some hours before sunrise and starts in the haste of getting a large shift of labourers down into the mine. It is usual to provide a small loaf of bread and a drink of "marewu" or, perhaps, coffee, which the Native must either consume in the hurry of his start for the mine or take with him to eat on the way. Apart from this, he gets no food until his return to the compound ten or more hours later, after a strenuous day of muscular work carried out, to all intents and purposes, on an empty stomach.

This arrangement, on the face of it, scarcely seems satisfactory, and should be capable of being improved with advantage to all concerned.

[I am unable to believe that this feeding arrangement is satisfactory.]

The arguments usually brought forward in support of it are that Native custom must be followed, that the Native is superstitious and will not eat in the depths of the mine, which he regards as dirty and haunted by evil spirits; and, finally, that the difficulty of bringing food to the Natives during the "shift" is too great to justify a change in the present arrangements.

None of these difficulties are insuperable, as is proved by the fact that, on the recommendation of Dr. Orenstein, meat sandwiches are now being issued, during working hours, to the Natives in the Village Deep, one of the most difficult mines from the point of view of distribution; and that these are readily eaten.

Drinking water is normally supplied to the workers in most of the mines, salt being added to it where the conditions involve a great loss of fluid in sweating; and if salted water can be distributed, there should be no insuperable difficulty in the distribution of a nourishing meat-broth or soup.

A good cup of warm soup, too, would be a very desirable addition to the morning meal issued before descending the mine, and a meal of this sort is given on one of the healthiest and, from the Native point of view, one of the most popular mines on the Rand.

To summarize my feelings about the feeding of the mine Natives, it seems clear that the food provided is good in quality, adequate in caloric value, well cooked and in line with Native preferences and habits. On the other hand, it is monotonous, inadequate in respect of fats, and the intervals between meals are unduly long. The elements in which the diet are admittedly deficient, vitamins A and D, are known to be of especial value to the body in its defence against tuberculous disease and the various septic infections.—S.L.C.]

(7) *Hours Underground and Hours of Work.*

The relation of hours underground to hours of work varies in the different mines according to the relative ease and rapidity with which the Natives can be transported from the surface to their working place and actually started on work.

It is no small feat of organization to get several thousand Natives down to, and up from, depths averaging over 4,000 feet below the ground-level, and delays must necessarily arise. Even when they have reached their working levels, the work cannot be started until the White miner responsible for the safety of working conditions has investigated and reported "all well."

As already stated, conditions vary from mine to mine, but probably $10\frac{1}{2}$ hours underground may be taken as a fair average for the whole Reef, not all of which, however, is spent on actual work.

[A couple of casual entries from my diary bearing on this point record the "hours underground" at a mine visited in September, 1929, as 10 to 11, while the actual working hours were 8. Here all the miners had to be lowered down a single shaft. At another mine, visited in July, 1929, the average time was 11 hours underground for 9 hours' work, and at another 10½ hours for about 8.

The Tuberculosis Commission of 1914³⁴, reporting on conditions of work in the coal mines at Witbank, stated (pp. 192 and 193) that shifts were from 6 a.m. to 6 p.m., without intervals for meals, and that overtime was sometimes worked straight on after completion of the shift time, the day's work sometimes lasting from 15 to 17 hours. As the Commissioners put it, "the average owner of a horse would not think of working it like this."

Things have much improved at Witbank where, to-day, the conditions of work are much less severe than in the more difficult gold mines.

But it is still a question whether "the average owner of a horse" would long enjoy the advantages of ownership if he kept his beast out of the stable and without a feed for 11 hours every day and made it pull a cart for 8 or 9 hours of the time.

Native mine-workers appear to be more enduring nor is this rather rhetorical comparison quite a fair one, though it expresses a truth in picturesque language.—S.L.C.]

It still remains true that the Natives are not in the habit of taking a midday meal and that the average Native miner gains in weight and health during his contract, proving that even these long hours of exertion are not beyond average capacity. But again it must be pointed out that we are not here concerned with the average Native. We are considering the factors which may tell against the Native with "larval" tuberculous lesions hidden in his tissues.

Whether any man, healthy or infected, can continue for long to do effective work for eight or nine consecutive hours, without intervals for meals, is an economic question as to which scientific tests must supply the answer; but it can hardly be doubted that, for the man whose health depends upon a delicate balance between larval tuberculous lesions and tissue resistance, a day's work of this length, without food, is calculated to swing the balance the wrong way.

(8) *Conditions of Work.*

Those desiring to gain an idea of the conditions under which these Native miners work should consult papers dealing with this question published by Orenstein and Ireland⁴³ and Mavrogordato and Pirow,⁷³ in both of which the physiology of South African gold mining receives consideration. The latter paper deals especially with deep-level mining and high temperature, and is based on an enquiry carried out

by the authors into a series of four deaths from heat-stroke which occurred in Natives working in the Village Deep mine in December, 1925, and January, 1926. In this mine, the deepest on the Reef, the working conditions, involving great heat, were, as is the case on all the mines, complicated by the necessity of reducing the dust-content of the air by means of sprays, thus raising the humidity and approximating the wet-bulb to the dry-bulb temperature, so that evaporation of sweat became difficult or impossible and temperature-regulation was interfered with. Discussing the problem, the authors say: "It will be seen that the deep-level mines on the Witwatersrand, in the absence of mechanical ventilation, realize something like the ideally bad conditions." Steady and successful effort in the direction of better ventilation has now led to a great improvement in this particular mine, but the quotation serves to indicate the natural difficulties always present in deep mining and the trying conditions of physiological stress under which the Native miners carry out their daily task. (At the time of publication this mine had practically ceased operations, for economic reasons.)

(9) *Acclimatization to Work at Deep Levels.*

As time goes on, men adjust themselves to these conditions, but it is the young Natives, the "new recruits," amongst whom tuberculosis is especially prevalent, with whom the Committee is now concerned.

To adapt oneself to the work of deep mining at a high temperature needs a period of "acclimatization"; a period in which not only is the new work learnt but during which the body adjusts itself to unfamiliar and trying conditions.

In this connexion, Mavrogordato and Pirow (*l.c.*) write as follows:—"It is neither kind nor wise to set a raw boy to learn 'lashing' at 86°F. wet-bulb." It may be said at once that efforts are made to get the new mine Natives gradually "entered" before allotting to them the harder tasks at the deep levels. Special gangs for new Natives have been organized on all deep-level mines and for a period of 24 working days they are thus gradually acclimatized.

The introduction of this system is a step in the right direction and every effort should be made to perfect it.

There is also a field for improvement in protecting the Natives during their return from hard work in the great heat of the deep levels from sudden changes in air-temperatures and velocities, either by means of suitable ventilation controls or, where this is impossible, by the provision of extra clothing.

[I am of opinion that there is still room for improvement in the direction of a well-defined system of "entering" new boys through a series of graduated tasks over a period of at least a month. While fully aware of the administrative difficulties involved, I consider that a whole-hearted effort in this direction is urgently desirable throughout the industry in the interests of the health of the Native miners.—S.L.C.]

(10) *Exposure to Silica-dust.*

Until quite recently there appeared to be good ground for the opinion that the influence of silica upon tuberculosis was manifest chiefly as an adjuvant to the development of a slow bacterial invasion contemporaneous with or subsequent to the appearance of silicotic fibrosis. All the epidemiological evidence pointed to this late effect; the silicotic fibrosis appearing first and the tuberculous element making itself manifest as a late or perhaps a terminal phenomenon. The salient fact brought forward as proof that silicosis predisposed to tuberculosis was the existence of a higher tuberculosis death-rate amongst silicotics of late middle-age and onwards than in the rest of the community.

Collis⁷⁴ lays down "latency of onset of the disease" as one of the characteristics of exposure to a dust predisposing to phthisis, and the Royal Commission on Metalliferous Mines and Quarries⁷⁵ puts the facts very clearly as follows:—"If in any given class a high death-rate from pulmonary tuberculosis is found occurring at a later period of life than is usual for pulmonary tuberculosis, and if this high death-rate is associated with a high death-rate from other respiratory diseases, then this class is exposed to the inhalation of injurious dust."

It is known from the important experiments of Gye and Purdy,^{76 77} Gye and Kettle⁷⁸ and Kettle⁷⁹ that silica, either in colloidal solution or in its crystalline state, is capable of assisting the invasive activity of tubercle bacilli introduced into the tissues of experimental animals, but the acute tuberculous processes thus produced appear to be so different from the chronic tuberculous disease associated with advanced pulmonary silicosis that it is difficult to see the precise bearing of these laboratory experiments upon the question of miners' phthisis.

New light has recently been thrown on this question by the publication of a highly important series of experiments by Leroy U. Gardner,⁸⁰ in which he shows that the exposure to silica-dust of guinea-pigs already infected with a low-grade tuberculosis caused by an attenuated strain (R.1) leads to a reactivation and often to a generalization of the disease. To quote his own words: "A series of guinea-pigs has been primarily infected by the inhalation of tubercle bacilli of low virulence. In normal animals such infection produces isolated sub-pleural pulmonary tubercles which attain a state of caseation, then retrogress, and finally heal by resolution. As a part of the picture of primary infection, the tracheo-bronchial lymph-nodes are also involved and the lesions in this situation undergo a similar series of changes. At serial intervals, ranging from 54 to 206 days and, in a few cases, 400 days, after such infection, groups of four animals were removed to each of three dusting chambers where they were exposed to the inhalation of quartz, carborundum and granite-dust until they died or were killed. The experiment has demonstrated that the inhalation of these three dusts will stimulate a renewed multiplication of bacilli in the healing tubercles. . . . With quartz, 73.6 per cent. of the animals exhibited evidence of progressive tuberculosis, with carborundum there were 31.8 per cent., and with granite only 26.3 per cent."

Here we have what can only be described as a remarkably close parallel to what appears to occur in new mine Natives. Gardner's guinea-pigs, infected in such a way as to produce what Professor Lyle Cummins has called, in man, "larval" tuberculosis, prove to possess what has been described above as "an acquired liability" to progressive tuberculosis when exposed to silica-dust; a liability which would never have come to light had it not been for some "factor of aggravation," possibly that introduced by the dust-exposure.

Applying the findings of Gardner in guinea-pigs to the problem of tuberculosis in raw South African mine Natives, it will be seen at once that there is a close parallel between the conditions obtaining on the Rand and the conditions artificially produced by Gardner in his animal experiments. On the one hand, there is the new mine Native arriving, infected but healthy, from his kraal. We know him to be healthy, since he has just passed a rigorous medical examination. We know him to be infected from tuberculin tests and post-mortem observations. He starts work in an atmosphere charged with a certain amount of silica-dust. We know that this is still true, in spite of the precautions taken, because of the continued occurrence of tuberculo-silicosis in the older miners. The necessary conditions for Gardner's experiment are, therefore, present: "larval" tuberculosis and exposure to silica-dust.

We may, therefore, have in silica-dust an important element in the production of the acute generalized tuberculosis of new boys. That other factors also contribute we infer from the fact that the acute generalized tuberculosis of Natives is not confined to the gold mines but occurs also in a certain number of Native coal-miners and diamond-miners not exposed to silica-dust. Indeed, it is common in the mental hospitals of South Africa, where neither dust nor industrial fatigue can be invoked to explain it. But it appears to be more common and to occur, on the average, after a shorter period of time, in the case of gold-mine Natives, and this special tendency may well depend on the adjuvant action of silica.

These experiments of Gardner's suggest to their author "that the evidence submitted may be applied to human pneumoconiosis and that it affords reason for thinking that all tuberculosis complicating this condition is not necessarily an exogenous industrial infection. In a certain proportion of the cases it seems probable that inhaled dusts of the proper type may light-up pre-existing quiescent foci of infection or disease."

This conclusion is admirably expressed and its possible bearing on the tuberculosis of the mine Natives at Johannesburg will not escape those familiar with the problem.

Previous experiments of Mavrogordato⁶⁰ have demonstrated the influence of inhaled silica in facilitating the effective infection of rats and guinea-pigs by the tubercle bacillus.

It seems that we may have to postulate a dual rôle for silica-dust in the determination of tuberculous disease in man; an early action while the lymphatic drainage of the lungs is still efficient, permitting

of the transport of phagocytosed silica-dust by the same channels as those along which tubercle bacilli had already been carried and to the same situations, glandular and other, in which the bacilli had already been arrested and had set up larval foci of infection; and a late action in which, owing to the previous establishment of silicotic fibrosis and lymph-blockage, inhaled tubercle bacilli and inhaled silica-dust must accumulate together in the lung parenchyma and set up the chronic tuberculosis so characteristically associated with the pneumoconiosis of White miners in Africa and elsewhere.

[The "saddle-back" curves of age-mortality once so evident in the lead-mining districts of Cardiganshire, the quarry districts of Pembrokeshire and of Anglesey, and other parts of North and West Wales may, perhaps, be taken to suggest that not only in Africa but in European districts also in which a silica risk occurs in industrial centres situated amongst relatively recently "tuberculized" populations, this dual mode of action of silica may afford part of the explanation.

To sum up my views as to the "simple tuberculosis" of the newer and younger Native miners, this form of the disease, apart from rare instances of the early infection of virgin soil, is due to the reactivation of larval tuberculous lesions under the stress of work in the gold-mining industry. The factors which are calculated to lead to this reactivation are discussed in the Committee's Report and are briefly as follows: Lack of adequate "acclimatization" to a trying industry; exposure to "secondary" respiratory infections in crowded compound hutments; the mixing-up of the relatively immune with non-immune persons; the poverty of the otherwise adequate dietary in vitamins A and D; the strain of deep mining and all that it implies in long hours underground; severe physiological stress and climatic contrasts between conditions underground and on the surface; and, lastly, exposure to silica-dust.

It is the cumulative effect of these several factors which proves too much for those whose previously acquired tuberculous lesions are in a state to be readily brought into fresh activity. —S.L.C.]

FACTORS LEADING TO TUBERCULOSIS IN "LONG-SERVICE" NATIVES.

Amongst older mine Natives, who have passed safely through the early years of work in the mines without loss of health, and who remain in the gold-mining industry either intermittently or in continuous employment, there tends to appear a relatively chronic type of tuberculosis not unlike that met with in Europeans of middle-age.

With this type, as has been already explained, is usually associated more or less silicotic fibrosis, affording proof of a considerable period of mine service and giving evidence of the cumulative effect of prolonged exposure to silica-dust.

There are, of course, intermediate types between this more or less chronic and localized pulmonary tuberculosis of the older men and the acute generalized disease met with in "new" boys; and it is true, also, that cases of generalized tuberculosis sometimes occur amongst the long-service Natives; but, on the whole, there is a rather sharp contrast between tuberculosis in the "old" and the "new" boys.

The question arises whether this relatively chronic type of phthisis can be explained as due to the persistence of early lesions and their late re-activation or whether it is due to super-infection from without; in other words, whether it is of endogenous or exogenous origin.

Apart from surgical tuberculosis, the only "local" tuberculosis met with in the Native labour force is this chronic pulmonary tuberculosis or the tuberculo-silicosis of the long-service boy. It is in this "tuberculosis of middle age" and in this type only that our Natives resemble Europeans in the manner of their response to effective infection by the tubercle bacillus. Arguments leading to the association of the chronic pulmonary tuberculosis of the European with exogenous inhalation re-infections apply equally to the Native. The main argument in this connexion has already been elaborated fully in the Pathological Section of this Report (p. 172) and need not be repeated again here.

The experiment of Mavrogordato⁶⁰ in which rats left underground in cages were later found to be infected with tuberculosis proves conclusively that mine-air may contain sufficient tubercle bacilli to produce infection and disease even in a highly-resistant animal like the rat.

In many cases, both in Europeans and Natives, tuberculosis of the lungs, when first recognized, is widely distributed through those organs and resembles an experimental inhalation infection.

Strachan and Simson⁸¹ have shown by inoculation experiments that in many cases of tuberculo-silicosis the dust and the living tubercle bacilli are associated in the same nodule. Dust is certainly an inhalation invasion and it has occurred that an X-ray plate has shown up the stigmata of dust in the lungs of a patient for the first time simultaneously with the recognition of pulmonary tuberculosis; thus, a miner whose chest has shown no evidence of either silicosis or tuberculosis may, three months later, present a typical X-ray plate of silicosis with associated tuberculosis. This abrupt appearance of the stigmata of silicosis is not met with apart from an associated tuberculous infection. These findings suggest that the dust and the tubercle bacilli have travelled by the same road at more or less the same time.

There are certain facts which may be quoted against the exogenous theory:—

Contact spot-maps of tuberculosis incidence in the compounds and in the mines have yielded no satisfactory evidence connecting case with case and the examination of mine-dust and air for tubercle bacilli has been inconclusive. Case-to-case infection, however, is never easy to

establish in tuberculosis even under family conditions owing to the slow rate of development of infection into disease. The detection of tubercle bacilli in dust and air is at any time rather a difficult procedure technically, and in the case of the mines was rather a forlorn hope from the outset, owing to the very minute samples of the whole which could be dealt with.

Despite failure to adduce complete proof of the presence of all the stages involved in exogenous infection, the Committee is of opinion that conditions favouring it are present in the case of the long-service miners.

Cases of tuberculosis continue to be detected at the periodical examination of White miners, at the monthly weighings of Natives, and through the X-ray investigation of long-service boys, proving that there are carriers at large in the mines and compounds; while the spitting habit, so common among Natives, ensures the repeated contamination of working places, waiting places, rooms, etc.

Examination of random samples of sputum collected underground (see Appendix 6) showed one specimen positive for tubercle bacilli out of 33 examined, and the conditions met with underground—warmth, humidity and absence of sunlight—are eminently calculated to favour the survival of tubercle bacilli outside the body.

On the whole, then, the evidence available is definitely in favour of the conclusion that the chronic pulmonary tuberculosis of long-service Natives is due in the main to exogenous re-infection aided by the simultaneous inhalation of silica-dust and the resultant silicotic fibrosis. In fact, it is the silicotic fibrosis that plays a large part in raising the fibrous tissue barriers that localize the disease. At autopsy it is found that the long-service Native who does not present a silicosis usually generalizes his tuberculosis.

Taking first the presence of infected persons, the outstanding characteristic of the tuberculosis of long-service Natives is, as has been pointed out above, the possession of an increased tolerance of the disease, with the result that "open" lesions often co-exist with a considerable measure of good health. This situation could develop into a vicious circle in which the presence of carriers leads on to repeated infection of relatively resistant persons and the tolerance of these persons for tuberculosis infection leads to their becoming carriers in their turn.

That the danger involved through the existence of this pool of infected persons is fully appreciated is shown by the elaborate measures taken to detect cases of this kind by monthly weighings, radiological examination of old mine workers, and constant attention to the elimination of clinically tuberculous persons during the medical examination of recruits.

Everything possible seems to be done on these lines, and the good effects are already evident in a gradual fall in the morbidity and mortality rates from tuberculosis. But the mere fact that cases continue to be

detected at these periodical examinations constitutes, in itself, the best proof that final success has not yet been reached, and that the efforts towards early detection must be sustained.

Even on the assumption that exogenous infection is of little importance in the etiology of the phthisis of long-service Natives, there would, of course, be no justification for relaxing the measures in force for the detection of cases. Their recognition would still remain a matter of importance for their own sakes, for the sake of the White miners and for the sake of the general population with which they come in contact about the mines, the compounds, the Reef and their kraals.

Turning to the question of exposure to silica-dust, precautions against dust have received and are receiving so much attention as to make it unnecessary to do more than stress the importance of not relaxing the attention paid to this question.

[My observations upon the risk of accumulation of coal-dust in the lungs of silicotic miners in Wales lead me to regard with a certain amount of apprehension the recent suggestion of "stone-dusting" as a precaution against silica, especially in an industry in which many of the older and more experienced workers must be in a sub-silicotic state. Even the least harmful dusts may, perhaps, accumulate to a dangerous extent where the lymph-drainage of the lungs is impaired by silicotic fibrosis.

Efforts towards "dry" mining and better ventilation so ably advocated by Professor Haldane during his recent visit to the Rand should be the inspiration of those responsible for further developments in dust precautions at Johannesburg.

It has come as a surprise to me to see such a limited use made of dust-catching apparatus at the point of application of the drill. I am aware that this subject has received and is receiving close attention from experts and that what is possible in European mines may be difficult or impossible with Native miners in South Africa. But the impression remains that more might be accomplished in this direction.—S.L.C.]

CHAPTER VII.—DISCUSSION ON PROPHYLACTIC MEASURES NOW IN FORCE OR CAPABLE OF BEING APPLIED IN SOUTH AFRICA

(WITH COMMENTARY BY PROFESSOR LYLE CUMMINS).

NOTE :—The Introductory Note to Chapter VI applies to this Chapter also.

Before attempting to consider anti-tuberculosis measures in detail, it is well to be clear as to the following points, which follow upon the foregoing discussion in Chapter VI :—

- (a) A majority of the Native mine recruits, drawn, as they are, from endemic areas, arrive at the mines already invaded by the virus of tuberculosis.
- (b) There are certain factors connected with the mining industry which tend, especially in the case of those with latent tuberculosis, to change this into active disease. These “factors of aggravation” constitute a special danger to new boys, and underlie the “simple tuberculosis” of the earlier periods of work on the mines.
- (c) Prolonged periods of work in the mining industry, involving danger of exposure to further exogenous infections with tubercle bacilli accompanied by a cumulative risk from inhalation of silica-dust, are conditions which predispose to the more chronic forms of pulmonary tuberculosis and tuberculo-silicosis of long-service miners.
- (d) The repatriation of Natives infected with tuberculosis, while often exaggerated as a cause of infection in the kraals, does undoubtedly make a constantly repeated contribution to the endemicity of tuberculosis in the Native Territories.

Inasmuch as the endemic tuberculosis of the Territories constitutes a danger to the mines and the “tuberculosis production” in the mines involves a danger to the Native Territories, any comprehensive anti-tuberculosis policy must therefore include measures on the Witwatersrand and also measures in the Native Territories.

ANTI-TUBERCULOSIS MEASURES ON THE WITWATERSRAND.

General Measures of Hygiene.

If it be true that “there are certain factors connected with the mining industry which tend . . . to change latent tuberculosis into active disease,” these factors ought to be sought out and, if possible, neutralized or eliminated.

A perusal of the foregoing will show that, in the opinion of the Committee, many of the factors involved are of a general nature and not exclusively connected with tuberculosis. Their amelioration may

raise financial and administrative problems, the consideration of which is not within the province of this Committee, which is solely concerned with the hygienic aspects.

There is unanimity amongst the members of the Tuberculosis Research Committee that many of the compounds are unsatisfactory ; that the accommodation of 40 or more men in the same room for sleeping and eating, with about 200 cubic feet of air-space per person, involves risks of overcrowding and the distribution of air-borne infections ; and that the newer type of room for a much smaller number of men diminishes these risks. That a period of from 9 to 11 hours underground without a rest interval and without a meal is hygienically unsound ; and that there is a probable lack of vitaminized fats in the diet which ought to be made good in the interests of health.

The Committee is of the opinion, however, that the initiation of a comprehensive policy of better housing, shorter working hours and additions to the Native diets would involve expenditure which might prove impossible for some mines at the present time.

When it is recalled that there is normally a Native labour force of about 200,000 men constantly at work in the gold mines, that land is exceedingly expensive in the vicinity of large and growing centres of population, that many of the older mines are barely holding their own or are actually running at a loss and that, in the opinion of many experts, the next 50 years will see the end of profitable gold-mining on the Reef, it is not to be wondered at that the Committee hesitates to recommend measures which appear to be outside the range of practical politics. The situation is well summed up in the reply commonly made to the suggestion that milk, butter or animal fat be added to the Native diet—"Do you realize that the additional expenditure of 1d. per head per day to the diet of 200,000 men means £25,000 per month or £300,000 per year ?"

Add to all this the fact that the Native makes no complaint about his diet, which is admittedly more generous than what he can obtain at home ; that the average Native miner gains in weight during his contract ; and the hesitation to recommend a further financial burden, which may very likely prove unproductive from the point of view of the balance-sheet, is easy to understand.

Yet the industry pays something like a million pounds annually in compensation for silicosis and tuberculosis, to say nothing of the expense involved in the accommodation, treatment and repatriation of sufferers from diseases which, if not entirely preventable, are certainly capable of being diminished.

Without desiring to discuss financial questions which are outside the province of this Committee, and which may be the over-riding factor in the matter, we are of opinion that there is a strong case to be made out for the gradual, if not the immediate, provision of more up-to-date compound accommodation on some of the mines ;

for a close investigation into working hours and hours underground, with a view to their shortening; an enquiry into the possibility of improving the mine-rations in respect of animal fats; and into the question of the provision of food at a suitable period during the working-shift.

To bring about these essential improvements a co-ordinated effort guided by expert advice will be necessary. With this end in view the Committee recommends that the Transvaal Chamber of Mines set up a Health Advisory Committee, consisting of consulting engineers, mine managers, medical officers and a representative from the South African Institute for Medical Research and from the Witwatersrand Native Labour Association; the personnel of the Committee to be, if possible, so adjusted as to ensure representation of each mining group by at least one member.

[The medical services of the gold mines are, from the point of view of curative work, excellent. The visitor cannot fail to be struck with admiration for the Native mine hospitals, and it may be stated with confidence that, since the initiation of a whole-time medical personnel following upon a recommendation to this effect in the report of Mr. H. O. Buckle on "Native Grievances" (1913-14), there has been steady progress in the treatment of the injured and the sick.

Not only has there been progress in curative medicine but a body of competent medical men has grown up in the mining industry and now includes many who have gained invaluable experience in the problems of mine hygiene. It would be incorrect to say that these medical men are sanitary specialists in the strict sense of the term. Few of them possess the Diploma of Public Health and all of them regard medicine and surgery as their chief province rather than preventive medicine. But they do possess a special knowledge of mine and compound hygiene gained through every-day familiarity with the medical problems of the mines and, in this respect, they are of great potential value to the industry. But they do not regard themselves, and are not regarded, as sanitary officers.

Apart from the "Corner House Group" (Rand Mines, Ltd.), an organized group of mines with a centralized system of sanitation under the control of a medical superintendent, the compound managers, a body of gentlemen highly trained in the administration of Natives but without any special knowledge of hygiene, constitute the real sanitary officers of the gold mines on the Reef.

The mine medical officers are there to advise and help but, for the most part, are kept fully occupied with the surgical and medical work needed for a large Native population engaged in an industry which involves many risks and provides plenty of patients.

The compound managers do wonderfully well, on individual mines, and some of them are first-rate sanitary officers, but it is their duty to look at things from the economic rather than from the hygienic point of view; nor can they be expected, in the course of a life full of urgent business of a non-medical nature, to familiarize themselves with the complex questions of modern preventive medicine.

The result is that there are inequalities between the efficiency of hygiene in the different compounds, that some mines provide better-cooked and more suitable food than others, and that the policy as to the rooms, with regard to air-space, the use of numerous blankets and hangings, the opening of windows and the general cleanliness, is not constant but subject to much variation.

Apart from the highly developed sanitary organization of the Corner House Group, there is no centralized system of hygiene for the gold-mining industry at Johannesburg. The local authorities of the administrative areas in which the individual mines are situated are vested with an agreed measure of sanitary control and carry out the usual inspections, but these arrangements, while doubtless adequate in the interests of the non-mining inhabitants of the areas concerned, are not calculated to take the place of the sort of sanitary service which is available, for instance, in the Corner House Group.

At first sight, this want of any centralized service of hygiene comes as a surprise; but it is necessary to realize that the mining industry itself is not centralized, but consists of a large number of separate business concerns, the individual mining companies or groups of mining companies, each responsible for its own organization and development, each employing its own medical staff and managing its own affairs after its own fashion. The proximity of one mine to another, the identity of the climatic, geological and other problems along the Reef, and the existence of such bodies as the Chamber of Mines, the Native Recruiting Corporation and the Witwatersrand Native Labour Association, give a spurious impression of centralization, but are, in fact, merely the expression of certain common needs. The individual groups and mines are independent concerns and the industry hardly lends itself to any such centralization of sanitary services as is found convenient, for instance, in military formations.

This absence of unification in the general direction of the industry seems to preclude any centralization of executive sanitary control, except on the initiative of the industry as a whole. Health regulations issued by a central authority and involving, perhaps, the expenditure of considerable sums of money would not meet with any enthusiastic welcome from independent mining companies. And yet the problems of health

are similar throughout the Reef and the monetary loss to every mine and every group through the payment of "compensation" and through "loss of time" due to illness suffices to show how much might be gained by a co-ordinated effort towards improved hygiene.

This need has obviously been felt for some time and efforts have been made to meet it. In the Mine Medical Officers' Association there exists a body to which sanitary problems are often referred and which is capable of rendering considerable help.

While this Association serves a most valuable purpose in making the mine medical officers acquainted with each other, in affording opportunities for discussing common problems of professional work, and in fostering the team spirit, it does not, so far as I can see, provide the industry with an entirely adequate machine for the working out and direction of sanitary policy.

Amongst its members are many highly-trained physicians and surgeons, but their training and their interest lie chiefly in the direction of the daily work of the mine hospitals and the routine of the mine compounds. They have neither the time nor the special training needed for the seeking out of new knowledge by research and the furnishing of expert advice on complicated questions in preventive medicine.

Leaving out of consideration the Corner House Group, which has already faced the problem of sanitation on excellent lines, and as to which no further suggestions are necessary, it seems to me that there is an urgent need for greater organization in hygiene services throughout the industry.

So far as the executive control of hygiene in mines and compounds is concerned, this must be vested in the directors of the companies or groups concerned. No executive authority is worth much unless it is in the hands of a body that can punish or dismiss an official for failure to carry out an order.

Without entering into details, it is my opinion that much could be accomplished on individual mines by the formation of Executive Mine Hygiene Committees consisting of the mine manager as chairman and the mine doctor and compound manager as members. Such a committee, meeting once a month to discuss problems of health, might serve to tighten up sanitary measures very effectually, and such discussions, carried out in the presence of the mine manager, should be of great service to both the doctors and the compound managers, in affording opportunities for expressing their views and in getting action initiated. Much improvement in relation to diets, housing, hours and conditions

of work and the daily life of the Native personnel might thus be attained, especially if the groups to which the mines belonged had established similar Group Committees, to which the larger issues might be referred.

But it is quite clear that, for the elaboration of a general sanitary policy and for the collection of the new knowledge upon which a progressive policy must be based, some more scientifically constituted, more centrally placed and more authoritative organization is required. As to the exact type of organization I am not equipped to make any final recommendation. There are so many factors to take into account in the shape of existing machinery, financial difficulties, personal equations and so on that only those in close touch with the local situation can work out an effective scheme.

But the work of the Tuberculosis Research Committee during the last three years serves to illustrate how a suitably chosen body, including expert research workers, Government and Chamber of Mines representatives, members of the Miners' Phthisis Medical Bureau, the Witwatersrand Native Labour Association, the Transvaal Mine Medical Officers' Association and others, can work out set problems through special sub-committees, piece together individual reports, and sort out information in such a way as to bring it to bear on current problems.

It appears to me that, quite apart from the executive side of sanitation, which hardly admits of centralization outside of the groups of mining companies, there is an urgent need for the creation of some authoritative sanitary organization, dealing not merely with tuberculosis, but with all the problems of the hygiene of the gold-mining industry, and so constituted as to be able to initiate research, co-ordinate knowledge and advise both the Chamber of Mines, the mining groups and companies and the mine hygiene committees as to the lines along which executive action might be directed.—S.L.C.]

So much for general measures of hygiene. As to the more particular question of tuberculosis prophylaxis, it will be evident, from the foregoing remarks, that, in the opinion of the Committee, the main need is for a general raising of the standards of living and working conditions in the compounds and mines. There remain, however, certain specific suggestions which must be further discussed.

Prophylactic Inoculation.

At the commencement of the present enquiry, it was hoped that it might be possible to adopt the direct method of active immunization against tuberculosis which has proved successful against certain acute bacterial diseases, and it was thought possible that B.C.G. vaccine might be used to this end. The discovery, however, that a large majority

of the Native mine recruits arrive at Johannesburg already allergic, as proved by tuberculin tests, suffices to show that the employment of B.C.G. vaccine is not to be recommended. Neither Calmette nor Guerin advise the use of this vaccine in tuberculin-positive adults.

Although its use in mine recruits is contra-indicated, a large field of possible usefulness which should be explored is to be found in the children of urban and rural locations, where tuberculosis is rife. The suggestion has also been made that tuberculin, applied by inunction or otherwise introduced, might help towards raising the immunity.

No significant difference has been observed in tuberculosis incidence and mortality between the large numbers of Native recruits given tuberculin injections intra-dermally during the present enquiry as compared with the Native miners to whom no such injections were given, although special attention was directed to this point in the "follow-up" of the tuberculin-tested groups. There is some argument, therefore, against the efficacy of tuberculin in prophylaxis.

Not much is to be hoped, then, at the present time, from attempts at active immunization against tuberculosis in mine recruits in South Africa, but the question of how to induce tuberculo-immunity is being pursued in many laboratories both in Europe and America, and it may well be that an effective method may yet be discovered. The importance of the problem to South Africa and the special circumstances attending the use of Native labour in industrial developments afford both a stimulus towards research and the opportunity for carrying it out.

[To try out the effects of tuberculin upon the tuberculosis of previously infected animals (since the Native mine recruits have been shown to arrive infected from the kraals), I undertook two series of experiments in guinea-pigs; the attempt being made to raise their immunity to subsequent tuberculosis by injections of tuberculin, B.C.G., and "Bacillary Emulsion" after a previous artificial infection but before the onset of symptoms. No results of a kind to suggest any acquisition of immunity were obtained. In fact, the treated animals died, for the most part, sooner than the non-treated "controls." Subsequent experiments on rabbits, however, have given more encouraging results.

While these experiments suggest, so far as they go, that little is to be expected from tuberculin in the treatment of healthy but infected individuals, it is difficult to say how far these results in guinea-pigs are applicable in the case of man. It is clear that further work is necessary before any attempt at systematic immunization can be initiated.

It is exactly such a problem as this that best illustrates how urgently is needed some competent body of experts associated with the mining industry able and willing to press forward

investigations in this direction. The opportunity for experiments in the effects of preventive inoculation of selected groups of Natives in mines conveniently situated is unique. It is hoped that work on these lines may be pursued by some of the research workers in the South African Institute for Medical Research.—S.L.C.]

Deficiency of Vitamin A in Mine-rations.

While this question has been discussed under "General Measures of Hygiene," it may be regarded, also, as having a specific bearing upon tuberculosis.

Work on this subject has been carried out by Schutz and Zilva,⁸² Smith and Hendrick⁸³ and others; and there is much experimental evidence to show that rats and other animals fed on diets deficient in vitamin A become less resistant to tuberculosis than adequately-nourished "controls."

[This problem is receiving the close attention of Dr. Orenstein, whose enquiries are directed to the finding of some cheap and readily available source of the A vitamin which can be added to the Native diets.

Here again the necessity for research, as a preliminary to sanitary recommendation, is well illustrated; and it would, in my opinion, be well worth the expense to the industry to invite to Johannesburg an expert worker on the problems of food-deficiency, to pursue nutrition experiments on the spot, with special reference to tuberculosis, as was done when Miss Delf worked at the subject in relation to scurvy.—S.L.C.]

Silica-dust as an Adjuvant to Tuberculosis.

The association between exposure to dust of free silica and an excess tuberculosis-prevalence needs no emphasis at this time of day. In our own case, by the systematic use of water, the concentration of airborne dust has been reduced to such an extent that tuberculosis now constitutes the chief factor of destruction in what might otherwise remain a relatively benign fibrosis. The Committee is troubled by the suspicion that the measure of control of the silicosis factor secured by the free use of water may have been secured at the expense of some facilitation of the tuberculosis factor. Certain considerations may be mentioned here. In connexion with our tuberculosis it has been argued that inhalation infections and re-infections play a considerable part and the viability of the tubercle bacillus outside the body is much favoured by damp conditions. It has been shown that, under experimental conditions, the presence of water droplets in the air favour the passage of micro-organisms and other particles into the lungs by inhalation. As far as we are aware, in phthisis-producing industries that can avoid the use of water, tuberculosis does not play so important a part in miners' phthisis or stone-cutters' rot, as is the case with us. In certain grinding industries the change from "wet-control" of dust

to "dry-control" of dust has been associated with a fall both in silicosis and tuberculosis incidence. While "wet-control" of dust is incomparably preferable to no control of dust the Committee is strongly of the opinion that every effort should be made to reduce the amount of water used underground in so far as this may prove to be practicable without prejudicing in any way the conditions with regard to air-borne dust. Apart from tuberculosis, the association of high temperature with high humidity is undesirable in many respects. The solution of the problem lies with the engineers and not with the medical service.

At the South African meetings of the Empire Mining and Metallurgical Congress, the British Association for the Advancement of Science and the International Silicosis Conference, emphasis was laid on the urgent need for introducing into mining practice some means of controlling dust without the use of water.

[The problems of silicosis and tuberculosis are indissolubly linked together and it seems to me that, whether as a sub-committee of some larger organization or as a special committee for a definite end, there should be brought into existence a small group of physiologists, bacteriologists and physicists to work together at Johannesburg on this combined problem of tuberculosis and silicosis, with the object of discovering more efficient methods of protection against dust and the bacteria that are suspended with it in the air of the mines.—S.L.C.]

"Carriers."

There remains the problem of the undetected "carriers" of tubercle bacilli, chiefly to be found amongst the long-service Natives.

As a means towards the elimination of "carriers," the periodical examinations are of great value. These examinations, including special examinations of "long-service" Natives, have now been brought to a high degree of efficiency, as the result of this Committee's interim recommendation.

[It would seem that, in addition to the clinical and radiological examinations, an attempt ought to be made to obtain specimens of sputum from all "long-service" Natives when brought up for X-Ray examination. A sputum bottle might be handed to each with a request to provide a sample if possible. Doubtless many would fail to produce any phlegm, but some would succeed in doing so. Stress is laid on this point, as it has been observed that a positive sputum not uncommonly goes with an X-ray film which appears otherwise not inconsistent with health. The trouble might be considerable but the risk from undetected "carriers" is a real one and must be diminished by every possible means.—S.L.C.]

Acquisition of Resistance.

There is at least one hopeful aspect to a problem fraught with many difficulties. The South African Native is becoming more resistant under the combined forces of elimination of the highly-susceptible

and the gradual acquisition of an augmented immunity by the more resistant survivors under the spur of exposure to endemic infection. We see in the older mine Natives a definitely increased tolerance of tuberculous infection and the opinion of many medical practitioners in the Transkei and elsewhere is that the type of tuberculosis seen to-day is less acute and the number of cases smaller than formerly. Given time and opportunity, the problem will solve itself; but, judging by the slow progress of the American Negro population in this respect, the day is far distant that will see the African Native and the White equally resistant.

In the interval, the problem of tuberculosis must remain urgent in South Africa, both from the point of view of the value to industry of a healthy Native population, and because of the debt which civilization owes to the less sophisticated peoples whose native culture and amenities it often destroys.

ANTI-TUBERCULOSIS MEASURES IN THE NATIVE TERRITORIES.

It has been shown in the preceding pages that much of the tuberculosis which develops amongst the Native mine workers in the gold-mining industry is due in reality to the breaking down of tuberculous lesions contracted while in the Territories; and this must apply to other industries also. Nor is the danger of tuberculous infection imported from the Territories confined to the Natives. The recruiting of Native workers from the kraals, where tuberculosis is endemic, is, in especial degree, a menace to the White miner, whose simultaneous exposure to silica-dust makes the presence of an infected Native mine population a very serious risk; but it is a risk also to all Whites who employ Native nurses, houseboys and other classes of domestic labour.

In these circumstances, it might be expected that Government would be deeply concerned in supplying an efficient tuberculosis service in the Territories, by means of which "contacts" might be traced, advanced cases isolated, curable cases treated, and the extent of the tuberculosis problem carefully investigated and controlled by means of a sound system of vital statistics.

Instead, one finds that not merely is there no serious attempt at the collection of vital statistics, or the organization of a tuberculosis service, but that, apart from the appointment of a few district surgeons, the provision of a small hospital at Umtata, and the voluntary and highly commendable work of the medical missionaries, there is no medical service of any kind for the large Native population of the Territories.

When one contrasts the generous provision of hospitals and efficient whole-time medical staffs by the mining industry for its Native workers on the Rand with the almost complete absence of a public medical service of any kind for the Natives in the Transkei—and, indeed, throughout South Africa—one appreciates the fact that industrial concerns often set an example to governments in the care of their dependants.

[Governments do not invariably lag behind private corporations in this respect. During my recent visit to Portuguese East Africa, I was able to observe, with great pleasure, the growing point of what is likely to become an excellent medical service for the Native population ; a sanitary organization with numerous hospitals, a good scientific equipment, an adequate medical staff and a growing number of Native out-patient sections, in which trained Native medical orderlies carry out simple measures of medical assistance under the supervision of the European doctors of the Native districts.

In the Anglo-Egyptian Sudan, the Government had already made extensive provision for the medical treatment of the Natives within a few years of the re-conquest of the Sudan.

In the French African Colonies, as has been so well described by Sir Edward Thornton,⁸⁴ a very comprehensive scheme for a Native medical service, in which Native doctors, trained on a modified syllabus at a medical school at Dakar, work amongst their fellow-countrymen under general supervision by European medical officers, has been brought into being and is being rapidly extended to meet the needs of a large Native population.

And yet, in none of these colonies or dependencies is the Native population of more dominating importance to industry and agriculture than in the Union of South Africa.—S.L.C.]

It seems almost unnecessary to lay stress on the economic value of a working population which appears content to give honest service in return for the privilege of being allowed to "squat" on land that was once its own ; to labour underground for wages less than one-tenth of those earned by the White man for shorter hours ; and so docile and agreeable under trying conditions, with little hope of attaining anything but the lowest standard of prosperity and comfort, that thoughtless people are inclined to argue that it is unnecessary to "do any more" for Native welfare.

[To one who is merely a visitor to South Africa, the sight of such a dependent population, giving so much and obtaining so little in return, is calculated to arouse feelings much deeper than surprise.—S.L.C.]

Surely the health of these people ought to be one of the most urgent considerations for the Union Government and all the local authorities in South Africa, not merely on grounds of humanity, but as an economic problem of first-rate importance in which not merely the health but the financial interests of the dominant races are concerned.

Yet there is no organized medical service for the Native Territories and, at a moment of the world's history when medical science can do so much to ameliorate human suffering, the majority of the subjects of the Union Government have no hope of medical aid beyond what they may obtain from their own witch-doctors.

The "Report of the Committee to Inquire into the Training of Natives in Medicine and Public Health" (Pretoria, 1928) is eloquent as to the need for a better medical service for the Natives. It quotes the report of a previous committee as follows: "It cannot be denied that at present there are hordes of Natives in many centres who have little chance of medical treatment, and the untreated sick become a menace to the community," and adds "the evidence submitted to your Committee fully confirms this opinion."

"In spite of the activities of the district surgeon, it is no exaggeration to say that in most parts of the country the Natives have had to depend on their own medicine-man and herbalist except where they have been fortunate enough to be within reach of a missionary doctor. The complete inadequacy of the available resources has been demonstrated by the history of recent epidemics."

The urgency of the problem may be gathered from an article by Dr. R. H. Welsh⁸⁵ in which he describes the actual conditions with the intimate knowledge only to be gained in the course of a life devoted to medical work in the Transkei. "It is quite certain," he says, "that under present conditions, the great mass of the Native population, who are more and more appreciating the benefits to be derived from European methods of treatment, cannot get them."

Sir Edward Thornton (*l.c.*), writing with the knowledge of a high official in the Health Department of the Union Government, expresses the following opinion: "We must frankly admit that even in urban areas very little is being done for the Native either in preventive or curative medicine and that the need is great appears to admit of no argument."

While there are conflicting views as to the details of organization, all these authorities agree that there is an urgent need for a Government medical service for the Native population and that, in the work of this service, doctors, health visitors, midwives and nurses should play a leading part.

"The Committee on the Training of Natives in Medicine and Public Health" is of opinion that the Government Native medical service should be open to all fully-qualified registered medical practitioners, whether European or Native. It recognizes that Natives would probably be more acceptable to their own people.

[In connexion with tuberculosis work amongst the Natives, it is interesting to note this view, since it is so amply confirmed by the experience of those who are organizing the anti-tuberculosis campaign amongst the negro population of the United States. Dr. H. R. H. Landis⁸⁶, discussing this problem, writes as follows:—"In spite of the excellent results obtained by all the public health movements, there was one portion of the population that benefited but very little, namely, the Negroes. While hospitals and dispensaries were open to them, they availed

themselves very slightly, or not at all, of their aids. . . . For the first ten years of its existence the attendance of Negroes at the dispensary averaged about 100 per year, and this in spite of the fact that Negroes lived in the closest proximity to the Institute.

"In 1913 it was realized that something should be done. It was evident that the machinery we had in operation was ineffective. It occurred to us that where the White doctor and nurse had failed, the Negro doctor and nurse might succeed." The experiment of employing Negro nurses was tried and the report adds: "Dating from this time the Negro work gradually increased, at first slowly, but within a few years the increase in the number of Negro patients became one of the outstanding features of the work of the Institute."

"Preventive work among the Negroes," says Dr. Landis, "can best be carried out by Negro physicians. Indeed, we do not believe that it can be done effectively otherwise. . . . For a time the feeling was entertained that it would be possible, eventually, to turn the entire responsibility of the Negro Bureau over to the Negroes themselves. This idea has been abandoned. for the present, at least. The race is too inexperienced to walk entirely alone. They still need guidance."

This article, written by Dr. Landis in relation to a problem so similar to that of South Africa, is one which has lessons for those responsible for the health of the Natives in the Territories of the Union. It is to be hoped that, before long, the importance of a healthy Native population, so clearly realized by the Health Department of the Union Government and by all who have first-hand knowledge of the subject, will become sufficiently realized by the White population and their representatives that action in the matter may follow.—S.L.C.]

At the present time, the White population appears to be indifferent and the Natives themselves, in the absence of any adequate representation in the government of their country, are dumb on a subject of urgent importance to themselves and their White neighbours. "Such a condition of things," says the Report of the Committee on the Training of Natives in Medicine and Public Health, "is a double menace to South Africa. Firstly, there is the immediate danger of the spread of infection and contagious diseases from areas where they may be said to be practically endemic. Secondly, there is the economic danger of the deterioration and eventual failure of the labour supply." Tuberculosis is one—perhaps the chief one—of these endemic diseases, and it is not an infection which may be safely ignored.

[In the absence of any systematic attempt as yet by the Government to deal with the problem of tuberculosis or, indeed, of disease in general, amongst the Native populations from which

the mine boys are drawn, it would be well worth the while of the mining industry itself to initiate, in its own interests, a system of medical "follow-up" of the repatriated Natives and a continuance of the tuberculosis survey of the more important recruiting areas. Dr. Allan has already accomplished so much in the way of preparing the ground that it seems a thousand pities that the opportunity for its extension should be lost.

Much would depend on a wise selection, as experience both of tuberculosis and of the Transkei Natives is essential and success would depend largely upon popularity with the Native chiefs and headmen, the European doctors, missionaries, magistrates and the Natives themselves. Such a man might accomplish much but his work would be chiefly that of preparation.

A tuberculosis service, gradually developed under the direction of a skilled medical man with a first-rate knowledge of tuberculosis and a personality commanding popularity and respect, might, especially if it were made to include Native doctors and nurses, extend in ways most valuable to the mining industry and might ultimately become a part of the Government Medical Service for Natives which is so badly needed and which is certain to be conceded in the future.

It should be the duty of the medical officer selected for this appointment to continue the work initiated by Dr. Allan in the follow-up of repatriated tuberculous mine boys, to develop Native methods of "isolation" of advanced cases in the kraals, to help in starting a system for the treatment of suitable cases; at first through the missionary hospitals and other existing organizations and, later, in any special institutions that may become available; to initiate experiments in the anti-tuberculosis immunization of the infants of tuberculous parents by means of B.C.G. or in other ways; to aid in preventing the recruitment of persons likely to develop tuberculosis in the mines, and to advise the mining industry in all matters relating to tuberculosis in the Native Territories.—S.L.C.]

The Committee, in agreement with Professor Lyle Cummins' comment, recommends that the mining industry give serious consideration to the appointment, through the Native Recruiting Corporation, of a medical officer whose special duty it should be to tour the recruiting territories in the Union of South Africa and adjacent Protectorates for the primary purpose of following up cases of tuberculosis repatriated from the mines, and advise and assist in their care, with a special view to preventing the spread of infection.

The Committee considers that such a medical officer would also be of great value in conferring with the medical examiners of the N.R.C. on methods of preliminary medical examination, thus co-ordinating and standardizing these. He should also advise the N.R.C. on matters connected with the hygiene and transport of recruits and repatriates.

The Committee hopes that such a medical officer would receive the support and co-operation of the Union and local health authorities, and that in his selection special attention would be paid to his knowledge of tuberculosis and personal adaptability in dealing with Government representatives.

So much for the Native Territories, areas in which little or nothing is done for the health of the Natives in general and for tuberculosis in particular. In regard to these areas, the indifference of the White population, is, at least, to be understood because the problem is remote and its bearing upon their own interests somewhat obscure except after deliberate enquiry.

But it is strange, indeed, that the White population of the large cities should show so little interest in the lot of the Native communities in their midst. With the exception of Capetown, where an active and progressive policy in regard to tuberculosis has been initiated by the local authority and pushed forward energetically by the Medical Officer of Health and an influential body of persons interested in prevention and after-care work, the municipal arrangements for the diagnosis, treatment and prevention of tuberculosis in the Natives are primitive or non-existent throughout South Africa. Yet the Natives play a large part in the life of the European populations as domestic servants, messengers, shop-boys and in other similar capacities.

So far the splendid climate, the high standards of prosperity and of life in general and the absence of overcrowding, have combined to render the White population of South Africa in a measure secure from tuberculosis. This fact helps to explain the seeming indifference to the wide diffusion of this disease in the Native and Coloured populations of the city locations and townships, where the conditions of life are so different from those of the Whites and where overcrowding, dirt, the traffic in illicit alcoholic drinks, and the fatalistic despair of persons lost to their own tribal discipline and as yet merely disturbed by the ideals and discipline of Europeans, all contribute to enhance and spread disease.

It is possible that the critical reader, bearing in mind the opening sentences of Chapter VI, where reference is made to "the absence of reliable vital statistics," may question the statement just made as to the wide diffusion of tuberculosis in the Native and Coloured populations of urban areas. It is true that we have no reliable figures as to the tuberculosis of these Natives, but what we do know is positive; that is to say that, while we know nothing of the cases that escape record, we are on safe grounds about those that do come to notice.

The records as to deaths from tuberculosis amongst the Whites are probably more accurate than those of European cities and may be taken to include nearly all the cases that occur. The records for Natives and Coloured persons are no guide to the actual incidence and mortality, but it is significant that, as far as they go, they show that the known

mortality from tuberculosis is from three to six times as great amongst the Natives as amongst the Whites. Were the figures to include all the cases, the contrast would be still greater.

It must be freely admitted that the problem of how to provide for the medical needs of the Natives in large cities, where the burden of the rates falls almost entirely on the relatively small White population, is far from simple. Perhaps there may be a subconscious admission, amongst those responsible, that "where ignorance is bliss, 'tis folly to be wise." One thing is certain; that an efficient system of out-patient service and an adequate provision of beds for Native and Coloured persons suffering from tuberculosis would, as in the case of Capetown, lead to an apparent rise in the incidence and mortality from the disease; but with this would go the advantage that the extent of the problem was better appreciated and the power of grappling with it increased.

The need for "vital statistics" as a preliminary to a scientifically-organized anti-tuberculosis campaign, or, indeed, any organized effort for health, was stressed by the Tuberculosis Commission in 1914, and the same need is fully realized by the Health Department of the Union to-day. It is remarkable that, 16 years after the publication of a far-reaching report by a committee nominated by the Government and set to work, at considerable expense, for several years, to study tuberculosis and make recommendations as to its prevention, this cardinal necessity for progressive work on prevention of disease should still remain unprovided.

[An entry from my diary, under date 2nd October, 1929, makes interesting reading in this connexion: "To Pretoria and called at Census Office where the Director gave me much information as to the absence of statistics bearing on Native population." Nothing could have been kinder than the reception given me by Dr. Holloway during this visit. No trouble was too great to seek for information of the kind needed; but the information had never been collected nor could it be collected under the circumstances now existing. Dr. Welsh, already quoted by the Committee, estimates that there is one doctor to every 27,000 Natives in the Territories. It is not to be wondered at, then, that vital statistics are still to seek.

I have before me at the moment a document recently received from Canada, a "Survey of Registration of Births, Deaths and Marriages among the Indians of British Columbia, 1917 to 1928." This document, while it bears evidence of the difficulty of attaining to accuracy in relation to Native tribes, represents an honest attempt to get down to facts about increase and decrease of population, and about the main causes of death. Were it possible to have access to any similar collection of figures bearing upon the South African Natives, the work of the Tuberculosis Research

Committee would have been greatly simplified ; and the task of officials in directing a progressive policy of preventive medicine for the Natives would be rendered less difficult.—S.L.C.]

Nor is this ignorance as to essential facts confined to the tuberculosis of man. As to tuberculosis in cattle, for instance, nothing, or next to nothing, is known, nor is there any definite policy for the control of infection in herds. Here, again, the problem is not merely one of economics for the farmer but has a still more important aspect in its bearing upon the health of the community.

The tuberculosis of the Native is not only a "Native" problem. It is a problem which touches the health of the White community very nearly and it will do so to an increasing extent as populations increase and as the movement of Natives towards the towns and of Europeans into areas now dominantly "Native" gathers force and becomes more general.

Those who take the long view will agree that the sooner the length and breadth of the problem is made known through the collection of vital statistics, the better for the Union of South Africa.

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