

INDUSTRIAL MEDICINE IN THE WITWATERSRAND GOLD MINES.

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Industrial medicine includes the preservation and improvement of the health of the workers as well as the care of these workers during illness or injury, *i.e.*, prevention and cure.

Our mining industry employs some 300,000 natives as against 30,000 Europeans. It is only natural, therefore, that the activities of preventive medicine are mainly concerned with the native workers. Our health problems differ from those normally associated with public health activities. As Major Gordon pointed out in his address to the S.A. Health Congress (Feb., 1934), "the congregation of so many natives in close contact with the largest urban population in Southern Africa is perhaps unique in the world's history, and has necessitated the solving of problems which do not come within the purview of the ordinary health official. This aggregation of the native tribes, occupying a very limited area, in close contact one with the other, tends to facilitate the transmission of disease among them."

The population spends all its working time in the depth of the earth; this necessitates protection involving not only every phase of hygiene and sanitation associated with mining but also the hazards from disease, accident and atmospheric environment inherent in deep mining as carried out on the Rand.

The labour force is not stable. There is a labour turnover of nearly 97% per year. Most of this turnover consists of natives returning to the mines for re-engagement after an absence of one or more years. There is, however, a continual addition of raw recruits to the native labour force. Increased mining activity can only be accomplished by the employment of still more raw recruits. It is well known that the raw native is much more susceptible to disease than the old hands.

Therefore, although our medical statistics are computed as though the labour force were stable, this is actually far from being the case.

Our medical problems also differ considerably from those met with in other branches of medicine. Thus, owing to the preliminary medical examinations, chronic diseases are largely eliminated. On the other hand, underground work predisposes to medical conditions only found associated with mining.

The surgical side is also different. Over 90% of the surgical work consists of traumatotherapy, *i.e.*, the restoration of function to tissue damaged by accident. Our operations are all emergency operations, not carefully planned dissections, but repair of limb or body mutilated by accident.

The industrialisation of native races has always been attended by a tragically high loss of life. Deep mining, such as is carried out on the Rand is a hazardous occupation; nevertheless, the total mortality from accident and disease has been reduced from 36.2 per thousand in 1911, to 10.52 per thousand in 1935. This reduction is not accidental, but a progressive phenomenon. I propose to outline very briefly some of the preventive measures which have been introduced on the Rand for the welfare and safety of its Bantu workers and to which can be attributed this reduction in mortality.

The preventive measures are of two kinds—general and specific. The general measures consist of compound supervision, sanitation, feeding and hospitalization. The specific measures are those directed towards the prevention and control of specific diseases and accidents.

General Preventive Measures

The Native Labour Force

The native labourers employed on the Rand mines are obtained from areas within British South Africa (B.S.A. natives) and from Portuguese East Africa (East Coast or E.C. natives), south of latitude 22° South. More than half the labour force consists of B.S.A. natives, the remainder are E.C. natives. The proportion of B.S.A. natives to E.C. natives varies periodically but there are always more B.S.A. than E.C. natives employed.

The procedure of obtaining the personnel is accomplished chiefly by the two large native labour organisations of the industry:— the Native Recruiting Corporation, and the Witwatersrand Native Labour Association. The Native Recruiting Corporation confines its activities to British South Africa, while the Witwatersrand Native Labour Association devotes itself to Portuguese East Africa. The natives employed can be classified according to their form of engagement, namely, "Recruited" or "Non-recruited." About half of the natives employed are "Non-recruited." These natives proceed to the Rand voluntarily

and apply for employment at the respective mines. The remaining half of the natives are "Recruited." "Recruited" natives contract themselves for periods of service on the Rand through representatives of the Native Recruiting Corporation stationed in the territories. These natives are advanced the rail fare to Johannesburg, rations for the journey and, where desired, money is advanced to provide for the needs of their family.

E.C. natives are all "Recruited." The natives contract themselves for service through the representatives of the Witwatersrand Native Labour Association stationed in Portuguese East Africa. These natives are advanced the cost of transport, clothing outfit, etc., before proceeding to the Rand. There is a further group of natives termed "Locally Recruited" natives. This group consists chiefly of natives who have completed their period of contracted service on some mine and who transfer for employment to some other mine. They belong, therefore, really to the "Non-recruited" class.

The period of service contracted for depends on the form of engagement. "Recruited" natives, in most cases are engaged for a period of about one year. "Non-recruited" natives are engaged for a period mutually agreed upon by the native seeking employment and the mining authorities of the different mines. The average period is about three to four months, but occasionally they are engaged on a monthly basis. The great majority, on completion of their service, return to their home on a system of extended leave and later re-apply for employment through the appropriate channels.

Medical Examination of New Natives

All recruited natives are medically examined in the native territories from which they are recruited as to their fitness for work in the mines. Non-recruited natives are first examined by the medical officer attached to the mine at which the natives seek employment. These natives are then sent to the Witwatersrand Native Labour Distributing Depot in Johannesburg where they undergo a further medical examination. The recruited natives, on arrival in the Witwatersrand Native Labour Distributing Depot, are medically examined for a second time and then are sent on to the various mines where they are submitted to a third examination by the medical officer

attached to that mine, before commencing work. This system of successive medical examination ensures that every native employed for underground work undergoes at least two. In all cases, the medical examination consists of a stethoscopic as well as a general examination. When necessary, they are examined radiologically. Only after passing these medical examinations is the native classed as fit for underground work. Natives who fail to pass these examinations are usually employed for surface work except where open tuberculous lesions of the lungs are found present, or there is complete physical disability.

The Compound

(i) *Housing*—

The modern standard compound now consists of brick rooms, housing twenty natives. These rooms are well lighted and ventilated, equipped with closed-in, cast iron fire places which serve the double purpose of heating the room and grilling the meat ration, the greater portion of which is issued raw. The stoves also act as a further means of ventilation.

The sleeping accommodation consists of concrete bunks arranged in such a way that every native is provided with a plentiful supply of fresh air, and is reasonably protected against contact and air-borne infection. The bunks are non-inflammable and vermin-proof, are easily cleaned and disinfected, and are very lasting.

In the front portion of each room a substantial area is provided for the occupants to sit round the fire, consume their food, etc. The doors are of the "stable" pattern, in order that the top half may be left open for light and ventilation and the bottom half kept closed to prevent draughts. The clothing, boxes and other personal effects of the natives are stored on concrete shelves above the bunks, and the feeding utensils are kept on steel shelves.

(ii) *Feeding*—

The minimum ration prescribed by Government Regulation is a well-balanced one, providing both good energy values and a sufficiency of vitamins. Its calorific value is about 4,000. In respect of vitamins, the main purpose is to prevent scurvy, which was formerly a very prevalent disease. The importance of the other vitamins, however, is not lost sight of and the diet is continually altered or added to in conformity with the

latest research regarding this important aspect of feeding. The underground native, probably as a result of tribal custom, appears particularly averse to having a meal before proceeding to work. This results in the native having only one large meal a day, which is taken immediately after returning to the compound from his work. By continued perseverance and encouragement, a "breakfast" habit is being gradually instilled in the native mine workers' daily programme.

(iii) *Bathing and Clothes Washing*—

All compounds are provided with bathrooms, which are equipped with self-closing hot and cold shower baths. Concrete wash-basins for clothes washing are also provided. The natives take full advantage of these.

(iv) *Disinfection*—

Approximately once a month, every room is emptied of its contents, disinfected and lime washed. Whilst these operations are in progress, the clothing, bedding and effects of the occupants are placed in a disinfecting chamber and are exposed to live steam for at least half an hour, and then to dry heat for another half hour. These measures are particularly directed against the transmission of typhus fever and other insect-borne disease.

(v) *Refuse Storage and Disposal*—

All refuse from the native compounds is stored in stout wrought-iron or concrete refuse bins, which are practically rat-proof, rain-proof and fly-proof. They are usually suspended on trunnions to facilitate emptying with a minimum of labour and damage to the container. The bins are emptied and cleaned once daily and the refuse is usually destroyed by incineration.

It is hardly necessary to add that, wherever possible, the sewage disposal is water-borne.

Hospitalization

All medical attention and hospital treatment is provided free to mine native workers without any deduction from their salary. Government regulations make it compulsory to provide hospital beds for the native employees in the ratio of two and a half per cent of the average number of natives employed. The majority of mines each have a native hospital on the property controlled by full time medical officers. During the year 1935, over 78,000 cases of disease and over 90,000 cases of accident were dealt with as inpatients in the native mine hospitals of the Reef.

In the group of mines with which I am

associated, the Central Mining/Rand Mines Group, a central organisation exists for the supervision of all matters pertaining to health. Apart from its other functions, this central organisation administers the hospitals. The cost of running the hospitals of this group is approximately £125,000 per year. Three of these hospitals are "Central Hospitals," situated on centrally-located mines, each serving several mines. The remaining hospitals each serve one mine only.

Owing to the larger size and, consequently, proportionately lower overhead costs, a "Central Hospital" is able to provide a higher grade of equipment than is economically possible in other mine hospitals. They are staffed by certificated European sisters and serve as training schools for native nurses. Most of the nursing is, therefore, done by student native nurses under the supervision of the European sister in charge of the ward.

The scheme for training these native nurses is briefly as follows: suitable native girls from any part of South Africa, on production of evidence of having passed at least the sixth school standard and of a medical certificate of physical fitness, are admitted as native nurse probationers. If no vacancy is available at the moment, their names are entered on a waiting list and they are notified as soon as a vacancy occurs. The increasing popularity of a nursing career is shown by the increasing length of these waiting lists.

During the first year they are taught elementary nursing, anatomy and physiology. The lectures are given by the Sister Tutor and medical officers of the respective hospitals. At the end of the year they are given a written, oral and practical examination. The examinations are set in English. If successful in the examination, they pass on to the second year when they are taught elementary medicine, surgery and more advanced anatomy and physiology. A second examination takes place at the end of that year. The third year is devoted to more advanced study terminating with the final examination. The final examination is conducted by medical officers and matrons appointed as examiners by the Central Mining/Rand Mines Group. If successful, the candidates are given a certificate of competence. Since these hospitals are training schools, certificated native nurses are not kept on but are readily found employment elsewhere, particularly in smaller hospitals in

the native territories. Such appointments carry a salary of £5-£7 per month and all found. Some of the certificated nurses go on to Midwifery Training Hospitals and eventually take the ordinary European Midwife's Certificate.

Specific Preventive Measures

Infectious Diseases—

Owing to the supervision and control exercised over all matters pertaining to native mine workers, infectious diseases in most cases are rapidly and effectively dealt with and epidemics are, therefore, prevented. It is impossible, in this paper, to give a comprehensive survey of all the infectious diseases that occur amongst the native workers and the preventive measures adopted to eliminate them. I shall, however, tabulate a few of the more prevalent diseases and make a few remarks on their control.

Pneumonia—

For our purpose, pneumonia has been included in the infectious diseases. Pneumonia has received, and is still receiving, more attention than practically any other disease associated with the native workers. The reason is obvious. Pneumonia is the most prevalent of the serious diseases and accounts for the greater portion of deaths on the medical side (from medical as opposed to surgical causes). During the year 1935, 6,000 cases of pneumonia were treated in the native mine hospitals of the Rand.

Innumerable preventive measures have been tried. Amongst those still in force, are the rejection of new recruits with bronchitis or other chest complaints, better feeding and housing in the compounds, the free issue of a coat to every new native for protection against the extremes of temperature met with both on the surface and underground, and prophylactic pneumonia inoculation.

The raw native (*i.e.*, the native who has never worked underground before) is more susceptible to pneumonia than the old hands. Therefore, there is always a higher incidence of pneumonia during periods of increased mining activity. Pneumonia incidence is much higher during the first few months of service and then rapidly falls off as acclimatisation sets in. As usual, pneumonia is much more prevalent during the winter months than the summer months.

Pulmonary Tuberculosis—

Pulmonary tuberculosis is classified as an

industrial disease and is controlled in accordance with the Miners' Phthisis Act. It must not be forgotten, however, that pulmonary tuberculosis in natives is not only associated with mine workers. Many natives arriving on the mines from their territories, who have never been near the Rand, are found to be suffering from pulmonary tuberculosis. One must, therefore, assume that pulmonary tuberculosis is common in the raw native in his own territory.

The mine medical officers act as examiners under the Phthisis Act and, in this capacity, form the most important part of the mechanism introduced for the early detection of silicosis and tuberculosis in mine natives. An initial examination of all new natives and all natives prior to leaving the mine on completion of their contracted period of service is made. All natives are weighed once monthly and their weights recorded. Any native who shows a loss in weight of 5 lbs. or more, since his last weighing, or 6 lbs. or over on three consecutive weighings, is brought up before the medical officer for examination. The weighing is done by specially trained Europeans whose duty it is also to look out for any apparent ill-health in the natives being weighed and to bring such natives before the medical officer irrespective of weight.

All natives who have completed a total of 5 years of underground work are examined by the medical officer every three months. All medical examinations include stethoscopic examination, supplemented by radiological examination where thought advisable.

Any native found to be suffering from pulmonary tuberculosis or silicosis is immediately transferred to the W.N.L.A. Compound where medical officers of the Phthisis Bureau assess the amount of disability for purposes of compensation under the Phthisis Act.

Enteric Fever—

Sporadic cases of enteric fever occur all along the Rand with occasional small epidemics localised to individual compounds, particularly where water-borne sewerage has not been introduced.

Enteric fever is controlled in the first place by excluding carriers in those who are responsible for handling food. Before a native is allowed to work in the kitchen or any other place where food is handled, he is admitted to hospital for the usual examinations to exclude the possibility of his being a carrier. Food

handlers are further re-examined periodically for the same purpose. Prophylactic inoculation against enteric fever has proved itself of such great value in suppressing mild outbreaks that most mines today are inoculating all new natives on arrival at the mine.

Hookworm—

A few years ago, hookworm was rampant among mine workers. Today, it is one of the lesser problems. This has been accomplished by the free use of common salt in the latrines both on the surface and underground. The salt, of course, acts as a larvacide and, therefore, prevents infection. Any native found suffering from hookworm is treated until clear of infection.

Meningococcal Meningitis—

Meningococcal meningitis occurs sporadically all along the Rand. It is more common amongst raw recruits and, therefore more prevalent during periods of increased mining activity. Epidemics are usually attributed to overcrowding, and the absence of epidemics on the Rand is no doubt due to the suitable arrangements for housing in the compounds. No effective preventive measure has yet been discovered.

Other Infectious Diseases—

Natives are very susceptible to children's illnesses such as mumps, measles and chicken pox. These diseases, except for the discomfort they produce and the isolation necessary, are of no serious medical importance.

Typhus fever has little chance of flourishing owing to the routine disinfection of new natives and their belongings and also the routine disinfection of the compound rooms and live steam disinfection of the bedding, etc. Only 6 cases of typhus fever out of 300,000 natives occurred during the year 1935, in spite of the fact that typhus fever was prevalent in some of the territories from which our labour force is recruited.

Plague and rodent infestation go hand in hand. Rodents are effectively dealt with by the use of Cyanogas, Zyklon and Zelio paste, and large numbers are caught in traps. These measures together with the routine delousing, etc., have been successful in preventing the introduction of plague into the compounds.

Other infectious diseases which occasionally have to be dealt with include yaws and tropical ringworm. These, however, in spite of their contagiousness are easily controlled and

are of minor importance. Small-pox, of course, owing to the conscientious vaccination of all new natives is non-existent.

Prevention of accidents.

Avoidable accidents—

Government Mining Regulations have been framed with the purpose of preventing avoidable accidents, *i.e.*, accidents due to gross carelessness or negligence. Contravention of any of these regulations is dealt with by prosecution in accordance with the mining laws.

The Government Mining Inspector is notified of all cases of injury where, in the opinion of the mine medical officer, a permanent disability (partial as well as complete) is likely to ensue, or where the injury is likely to necessitate detention in hospital for 14 days or longer. On receipt of such a report the mining inspector investigates the cause of the accident in order to determine whether the accident has resulted from a contravention of any of the mining regulations.

Unavoidable accidents—

It is obvious that suitable protection of various parts of the body will minimise the severity, if not completely prevent, injuries caused by falling fragments of rock. The edges of these fragments are extremely sharp and even very small pieces may produce severe wounds.

Such injuries may be termed unavoidable accidents in the sense that no amount of supervision or care can prevent occasional fragments of rock being dislodged accidentally in an occupation such as mining. It is in order to minimise such accidents that hard hats, shin, knee and hand guards, and boots are provided to underground native workers.

Naturally, every native does not go underground equipped with all this paraphernalia. Knee guards, for example, are only issued to natives whose particular type of work makes them more susceptible to knee injuries. The form of protector issued to individual natives, therefore, differs with the particular type of work.

The difficulty is not so much the judicious distribution of the various forms of protector but rather ensuring that the native wears it during work, especially in hot mines where even light shin guards are decidedly uncomfortable. However, as a result of proper supervision the native today wears whatever

form of protection is provided with the result that the so-called unavoidable accidents have been greatly reduced.

Central organisation for the control of accidents

The Prevention of Accidents Committee of the Transvaal Chamber of Mines has been responsible for an enormous amount of good work in the cause of safer mining. This committee consists of representatives from the Rand Mutual Assurance Co., Government Mines Department, Mine Managers, Mine Medical Officers, Native Affairs Department and other technical advisers.

The function of this committee, apart from propaganda, is to collect data regarding accidents, to investigate the causes and to co-ordinate preventive measures. This committee is also responsible for originating and running the Inter-mine Safety Competitions. These competitions are designed to stimulate friendly rivalry between the various mines for the honour of being termed the safest mine. There is no doubt that these competitions have been very successful in this direction.

Native First Aid Workers

It is no exaggeration to say that the prompt first aid treatment given to the injured by native "Boss Boys" has been instrumental in saving many a life and limb of both European and native mine workers. One has only to watch a native first aid competition to realise how proficient native mine workers have become in the first aid treatment of injuries. Up to 5% or more of the native miners are holders of the Red Cross First Aid Certificate.

Before a native is granted the Certificate he must attend a practical course of instruction in the arrest of haemorrhage, treatment of fractures, artificial respiration, bandaging and transport. After completing the course, the native must pass an examination in practical first aid set by the mine medical officer.

Apart from the value of these natives from a first aid point of view it must not be forgotten that their instruction is combined with the teaching of accident prevention, thereby instilling into the native mind the great importance of "Safety First" in connection with his work.

Control of Injured Natives

Experience has shown that, in the case of natives, restoration to health and the prevention of sepsis following injury and consequent sequelae are accomplished more satisfactorily by detention in hospital. Accordingly all

natives who have sustained an injury of even comparatively trivial nature are detained in hospital. Further, every native coming off shift is examined by Native Police Boys before entering the compound in order to detect any injuries that have either been overlooked underground or that the native is trying to hide. Such natives are taken to hospital under escort and there detained. Ambulatory outpatient treatment is not encouraged.

Rescue Training Station.

This station is fully equipped on modern lines for the training of men in rescue work in cases of fire or gassing underground. Men from most of the gold mines and collieries are trained in the use of gas masks and oxygen breathing apparatus. These men exercise in specially built airtight chambers fitted out as underground working places and filled with poisonous gases or smoke.

The trained men are arranged into teams—"Proto" teams—and are available at all times to deal with cases of fire or gassing underground. In addition, experiments with new and improved apparatus are constantly carried out at this station.

Underground Atmospheric Environment

Leonard Hill was the first to show that the beneficial effects both to health and working efficiency derived from ventilation depend on the cooling power of the air as opposed to the old theory of carbon-dioxide content.

An atmosphere with low cooling power prevents dissipation of heat from the surface of the body and thereby produces the distressing effects and lack of vitality associated with bad ventilation.

On the Rand, unfortunately, we have in our mines, all the factors that go to make a low cooling power, *i.e.*, heat, humidity and lack of air movement. I shall not attempt to describe the various methods used for improving the underground environment except to mention that the mining industry today has installed and is maintaining every known means of underground ventilation.

However, even these measures are not always successful in preventing the overtaxing of human endurance with the consequent pathological reactions which frequently terminate in death. These pathological reactions (heat stroke, etc.) are intimately associated with the problem of acclimatisation. On most deep mines, therefore, a system of acclimatisa-

tion has been adopted. All new natives are given light work during their first week or two underground so as to become accustomed to the strenuous underground environment. Only after completing this period of acclimatisation is the new native allowed to undertake normal underground work. Experience, however has taught us that the period of acclimatisation required varies in different individuals. Accordingly on two of the hottest mines of the Rand a procedure has been evolved for testing all new natives in specially erected heat chambers to determine beforehand the period of acclimatisation required by individual natives. This testing process also protects new natives by stimulating their acclimatisation properties.

The subject of underground atmospheric environment is too large to attempt to give any more than the brief outline above. Suffice it to say that the practicability of deeper mining on the Rand depends on the control of underground atmospheric environment. We are already rapidly approaching the limit of deep mining under present conditions. The problem is, therefore, of extreme importance to the industry and is still awaiting satisfactory solution.

MEDICINE AMONG THE SOUTH EASTERN BANTU.

HILDA KUPER.

Arca and People—

The South Eastern Bantu are a group of tribes and nations which have certain linguistic and cultural affinities and which include among others, the Zulu, Xosa, Thonga, Fingo and Swazi. These people inhabit the Eastern Province and Native territories of the Cape, the province of Natal and Zululand, and the East Coast as far as the Sabi on the North, and inland to Southern Rhodesia. The principal features of their medical knowledge, the categories of practitioners in the medical fraternity, and the general philosophy of life, the "weltanschauung" which determines their scientific outlook, is sufficiently similar in all these peoples to allow them to be discussed together. It must be remembered, however, that there are local and tribal differences which, especially in practical work, cannot be ignored. The concrete illustrations of general principles, except where otherwise stated, are

drawn from my fieldwork as an anthropologist in Swaziland.

One of the aims in this paper is to stimulate medical research in problems with which the anthropologist without medical training is unable to deal. But in order for the European medical man to be of real assistance to the anthropologist, it is necessary that he does not approach his Native confreres, nor Native remedies, nor even Native ailments from the limited range of Western European medical standards. If he does, many things will appear ludicrous, and unworthy of investigation, things which, to the Native people, are intensely real, real enough to kill.

Native Theory—

The Natives have a theory of disease, of its cause, effect and method of treatment, which no European doctor, interested in Native welfare, can afford to ignore. But let us see from what principles they have arrived at their conclusions, how much is based on observation and experimentation and how much on magical beliefs and imagination.

The South Eastern Bantu have never made an anatomical study of a human corpse, but by careful observation of man and beast, and by the dissection of animals for food or medicines, the average Native, and the doctors in particular, have some conception of anatomy and physiology. Certain factors, however, differentiate the knowledge of the Native medical specialist, or *inyanga*, from that of his European colleague. His dissections, except for rare and nefarious purposes, are limited to the bodies of animals. Between men and animals, Natives recognise a difference in structure. Many Swazi say that every human being has a snake, *inyoka*, in his stomach, *sisu*, but this snake is absent in cattle. It is the snake which transforms the food which enters in through the mouth to the form which it takes as excreta. In cattle, 'the grass goes out as it came in,' and in chickens, one man carefully explained, there is a special sack of grit which serves as teeth to grind down the food, occasionally allowing whole mealies, beads, and other large objects to pass through. The snake in the human body grows with the development of the human being in whom it resides, but exactly how it first came into his body is not clear. Some say it is the nucleus of the child, and it is usually considered as the *impilo*, the life, which dies when the person himself dies.