Silicosis and tuberculosis among miners in South Africa during the 20th century

INTRODUCTION
This study traces the development of the current epidemics of silicosis and tuberculosis among South African miners by means of a series of stepping stones selected from the vast body of records and reports dealing with the country’s largest industry. The advent of a second epidemic of chronic communicable disease (HIV/AIDS) has complicated the situation among miners, and the population as a whole, enormously. Currently, the majority of the countries in sub-Saharan Africa, including South Africa, face a public health disaster of unprecedented proportions.

THE CORNISH CONNECTION
‘Wherever a hole is sunk in the ground to-day – no matter in what corner of the globe – you will be sure to find a Cornishman at the bottom of it, searching for metal’.  

The inquiry which produced the Report to the Secretary of State for the Home Department on the Health of Cornish Miners began work in October 1902. Its terms of reference were ‘To enquire into and report upon the health and conditions of the miners employed in Cornish mines in Cornwall, with special reference to the injurious effects alleged to be produced by the state of ventilation in the mines, the dust arising from the use of rock drills, and the introduction of impurities into working-places through the use of compressed air’. A previous commission had enquired into the conditions in ‘all mines other than coal’ in Great Britain forty years before. The findings of that report, based on the situation before the main migration of Cornishmen to the Witwatersrand following the discovery of gold in 1886, make it clear that some of the ‘kindred eyes’ who worked in Cornwall ‘lived on bread and water’ and were not exposed to dust.

In 1902, the Milner Commission, the first of many South African commissions of inquiry into health and safety in mines began work, prompted by concern about the mortality among skilled, often or perhaps mostly migrant, miners on the Witwatersrand. The fact that these inquiries began in the same year as a result of identical concerns may be no more than coincidence, but the fact that data was exchanged prior to the publication of either of the reports certainly is not. It is appropriate to begin by examining the external evidence of high levels of silica exposure on the Witwatersrand and the reason for Cornish interest in the findings of the Milner Commission.

Cornish mines produced tin and other metals from ore bodies set in hard rock at depths of between 2000 and 3000 feet. Development of shafts and roadways, and the winzes and raises connecting the horizontal roadways with one another, was done with drills driven by compressed air (referred to in the report as rock-drills). Ore was recovered from the stopes using hand-drills (to distinguish them from machine-drills). Dust levels were high: ‘The men working machine-drills, under present conditions, are greatly exposed to dust, as while the drill is at work, particularly on dry rock, a very large amount of fine dust is given off from holes bored horizontally or upwards … . In the case of holes bored in a downward direction no dust is produced, as the men pour in water in order to clear the holes and to keep the point of the drill from heating and so becoming blunt sooner than would otherwise be the case. Estimations of the amount of dust present in the air … showed that there is commonly as much as 0.5–0.6 milligrams of stone dust per litre of air [or 500 mg/m³] breathed by the men when boring a hole upwards’.

The influence on health of the various tasks in mines, and of work in mines abroad, was investigated in the Redruth District. This district included 4102 (68%) of the 6059 men employed in Cornish mines. Personal enquiries were made into the cause of death of miners who had died during the years 1900, 1901 and 1902, and into the work done by them since boyhood. The proportion of mortality from lung diseases was much higher among miners who had at any time worked machine-drills (133/142; 94%) and their average age at death much lower (37.2 years) than among miners who had never worked machine drills (120/179; 67%) who were much older at death (53 years). Comparisons with the statistics for all occupied males and for colliers or ironstone miners showed that ‘the death-rate among machinemen from respiratory diseases was about fifteen times and their total death-rate about eight times that for average

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occupied males in this country. Or to make another comparison, the death-rate among machinemen from respiratory diseases was about 30 times, and the total death-rate about 10 times as great as that among colliers or ironstone miners of the same age [emphasis as in the original]. A further comparison with the proportional mortality of all occupied males in England and Wales at comparable ages showed that 'the proportion of deaths from lung diseases among Cornish miners who had not worked rock-drills was about three times the normal, and the total death-rate about 1.8 times the normal, at the age in question' [original emphasis].

The influence of work abroad, i.e. outside Britain, was clearly defined. Cornish miners working on rock-drills had done so in the Transvaal, India, America, West Africa and Brazil. Where the length of service was known, seventeen men who had worked rock-drills in Cornwall only died of lung disease after an average of 8.4 years service, whereas 47 men who had worked only in the Transvaal died after an average of 4.7 years service. Of 142 rock-drillers who had died, 49 (35%) had worked in the Transvaal only and 41 (29%) in the Transvaal and elsewhere (Cornwall, India, America and Brazil). Of these 90 men 84 (93%) died of phthisis, two of other lung diseases and four of all other causes combined. The average age at death of the Transvaal only group was 36.3 years. ‘These figures … confirm the general opinion among miners that the conditions under which rock-drill work has hitherto been carried out have been far more detrimental to health in Transvaal than in Cornish mines’.

**PHthisis in the Transvaal**

The present state of vital statistics and their utilisation for public health purposes in Great Britain may be viewed as the great achievement of William Farr and his successors’.5

The work of a commission of inquiry in the new city, less than twenty years old, which had mushroomed in association with an immensely rich and extensive goldfield, was a very much more difficult undertaking than that of the commission which worked in Cornwall. Vital statistics in South Africa at the end of the 19th century and the beginning of the 20th were rudimentary. Viscount Milner, the Governor of the Transvaal and the High Commissioner for South Africa appointed the Commission to Enquire into and Report on the Disease commonly known as MINERS’ PHthisis in November 1902,6 less than six months after the end of the South African War, and it held its first meeting on 4 December. The terms of reference were to enquire into the extent to which Miners’ Phthisis prevails, to ascertain the cause of the disease, and to make recommendations as to the preventive and curative measures which should be adopted either by legislation or otherwise. The report is brief – 18 pages – but is published with a verbatim transcript of the evidence which gives a huge amount of first hand information and opinion.

In the absence of usable vital statistics, and faced (no doubt) with a variety of irreconcilable opinions, ‘it was decided to send forms to each mine manager of the Witwatersrand to be filled in by the medical officer attached to the mine, the latter being requested to medically examine the miners and to report upon the presence or otherwise of the disease in each individual case’. This produced a clear demonstration of what was to become the traditional South African response to attempts to deal with serious public health problems – the failure to respond. The report continues: ‘In pursuance of this resolution over 200 mines were circularized, and your Commissioners consider it a grave matter for regret that out of the 71 which might reasonably have been expected to comply with the request, completed returns from only 45 were received. Moreover, in the case of those mines which sent in returns, owing to the reluctance of the miners to submit to medical examination, the number of miners in these returns is far below the number actually employed’.

Twenty-seven percent of the 4403 miners working underground were medically examined (1210) and ‘of this number 187 or 15.4 per cent were certified by the examining doctors to be affected by the disease, while a further 88 [7.3%] were suspected cases’. Further analysis showed that 92% of the certified cases had been employed on rock drills, for 6.49 years on average, and that ‘a considerable section of the group have been exposed to risks of contracting silicosis in other countries where the work of rock drilling has been carried on under more or less similar conditions. Therefore, it is not only in the Transvaal that this disease prevails, for out of the 187 men referred to, it has been ascertained that 169 have been employed in this country for an average of 4.89 years, whereas 61 men have worked for an average of 4.76 years on rock drills in countries outside the Transvaal’. The longer average length of service of the Witwatersrand drillers examined in life, compared with those who had died in Cornwall, indicates that there is a survivor effect.

The findings in Cornwall from studying the mortality among miners, and the results of the examination of living miners in South Africa are in broad agreement that the disease was prevalent and acquired after short service by, in the main, rock drillers. The fact that rock drillers commonly worked in more than one country was clearly identified by both commissions. The South African commission reported that ‘On September 6th, 1902, a letter was published in the medical journals asking doctors in England to forward to the Medical Officer of Health, Transvaal, notes of cases of Miners’ Phthisis amongst those who had previously worked in this country. This letter was published for two reasons: first, because many statements had been made in the medical press that a large number of miners returning from Johannesburg were dying in England: and, secondly, because information on the subject would be useful when the Commission commenced enquiries’. The commission sitting in Cornwall was able to read the South African report before they
finished writing their own report. They wrote: ‘Since the above was written [the section of the report entitled Nature and Cause of Miners’ Phthisis] we have received the very important report by the Commissioners appointed to enquire into Miners’ Phthisis in the Transvaal. Their general conclusions with regard to the essential causes and the prevalence of miners’ phthisis agree closely with our own. Their evidence shows that among Transvaal miners the disease is very common, but practically confined to rock-drill men; and they conclude that dust inhalation is the cause. They quote in full a most valuable report by the

short service? The possible answers must include simple silicosis (unlikely), acute or accelerated silicosis, progressive massive fibrosis and the combination of silicosis and tuberculosis. It is important to bear in mind that the Milner Commission was concerned only with skilled (i.e. white) miners.

NEW HISTORICAL INFORMATION

In the Adler Museum of Medicine at the University of the Witwatersrand reports of 300 autopsies carried out at the Witwatersrand Native Labour Association (WNLA) Committee of the Transvaal Medical Society on Miners’ Phthisis. As this report is not very readily accessible, we reproduce from it the following specially important passages.’

‘By the end of 1904, as a result of enquiries in Cornwall and in the Transvaal, there was no doubt that the dust from rock drilling and other sources was damaging. The health effects, in terms of morbidity and mortality, had been investigated and shown to be serious, and the time relationship of rising mortality to the introduction of drills powered by compressed air was clear. There was also no doubt in the mind of Mr. Thomas Pryce Rosser, an overseer [shift boss] at the Wolhuter Deep Mine, that it was quite possible to allay all dust in a mine ‘simply by meeting it on the spot where it is created’.”

The position in respect of tuberculosis is less clear. Both reports appear to minimize the impact of tuberculosis and both fail to give it the prominence it deserves. The Milner Commission stated: ‘Medical evidence has not disclosed the existence of an appreciable amount of tuberculous disease among miners, and the emphatic statements that have been made dispose of any impressions that may have existed that miners frequently come to this country to restore health previously undermined by lung disease’. An important question is posed by this provocative statement: Of what were the drillers dying so young and after such
William Crawford Gorgas, the Surgeon-General of the United States Army and the Chief Sanitary Officer of the Isthmian Canal Commission, was invited by the Chamber of Mines to inspect the mines on the Witwatersrand and ‘to make investigation into the cause of the high death rate from pneumonia among the native labourers working in the mines of the Rand, and as a result of this investigation, recommend such measures as might appear necessary for the reduction of the death rates, and the improvement of the general sanitary conditions of the mines and compounds’. Gorgas was the man who made it possible to complete the Panama Canal. As an officer in the medical corps of the United States Army he was sent to Cuba where he was in charge of yellow fever cases. From 1898-1902 he served as the chief sanitary officer for the city of Havana. As a result of his campaign to control mosquitoes the number of deaths from yellow fever in the city fell from about 1300 in 1896 to less than 20 in 1901.

In 1904 he was sent as the chief sanitary officer to Panama where a second attempt to build the inter-ocean canal was threatened with failure. His views were at first ignored, but intervention by President Theodore Roosevelt led to his appointment as a member of the Panama Canal Commission. Vested with new authority he systematically eradicated the breeding places of mosquitoes and removed the threat of yellow fever and malaria. By the time he arrived in South Africa he had served as president of the American Medical Association, and may be considered to have been at the height of his powers as a public health practitioner. Naturally enough he makes frequent reference to his experience in Panama.

Large numbers of workers were recruited from the Caribbean Islands, housed in barracks or compounds and put to work digging a waterway through country in which yellow fever and malaria were endemic. The result was a disaster, and there can be no doubt that Gorgas recognized a parallel situation on the Witwatersrand.

Of the compounds he writes: ‘In general the care of the compound yards showed everywhere neatness, cleanliness and commendable care and discipline. But when we came to examine the interior of the native living quarters the very opposite was the case. Food was always present in dirty and unkept vessels in considerable quantities, old clothing and wearing apparel of all kinds, soiled and dirty, littering up everything, and litter of all kinds was stowed away under the sleeping platforms’. He had earlier estimated that for each man there was 200 cubic feet of air space and about 14 [square] feet of floor space. His recommendation was 50 square feet per man, an increase by a factor of 3.6. Of the food provided he says ‘I have never seen so large a proportion of the ration supplied by one article as is here supplied by mealie [maize] meal’.

His comments about tuberculosis make for compelling reading. ‘The report for the year 1912 shows that the total [death] rate for all native miners was 5.65 per thousand for pulmonary tuberculosis. The rate in Panama for the same year was less than 1 per 1000. The rate for London was 1.03 for 1911, and the rate for New York 1.67.

During the year 1912 1168 cases of tuberculosis in all its forms were repatriated by the Witwatersrand Native Labour Association [emphasis added]. It is not a high estimate to say that half of these (584) died during this year. During this same year 33 cases of tuberculosis died in the WNLA compound.

Judging from the findings of autopsies, witnessed by Dr Darling, I am of the opinion that a considerable number of cases of deaths, reported as pneumonia, are really tuberculosis. This, under the circumstances, is an unavoidable clinical error. The actual number of tuberculous deaths for the year 1912 among your 156 534 natives is probably: 885 reported, 584 deported, 33 in Compound, 200 error in diagnosis; total 1702. This gives a death rate of 10.87 ... Considerably higher than the 5.65 for 1912 and 4.80 for 1913 shown by the Chamber of Mines reports.

‘I am inclined to think that for the future, present conditions continuing, tuberculosis will cause you more trouble among natives than does pneumonia at present’ [emphasis added].

Assuming that his calculations were approximately correct, the death rate from tuberculosis was twice what the published figures suggested. The major reason for the underestimate by the Chamber of Mines was the failure to recognize by the Chamber of Mines was the failure to recognize
to include ‘deported cases’. Gorgas thus identifies the critical influence of the migrant labour system on health statistics and on the spread of communicable disease in southern Africa.

He echoes Tom Pryce Rosser’s statement in evidence to the Milner Commission in his comment on miners’ phthisis. “The hygiene of this disease is obvious, that of laying the dust ….. I advise that such measures be generally and carefully enforced and extended. I believe they will soon reduce miners’ phthisis to a minimum. At the present time on the Rand most cases of miners’ phthisis die from an incidental tuberculosis implanted upon a silicised lung, rather than from silicosis itself” [emphasis added].

The recommendations begin by setting out, at some length, a system for ‘sanitary work’ on the mines controlled by a chief sanitary officer, responsible to the Chamber of Mines and ‘entirely independent of the management of individual mines’. It is probably sensible to translate the use of the words sanitary and sanitation as public health.

The conclusion of the report is quoted in its entirety below:

‘Of these sanitary recommendations I consider that of increasing the floor space to about 50 [square] feet the most important and pressing, and by far the best way of doing this to be the village hut system and the introduction of families.

‘If this particular method cannot be carried out, to come as near it as feasible.

‘The second in importance I consider to be the improvement in the hospital system and the care of the sick native. This can be best carried out by a central hospital. If a central hospital is not feasible, by such concentration of hospitals as is possible.

‘The third in importance is the establishment of a central Sanitary Bureau or Department under the Chamber of Mines — the head of this department to represent the mines on all sanitary questions.

‘The revision of the present regulations regarding matters of sanitation so that the sanitation of the mines might be accomplished by the authority of one official,

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**SO FAR, SO BAD?**

During the opening years of the 20th century, in an interlude between the South African [Boer] War and World War I, two commissions of inquiry and an inspection by one of the world’s foremost practitioners of international public health – the other was Sir Ronald Ross – had described in detail two serious public health problems – one was dust and the other was pulmonary tuberculosis. In each case the conclusions were supported by relevant vital statistics and/or research findings. The collation of new documents will provide estimates of prevalence for the labourers, thus filling the gap left by the commissions which confined their work to skilled miners. That Gorgas’s advice was largely ignored is common cause, but detailed study is required to establish to what extent selected portions of his advice were implemented, and the possible reasons why his major recommendations were ignored by the mining industry at the time, and also by his protégé, Orenstein, and the company which employed him, Rand Mines, for the following 50 or more years.

From here on the epidemic follows exactly the course one might expect. The literature dealing with mines and mining is vast – but there are a series of studies which enable the story to be brought to a conclusion quite quickly.

**‘THE SUBSEQUENT HISTORY OF REPARTRIATED BOYS’**

The Medical Committee on Tuberculosis was formed by the Chamber of Mines and the South African Institute for Medical Research in May 1925. In 1926 its name was changed to the Tuberculosis Research Committee. The reason given for the change of name is revealing: ‘The problem with which it was confronted could not be adequately investigated as a purely local one, confined merely to the mine labourers temporarily employed upon the Witwatersrand. This labour force is recruited from many regions of Africa …’. The historical reach of the migrant labour system included all the countries south of a line along the northern border of Angola, the western border of Zambia and the western and northern borders of Tanzania. The committee decided that it was ‘essential to obtain information, by means of a field survey, regarding tuberculosis as it exists in these permanent home areas of the various tribes concerned,’ and went on to state ‘[V]ital statistics concerning the Native populations of South Africa are non-existent, and at the time of this enquiry the extent of their tuberculization was unknown, the detailed pathology and type or types of the disease had not been closely scrutinized, whilst the relative part played by human and bovine tubercle was merely a matter of speculative opinion.’

Dr Peter Allan, the Superintendent of the Government Tuberculosis Sanatorium at Nelspoort, was appointed Field Research Officer. He had previously published a report of a tuberculosis survey of South Africa in 1924. It will be interesting to find out what this report showed. Allan was responsible for writing Chapter V of the report, entitled *Tuberculosis Survey of the Native Territories*, though there is a sense that his text was extensively edited. Chapter VI entitled *Inferences drawn from the foregoing chapters in regard to tuberculosis in the South African Natives*, contains interpolated comments by Col S. Lyle Cummins, at that time the David Davies Professor of Tuberculosis at the Welsh National School of Medicine, Cardiff.

Allan recorded that in 1927 there were 141 903 general tax-payers (i.e. adult males) in the Umtata area, of whom 39 572 (28%) got passes to work on the gold mines during that year. Tuberculin test results based on 6508 tests showed that more than two-thirds of males and females were tuberculin positive. The tests ‘were performed by the intra-dermal method, using one-tenth of 1 c.c. of 1/50 000 of Koch’s “old tuberculin”.’ In many areas more than 90% of men over twenty years of age were tuberculin positive. On average women were as likely to be tuberculin positive as men, and among children the positivity rate was frequently close to 50%. There can be no doubt that by 1930 tuberculosis infection was widespread in the Transkei.

Gorgas, in drawing a distinction between reported and exported cases of tuberculosis among the mine labourers, estimated that half of those repatriated to the labour-sending areas would die within twelve months. Six-hundred-and-ninety-four labourers with tuberculosis were repatriated to the Transkei in the four years 1926–29. Dr Allan was supplied with lists of the repatriated men, and in 1928 and 1929 traced and recorded the vital status of 475 (68%). The follow-up period was four years for those repatriated in the first year and six months for those reported in 1929. Of those repatriated in 1926, 58% had died within three years, of those repatriated in 1927 61% died within two years, of those repatriated in 1928, 45% had died within one year. Of those repatriated in 1929, 35% were dead within six months and a further six within twelve months. Overall 40% (189) of the 475 individuals died within one year. Of the 207 men repatriated in 1926 and 1927 who were traced 120 (58%) were dead within two years. Summarising the outcome of the study of ‘repatriated boys’ at the end of two years, (in round figures) 60% had died, 10% were alive but unfit for any work, 26% were alive and fit for light work at home and 4% were fit to return to heavy work.

Chapter VI includes the following attempt to compare the situation among labourers in the Witwatersrand mines with that of the ‘male population of England and Wales’. ‘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'.

**Tuberculosis in the mining industry in the 1960s**

Dr J.G.D. Laing reported the results of a study entitled *An Investigation into Tuberculosis in the Mining Industry* in 1967. The study population was drawn from three selected mines and was confined to African (black) employees. The first of the conclusions drawn from the results of the study echoes the opinion expressed by Gorgas more than fifty years earlier. 'There is a higher incidence of Tuberculosis in the Mining Industry than was generally accepted'. The average incidence among all employees was 10.9 per 1000 per annum; among workers over 35 years of age 31.1; among surface workers over 35 years of age 65.6. For purposes of comparison the equivalent rates for the three countries at the top of the world rankings in 1970–73, Macau (a free port in southern China), Swaziland and Bolivia, were 4.7, 4.7 and 4.1. The rate for the whole population of South Africa was 2.4, at that time ninth on the world rankings.

The results of tuberculin tests carried out on new workers showed that among those from the Transkei, the area in which Dr Peter Allan traced the fate of ‘deported miners with tuberculosis’ more than thirty years earlier, only 1.4% were tuberculin negative; that is, had not previously met the tuberculosis germ. The second conclusion reads: ‘There is a significant percentage of susceptibles entering the Industry, a number of whom are being infected’. On the mine on which no infectious case of tuberculosis was found among new recruits by examination of the sputum, over 30% of tuberculin negative workers became positive within twelve months.

The third conclusion, therefore, comes as no surprise: ‘There is an undetected infector pool of Tuberculosis among the African employees’. It is self-evident that continued production of new cases despite control measures implies ongoing infection on the mine, as the tuberculin conversion rate quoted above shows.

The fourth conclusion reads: ‘The physical environment is not a significant cause of transmission of the disease’. Gorgas made a clear statement, that tuberculosis was frequently superimposed on silicised lung, and that this was the common reason for death. It would be rash to assume that this implies that he knew that the risk of tuberculosis was increased not only by the development of lung fibrosis (silicosis) as a result of quartz dust exposure, but also by simple exposure to quartz dust. The association between dusty trades and a raised incidence of tuberculosis had been recognized for many decades – it is odd that in the course of the report the word dust does not occur. It is now well-known that quartz dust exposure confers a lifelong risk of increased susceptibility to tuberculosis.

The fifth conclusion arises from the analysis of the
degree of the tuberculin reaction and the relative incidence of new cases among those with weakly positive or strongly positive reactions. The conclusion as written is self-evident: ‘Certain groups of African employees with a high risk of Tuberculosis exist in the complements of the mines’.

These conclusions are followed by a list of ‘several major factors which [are considered] to have given rise to the present situation’. Defects in the X-ray screening system, the lack of specific protection for susceptible individuals against infection and the misinterpretation by the mine medical officers of the function of the Miners’ Certification Committee are listed.

The situation described in this report conforms precisely to the situation which the Leon Commission accepted after hearing the evidence presented by experts appearing on behalf of the National Union of Mineworkers in 1994.10

**OCCUPATIONAL LUNG DISEASE IN THE LABOUR-SENDING AREAS**

In the latter half of the 1980s nothing was known about the prevalence of occupational lung disease in the labour-sending areas. The traditional labour-sending areas within South Africa’s borders had been transformed into independent states/homelands. Tuberculosis incidence figures were still included with South Africa’s statistics, but serious contradictions were apparent in the calculated annual incidence of newly diagnosed cases in provinces/independent states/homelands within the same geographical region.6 For example, in the three regions of the Cape Province the incidence per 100 000 per annum was: Eastern Cape 448,0; Western Cape 638,6; Northern Cape 304,2. In the two independent states formerly parts of the Cape Province the figures were: Ciskei 263,0; Transkei 10,4. Two of the four independent states (TBVC countries), Transkei and Bophutatswana, had rates lower than those for white, American-born citizens of the USA.

The (Leon) Commission of Inquiry into Safety and Health in the Mining Industry10 reported its findings in 1995. Inter alia the Commission put on record that:

1. In South Africa no discussion of occupational disease was complete without taking into account the link between the migrant labour system and the long lag period between exposure and disease manifestation.

2. Evidence submitted to the Commission demonstrated clearly the failure to collect and use data effectively.

3. No evidence had been submitted to suggest that occupational diseases had been adequately controlled by the industry as a result of the existing regulatory system.

4. Beadle, on the basis of dust measurements made between 1956 and 1960, had concluded that there was little evidence of a decline in dust levels between 1938 and 1969. Du Toit and King both reviewed and attempted to extend Beadle’s work, and led the Commission to conclude that dust levels had remained roughly the same over a period of about fifty years.

Botswana has been a source of migrant labour for the greater part of the 20th century and in 1992 there were 13 000–15 000 Botswana citizens working in South African mines. Steen and his colleagues11 carried out a house to house survey of the village of Thamaga to identify all former miners. From the 1008 retired or former miners thus identified 220 were chosen at random (of whom 101 attended) and a further 203 offered places on a first come first served basis. In total 304 former miners were examined of whom 234 had worked underground on gold mines. Four new infective (sputum positive) cases of tuberculosis were found. This gives a point prevalence of 13,2 per 1000, which probably reflects an annual incidence of new cases higher than this – say 15–20 per thousand or 1500–2000 per 100 000 per annum, a rate between seven and ten times the rate for the population of RSA in 1990. Twenty-one percent stated that they had been treated for tuberculosis once, and 6% twice.

The prevalence of pneumoconiosis (greater than or equal to 1/0 on the ILO scale of profusion) was 26,6–31%, and 6,8% had progressive massive fibrosis.

Within South Africa, the areas of the Eastern Cape Province formerly known as the Ciskei and Transkei have been prominent labour-sending areas for more than a hundred years. The Libode Village, the administrative centre of the Libode District, is 25 kilometres northeast of Umtata. The local office of The Employment Bureau of Africa (TEBA) provided complete records of recruitment to the mines from 1969–1980, and from these records of 11 706 men a random sample of 800 men was drawn. Of the 800 men in the original sample, 446 (56%) were found to have died and 116 (15%) were still involved in migrant work and were not available for examination. The remaining 238 (30%) were available for examination.

Trapido12 studied this sample of former miners and her findings are concordant with those of the Thamaga study. The radiological prevalence of tuberculosis was 33%. The radiological prevalence of pneumoconiosis (greater than or equal to 1/0) was 26%.

**CONTEMPORARY PREVALENCE DATA AMONG WORKING MINERS**

South African statute requires any doctor who knows, or has reason to believe, that a deceased person has worked on or in a mine to arrange for the heart and lungs to be removed and sent to the Medical Bureau for Occupational Diseases subject to the agreement of the next of kin. The agency which performs the examinations now holds a computerised database containing close to one hundred thousand records. ‘A bias operates in this autopsy series due to the fact that black men are infrequently [emphasis added] autopsied after leaving employment in the mines, whereas the majority of whites come to autopsy after retirement. The autopsy rate for white miners and ex-miners is around 85%. The referral rate for black men who die while in employment is also around 85%’. The availability of an autopsy diagnosis on the vast majority of men dying in service can be assumed...
to be a close reflection of the prevalence of disease among the workforce as a whole.13

In 1997 the data from 3208 autopsies showed a prevalence of silicosis of 18.8% of black (n = 329) and 17.6% of white (n = 118) gold miners. The gold mines were responsible for 93% of the cases of silicosis in this series. The prevalence of active pulmonary tuberculosis in black gold miners was 14.5%. Five years earlier the comparable figure was 7% and in 2004 was 34.1%. Among white gold miners the prevalence in 1997 was 1.6% and in 2004 was 4.2%. Among black mine workers as a whole the prevalence of active tuberculosis at autopsy has risen over the past 25 years from about 50 per thousand in 1979 to 322 per thousand in 2004.

The earliest estimate of the prevalence of silicosis among black miners at work was published by Cowie and van Schalkwyk in 1987.14 Using two methods of calculation they arrived at prevalence figures of about 0.87 – 1.38%, based on data collected in 1984. At the time the authors suggested that this was ‘certainly less than the true prevalence of the disorder’. Corbett et al.15 compared the changes on stored (mini) radiographs with the autopsy findings in 214 miners who had died between January 1996 and July 1997 while at work on gold mines in the Free State Province. Thirty-five percent had died from trauma and 17% from tuberculosis. Forty-four percent were known to have been HIV positive prior to death, including 73% of those who died of tuberculosis. The prevalence of pneumoconiosis (1/1 or greater) was found to be 13.7% from a study of available radiographs, and the prevalence at autopsy (more than five palpable nodules) 14.5%. These figures show close agreement between the radiological changes and the autopsy findings, in contrast to the claims made over many years by those who accept the conventional wisdom uncritically. Cowie and van Schalkwyk’s estimate was more than an order of magnitude too low. Between November 2000 and March 2001 a sequential study of 520 miners was recruited from a gold mine in the North West Province of South Africa.16 The radiological prevalence of silicosis (ILO category ≥ 1/1) among older miners (mean age 46.7 years; average exposure 21.8 years) was almost 20% (Reader 1: 18.3%; Reader 2: 19.9%).

CONCLUSIONS

Two inquiries many thousands of miles apart using different data sets concluded that exposure of drillers to the dust of South African gold mines was particularly damaging. William Gorgas drew the distinction between reporting and deporting cases of tuberculosis. He made some commonsense calculations and doubled the official tuberculosis death rate, and went on to predict that tuberculosis, often superimposed on ‘silicised’ lungs would cause more trouble than mine dust. Studies of repatriated ‘mine boys’ in the 1920s, of new recruits in the 1960s, and of retired miners in the labour sending areas in the 1990s all demonstrate the relentless progress of occupational lung disease among the migrant labourers working in or on the mines. Studies done on the autopsy data collected by the National Institute for Occupational Health show a very serious situation reflecting the synergy between HIV and tuberculosis and dust.

REFERENCES

13. Murray J, et al. Professor Jill Murray is the first author of a series of reports which collate the annual data sets from the PATHAUTILITY at the National Centre for Occupational Health, now the National Institute for Occupational Health, a part of the National Health Laboratory Service. Reports covering the years 1997-2004 give a detailed breakdown of autopsy findings by mineral type and ethnic origin.