AN AUTOPSY SURVEY OF BANTU SOUTH AFRICAN COAL-MINERS

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An autopsy survey of 1,010 Bantu South African coal-miners has been carried out in order to ascertain the commonest causes of death and the incidence of cardiorespiratory tuberculosis and of coal-workers' pneumoconiosis. These are consecutive autopsy cases. By law, all miners who die from any cause whatsoever, while still employed by the mines immediately before death, must be autopsied, but few autopsies are performed on repatriated miners who die in their homes. For this reason a serious bias has taken place and this limits the possibility of generalizing from this paper. The commonest cause of death was multiple injuries. Primary carcinoma of the liver was the commonest malignancy and the incidence of bronchogenic carcinoma was low. These are the usual findings in the Bantu. Active tuberculosis of the respiratory organs was found in 12% of cases. Coal-workers' pneumoconiosis was present in 26.8%, and 94% of these cases were of the simple type. There were only 17 cases of progressive massive fibrosis, and this is due to the fact that few autopsies were carried out on such cases. Active tuberculosis of the respiratory organs was present in 21% of cases with simple coal-workers' pneumoconiosis. The commonest cardiac lesion was chronic non-specific adhesive pericarditis. Myocardial infarction was absent in this series but this is not unusual as infarction of the heart is rare in the Bantu.

The South African coal-mining industry employs a considerable number of Bantu labourers; 56,400 were employed in 1959. Forty per cent were recruited from Portuguese East Africa and the remainder from the Republic of South Africa and the adjacent territories of Basutoland, Bechuanaland, and Swaziland (Frazer, 1961). These recruits undergo medical and radiological examinations before being employed to exclude all but the physically fit. Employed in various capacities underground and on the surface, these workers serve for varying lengths of time. Little accurate information is available about the autopsy incidence and pattern of disease in this group of miners. To fill this gap the following autopsy survey was carried out. Particular attention has been paid to the incidence of coal-workers' pneumoconiosis and to tuberculosis of the cardiorespiratory organs.

Material Studied

This consisted of 1,010 autopsies on Bantu coal-workers performed during the period January, 1958, to June, 1961. By law, all miners who die from any cause whatsoever when still employed by the mines must undergo an autopsy.

This survey therefore includes all such cases and in addition a few miners who died in their homes following repatriation and where autopsy was specifically requested by the relatives. This introduces an unavoidable error of case selection. The majority of the autopsies were performed by various mine medical officers and district surgeons, and a few by the trained pathologists of the Pneumoconiosis Research Unit. This introduces an unavoidable variation in the standard performance of the general autopsy and the certified cause of death. However, the person performing the autopsy has, by law, to submit the cardiorespiratory organs, together with details of age, service record, and autopsy findings, to the Miners' Medical Bureau where macroscopic and microscopic examinations are performed by the trained pathologists of the Pneumoconiosis Research Unit. Such examinations are detailed and standardized, and were not subject to any variation during the period of this survey.

Results of the Survey

Age Incidence.—The ages of labourers are certified by the mine which employs the individual and are obtained during life by skilled interrogators in the worker's own language. They can be regarded as

reasonably accurate. The age incidence of these autopsy cases is shown in Table 1.

TABLE 1
AGE INCIDENCE OF 1,010 BANTU COAL-WORKERS

Age (years)	Number of Cases
16—19	32
20—	95
25—	81
30—	107
35—	107
40—	121
45—	130
50—	117
55—	65
60—	50
65—	22
70+	13
Unknown	70
Total	1,010

From Table 1 it is noted that 518 out of 940 cases (55%) are 40 years and over and 267 out of 940 cases (28%) are 50 years and over. This high percentage of cases 40 years and over in a Bantu autopsy survey in Africa is unusual. The majority of autopsy cases studied by Becker (1943), Higginson (1951), and Davies (1948) fall into the younger age groups.

The Causes of Death.—The causes of death of the 1,010 Bantu coal-miners are shown in Table 2.

TABLE 2
CAUSES OF DEATH OF 1,010 BANTU COAL-MINERS

Cause of Death	No. of Cases
Unnatural	275
(a) Multiple injuries	210
(b) Miscellaneous (drowning, burns, electrocution, etc.)	65
Natural	484
(a) Tuberculosis	91
(b) Primary pneumonia	100
(c) Diseases of the alimentary tract	50
(d) Diseases of the cardio-vascular system	108
(e) Diseases of the central nervous system	27
(f) Diseases of the kidneys	21
(g) Malignant disease	52
(h) Miscellaneous	35
Not specified	251

From Table 2 it is noted that the causes of death were specified in 759 cases only; of these 275 (36%) died from various forms of violence such as mine and road accidents. The remaining 484 miners died of natural causes. Tuberculosis was responsible for 91 out of 759 deaths (12%) (*cf.* Becker's (1943) series, 27%). There is very little comparative literature on autopsy studies of tuberculosis in South African Bantu non-miners. Schrier (1948) found tuberculosis to be the cause of death in 6.6% of employees in one of the divisions in General Motors Corporation, and Lavenne (1960) in 13.7% of 338 Welsh coal-miners

with pneumoconiosis. Primary pneumonia caused 100 out of 759 deaths in South African Bantu coal-miners, and Vint (1937) found primary pneumonia to be the cause of death in 29.8% of East African natives. Cardiovascular disease was the cause of death in 13% of these coal-miners (*cf.* Becker (1943), 11%).

Malignant Disease.—Malignant disease accounted for 52 deaths (7%). The types of malignant disease are shown in Table 3.

TABLE 3
TYPES OF MALIGNANT DISEASE IN 759 BANTU COAL-MINERS

Type of Malignant Disease	No. of Cases
Primary carcinoma of the liver	32
Bronchogenic carcinoma	4
Carcinoma of the bladder	3
Carcinoma of the oesophagus	2
Carcinoma of the pancreas	3
Carcinoma of the stomach	1
Carcinoma of the bowel	2
Miscellaneous	5
Total	52

In a recent survey of malignant disease in Bantu gold-miners the incidence of malignant disease was found to be 6.3% (Chatgidakis, 1960). Primary carcinoma of the liver was the commonest type of malignancy in these coal-miners, constituting 61% of all malignancies compared with 72% in Bantu gold-miners (Chatgidakis, 1960). In Berman's (1935) series of Bantu labourers on the Rand gold-mines primary carcinoma of the liver accounted for 90.5% of all malignancies. Only four cases of bronchogenic carcinoma occurred in these coal-miners, giving an autopsy incidence of 0.5%, and 7.6% of all malignancies. In a recent survey of malignant disease in Bantu South African gold-miners, the autopsy incidence of bronchogenic carcinoma was 0.3%, and 4% of all malignancies (Chatgidakis, 1960). Berman (1935) found at autopsy three cases of bronchogenic carcinoma amongst 358 mine labourers. Duchon (1954) found the autopsy incidence of bronchogenic carcinoma to be 3.8% in white males and 1.4% in African males. The details of the miners with bronchogenic carcinoma in this series are as follows:

- (1) Age, 48 years. Service, 9 years. Large cell carcinoma arising from the right main upper lobe bronchus. No evidence of coal-workers' pneumoconiosis.
- (2) Age, 58 years. Service, 12 years. Squamous carcinoma arising from the right main upper lobe bronchus. No evidence of coal-workers' pneumoconiosis. Active tuberculosis was present in the lungs.
- (3) Age unknown. Service, unknown. Small cell carcinoma arising from the main bronchus of the right lower lobe. Simple pneumoconiosis was present.

(4) Age, 59 years. Service, unknown. Squamous carcinoma of the right main bronchus. No evidence of coal-workers' pneumoconiosis.

Types and Incidence of Respiratory Tuberculosis.—Evidence of tuberculosis was found in 257 cases in this series, an autopsy incidence of 27%. Carnes of Johns Hopkins Hospital (1942), eliminating the fatal cases of tuberculosis in his series, found 147 out of 229 Negroes with tuberculous lesions (44%) when a complete examination of the lungs and all lymph glands was done and in addition the x-ray films were examined. In this series of Bantu coal-miners, if the 91 fatal cases of tuberculosis were eliminated, the incidence of tuberculosis would be 19%. Naegeli (1900), in 508 autopsies on persons 18 years and over, found healed, inactive, and active tuberculosis in the lungs of 93%. Wason (1922), in 600 autopsies where no special effort was made to search for tuberculous lesions, "but pleura, apices of lungs and lymph nodes were noted", found an incidence of tuberculosis in 82% of adults 20 years and over. Todd in Edinburgh (1927) examined 404 cadavers and found evidence of tuberculosis in 69% of cases which had died of other diseases, and in 18 cases tuberculosis was the cause of death. Landé and Wolff of Washington Country Hospital (1941), with macroscopic examination only, found evidence of tuberculosis in 39.4% of 165 autopsies. Medlar (1955) examined fresh tissues from 1,332 bodies after sudden death and although a complete necropsy was performed in only about 20%, he found necrotic or calcified lesions in 1,000 cases (75%). Opie (1917), using x-ray plates to identify the less readily distinguishable nodules in the lung and hilar lymph nodes, found that after the age of 18 years 100% of bodies revealed lesions of tuberculosis. From a comparison of the above autopsy incidences it appears that the incidence of tuberculosis in this particular group of coal-workers is not exceptionally high.

The criteria used for the diagnosis of the various types of tuberculosis are as follows:—

1. Active tuberculosis. Non-encapsulated caseations; encapsulated caseation with non-granular cell reaction on the periphery or polymorphonuclear cell infiltration into the caseous material; acute inflammatory reaction showing the presence of acid-fast bacilli; tuberculous follicles.

2. Inactive tuberculosis. Encapsulated caseation with no cellular reaction on the periphery and no acid-fast bacilli. The caseous material may or may not show calcification. (Histoplasmosis and coccidioides are rare in this country.)

3. Healed tuberculosis. Complete fibrosis of the lesion with or without calcification.

The incidence of the various types of respiratory tuberculosis is shown in Table 4.

From Table 4 it is noted that active tuberculosis was the commonest type found, forming 45% of all tuberculous lesions and giving an autopsy incidence of 12%. Macroscopic caseation in the hilar glands was noted in only 37 cases and no glands were grossly enlarged. Chronic tuberculous cavities are rarely found in the Bantu and in this series no case showed the presence of chronic cavities.

Calcification of Tuberculous Lesions.—Calcification occurred in 23 cases showing evidence of tuberculous lesions (8.7%). Medlar (1955) states that calcified foci are frequently observed in adults. Opie (1917) stated that 98% of white adults dying of diseases other than tuberculosis have calcified tuberculous lesions, and calcification is less extensive in coloured than in white adults.

Coal-workers' Pneumoconiosis.—The main coal production areas in South Africa are situated in the Orange Free State, Transvaal, and Natal. The labour employed is mainly migratory. On the average, the Bantu labourer works about 12 to 15 months and then returns to his home for an average period of six to nine months before coming back for further employment, not necessarily at the same mine or

TABLE 4
INCIDENCE OF THE VARIOUS TYPES OF RESPIRATORY TUBERCULOSIS IN 1,010 BANTU COAL-MINERS

Type of Tuberculosis	No. of Cases	Autopsy Incidence (%)	% of all Tuberculous Lesions	Calcification (Cases)
Healed	92	9	33	12
(a) Hilar glands only	76			
(b) Lungs	16			
Inactive	59	5.7	21	10
(a) Hilar glands only	49	12		
(b) Lungs	10			
Active	124	12	45	1
(a) Hilar glands only	30			
(b) Lungs	94			

even in the same class of work. The great majority are housed in compounds or single quarters equipped with communal feeding, health, and recreation services. About 3% of the labour force are housed with their families in married quarters adjacent to the compounds (Frazer, 1961). All South African collieries use the Bord and pillar system of mining. Water is used for dust suppression at all stages of work (Frazer, 1961), and more than half the coal produced is washed (4th Geological Survey, S. Africa, 1959). The greatest amount of coal produced in South Africa is bituminous (Walters, L. G., 1961; personal communication). Plumstead (1957) states that the whole bulk of the South African coal industry is based on bituminous coals of the late Paeleozoic Age and that there is no true anthracite in this country as none of the coal-bearing rocks have suffered lateral compression.

The various degrees of coal-workers' pneumoconiosis were as follows:—

1. Minimal. A moderate degree of coal-dust deposition in the lungs with foci of dust reticulosis and a slight degree of emphysema related to the dust deposits.

2. Slight. A moderate to marked coal-dust deposition in the lungs with numerous foci of dust reticulosis and a moderate to marked emphysema related to the dust deposits or palpable macule formation with a moderate to marked emphysema related to the dust deposits.

3. Moderate. Marked coal-dust deposition in the lungs with numerous palpable macules with or without foci of pigmented fibrosis of less than 2½ cm. in diameter and a well-marked emphysema related to the dust deposits.

4. Marked (P.M.F.). Marked coal-dust deposition in the lungs with areas of massive fibrosis greater than 2½ cm. in diameter and a well-marked emphysema related to the dust deposits.

There were 270 cases showing evidence of coal-

workers' pneumoconiosis in the whole series, giving an autopsy incidence of 26·8%. Of these, 253 cases were of the simple type (94%) and 17 of progressive massive fibrosis. James and Thomas (1956), from an analysis of 1,000 Welsh coal-miners (1947 to 1950), found 546 cases of simple pneumoconiosis and 454 cases of massive fibrosis. It is obvious that in this series cases of massive fibrosis are poorly represented and this is due to repatriation of these miners and a consequent lack of autopsies. The histology of coal-workers' pneumoconiosis found in this series of cases does not differ in any way from the lesions described by Gough (1946, 1949).

Simple Coal-workers' Pneumoconiosis.—The age incidence correlated with the degree of simple coal-workers' pneumoconiosis is shown in Table 5.

Statistical analysis of Table 5 indicates that the distribution of the various degrees of simple coal-workers' pneumoconiosis varies with the age. Minimal silicosis is present in three-quarters of the cases in the age group 25-44, half of these cases in the age group 45-64, and in less than two-fifths of these cases in the 65+ age group.

The length of service of miners with simple coal-workers' pneumoconiosis correlated with the degree of pneumoconiosis is shown in Tables 6 and 7.

From Table 7 it is noted that with increasing service the number of cases without pneumoconiosis falls and the frequency of a slight and a moderate

TABLE 6
LENGTH OF SERVICE CORRELATED WITH THE DEGREE OF SIMPLE COAL-WORKERS' PNEUMOCONIOSIS (PERCENTAGES OF TOTALS)

Length of Service (years)	Degree of Coal-workers' Pneumoconiosis				Total
	Nil	Minimal	Slight	Moderate	
0-4	86.1	8.2	5.1	0.7	100.1
5-9	59.1	24.6	14.9	1.4	100.0
15+	28.6	20.4	36.7	14.3	100.0
Unknown	69.5	19.2	9.0	2.3	100.0

TABLE 5
AGE INCIDENCE CORRELATED WITH THE DEGREE OF COAL-WORKERS' PNEUMOCONIOSIS

Age (years)	Degree of Coal-workers' Pneumoconiosis			Total	
	Minimal	Slight	Moderate	No.	%
25—	3	3	0	6	2.4
30—	10	2	1	13	5.1
35—	10	3	0	13	5.5
40—	29	10	1	40	15.7
45—	24	14	1	39	15.4
50—	20	27	1	48	18.9
55—	18	8	6	32	12.6
60—	13	8	7	28	11.0
65—	5	11	1	17	6.7
70+	2	2	0	4	1.6
Unknown	6	7	0	13	5.1
Total	140	95	18	253	100.0

TABLE 7

LENGTH OF SERVICE CORRELATED WITH THE DEGREE OF SIMPLE COAL-WORKERS' PNEUMOCONIOSIS

Length of Service (years)	Degree of Coal-workers' Pneumoconiosis				Total (Coal-workers' Pneumoconiosis)	
	Nil	Minimal	Slight	Moderate	No.	%
0-4	475	51	28	7	86	34.0
5-9	100	25	17	2	44	17.4
10-14	27	26	16	0	42	16.6
15-19	10	5	7	0	12	4.7
20+	4	5	11	7	23	9.1
Unknown	124	28	16	2	46	18.1
Total	740	140	95	18	253	99.9

degree of simple coal-workers' pneumoconiosis increases markedly.

Tuberculosis was the cause of death in 32 cases with simple coal-workers' pneumoconiosis, *i.e.* 32 out of 200 cases in which the cause of death was known (16%). The type of tuberculosis found in these cases of simple coal-workers' pneumoconiosis and the incidence are shown in Table 8.

TABLE 8

INCIDENCE AND TYPE OF RESPIRATORY TUBERCULOSIS IN 253 CASES OF SIMPLE COAL-WORKERS' PNEUMOCONIOSIS

Type of Tuberculous Lesion	No. of Cases
Active	52
(a) Hilar glands only	11
(b) Lungs	45
Inactive	26
(a) Hilar glands only	19
(b) Lungs	7
Healed	57
(a) Hilar glands only	50
(b) Lungs	7
Total	135

From Table 8 it is noted that 135 out of 253 cases (53%) showed some evidence of tuberculosis in the respiratory system and in 80 out of 135 (59%) the hilar glands alone were involved. Active tuberculosis was present in 21%, inactive in 10%, and healed in 23% of cases.

There are no comparable figures for the incidence of these various types of tuberculosis in the Bantu non-miner in South Africa. Gough (1960) found that 28.5% of cases of the nodular type of simple coal-workers' pneumoconiosis in Welsh coal-miners showed naked-eye tuberculous lesions. In this series 43 out of 250 cases (17%) showed naked-eye lesions of tuberculosis.

Only one case of bronchogenic carcinoma occurred in 253 cases of simple pneumoconiosis. James (1955) found 5.1% of cases with bronchogenic carcinoma in miners with simple coal-workers' pneumoconiosis and states that it is less frequently found in coal-miners than in non-miners; the majority of cases in

this mining and non-mining groups were over the age of 50 years.

Chronic cor pulmonale was present in six cases with simple pneumoconiosis in this series. Lavenne (1960) states that 20% of coal-miners with right heart failure showed the presence of simple pneumoconiosis. There were 17 cases of chronic cor pulmonale in this series.

Progressive Massive Fibrosis.—There were only 17 cases in this series showing this type of lesion. This group is poorly represented as the lungs of fully compensated cases are not usually sent to the South African Pneumoconiosis Bureau for examination. Twelve of these cases were in the 50-59 age group. The length of service varied from six to 40 years. Eight cases showed evidence of tuberculosis, six being active. There were six cases of chronic cor pulmonale, and bronchogenic carcinoma was not observed.

Miscellaneous Respiratory Lesions.—The following were noted.

Pleurisy.—Chronic non-specific pleurisy with tags of fibrous adhesions was found in 259 cases, giving an autopsy incidence of 24%. Evidence of tuberculosis in the hilar glands or lung was present in 50% of cases. In 62% of cases the pleurisy was bilateral.

There were nine cases of acute fibrinous pleurisy with no lung lesions. Evidence of tuberculosis in the hilar glands was found in six of these cases, although no histological evidence of tuberculosis was noted in sections of the pleurae.

There were six cases of tuberculous pleurisy showing a fibrino-haemorrhagic exudate and one case of tuberculous empyema.

Bronchiectasis.—Bronchiectasis was noted in four cases. The atelectatic type was present in two cases affecting the middle lobe of the right lung. A diffuse cylindrical or digitate type of bronchiectasis was present in the basal lobes in two cases, one of which showed marked follicular lymphoid hyperplasia in the bronchial walls. Only one case showed the presence of simple pneumoconiosis.

TABLE 9
INCIDENCE OF VARIOUS TYPES OF PERICARDITIS IN 1,010 COAL-MINERS

	Tuberculous	Fibrinous	Suppurative	Chronic Non-specific	Malignant
Number of cases	22	7	1	31	1
% of all types of pericarditis	35	11		51	

Animal Parasitic Lesions of the Lungs.—Bilharzial lesions were noted in eight cases. The lesions were mild, showing an occasional bilharzial follicle or calcified ova in the interstitial tissue with no reaction in relation to them.

Fibrocystic Disease of the Lungs.—There were two cases of fibrocystic disease of the lungs. In one case the lesion affected both lungs, and in the other it was localized to the left apical lobe.

Cardiac Lesions.—There were 170 cases showing evidence of cardiac involvement, giving an autopsy incidence of 16.8%. Lavenne (1960) found the autopsy incidence of heart disease to be 23.7% in white Welsh coal-miners. Vint (1937) found an autopsy incidence of heart disease in 5.6% of Kenya natives.

Pericarditis.—Pericarditis was present in 62 cases, giving an autopsy incidence of 6.2% (Becker (1943), 3.5%).

The incidence of the various types of pericarditis is shown in Table 9.

From Table 9 it is noted that chronic non-specific adhesive pericarditis constitutes 51% of all types of pericarditis. The autopsy incidence of chronic non-specific pericarditis was 3% (Becker (1943), 4.9%). Evidence of tuberculosis in the lungs or hilar glands was found in 80% of cases with chronic non-specific pericarditis. In no case was infarction of the myocardium the cause of the pericarditis. Tuberculous pericarditis constituted 35% of all types of pericarditis (Becker (1943), 58%) and the autopsy incidence was 2%. All cases were of the acute type except one which showed a chronic constrictive pericarditis. Sweeney (1940) found the average autopsy incidence of tuberculous pericarditis to be 1%. Other types of pericarditis were found to be uncommon in this series.

Rheumatic Carditis.—Rheumatic carditis was present in 19 cases, giving an autopsy incidence of 1.8% (Becker (1943), 3.5%). The autopsy incidence in the United States varied from less than 1% to 9% (Becker, 1943). Rheumatic carditis constituted 11% of all cardiovascular lesions in this series (Becker (1943), 7.7%). The average age incidence was 39 years. The commonest valve affected was the aortic

valve, and only one case showed superadded bacterial endocarditis.

Cardiovascular Syphilis.—Cardiovascular syphilis was present in 11 cases, giving an autopsy incidence of 1%, and constituted 6.5% of all cardiovascular lesions (Becker (1943), 12.7%). There were nine cases of aortic incompetence.

Chronic Cor Pulmonale.—Chronic cor pulmonale was present in 17 cases, giving an autopsy incidence of 1.6% (Becker (1943), 1.5%), and constituted 1% of all cardiovascular lesions (Becker (1943), 19%). Dyson (1934) found an incidence of 14% in anthracite coal-miners. Lavenne (1960) found an autopsy incidence of 23.7%, and 20% of these coal-miners with right heart failure showed simple pneumoconiosis. In this series progressive massive fibrosis was inadequately represented. Coal-workers' pneumoconiosis was found in 12 cases and six were simple. Wells (1954) states that in early simple pneumoconiosis cor pulmonale occurs frequently but could rarely be attributed to the industrial disease. Lavenne (1960) found cor pulmonale in 83 out of 338 Welsh coal-miners with pneumoconiosis.

Hypertensive Heart Disease.—Hypertensive heart disease was found in 50 cases, giving an autopsy incidence of 5% (Becker (1943), 8.2%), and constituting 29% of all cardiac lesions; 82% were due to essential hypertension (Becker, 61%). Hart and Aslett (1942) stated that during the chronic ambulatory stages the pneumoconiosis found in South Wales coal-miners does not produce a raised blood pressure, certainly not a progressive one.

Myocarditis.—Myocarditis was noted in seven cases; six were of the acute non-specific type and one was suppurative.

Animal Parasitic Lesions.—Only one case of parasitic infestations of the heart was found, a case of cysticercosis.

REFERENCES

- Becker, B. J. P. (1943). *Cardio-Vascular Disease in the Bantu and Coloured Races of South Africa*. Thesis. University of the Witwatersrand, Johannesburg.
 Berman, C. (1935). *S. Afr. J. med. Sci.*, 1, 12.
 Carnes, W. H. (1942). *Bull. Johns Hopk. Hosp.*, 70, 101.
 Chatgidakis, C. B. (1960). *Arch. environm. Hlth*, 1, 17.
 Davies, J. N. P. (1948). *E. Afr. med. J.*, 25, 117.

- Duchen, L. W. (1954). *S. Afr. J. med. Sci.*, 19, 65.
 Dyson, J. M. (1934). *Amer. Heart J.* 9, 764.
 Frazer, A. E. (1961). *Coal Mining in South Africa*. 7th Commonwealth Mining and Metallurgical Congress.
 Gough, J. (1946). *Lancet*, 1, 462.
 ———. (1949). *Postgrad. med. J.*, 25, 611.
 ———. (1960). In *Proceedings of the Pneumoconiosis Conference, Johannesburg, 1959*, edited by Orenstein, A. J., pp. 322-324. Churchill, London.
 Hart, P. D'Arcy, and Aslett, E. A. (1942). Chronic Pulmonary Disease in South Wales Coalminers. *B. Medical Survey. Spec. Rep. Ser. med. Res. Coun. (Lond.)*, No. 243, pp. 1-202. H.M.S.O. London.
 Higginson, J. (1951). *Cancer (Philad.)*, 4, 1224.
 James, W. R. L. (1955). *Brit. J. Industr. Med.*, 12, 87.
 ———, and Thomas, A. J. (1956). *Ibid.*, 13, 24.
 Landé, K. E., and Wolff, G. (1941). *Amer. Rev. Tuberc.*, 44, 223.
 Lavenne, F. (1960). In *Proceedings of the Pneumoconiosis Conference*, edited by Orenstein, A. J., pp. 217-219. Churchill, London.
 Medlar, E. M. (1955). The Behaviour of Pulmonary Tuberculous Lesions. *Amer. Rev. Tuberc.*, 71, No. 3, pt. 2 (Suppl.).
The Mineral Resources of the Union of South Africa (1959). Department of Mines, Office of the Geological Survey, 4th ed., Government Printer, Pretoria.
 Naegeli, O. (1900). *Virchows Arch. path. Anat.*, 160, 426. Quoted by Landé, K. E., and Wolff, G. (1941)
 Opie, E. L. (1917). *J. exp. Med.*, 25, 855.
 Plumstead, E. P. (1957). *Coal in Southern Africa*, p. 23. Witwatersrand University Press, Johannesburg.
 Schrier, C. F. (1948). *Industr. Med.*, 17, 47.
 Sweeney, J. A. (1940). *Amer. Heart J.*, 20, 345.
 Todd, T. R. R. (1927). *Edinb. med. J.*, N.S. 34, 127.
 Vint, F. W. (1937). *E. Afr. med. J.*, 13, 332.
 Wason, I. M. (1922). Quoted by Landé, K. E. and Wolff, G. (1941).
 Wells, A. L. (1954). *Brit. Heart J.*, 16, 74.

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