



NATIONAL INSTITUTE FOR OCCUPATIONAL HEALTH

**Pathology Division
Surveillance Report:
Demographic Data and
Disease Rates for
January to December
2003**

**Dr Jill Murray
Dr Geoff Candy
Gill Nelson
Zodwa Ndlovu**

**NATIONAL HEALTH
LABORATORY SERVICE**

NIOH Report 15/2004

**PO Box 4788
JOHANNESBURG
2000
e-mail:
jill.murray@nioh.nhls.ac.za**

ACKNOWLEDGEMENTS

We thank the following staff members of the NIOH Pathology Department, without whose contribution this annual surveillance report could not be published:

Phyllis Back
Jemima Cantrell
Juliet Buthelezi
Anna Khumalo
Joseph Mukhovi
May Humby
Martha Rikhotso
Natisha Khoosal
Johanna Dibedi
Rosinah Soko
Nora Ngutshane
Jay Vallabh
Julienne Mkhize
Goodman Rani
Patrick Mbhontsi
Wilson Mashele
Johannes Mathetha
Johannes Makoena

Thanks also to Michelle Kotze (IT Directorate, National Department of Health) for upgrading and maintaining the PATHAUT system.

Notes:

The following terminology has changed since the annual report of the 2002 data was produced:

"Ethnic group" is now referred to as "population group"

"Industry" is now referred to as "commodity" (e.g. gold, coal, etc.)

National Institute for Occupational Health, PO Box 4788, Johannesburg, 2000, South Africa

ISSN 1812-7681

EXECUTIVE SUMMARY

During 2003, 2 318 cases came to autopsy at the NIOH. Of these, 66.3% were black men, 32.1% were white, 1.0% were coloured and 0.6% were submitted without information on population group. Overall disease rates (per 1000 autopsies) for 2003 are shown in Figure 1.

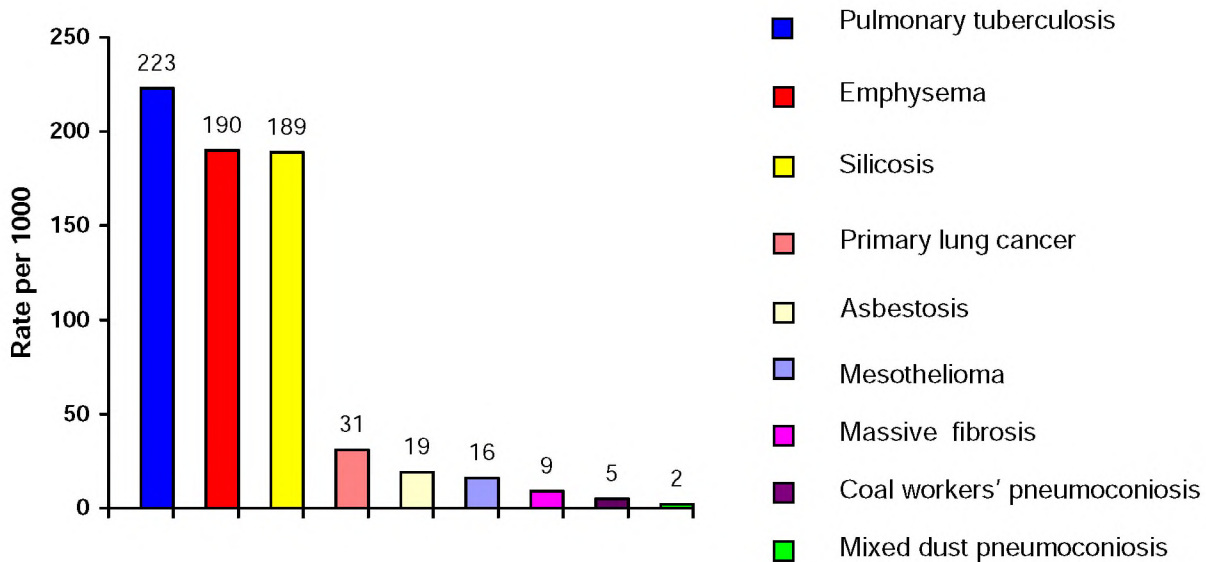


FIG. 1 OVERALL DISEASE RATES FOR 2003

In 2003 the prevalence of silicosis was similar to that in previous years. However, the prevalence of pulmonary tuberculosis (PTB) increased, following the trend of the last several years. The rise in PTB was particularly evident in black gold miners where the rate increased from 274 per 1000 in 2002 to 328 per thousand in 2003.

During 2003 six reports were written, utilising the PATHAUT data (see appendix 2). Research projects for which the data were used were presented at a number of forums. Two post-graduate students from the University of the Witwatersrand also utilised the data.

TABLE OF CONTENTS

EXECUTIVE SUMMARY	i	
GLOSSARY	iv	
SECTION 1: BACKGROUND	1	
SECTION 2: DEMOGRAPHIC DATA	2	
SECTION 3: ACTIVE TUBERCULOSIS	8	
SECTION 4: SILICOSIS	10	
SECTION 5: OTHER PNEUMOCONIOSES		
Massive Fibrosis	12	
Coal Workers’ Pneumoconiosis	12	
Mixed Dust Pneumoconiosis	12	
Asbestosis and pleural plaques	11	
SECTION 6: EMPHYSEMA	13	
SECTION 7: MESOTHELIOMA	15	
SECTION 8: PRIMARY LUNG CANCER	16	
SECTION 9: CLINICAL CAUSES OF DEATH	17	
LIST OF TABLES		
Table 2.1	Distribution of autopsies by year and population group (1975-2003)	2
Table 2.2	Number and proportion of autopsies by age and population group (2003)	3
Table 2.3	Number and proportion of autopsies by type and population group (2003)	3
Table 2.4	Number and proportion of autopsies by commodity and population group (2003)	5
Table 2.5	Number and proportion of autopsies by years of service and population group (2003)	6
Table 2.6	Mean age by commodity and population group (2003)	7
Table 2.7	Mean duration of service by commodity and population group (2003)	7
Table 3.1	Number of cases and prevalence of active PTB by commodity and population group (2003)	9
Table 3.2	Number of cases and prevalence of active PTB by age and population group (2003)	9
Table 4.1	Number of cases and prevalence of silicosis by commodity and population group (2003)	10
Table 4.2	Number of cases and prevalence of silicosis in the gold mining industry, by age and population group (2003)	11
Table 4.3	Number of cases and prevalence of silicosis in the gold mining industry, by years of service and population group (2003)	11

Table 5.1	Number of cases and prevalence of asbestosis by age and population group (2003)	12
Table 6.1	Number of cases and prevalence of emphysema by age and population group (2003)	13
Table 6.2	Number of cases and prevalence of emphysema by commodity and population group (2003)	13
Table 6.3	Number of cases and prevalence of emphysema by years of service and population group (2003)	14
Table 7.1	Number and proportion of mesothelioma cases by age and population group (2003)	15
Table 7.2	Number and proportion of mesothelioma cases by commodity and population group (2003)	15
Table 8.1	Number of cases and prevalence of primary lung cancer by age and population group (2003)	16
Table 8.2	Number of cases and prevalence of primary lung cancer by commodity and population group (2003)	16
Table 9.1	Clinical causes of death by population group (2003)	17

LIST OF FIGURES

Figure 1	Overall disease rates for 2003	i
Figure 2.1	Distribution of autopsies by age and population group (2003)	4
Figure 2.2	Distribution of autopsies by commodity and population group (2003)	5
Figure 2.3	Distribution of autopsies by years of service and population group (2003)	6
Figure 3.1	Distribution of active TB by site (2003)	8
Figure 9.1	Clinical cause of death as given by the clinicians who submit the organs to the NIOH (2003)	17

APPENDICES

Appendix 1:	Distribution of autopsies according to the last mine where the deceased worked (2003)	18
Appendix 2:	PATHAUT publications and activities (2003)	23

GLOSSARY

Asbestosis	Lung fibrosis caused by asbestos fibres
Coal workers' pneumoconiosis	Lung fibrosis caused by exposure to coal dust
Emphysema	Lung disease caused by the destruction of the alveolar walls
Massive fibrosis	Lung fibrosis caused by exposure to dust and measuring more than 1cm in diameter
Mesothelioma	A malignant tumour of the pleural cavity of the lungs
Miner	A person who has worked in a controlled mine or works
Mixed exposures	The multiple dust types to which a miner may be exposed, having worked in several mining commodities in his lifetime
Prevalence	The number of cases in a defined population at a given time
Silicosis	Lung fibrosis caused by inhalation of silica dust; detected by the presence of silicotic nodules in the lung tissue
Surveillance	The ongoing and systematic collection, analysis and interpretation of data related to either occupational exposure or adverse health outcomes

SECTION 1 – BACKGROUND

The Occupational Diseases in Mines and Works Act, 1973 (Act 78 of 1973) requires that the cardio-respiratory organs of a deceased person who has worked at a controlled mine or a controlled works be examined for the presence of occupational disease, regardless of the clinical cause of death and provided that the next of kin agrees. These examinations are performed by pathologists at the National Institute for Occupational Health (NIOH). A detailed report on each case examined is sent to the Medical Bureau for Occupational Diseases (MBOD). Cases certified as having a compensatable disease are then referred to the Compensation Commissioner's office, where payment for compensation is managed.

Since 1975, the pathological findings from the autopsy examinations have been recorded on the computerized PATHAUT database. PATHAUT comprises data from autopsy examinations and clinical files which include occupational histories. The database is unique and provides an important resource for both surveillance and research. These data are the only comprehensive surveillance data on occupational lung disease in the South African mining industry.

The data presented in this report summarise the PATHAUT system surveillance results, i.e. the results of the systematic collection, collation, and analysis of the pathology findings in the cardio-respiratory organs of mine workers. Data from PATHAUT are exported into, and analysed, using SAS v8.8.

This is the seventh consecutive annual report and describes autopsy cases examined during the year 2003. Many of the cases had "mixed" exposures in that they had been employed in more than one commodity. For simplicity, cases are categorized according to the commodity in which most years of service were recorded, i.e. the commodity in which they had worked for the longest period. In Appendix 1, however, the cases are listed according to the most recent (last) mine at which the miners worked.

All disease rates reported in this document are expressed per 1000. In all calculations, the denominators used are the total numbers of autopsies in specific commodities, age groups or population groups. Some of these rates must be viewed with caution, as the denominators are very small. This applies, for example, to those commodities where few workers are employed (such as tin mining), and to the older age groups in some instances.

SECTION 2 – DEMOGRAPHIC DATA

The number of autopsies performed since 1975 is presented in Table 2-1.

TABLE 2-1 DISTRIBUTION OF AUTOPSIES BY YEAR AND POPULATION GROUP (1975 - 2003)

Year of autopsy	Black		White		Coloured		Indian		Unknown		Total N
	N	%	N	%	N	%	N	%	N	%	
1975	2 190	71	854	28	32	1					3 076
1976	2 335	68	1 072	31	27	1					3 434
1977	2 351	69	1 039	30	33	1					3 423
1978	2 245	67	1 090	32	32	1					3 367
1979	2 118	66	1 026	33	45	1					3 189
1980	2 338	64	1 274	35	46	1					3 658
1981	2 209	66	1 117	33	33	1					3 359
1982	2 312	63	1 302	36	44	1					3 658
1983	2 096	65	1 109	34	41	1					3 246
1984	1 966	64	1 098	36	28	1					3 092
1985	2 275	64	1 200	34	66	2					3 541
1986	2 456	68	1 125	31	45	1					3 626
1987	2 594	68	1 168	30	78	2					3 840
1988	2 518	67	1 165	31	77	2					3 760
1989	2 138	65	1 090	33	60	2					3 288
1990	2 172	64	1 155	34	51	2					3 378
1991	2 143	65	1 080	33	66	2					3 289
1992	2 144	66	1 049	32	70	2					3 263
1993	1 863	65	956	33	65	2					2 884
1994	1 737	61	1 021	36	94	3					2 852
1995	2 830	71	1 059	27	99	2					3 988
1996*	766	68	329	29	19	2			14	1.2	1 128
1997	2 223	69	897	28	70	2			18	0.6	3 208
1998	1 977	69	836	29	49	2	1		17	0.6	2 880
1999	1 656	65	832	33	29	1			12	0.5	2 529
2000	1 798	69	761	29	41	2			8	0.3	2 608
2001	1 690	67	813	32	13	1			13	0.5	2 529
2002	1 677	67	763	30	50	2			28	1.1	2 518
2003	1 536	66	745	32	23	1	1		13	0.6	2 318
Total	60 353	66	29 025	32	1 426	2	2	0	123	0.1	90 929

* Data for only $\pm$ 6 months are available for 1996

It is important to note that a referral bias exists: black men are infrequently autopsied after leaving employment in the mines, whereas the majority of whites come to autopsy after retirement. The numbers of miners coming to autopsy has decreased steadily over the years, probably reflecting the concomitant decrease in the number of miners. In 1994 there were around 344 000 people employed in the gold mining industry compared to 183 000 in 2003.

The pathologists at the NIOH perform two types of autopsy examinations. For men dying distant from Johannesburg, the cardio-respiratory organs are removed locally, preserved in formalin and sent to the NIOH. Full autopsies are undertaken on men who die close to Johannesburg.

Table 2-2 shows the distribution of autopsies by population group for 2003. Autopsies of only cardio-respiratory organs comprised 94.8% of all examinations.

TABLE 2-2 NUMBER AND PROPORTION OF AUTOPSIES BY TYPE AND POPULATION GROUP (2003)

Autopsy type	Black		White		Coloured		Unknown		Total	
	N	%	N	%	N	%	N	%	N	%
Cardiorespiratory organs only	1531	99.7	630	84.6	23	100	13	100	2198	94.8
Full autopsy	5	0.3	115	15.4	0	-	0	-	120	5.2
Total	1536		745		23		13		2318	

The age distribution of autopsies for 2003 is shown in Table 2-3 and Figure 2-1. The mean age at autopsy for black men has increased from 37.9 years in 1998 to 43.4 years in 2003. The mean age of white men at autopsy has remained essentially unchanged (63.5 in 2003).

TABLE 2-3 NUMBER AND PROPORTION OF AUTOPSIES BY AGE AND POPULATION GROUP (2003)

Age group (years)	Black		White		Coloured		Unknown		Total	
	N	%	N	%	N	%	N	%	N	%
20-29	67	4.4	5	0.7	0	-	0	-	72	3.1
30-39	386	25.1	20	2.7	1	4.3	0	-	407	17.6
40-49	686	44.7	84	11.3	2	8.7	1	7.7	773	33.3
50-59	287	18.7	151	20.3	6	26.1	0	-	444	19.2
60-69	22	1.4	228	30.6	6	26.1	0	-	257	11.1
70-79	7	0.5	173	23.2	5	21.7	0	-	185	8.0
80+	5	0.3	79	10.6	2	8.7	0	-	86	3.7
Unknown	76	4.9	5	0.7	1	4.3	12	92.3	94	4.1
Total	1 536		745		23		13		2 318	

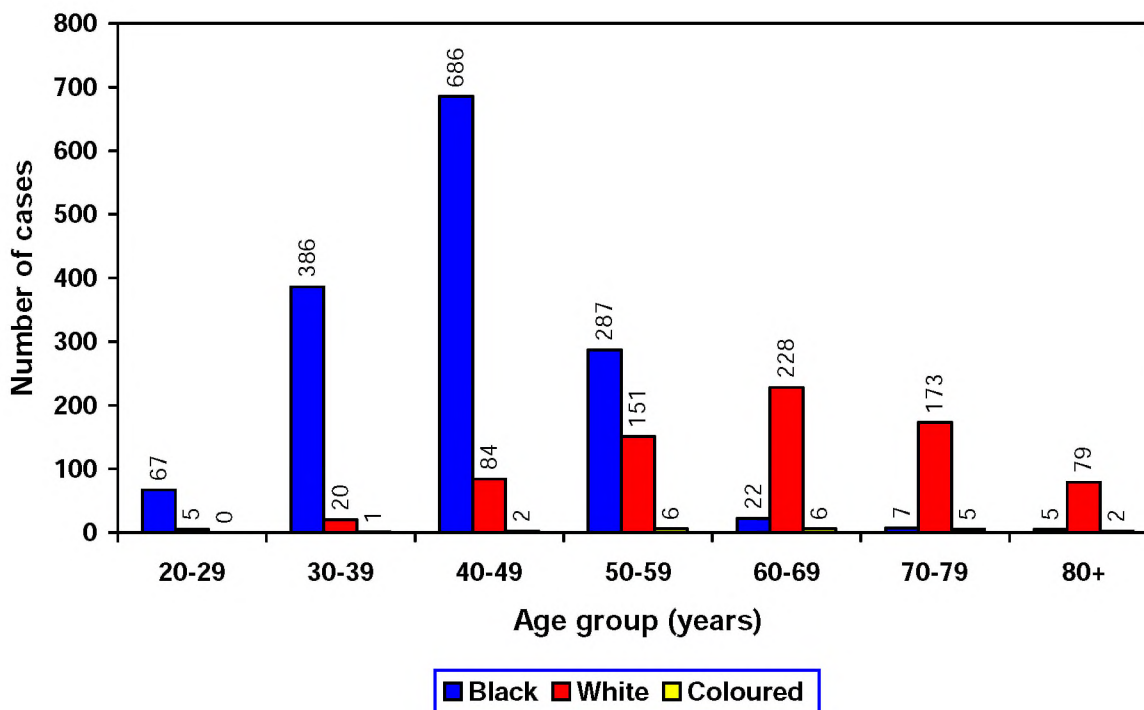


FIG 2-1 DISTRIBUTION OF AUTOPSIES BY AGE AND POPULATION GROUP (2003)

Table 2-4 and Figure 2-2 show the distribution of autopsies by commodity and population group for 2003. The percentage of autopsies received from the gold mining industry has been consistent over the last three years (68.0% in 2001, 67.5% in 2002, and 69.0% in 2003). The percentage of autopsies from platinum miners increased from 8.3% in 1999, to 14.3% in 2000, to 14.4% in 2001, to 15% in 2002, to 15.3% in 2003. As in previous years, the majority of coloured men who came to autopsy were asbestos miners (70%).

Cases were categorized according to the commodity in which they had worked for the longest duration (most exposure). Many men, however, worked in a number of different mining commodities during their lifetimes and had "mixed" exposures. This was not taken into account in the analysis of exposure type (commodity) and all results are presented using longest exposure.

TABLE 2-4 NUMBER AND PROPORTION OF AUTOPSIES BY COMMODITY AND POPULATION GROUP (2003)

Commodity	Black		White		Coloured		Unknown		Total	
	N	%	N	%	N	%	N	%	N	%
Gold	1 100	71.6	498	66.8	1	4.3	1	7.7	1 600	69.0
Platinum	315	20.5	38	5.1	2	8.7	0	-	355	15.3
Coal	44	2.9	64	8.6	1	4.3	0	-	110	4.7
Asbestos	35	2.3	35	4.7	16	69.6	0	-	86	3.7
Iscor	0	-	27	3.6	0	-	0	-	27	1.2
Diamond	11	0.7	10	1.3	0	-	0	-	21	0.9
Copper	2	0.1	13	1.7	0	-	0	-	15	0.6
Iron	2	0.1	11	1.5	0	-	0	-	13	0.6
Manganese	9	0.6	2	0.3	0	-	0	-	11	0.5
Other	7	0.5	19	2.6	0	-	0	-	26	1.1
Unknown	11	0.7	28	3.8	3	13.0	12	92.3	54	2.3
Total	1 536		745		23		13		2 318	

Note: this table reports only those commodities where a total of 10 or more autopsies were received

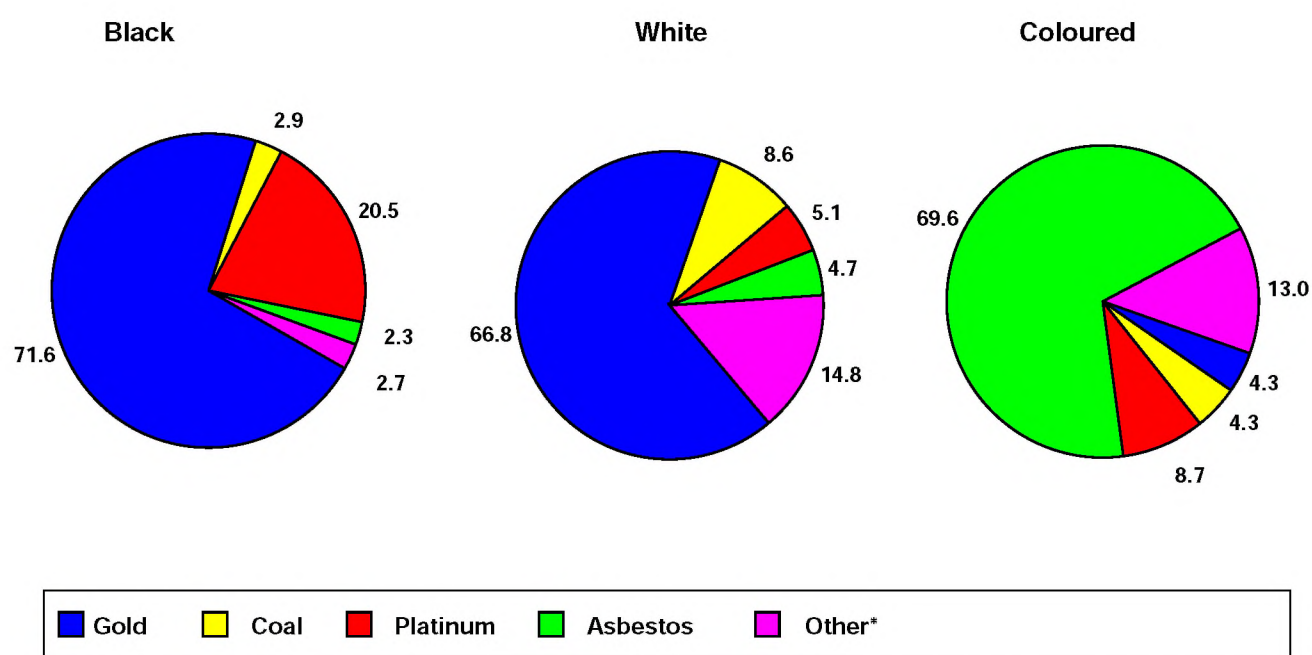


FIG 2-2 DISTRIBUTION OF AUTOPSIES BY COMMODITY AND POPULATION GROUP (2003)

* Includes Iscor, copper, diamond, quarry, silica (silicon smelters), manganese, tin, zinc, minerals, steel and chrome, iron, manganese, fluorspar, lime, railways and other industries, as well as cases where information about type of mining is missing

Detailed information about the years in mining service by population group is presented in Table 2-5 and Figure 2-3. It is important to note the large proportion of cases with missing information about the duration of service (21.8%). This proportion is similar to that found in 2002 (21.6), 2001 (24.4%), 2000 (22.6%) and 1999 (22.7%) but considerably lower than that for 1998 (43%).

TABLE 2-5 NUMBER AND PROPORTION OF AUTOPSIES BY YEARS OF SERVICE AND POPULATION GROUP (2003)

Years of service	Black		White		Coloured		Unknown		Total	
	N	%	N	%	N	%	N	%	N	%
<1	26	1.7	2	0.3	0	-	0	-	28	1.2
1 - 5	129	8.4	56	7.5	4	17.4	0	-	189	8.2
6-10	248	16.1	42	5.6	2	8.7	1	7.7	293	12.6
11-15	292	19.0	66	8.9	1	4.3	0	-	359	15.5
16-20	300	19.5	86	11.5	3	13.0	0	-	389	16.8
21-25	151	9.8	92	12.3	2	8.7	0	-	245	10.6
26-30	53	3.5	79	10.6	0	-	0	-	132	5.7
31-35	9	0.6	79	10.6	0	-	0	-	88	3.8
36-40	3	0.2	58	7.8	0	-	0	-	61	2.6
41+	1	0.1	28	3.8	1	-	0	-	31	1.3
Unknown	324	21.1	157	21.1	10	43.5	12	92.3	503	21.7
Total	1 536		745		23		13		2 318	

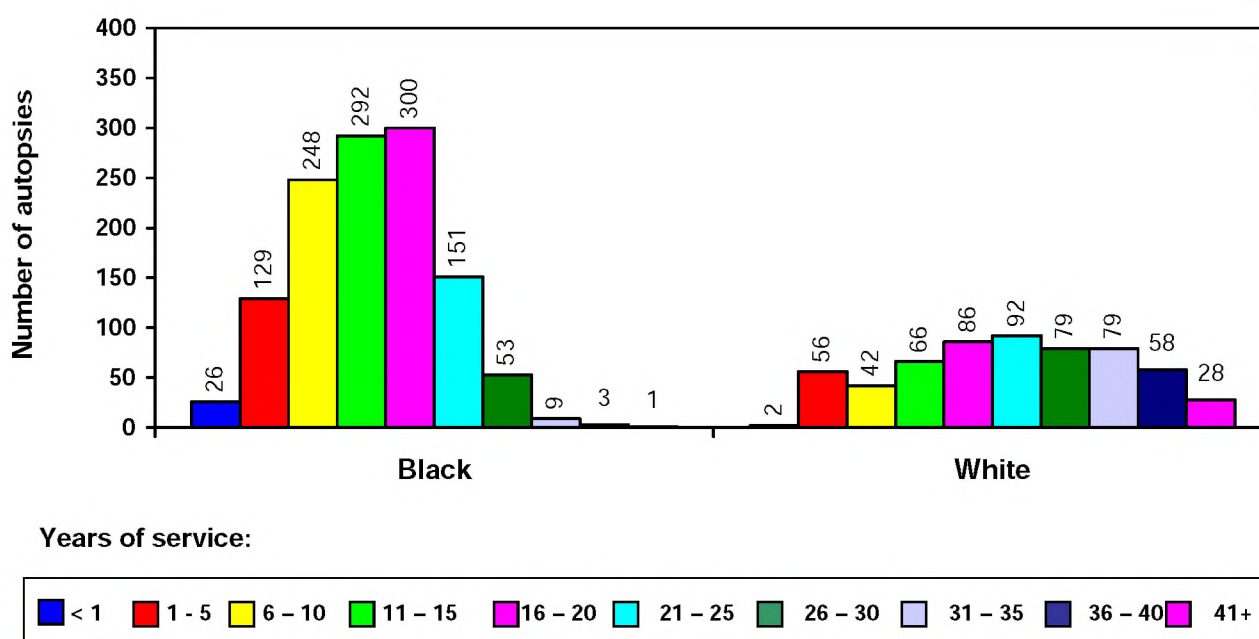


FIG 2-3 DISTRIBUTION OF AUTOPSIES BY YEARS OF SERVICE AND POPULATION GROUP (2003)

The mean age and duration of service by commodity type and population group for those cases for which information was available are shown in Tables 2-6 and 2-7.

TABLE 2-6: MEAN AGE BY COMMODITY AND POPULATION GROUP (2003)

Commodity	Black			White		
	N	Mean	SD*	N	Mean	SD*
		(years)			(years)	
Gold	1028	42	7	496	64	13
Coal	44	46	9	64	62	14
Platinum	313	44	8	38	59	11
Asbestos	35	57	14	35	65	8
Diamond	11	48	8	10	61	12
Copper	2	46	8	13	67	10
Iscor	0	-	-	27	64	11
Other	18	54	13	32	63	11
Unknown	9	51	16	25	60	14
Total	1460	43	8	740	64	13

* Standard deviation

TABLE 2-7: MEAN DURATION OF SERVICE BY COMMODITY AND POPULATION GROUP (2003)

Commodity	Black			White		
	N	Mean	SD*	N	Mean	SD*
		(years)			(years)	
Gold	920	14	7	421	24	11
Coal	37	19	9	49	23	11
Platinum	208	14	6	24	17	8
Asbestos	26	9	11	28	12	9
Diamond	10	23	6	7	18	8
Copper	0	-	-	8	15	14
Iscor	0	-	-	25	22	11
Other	11	16	10	26	20	9
Unknown	0	-	-	0	-	-
Total	1212	14	7	588	23	11

* Standard deviation

SECTION 3 – ACTIVE TUBERCULOSIS

The distribution of active tuberculosis (TB) by anatomical site is presented in Figure 3-1 (n=639). Active pulmonary TB (PTB) was diagnosed in 22.3% (518) of all cases autopsied in 2003, in comparison to 20.7% (521) in 2002, 19.2% (486) in 2001, and 16.0% (416) in 2000. Most of the men with PTB were black (92.9%; 481 cases), 5.4% (28 cases) were white, 1.2% (6 cases) were coloured, and in 0.6% (3 cases) the population group was unknown

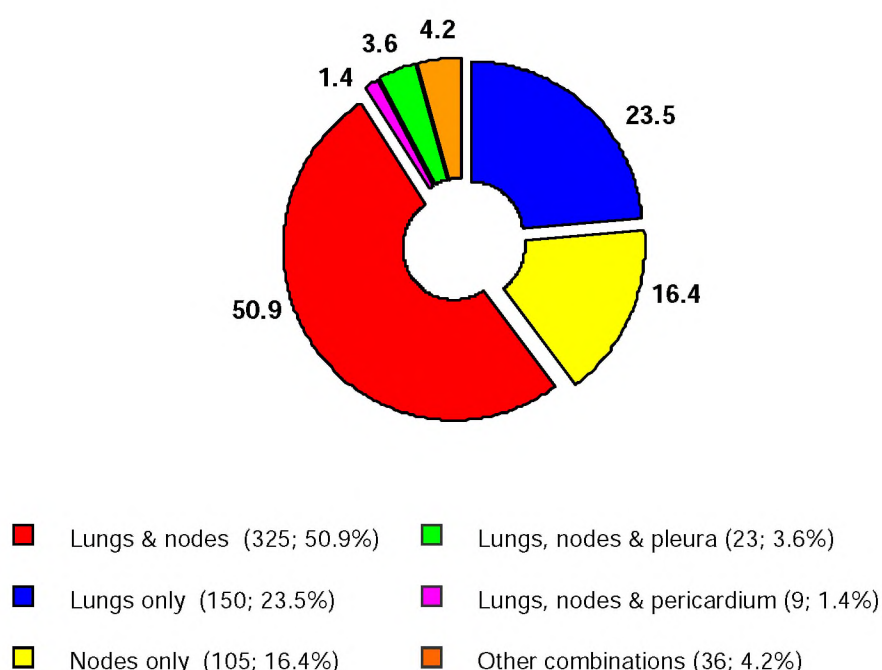


FIG 3-1 DISTRIBUTION OF ACTIVE TB BY SITE (2003)

The overall rate of PTB (223/1000) has increased from 207/1000 in 2002, 192/1000 in 2001, 160/1000 in 2000 and 123/1000 in 1999. This is attributed to the increase in the PTB rate in black men to 313/1000, from 287/1000 in 2002, 267/1000 in 2001, 217/1000 in 2000, and 174/1000 in 1999. In black gold miners, the rate of PTB has increased annually from 171/1000 in 1999 to 328 in 2003. Rates in black platinum miners increased steadily from 1999 (179/1000) to 2002 (383/1000). However, in 2003 the rate decreased to 305/1000.

The distribution of active PTB cases by commodity is shown in Table 3-1. Rates in this and the following tables are expressed per 1000. The majority of active PTB cases (73.6%) came from the gold mining industry (69.0% of all autopsy cases came from that commodity).

TABLE 3-1 NUMBER OF CASES AND PREVALENCE OF ACTIVE PTB BY COMMODITY AND POPULATION GROUP (2003)

Commodity	Black		White		Coloured		Unknown		Total	
	N	Rate	N	Rate	N	Rate	N	Rate	N	Rate
Gold	361	328	20	40	0	-	0	-	381	238
Platinum	96	305	3	79	1	500	0	-	100	282
Coal	6	136	1	16	0	-	0	-	7	64
Asbestos	8	229	1	29	5	313	0	-	14	163
Diamond	4		2		0		0		6	
Copper	0		1		0		0		1	
Other	3		0		0		0		3	
Unknown	3		0		0		3		6	
Total	481	313	28	38	6	261	3	231	518	223

Note: rates have not been calculated where numbers are small

The age distribution of cases with active PTB is shown in Table 3-2. Most (68.3%; 354 cases) were in the age group 30-49 years.

TABLE 3-2 NUMBER OF CASES AND PREVALENCE OF ACTIVE PTB BY AGE AND POPULATION GROUP (2003)

Age group (years)	Black		White		Coloured		Unknown		Total	
	N	Rate	N	Rate	N	Rate	N	Rate	N	Rate
20-29	16	239	0	-	0	-	0	-	16	222
30-39	117	303	1	50	0	-	0	-	118	290
40-49	232	338	3	36	1	500	0	-	236	305
50-59	81	282	8	53	0	-	0	-	89	200
60-69	7	318	11	48	3	500	0	-	21	82
70-79	1	143	3	17	2	400	0	-	6	32
80+	0	-	2	25	0	-	0	-	2	23
Unknown	27	355	-	-	0	-	3	250	30	319
Total	481	313	28	38	6	261	3	231	518	223

SECTION 4 – SILICOSIS

Silicotic nodules were found in the lungs of 437 cases (18.9% of all autopsies), 91.5% of which came from the gold mining industry. Of all cases of silicosis, occasional silicotic nodules were found in 57.9% of cases, a few in 19.5%, a moderate number in 19.9% and a large number in 2.8%.

The distribution of cases with silicosis by commodity and population group is presented in Table 4-1. As indicated previously, cases are categorized according to the commodity in which the most years of service occurred. The rate of silicosis in gold miners has remained fairly constant over the last three years, viz. 228/1000 in 2001, 252/1000 in 2002, and 250/1000 in 2003. Cases of silicosis from the platinum mining industry might be explained by unstated previous service in gold mines. Rates are expressed per 1 000 autopsies.

TABLE 4-1 NUMBER OF CASES AND PREVALENCE OF SILICOSIS BY COMMODITY AND POPULATION GROUP (2003)

Commodity	Black		White		Coloured		Unknown		Total	
	N	Rate	N	Rate	N	Rate	N	Rate	N	Rate
Gold	290	264	109	219	1	1000	0	-	400	250
Asbestos	2	57	2	57	0	-	0	-	4	47
Coal	1	23	4	63	0	-	0	-	5	45
Platinum	13	41	0	-	0	-	0	-	13	37
Diamond	2		2		0		0		4	
Copper	0		1		0		0		1	
Other	2		3		0		0		5	
Unknown	0		3		0		2		5	
Total	310	202	124	166	1	43	2	154	437	189

Note: rates have not been calculated where numbers are small

Although the silicosis rates increased with increasing age in both black and white men, the age distribution of cases with silicosis (Table 4-2) differed between the two population groups. Higher rates of silicosis were found in blacks at younger ages. Nevertheless, silicosis was diagnosed in young men (< 30 years old) in both population groups, as well as in those with few years (< 5 years) of silica exposure (Table 4.3).

TABLE 4-2 NUMBER OF CASES AND PREVALENCE OF SILICOSIS IN THE GOLD MINING INDUSTRY, BY AGE AND POPULATION GROUP (2003)

Age group (years)	Black		White		Coloured		Unknown		Total	
	N	Rate	N	Rate	N	Rate	N	Rate	N	Rate
20-29	1	19	0	-	-	-	0	-	1	18
30-39	30	99	1	71	-	-	0	-	31	98
40-49	159	317	5	96	-	-	0	-	164	295
50-59	79	485	19	188	-	-	0	-	98	371
60-69	5	625	37	253	-	-	0	-	42	273
70-79	0	-	34	286	-	-	0	-	34	283
80+	0	-	12	200	-	-	0	-	12	200
Unknown	16	222	1	500	1	1 000	0	-	18	240
Total	290	264	109	219	1	1 000	0	-	400	250

TABLE 4-3 NUMBER OF CASES AND PREVALENCE OF SILICOSIS IN THE GOLD MINING INDUSTRY, BY YEARS OF SERVICE AND POPULATION GROUP (2003)

Years of service	Black		White		Coloured		Unknown		Total	
	N	Rate	N	Rate	N	Rate	N	Rate	N	Rate
<1	3	176	1	500	-	-	0	-	4	211
1 - 5	17	181	3	88	-	-	0	-	20	156
6-10	26	127	2	80	-	-	0	-	28	122
11-15	51	222	7	167	-	-	0	-	58	213
16-20	83	379	12	207	-	-	0	-	95	343
21-25	50	459	11	175	-	-	0	-	61	355
26-30	16	432	17	298	-	-	0	-	33	351
31-35	4	500	23	343	-	-	0	-	27	360
36-40	1	500	17	354	-	-	0	-	18	360
41+	-	-	4	160	-	-	0	-	4	160
Unknown	39	217	12	156	1	1 000	0	-	52	202
Total	290	264	109	219	1	1 000	0	-	400	250

SECTION 5 – OTHER PNEUMOCONIOSES

MASSIVE FIBROSIS

There were 20 (0.9%) cases of massive fibrosis (11 black, 8 white). Eighteen were from the gold mining industry.

COAL WORKERS' PNEUMOCONIOSIS

There were 11 (0.5%) cases of coal workers' pneumoconiosis.

MIXED DUST PNEUMOCONIOSIS

There were 4 (0.2%) cases of mixed dust pneumoconiosis.

ASBESTOSIS AND PLEURAL PLAQUES

There were 44 cases of asbestosis of which 61.4% (n=27) had slight, 31.8% (n=14) moderate and 6.8% (n=3) marked fibrosis. 32 cases had worked in the asbestos mining industry at some time in their lives.

Only three of the cases submitted with a history of asbestos exposure had asbestos plaques. However, the parietal pleura (the site where plaque formation usually occurs) is seldom submitted with the lungs.

The distribution of asbestosis by age and population group is shown in Table 5-1. No asbestosis was diagnosed in cases under 40 years of age.

TABLE 5-1 NUMBER OF CASES AND PREVALENCE OF ASBESTOSIS BY AGE AND POPULATION GROUP (2003)

Age group (years)	Black		White		Coloured		Unknown		Total	
	N	Rate	N	Rate	N	Rate	N	Rate	N	Rate
40-49	4	6	0	-	0	-	0	-	4	5
50-59	7	24	4	26	2	333	0	-	13	29
60-69	3	136	6	26	2	333	0	-	11	43
70-79	3	429	6	35	1	200	0	-	10	54
80+	3	600	3	38	0	-	0	-	6	70
Unknown	0	-	0	-	0	-	0	-	0	-
Total	20	13	19	26	5	217	0	-	44	19

SECTION 6 – EMPHYSEMA

There were 440 cases of emphysema, the extent of which was mild in 78.6% (n=346), moderate in 18.6% (n=82) and marked in 2.7% (n=12). The distribution of emphysema by age and population group is presented in Table 6-1.

TABLE 6-1 NUMBER OF CASES AND PREVALENCE OF EMPHYSEMA BY AGE AND POPULATION GROUP (2003)

Age group (years)	Black		White		Coloured		Unknown		Total	
	N	Rate	N	Rate	N	Rate	N	Rate	N	Rate
30-39	9	23	0	-	0	-	0	-	9	22
40-49	63	92	8	95	0	-	0	-	71	92
50-59	56	195	43	285	1	167	0	-	100	225
60-69	2	91	103	452	4	667	0	-	109	424
70-79	2	286	91	526	2	400	0	-	95	514
80+	4	800	42	532	0	-	0	-	46	535
Unknown	6	79	1	200	1	1000	2	167	10	106
Total	142	92	288	387	8	348	10	154	440	190

The majority of black and white men with emphysema 62.0% (n=273) were from the gold mining industry (Table 6-2).

TABLE 6-2 NUMBER OF CASES AND PREVALENCE OF EMPHYSEMA BY COMMODITY AND POPULATION GROUP (2003)

Commodity	Black		White		Coloured		Unknown		Total	
	N	Rate	N	Rate	N	Rate	N	Rate	N	Rate
Gold	81	74	191	384	1	1000	0	-	273	171
Platinum	30	95	15	395	0	-	0	-	45	127
Coal	15	341	26	406	1	1000	0	-	42	382
Asbestos	8	29	11	314	6	375	0	-	25	291
Iscor	0	-	12	444	0	-	0	-	12	444
Copper	0		3		0		0		8	
Diamond	3		3		0		0		6	
Other	4		15		0		0		19	
Unknown	1		12		0		2		15	
Total	142	92	288	387	8	348	2	154	440	190

Note: rates have not been calculated where numbers are small

TABLE 6-3 NUMBER OF CASES AND PREVALENCE OF EMPHYSEMA BY YEARS OF SERVICE AND POPULATION GROUP (2003)

Years of service	Black		White		Coloured		Unknown		Total	
	N	Rate	N	Rate	N	Rate	N	Rate	N	Rate
1 - 5	7	54	13	232	2	500	0	-	22	116
6-10	16	65	17	405	1	500	0	-	34	116
11-15	27	92	18	273	1	1000	0	-	46	128
16-20	32	107	25	291	1	333	0	-	58	149
21-25	27	179	37	402	0	-	0	-	64	261
26-30	7	132	36	456	0	-	0	-	43	326
31-35	2	222	34	430	0	-	0	-	36	409
36-40	1	333	31	534	0	-	0	-	32	525
41+	1	1000	13	464	1	1000	0	-	15	484
Unknown	22	68	64	408	2	200	2	167	90	179
Total	142	92	288	387	8	348	2	154	440	190

SECTION 7 – MESOTHELIOMA

The number of cases of mesothelioma in 2003 (n=37) was higher than in previous years (19 in 1998, 24 in 1999, 17 in 2000, 18 in 2001 and 27 in 2002). Sixteen cases (43.2%) had previously worked in the asbestos mining industry (not necessarily for the longest period).

TABLE 7-1 NUMBER AND PROPORTION OF MESOTHELIOMA CASES BY AGE AND POPULATION GROUP (2003)

Age group (years)	Black		White		Coloured		Total	
	N	%	N	%	N	%	N	%
40-49	5	33.3	3	13.6	0	0.0	8	21.6
50-59	4	26.7	3	13.6	0	0.0	7	18.9
60-69	3	20.0	12	54.5	0	0.0	15	40.5
70-79	3	20.0	4	18.2	0	0.0	7	18.9
80+	0	0.0	0	0.0	0	0.0	0	0.0
Total	15		22		0		37	

The distribution of mesothelioma by commodity and population group is presented in Table 7-2. The highest proportion of mesothelioma cases was found in asbestos miners (35.1%).

TABLE 7-2 NUMBER AND PROPORTION OF MESOTHELIOMA CASES BY COMMODITY AND POPULATION GROUP (2003)

Commodity	Black		White		Coloured		Total	
	N	%	N	%	N	%	N	%
Asbestos	9	60.0	4	18.2	0	0.0	13	35.1
Gold	3	20.0	8	36.4	0	0.0	11	29.7
Platinum	1	6.7	0	0.0	0	0.0	1	2.7
Copper	0	0.0	1	4.5	0	0.0	1	2.7
Isacor	0	0.0	1	4.5	0	0.0	1	2.7
Other	1	6.7	4	18.2	0	0.0	5	13.5
Unknown	1	6.7	4	18.2	0	0.0	5	13.5
Total	15		22		0		37	

*2 February 2006. In an earlier print run of this report, the total number of mesothelioma cases was given as 36. Changes have been made to the text and tables.

SECTION 8 – PRIMARY LUNG CANCER

Seventy two cases of primary lung cancer were found at autopsy, 19.4% of which were in black, 76.4% in white, and 4.2% in coloured men. Most of the cases were adenocarcinomas (30.6%; n = 22), followed by squamous cell type (27.8%; n = 20), small cell type (22.2%; n = 16), and large cell type (18.1%; n = 13). One case of bronchoalveolar carcinoma was diagnosed.

The distribution of primary lung cancer by age and population group is presented in Table 8-1.

TABLE 8-1 NUMBER OF CASES AND PREVALENCE OF PRIMARY LUNG CANCER BY AGE AND POPULATION GROUP (2003)

Age group (years)	Black		White		Coloured		Total	
	N	Rate	N	Rate	N	Rate	N	Rate
30-39	1	3	0	-	0	-	1	2
40-49	6	9	1	12	0	-	7	9
50-59	5	17	10	66	1	167	16	36
60-69	1	45	25	110	1	167	27	105
70-79	0	-	11	64	1	200	12	65
80+	1	200	8	101	0	-	9	105
Unknown	0	-	0	-	0	-	0	0
Total	14	9	55	74	3	130	72	31

The distribution of primary lung cancer by commodity and population group is presented in Table 8-2. For white men, the majority of cases came from the gold mining industry.

TABLE 8-2 NUMBER OF CASES AND PREVALENCE OF PRIMARY LUNG CANCER BY COMMODITY AND POPULATION GROUP (2003)

Commodity	Black		White		Coloured		Total	
	N	Rate	N	Rate	N	Rate	N	Rate
Gold	4	4	34	68	0	-	38	24
Coal	3	68	1	16	0	-	4	36
Asbestos	3	86	6	171	2	125	11	128
Platinum	2	6	6	158	0	-	8	23
Copper	0	-	1	77	0	-	1	67
Isacor	0	-	2	74	0	-	2	74
Other	2	286	4	211	0	-	6	231
Unknown	0	-	1	36	1	333	2	37
Total	14	9	55	74	3	130	72	31

SECTION 9 – CLINICAL CAUSES OF DEATH

Table 9-1 and Figure 9-1 show the clinical cause of death that accompanied the cardio-respiratory organs, by population group. Diseases of the respiratory system were the most frequent (43.4%) overall. Black men had the highest proportion of unnatural causes of death (14.3%). There was a steady decline in the proportion of unnatural deaths in black men from 1998 to 2002 (19.2% in 1998, 16.8% in 1999, 13.3% in 2000, 11.2% in 2001 and 9.4 in 2002). However, this proportion increased to 12.2% in 2003. In 13.3% of cases the cause of death was not stated.

TABLE 9-1 CLINICAL CAUSES OF DEATH BY POPULATION GROUP (2003)

System	Black		White		Coloured		Unknown		Total	
	N	%	N	%	N	%	N	%	N	%
Respiratory	787	51.2	209	28.1	10	43.5	0	0.0	1006	43.4
Cardio-vascular	51	3.3	112	15.0	1	4.3	0	0.0	164	7.1
Central Nervous System	116	7.6	20	2.7	0	0.0	0	0.0	136	5.9
Gastro intestinal	89	5.8	25	3.4	0	0.0	0	0.0	114	4.9
Genito urinary	34	2.2	19	2.6	1	4.3	0	0.0	54	2.3
Haematological	16	1.0	5	0.7	0	0.0	0	0.0	21	0.9
Unnatural	220	14.3	62	8.3	0	0.0	1	7.7	283	12.2
Miscellaneous	140	9.1	91	12.2	0	0.0	0	0.0	231	10.0
Not stated	83	5.4	202	27.1	11	92.3	12	92.3	309	13.3
Total	1 536		745		23		13		2318	

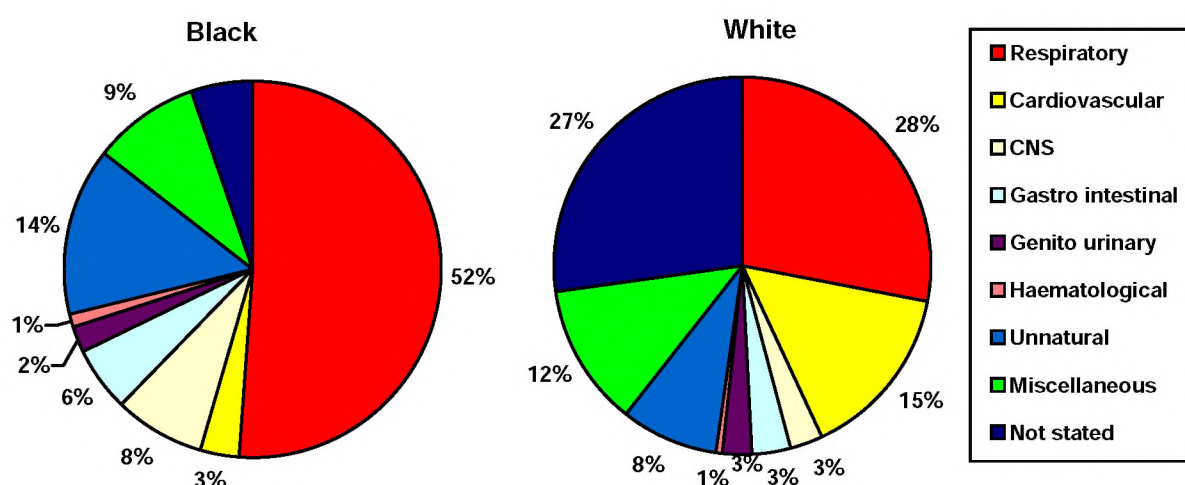


FIGURE 9-1 CLINICAL CAUSE OF DEATH AS GIVEN BY THE CLINICIANS WHO SUBMIT THE ORGANS TO THE NIOH (2003)

APPENDIX 1: DISTRIBUTION OF AUTOPSIES ACCORDING TO THE LAST MINE WHERE THE DECEASED WORKED (2003)

Commodity	Last mine worked	Black	White	Coloured	Unknown	Total
Antimony	Helam Antimony Mine		1			1
Asbestos	African Chrysolite Asbestos	1	1			2
	Asbestos Mine	1	4			5
	Bandag Asbestos Mine	1				1
	Bewaarkloof Asbestos Mine		1			1
	Black Rock Asbestos Mine	1	3			4
	Blackrich Asbestos		1			1
	Cape Blue		3	1		4
	Danielskuil Asbestos mine		1	1		2
	Everite		2			2
	Gefco	30	10	5		45
	Kliphuis		1			1
	Koegas		4	7		11
	Mashaba Asbestos Mine		1			1
	Noupoort Asbestos Mine			1		1
	Penge Asbestos	1	1			2
	Pomfret Asbestos Mine		3			3
	Turnall Asbestos		1			1
Total from asbestos mines		35	37	15		87
Chrome	Chrome Mine		4			4
	Mooinooi		1			1
	Palmiet Chrome		1			1
Total from chrome mines			6			6
Coal	Arnot Colliery	6	2			8
	Atcom Opencast Coal Mine	1				1
	Amcoal Colliery		1			1
	Bank Colliery	4				4
	Brandspruit Colliery	1	1			2
	Coalbrook Colliery		1			1
	Coalfield Mine		1			1
	Cornelia Colliery		3			3
	Delmas Colliery		1			1
	Douglas Colliery	1	2			3
	Duiker Colliery		1			1
	Durban Navigation Colliery		1			1
	Durnacol Mine		1			2
	Duvha Opencast		1			1
	Ermelo Coal		1			1
	Goedehoop Colliery	4	1			5
	Greenside Colliery		1			1
	Grootgeluk		1			1
	Hlobane Colliery		1			1
	Kleinkopje Colliery	2	2			4
	Koornfontein Coal		3			3
	Kriel Colliery	6	2			8
	Landau Colliery		1			1
	Longridge Collieries		1			1
	Matla Coal	7	5			12
	Middelburg Colliery	1	1			2

Commodity	Last mine worked	Black	White	Coloured	Unknown	Total
Coal (continued)	New Clydesdale Colliery	1	1			2
	New Denmark	2				2
	New Vaal Colliery	1	1			2
	Northfield Colliery		1			1
	Optimum Colliery		1			1
	Phoenix Colliery		1			1
	Sasol Coal Mine	1	2			3
	Savemore Colliery	1				1
	Secunda Colliery		3			3
	Sigma Colliery		1			1
	Springfield Colliery		1			1
	Springlake Colliery	1		1		2
	Spitzkop		2			2
	Strathrae Collieries		1			1
	Tavistok Colliery		2			2
	Tselentis Coal Mine		1			1
	Tweefontein	1	3			4
	Usutu Colliery		2			2
	Vryheid Coronation		2			2
	Welgedacht		2			2
	Witbank Collieries	1	2			3
Total from coal mines		42	65	1	1	109
Copper	Inchanga Copper Mine		1			1
	Messina Copper		3			3
	O'Kiep Copper	1	1			2
	Phalaborwa	1	2			3
	Prieska		2			2
Total from copper mines		2	9			11
Diamond	Cullinan Diamond Mine		3			3
	De Beers Consolidated	1	9			10
	Diamond Mine		1			1
	Helam Diamond Mine		1			1
	Loxton Exploration	4				4
	Premier Diamond	5				5
	Rex Diamond Mine	1				1
Total from diamond mines		11	14			25
Gold	African Rainbow Minerals & Exploration	11	2			13
	Afrikaner GM		1			1
	Anglo American GM		2			2
	Anglogold Health Service (Free State)	1				1
	Anglogold Metallurgy	1				1
	Bambanani GM	55	1			56
	Bayer GM		1			1
	Beatrix Gold	77	2			79
	Blyvoorquizecht	1	19			20
	Bracken Mines	1	1			2
	Brakpan GM		3			3
	Buffelsfontein Gold	25	23	1		49
	Carletonville GM	1				1
	Cementation	1	1			2
	Chamber of GM			1		1

Commodity	Last mine worked	Black	White	Coloured	Unknown	Total
Gold (continued)	Chavani GM		1			1
	City Deep		1			1
	Consolidated Murchison		1			1
	Crown Mines		2			2
	Daggasfontein		4			4
	Deelkraal		5			5
	Doornfontein		6			6
	Doringkop GM		1			1
	Durban Roodepoort Deep		9			9
	East Driefontein	74	14			88
	East Rand Prop	5	21			26
	Elandsrand		3			3
	Evander GM	43	4			47
	Freddies Gold	3				3
	Free State Geduld		14			14
	Free State Saaiplaas		1			1
	Goldfields	5				5
	Grinaker GM	1				1
	Grootvlei Prop		10			10
	Harmony	100	27			127
	Hartebeesfontein	74	16			90
	J.I.C. Gold Mine	4	3			7
	Joel	6	1			7
	Kinross	13	2			15
	Kloof	88	11			99
	Kopanang GM	1	-			1
	Loraine	-	3			3
	Leeudoorn	13	6			19
	Leslie	1				1
	Libanon	13	8			21
	Luipaardsvlei Estate GM		1			1
	Marievale		3			3
	Masimong Gold Mine	16				16
	Matjabeng Gold Mine	13				13
	Merriespruit GM	1				1
	Middelburg GM		1			1
	Minroc GM		1			1
	New Kleinfontein GM		2			2
	Nigel GM		1			1
	Oryx	37				37
	Placer Dome GM	27	1			28
	Poortjie GM		1			1
	President Brand	1	18		1	20
	President Steyn		12			12
	Rand Leases		2			2
	Rand Mines		1			1
	Randfontein	26	17			43
	S A Land		1			1
	Saaiplaas GM		1			1
	South Deep GM	1				1
	South Roodepoort		1			1
	Spaarwater GM		1			1
	Springs GM		1			1
	St Helena	25	6			31
	State GM	1				1
	Stilfontein		11			11

Commodity	Last mine worked	Black	White	Coloured	Unknown	Total
Gold (continued)	Sub Nigel		1			1
	Transvaal GM		1			1
	Tshepone GM	22	2			24
	Ubuntu Small Scale GM	2				2
	Unisel GM	1	1			2
	Vaal Reefs	179	44			223
	Ventersport		8			8
	Virginia GM		2			2
	Vlakfontein		3			3
	Vogelstruisbult		1			1
	Welkom GM	1	5			6
	West Driefontein	54	21			75
	West Rand Consolidation	1	7			8
	West Witwatersrand		2			2
	Western Areas		13			13
	Western Deep Levels	54	16			70
	Western Holdings		13			13
	Winkelhaak		1			1
	Wit Nigel GM		3			3
Total from gold mines		1080	457	2	1	1540
Platinum	Atok Platinum	1				1
	Bafokeng	4	1			5
	Eastern Platinum		2			2
	Impala Platinum	90	19	2		111
	Karee Platinum	14	1			15
	Lebowa Platinum	2	1			3
	Modikwa Platinum	2	1			3
	Messina Platinum	2				2
	Northam Platinum	13	2			15
	Paardekraal Anglo Plats		1			1
	Rustenburg Platinum	188	24			212
	Swartklip Platinum	2				2
	Townlands Platinum Mine		1			1
	Western Platinum		8			8
	Wildebeestfontein	5				5
	Zondereinde Platinum	13				13
	Unknown Platinum		1			1
Total from platinum mines		336	62	2		400
Iron	Iron Ore Mine	1				1
	Sishen Iron Mine	1	1			2
	Thabazimbi Iron Mine		1			1
Total from iron mines		2	2			4
Manganese	Hotazel	2				2
	Manganese Mine		3			3
	National Manganese	1				1
	S A Manganese	3	1			4
Total from manganese mines		6	4			10
Tin	Rooiberg Mineral Division		1			1
	Rooiberg Tin Mine		1			1
	Zaaiplaats Tin Mine		1			1
Total from tin			3			3

Commodity	Last mine worked	Black	White	Coloured	Unknown	Total
mines						
Fluorspar	Witkp Fluorspar Mine		1			1
Iron & Manganese	Associated Manganese	2	2			4
Lead & Minerals	Blackmountain	2				2
Quarries	Stone Allied Crushers		1			1
Silica	Silicon Smelters	2	1			3
Sinkers	Shaft Sinkers		1			1
Steel	Highveld Steel and Vanadium		4			4
Steel & Iron	Iscor	1	38			39
Zinc	Zinc Corporation	1				1
Non-Miner	Industry	2	10			12
	Rhodesia Railways		1			1
	Transnet		1			1
Unknown	Unknown	11	25	3	12	51
TOTAL		1536	745	23	13	2 318

APPENDIX 2: PATHAUT PUBLICATIONS AND ACTIVITIES (2003)

Journal articles

Published:

1. Murray J, Rees D. Tuberculosis and silicosis in South African gold mining. OSH and Development 2003; 5: 2-10.

In press:

1. Gerston KF, Blumberg L, Tshabalala VA, Murray J. Viability of mycobacteria in formalin-fixed lungs. (In press: Human Pathology).
2. Murray J, Nelson G. Demographic data and disease rates in deceased South African miners. (In press: Occupational Health Southern Africa).
3. Ross MH, Murray J. Occupational respiratory disease in mining. (In press: Occupational Medicine).
4. Murray J, Back P, Nelson G. Pulmonary nocardiosis in autopsies of South African miners. (In press: South African Journal of Epidemiology and Infectious Diseases).

Submitted:

1. Naidoo RN, Robins TG, Murray J, Green FHY, Vallyathan V. Validation of autopsy data for epidemiologic studies of coal miners. (Submitted: American Journal of Industrial Medicine).

Congresses

1. Candy G, Murray J. Trends in atheroma diagnosed at autopsy in SA miners 1975 – 2001. 13th congress of South African Hypertension Society. March 2003, Sandton City Conference Centre, Johannesburg.
2. Phillips J, Murray J, Nelson G. Asbestos, Simian Virus 40 and Mesothelioma. Mine Medical Officers Association, Sixth Annual congress. May 2003, Sparkling Waters Hotel, Rustenburg.
3. Calverley A, Murray J. South Africa's treasure chest: Pandora's box for health? 9th International Inhalation Symposium. June 2003, Hannover, Germany.
4. Candy G, Murray J. Increasing prevalence of coronary artery atherosclerosis in South African black and white miners: NCOH PATHAUT mining autopsy data. 43rd Conference of the federation of South African Society of Pathology. June 2003, Johannesburg.
5. Honma K, Murray J. Intrapulmonary lymph nodes in South African miners – An autopsy survey. 19th European Congress of Pathology. September 2003, Ljubljana, Slovenia.

Higher degrees

1. Sartorius B. MSc in Epidemiology and Biostatistics : Prevalence, trends and risk factors of arteriosclerosis in autopsied SA miners from 1975 – 2001. Completed 2003. School of Public Health, University of the Witwatersrand
2. Chaudry S. MSc in Epidemiology and Biostatistics: Attribution of lung cancer to asbestos exposure in miners in South Africa. Ongoing, started 2003. School of Public Health, University of the Witwatersrand.

Material from the autopsy service was presented to a wide range of audiences, e.g. health care workers on the mines, occupational health nurses, members of the National Union of Mineworkers, Department of Labour employees; and at various forums, such as University of the Witwatersrand Research Days and local workshops.

DISTRIBUTION LIST

Individuals

Dr John Robinson	National Health Laboratory Services (NHLS)
Prof David Rees	National Institute for Occupational Health (NIOH)
Prof Mary Ross	Safety in mines Research Advisory Committee (SIMRAC)
Ms May Hermanus	Department of Minerals and Energy (DME)
Mr Doug Rowe	Department of Minerals and Energy (DME)
Dr Molly Ohaju	Department of Minerals and Energy (DME)
Ms Michelle Kotze	Department of Health (DoH)

Institutions

Medical Bureau of Occupational Diseases (MBOD)
Compensation Commissioner for Occupational Diseases (CCOD)
Department of Labour (DoL)
National Institute for Occupational Safety and Health (NIOSH)
Department of Health (DoH)

Libraries

National Institute for Occupational Health
National Health Laboratory Services
University of the Witwatersrand Medical School

Mine Occupational Health Services