



NATIONAL INSTITUTE FOR OCCUPATIONAL HEALTH

**Pathology Division
Surveillance Report:
Demographic Data and
Disease Rates for
January to December
2005**

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NIOH Report 2/2006

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**NATIONAL HEALTH
LABORATORY SERVICE**



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EXECUTIVE SUMMARY

During 2005, 1 876 cases came to autopsy at the NIOH. Of these, 68% were black men, 30% were white, 1% were coloured and 1% were submitted without information on population group. Overall disease rates (per 1000 autopsies) for 2005 are shown in Figure 1.

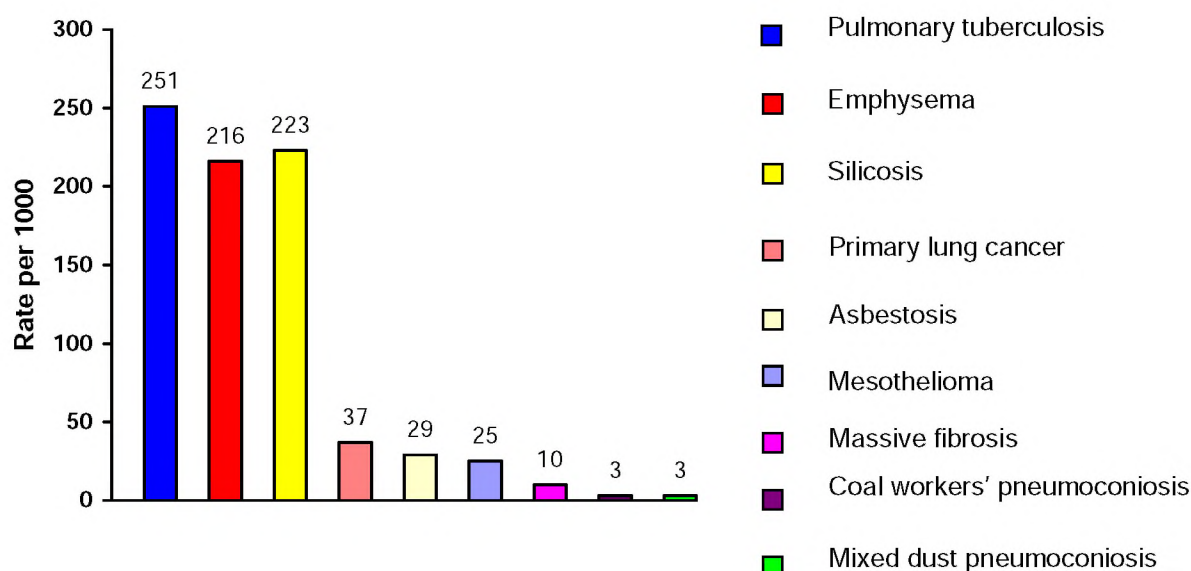


FIG.1 OVERALL DISEASE RATES FOR COMPENSABLE LUNG DISEASES (2005)

In 2005 the overall prevalence of silicosis increased from that in previous years. The prevalence of pulmonary tuberculosis (PTB) also 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 341 per thousand in 2004 to 348 per thousand in 2005.

For the first time, some data on females is included in the annual report (Section 10). Forty three (2.3%) of the cases examined in 2005 were women.

Concerted efforts to obtain service histories resulted in fewer cases with incomplete information in 2005.

During 2005, four journal articles utilising the PATHAUT data were published and research findings were presented at a number of forums (see Appendix 2). An MSc student completed her studies (University of the Witwatersrand) and a PhD has been registered (University of the Witwatersrand). Both dissertations are based on PATHAUT data.

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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 1 cm 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 compensable disease are then referred to the Compensation Commissioner's office, where the payment for compensation is managed.

Since 1975, the pathological findings from the autopsy examinations have been recorded on the computerised 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 v9.1.

This is the ninth consecutive annual report and describes autopsy cases examined during the year 2005. Some of the earlier reports and this report can be accessed at www.nioh.ac.za.

Throughout this report (except in Section 10), the term 'men' and all data include both men and women.

Many of the cases had "mixed" exposures in that they had been employed in more than one commodity. For simplicity, cases are categorised according to the commodity in which most years of service were recorded, i.e. the commodity in which the miners 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 manganese 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 - 2005)

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						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
2004	1 428	69	596	29	22	1	1		8	0.4	2 055
2005	1 274	68	562	30	22	1			18	1.0	1 876
Total	63 055	66	30 183	32	1 470	2	3	0	149	0.2	94 860

* Data for only ± 6 months are available for 1996

It is important to note that a referral bias exists: there is a low autopsy rate for black men who have left employment at the mines, whereas the majority of white retired miners come to autopsy. 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 approximately 155 000 in 2005.

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 2005. Autopsies of only the cardio-respiratory organs comprised 95.7% of all examinations.

TABLE 2-2 NUMBER AND PROPORTION OF AUTOPSIES BY TYPE AND POPULATION GROUP (2005)

Autopsy type	Black		White		Coloured		Unknown		Total	
	N	%	N	%	N	%	N	%	N	%
Cardiorespiratory organs only	1 271	99.8	484	86.1	22	100	18	100	1 795	95.7
Full autopsy	3	0.2	78	13.9	0	-	0	-	81	4.3
Total	1 274		562		22		18		1 876	

The age distribution of autopsies for 2005 is shown in Table 2-3 and Figure 2-1. The mean age at autopsy for black men has increased annually from 37.9 years in 1998 to 45.2 years in 2005. The mean age of white men at autopsy (63.8 years) has remained essentially unchanged.

TABLE 2-3 NUMBER AND PROPORTION OF AUTOPSIES BY AGE AND POPULATION GROUP (2005)

Age group (years)	Black		White		Coloured		Unknown		Total	
	N	%	N	%	N	%	N	%	N	%
20-29	48	3.8	4	0.7	0	-	0	-	52	2.8
30-39	280	22.0	16	2.8	3	13.6	0	-	299	15.9
40-49	585	46.0	65	11.6	4	18.2	1	5.6	655	34.9
50-59	274	21.4	112	19.9	5	22.7	1	5.6	392	20.9
60-69	45	3.5	156	27.8	3	13.6	0	-	204	10.9
70-79	14	1.1	142	25.3	6	27.3	0	-	162	8.6
80+	13	1.0	63	11.2	1	4.5	0	-	77	4.1
Unknown	15	1.2	4	0.7	0	-	16	88.9	35	1.9
Total	1 274		562		22		18		1 876	

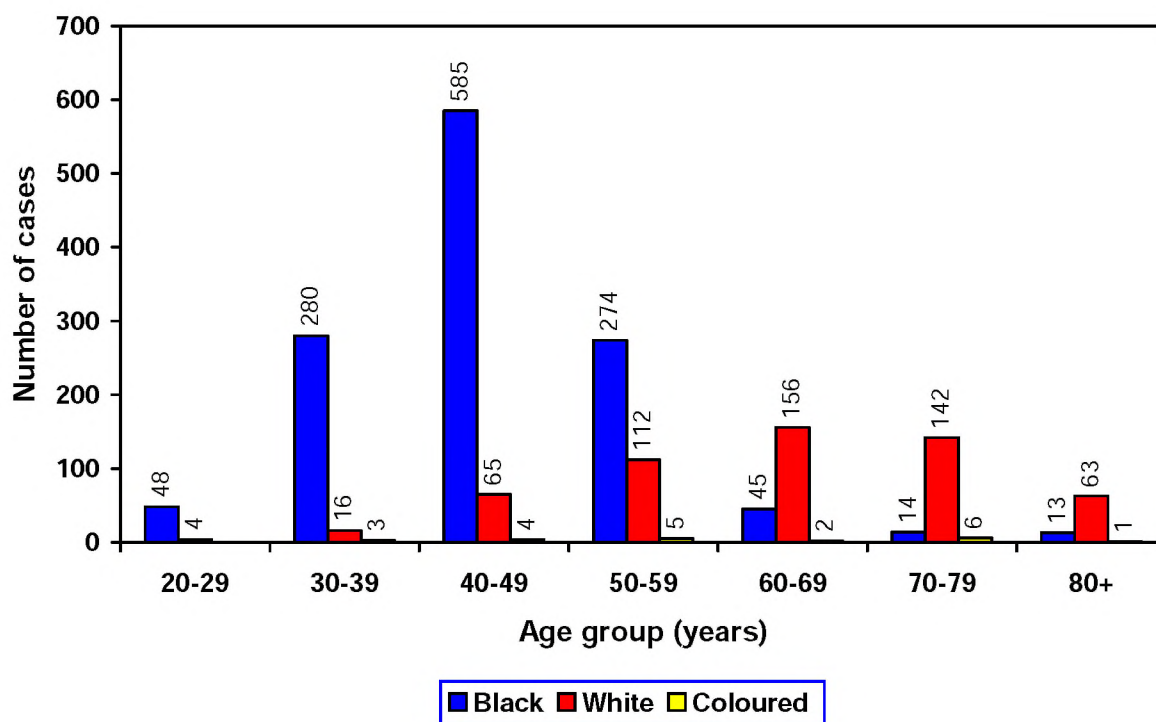


FIG 2-1 DISTRIBUTION OF AUTOPSIES BY AGE AND POPULATION GROUP (2005)

Table 2-4 and Figure 2-2 show the distribution of autopsies by commodity and population group for 2005. The percentage of autopsies received from the gold mining industry has been consistent over the last five years, at around 69%. The percentage of autopsies from platinum miners doubled from 8.3% in 1999 to 16% in 2004 and remained fairly constant in 2005 (15%). As in previous years, the majority of coloured men who came to autopsy (72.7%) were asbestos miners.

Cases were placed in categories 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). All results are presented using longest exposure.

TABLE 2-4 NUMBER AND PROPORTION OF AUTOPSIES BY COMMODITY AND POPULATION GROUP (2005)

Commodity	Black		White		Coloured		Unknown		Total	
	N	%	N	%	N	%	N	%	N	%
Gold	863	67.7	429	76.3	2	9.1	0	-	1294	69.0
Platinum	257	20.2	24	4.3	1	4.5	0	-	282	15.0
Coal	35	2.7	32	5.7	1	4.5	0	-	68	3.6
Asbestos	76	6.0	17	3.0	16	72.7	0	-	109	5.8
Iscor	2	0.2	16	2.8	0	-	0	-	18	1.0
Diamond	10	0.8	8	1.4	0	-	0	-	18	1.0
Copper	4	0.3	6	1.1	1	4.5	0	-	11	0.6
Manganese	13	1.0	3	0.5	0	-	0	-	16	0.9
Industry	4	0.3	8	1.4	0	-	0	-	12	0.6
Other	6	0.5	11	2.0	0	-	0	-	17	0.9
Unknown	4	0.3	8	1.4	1	4.5	18	100	31	1.7
Total	1 274		562		22		18		1 876	

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

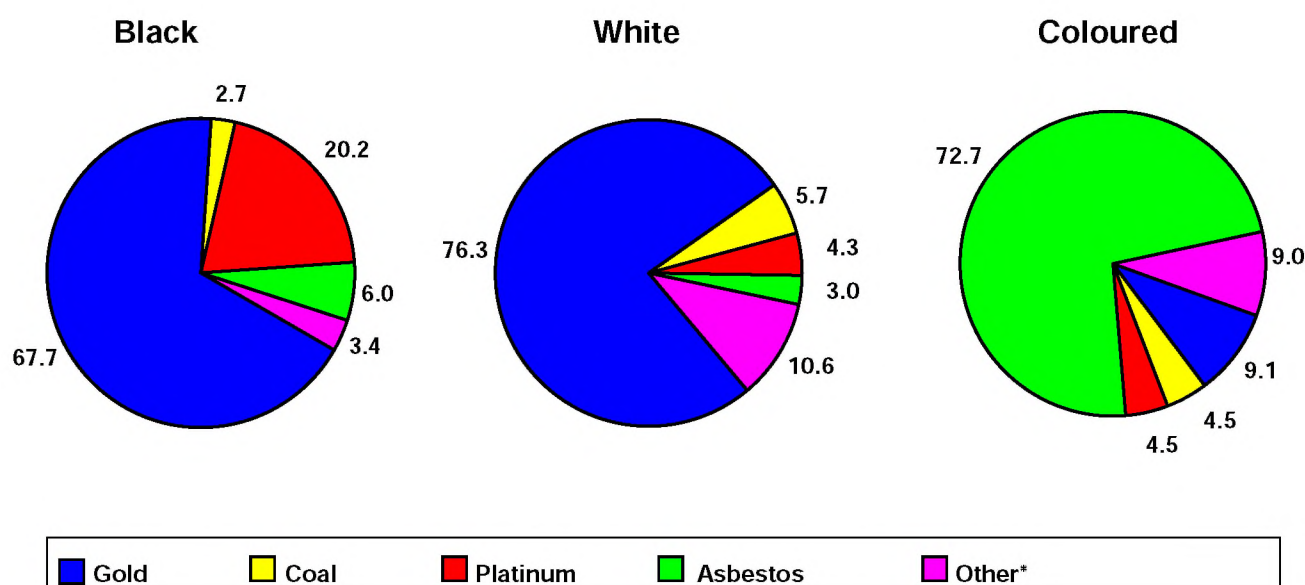


FIG 2-2 DISTRIBUTION OF AUTOPSIES BY COMMODITY AND POPULATION GROUP (2005)

* Includes Iscor, copper, diamond, quarry, silica (silicon smelters), manganese, zinc, minerals, steel, chrome, iron, manganese, emerald and other industries, as well as cases where no service histories were obtained.

Detailed information about the years in mining service by population group is presented in Table 2-5 and Figure 2-3. In 2005, duration of service was obtained for all but 3.5% of the cases. This is much the same as in 2004 (4.4%) and much lower than previous years (e.g. 21.8% in 2003). The decrease is attributed to improvement in the follow-up of cases to obtain complete service histories.

TABLE 2-5 NUMBER AND PROPORTION OF AUTOPSIES BY YEARS OF SERVICE AND POPULATION GROUP (2005)

Years of service	Black		White		Coloured		Unknown		Total	
	N	%	N	%	N	%	N	%	N	%
<1	21	1.6	0	-	0	-	0	-	21	1.1
1-5	169	13.3	27	4.8	5	22.7	0	-	201	10.7
6-10	216	17.0	52	9.3	4	18.2	0	-	272	14.5
11-15	219	17.2	70	12.5	1	4.5	0	-	290	15.5
16-20	318	25.0	76	13.5	4	18.2	0	-	398	21.2
21-25	188	14.8	106	18.9	1	4.5	0	-	295	15.7
26-30	84	6.6	80	14.2	0	-	0	-	164	8.7
31-35	30	2.4	70	12.5	0	-	0	-	100	5.3
36-40	3	0.2	44	7.8	1	4.5	0	-	48	2.6
41+	3	0.2	18	3.2	0	-	0	-	21	1.1
Unknown	23	1.8	19	3.4	6	27.3	18	100	66	3.5
Total	1 274		562		22		18		1 876	

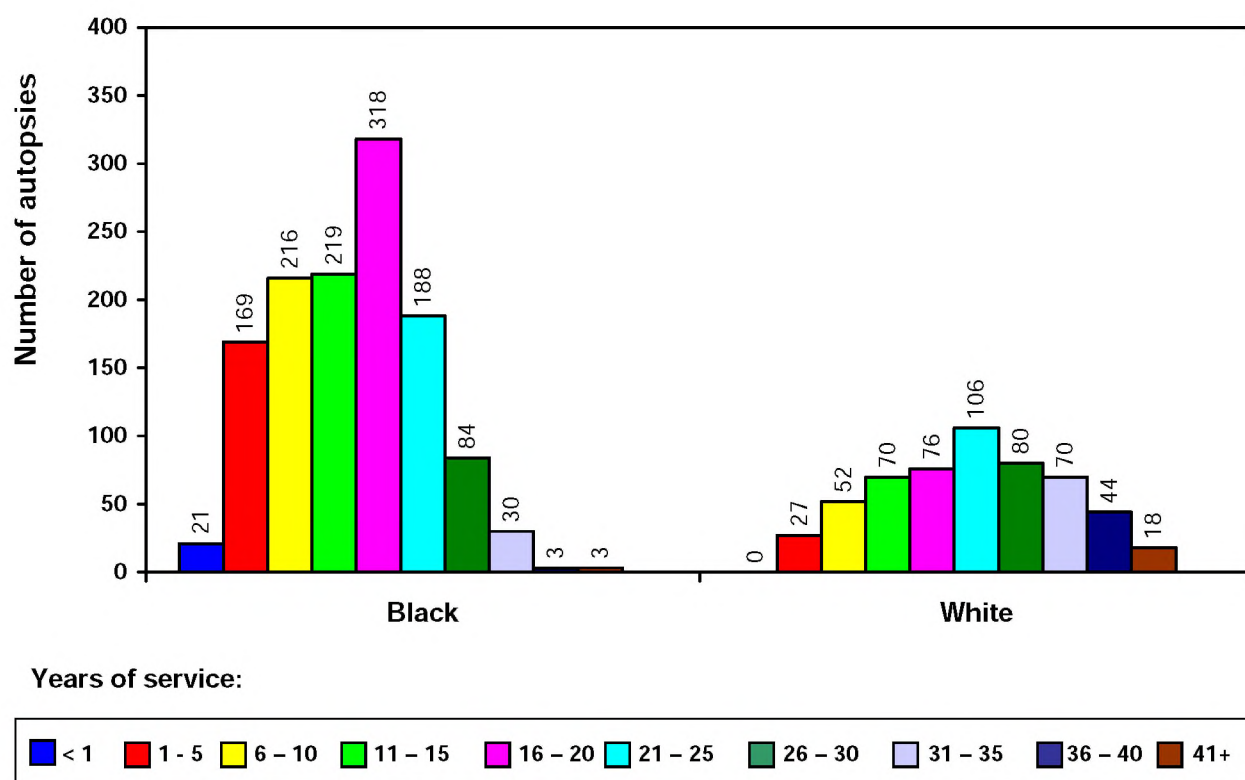


FIG 2-3 DISTRIBUTION OF AUTOPSIES BY YEARS OF SERVICE AND POPULATION GROUP (2005)

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 (2005)

Commodity	Black			White		
	N	Mean (years)	SD*	N	Mean (years)	SD*
Gold	853	43	8	429	64	13
Coal	34	47	7	32	63	11
Platinum	257	45	8	24	63	13
Asbestos	76	60	13	17	67	10
Diamond	10	51	11	8	61	14
Copper	4	65	5	6	61	16
Iscor	2	43	23	15	66	8
Manganese	13	51	8	3	54	14
Industry	4	41	15	8	62	10
Other	6	61	21	11	60	16
Unknown	0	0	-	5	59	8
Total	1 259	45	10	558	64	13

* Standard deviation

TABLE 2-7 MEAN DURATION OF SERVICE BY COMMODITY AND POPULATION GROUP (2005)

Commodity	Black			White		
	N	Mean (years)	SD*	N	Mean (years)	SD*
Gold	855	16	8	424	24	10
Coal	34	20	10	32	20	8
Platinum	255	16	8	22	20	7
Asbestos	70	7	8	15	10	9
Diamond	10	19	12	8	17	9
Copper	4	21	8	5	19	9
Iscor	2	2	1	15	19	8
Manganese	13	13	13	3	24	7
Industry	2	12	15	8	22	12
Other	6	12	6	10	12	10
Unknown	0	0	-	1	26	-
Total	1 251	15	8	543	23	10

*Standard deviation

SECTION 3 – ACTIVE TUBERCULOSIS

The distribution of active tuberculosis (TB) by anatomical site is presented in Figure 3-1 (n=558). Active pulmonary TB (PTB) was diagnosed in 25.1% (470) of all cases autopsied in 2005, compared to 16.4% (416) in 2000. Most of the men with PTB were black (93.2%; 438 cases), 5.7% (27 cases) were white, 0.9% (4 cases) were coloured and in 0.2% (1 case) the population group was unknown.

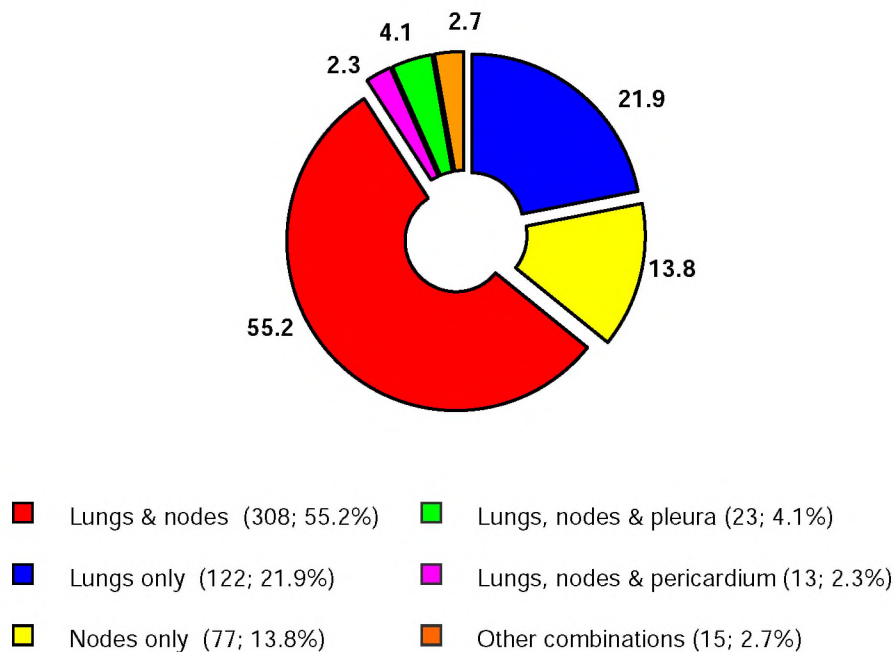


FIG 3-1 DISTRIBUTION OF ACTIVE TB BY SITE (2005)

The overall rate of PTB (251/1000) has increased, from 160/1000 in 2000. This is attributed to the increase in the PTB rate in black men from 217/1000 in 2000 to 344/1000 in 2005 (Table 3.1). As indicated previously, cases are assigned to categories according to the commodity in which the most years of service occurred. In black gold miners, the rate of PTB has increased annually from 171/1000 in 1999 to 379/1000 in 2005. Rates in black platinum miners have decreased in the last few years from 383/1000 in 2002 to 315/1000 in 2005.

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FIG 3-2 ACTIVE PTB RATES IN BLACK MINERS AT AUTOPSY (1975 to 2005)

The distribution of active PTB cases by commodity is shown in Table 3-1. Rates in this and subsequent tables and figures are expressed per 1000. The majority of active PTB cases (74%) came from the gold mining industry (69% of all autopsy cases came from that commodity).

TABLE 3-1 NUMBER OF CASES AND PREVALENCE OF ACTIVE PTB BY COMMODITY AND POPULATION GROUP (2005)

Commodity	Black		White		Coloured		Unknown		Total	
	N	Rate	N	Rate	N	Rate	N	Rate	N	Rate
Gold	327	379	20	47	1	500	0	-	348	269
Platinum	81	315	1	42	0	-	0	-	82	291
Coal	7	200	1	31	0	-	0	-	8	118
Asbestos	19	250	2	118	2	125	0	-	23	211
Diamond	2		0		0		0		2	
Copper	0		1		0		0		1	
Other	1		2		0		0		3	
Unknown	1		0		1		1		3	
Total	438	344	27	48	4	182	1	56	470	251

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 (45.5%; 214 cases) were in the age group 40-49 years, followed by 24.5% (115 cases) in the 30-39 year age group.

TABLE 3-2 NUMBER OF CASES AND PREVALENCE OF ACTIVE PTB BY AGE AND POPULATION GROUP (2005)

Age group (years)	Black		White		Coloured		Unknown		Total	
	N	Rate	N	Rate	N	Rate	N	Rate	N	Rate
20-29	15	313	0	-	0	-	0	-	15	288
30-39	114	407	0	-	1	333	0	-	115	385
40-49	204	348	8	123	2	500	0	-	214	327
50-59	88	321	5	45	0	-	0	-	93	237
60-69	8	178	10	64	1	333	0	-	19	93
70-79	4	286	3	21	0	-	0	-	7	43

80+	2	154	1	16	0	-	0	-	3	39
Unknown	3	200	0	-	0	-	1	63	4	114
Total	438	344	27	48	4	182	1	56	470	251

SECTION 4 – SILICOSIS

Silicotic nodules were found in the lungs of 418 cases (22.3% of all autopsies), 91.4% of which came from the gold mining industry. Of all cases of silicosis, occasional silicotic nodules were found in 50.7% of cases, a few in 19.6%, a moderate number in 26.6% and a large number in 3.1%.

The distribution of cases with silicosis by commodity and population group is presented in Table 4-1. The rate of silicosis in gold miners has increased from 191/1000 in 2000 to 295/1000 in 2005.

TABLE 4-1 NUMBER OF CASES AND PREVALENCE OF SILICOSIS BY COMMODITY AND POPULATION GROUP (2005)

Commodity	Black		White		Coloured		Unknown		Total	
	N	Rate	N	Rate	N	Rate	N	Rate	N	Rate
Gold	273	316	109	254	0	-	0	-	382	295
Platinum	9	35	2	83	0	-	0	-	11	39
Asbestos	7	92	0	-	0	-	0	-	7	64
Coal	3		0		0		0		3	
Diamond	3		1		0		0		4	
Copper	0		1		1		0		2	
Other	1		2		0		0		3	
Unknown	1		1		0		4		6	
Total	297	233	116	206	1	45	4	222	418	223

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 differed between the two population groups (Table 4-2). More cases of silicosis were diagnosed in blacks at younger ages (<40) and in men who were exposed to silica for fewer years (< 5 years) (Table 4-3).

TABLE 4-2 NUMBER OF CASES AND PREVALENCE OF SILICOSIS IN THE GOLD MINING INDUSTRY, BY AGE AND POPULATION GROUP (2005)

Age group (years)	Black		White		Coloured		Unknown		Total	
	N	Rate	N	Rate	N	Rate	N	Rate	N	Rate
30-39	27	122	1	71	0	-	0	-	28	114
40-49	155	366	8	174	0	-	0	-	163	347
50-59	77	484	9	99	0	-	0	-	86	344
60-69	5	417	30	275	0	-	0	-	35	289
70-79	3	1000	41	366	0	-	0	-	44	383
80+	1	500	20	370	0	-	0	-	21	375
Unknown	5	500	0	-	0	-	0	-	5	500
Total	273	316	109	254	0		0		382	295

TABLE 4-3 NUMBER OF CASES AND PREVALENCE OF SILICOSIS IN THE GOLD MINING INDUSTRY, BY YEARS OF SERVICE AND POPULATION GROUP (2005)

Years of service	Black		White		Coloured		Unknown		Total	
	N	Rate	N	Rate	N	Rate	N	Rate	N	Rate
1 - 5	5	63	1	71	0	-	0	-	6	64
6-10	21	126	3	81	0	-	0	-	24	117
11-15	44	275	7	143	0	-	0	-	51	244
16-20	101	428	9	184	0	-	0	-	110	385
21-25	64	481	17	191	0	-	0	-	81	365
26-30	26	500	17	279	0	-	0	-	43	381
31-35	8	444	28	424	0	-	0	-	36	429
36-40	1	1000	18	429	0	-	0	-	19	442
41+	1	1000	9	529	0	-	0	-	10	556
Unknown	2	250	0	-	0	-	0	-	2	154
Total	273	316	109	254	0		0		382	295

SECTION 5 – OTHER PNEUMOCONIOSES

MASSIVE FIBROSIS

There were 18 (1%) cases of massive fibrosis (15 black, 3 white). Sixteen were from the gold mining industry.

COAL WORKERS' PNEUMOCONIOSIS

There were 6 (0.3%) cases of coal workers' pneumoconiosis.

MIXED DUST PNEUMOCONIOSIS

There were 5 (0.3%) cases of mixed dust pneumoconiosis.

ASBESTOSIS AND PLEURAL PLAQUES

There were 54 cases of asbestosis of which 57.4% (n=31) had slight, 33.3% (n=18) moderate and 9.3% (n=5) marked fibrosis. Forty eight of these cases had worked in the asbestos mining industry at some time in their lives.

Forty three of the cases 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. Only one case was diagnosed in cases below 40 years of age.

TABLE 5-1 NUMBER OF CASES AND PREVALENCE OF ASBESTOSIS BY AGE AND POPULATION GROUP (2005)

Age group (years)	Black		White		Coloured		Unknown		Total	
	N	Rate	N	Rate	N	Rate	N	Rate	N	Rate
30-39	1	4	0	-	0	-	0	-	1	3
40-49	6	10	0	-	0	-	0	-	6	9
50-59	11	40	0	-	0	-	0	-	11	28
60-69	14	311	3	19	1	333	0	-	18	88
70-79	5	357	2	14	2	333	0	-	9	56
80+	6	462	1	16	1	1000	0	-	8	104
Unknown	0	-	0	-	0	-	1	63	1	29
Total	43	34	6	11	4	182	1	56	54	29

SECTION 6 – EMPHYSEMA

There were 406 cases of emphysema, the extent of which was mild in 85.5% (n=347), moderate in 13.6% (n=55) and marked in 1% (n=4). 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 (2005)

Age group (years)	Black		White		Coloured		Unknown		Total	
	N	Rate	N	Rate	N	Rate	N	Rate	N	Rate
20-29	1	21	0	-	0	-	0	-	1	19
30-39	9	32	0	-	0	-	0	-	9	30
40-49	82	139	7	108	0	-	0	-	89	136
50-59	48	175	37	330	4	800	0	-	89	227
60-69	16	356	72	462	2	667	0	-	90	441
70-79	3	214	77	542	4	667	0	-	84	519
80+	7	538	30	476	0	-	0	-	37	481
Unknown	2	133	1	250	0	-	4	250	7	200
Total	168	132	224	399	10	455	4	222	406	216

The majority of black and white men with emphysema were from the gold mining industry (64.5%, n=262) (Table 6-2).

TABLE 6-2 NUMBER OF CASES AND PREVALENCE OF EMPHYSEMA BY COMMODITY AND POPULATION GROUP (2005)

Commodity	Black		White		Coloured		Unknown		Total	
	N	Rate	N	Rate	N	Rate	N	Rate	N	Rate
Gold	97	112	165	385	0	-	0	-	262	202
Platinum	32	125	12	500	0	-	0	-	44	156
Coal	12	343	14	438	0	-	0	-	26	382
Asbestos	21	276	8	471	9	563	0	-	38	349
Diamond	2		4		0		0		6	
Copper	1		1		1		0		3	
Other	3		18		0		0		21	
Unknown	0		2		0		4		6	
Total	168	132	224	399	10	455	4	222	406	216

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 (2005)

Years of service	Black		White		Coloured		Unknown		Total	
	N	Rate	N	Rate	N	Rate	N	Rate	N	Rate
<1	6	286	0	-	0	-	0	-	6	286
1 - 5	15	89	14	519	1	200	0	-	30	149
6-10	22	102	14	269	3	750	0	-	39	143
11-15	18	82	25	357	1	1000	0	-	44	152
16-20	40	126	33	434	1	250	0	-	74	186
21-25	35	186	33	311	0	-	0	-	68	231
26-30	20	238	34	425	0	-	0	-	54	329
31-35	6	200	32	457	0	-	0	-	38	380
36-40	1	333	23	523	0	-	0	-	24	500
41+	2	667	10	556	0	-	0	-	12	571
Unknown	3	130	6	316	4	667	4	222	17	258
Total	168	132	224	399	10	455	4	222	406	216

SECTION 7 – MESOTHELIOMA

The number of cases of mesothelioma in 2005 (n=41) was higher than in previous years (14 in 2000, 17 in 2001, 25 in 2002, 36 in 2003 and 25 in 2004).

TABLE 7-1 NUMBER AND PROPORTION OF MESOTHELIOMA CASES BY AGE AND POPULATION GROUP (2005)

Age group (years)	Black		White		Coloured		Total	
	N	%	N	%	N	%	N	%
40-49	7	27	2	14	1	100	10	24
50-59	8	31	3	21	0	-	11	27
60-69	8	31	5	36	0	-	13	32
70-79	3	11	4	29	0	-	7	17
Total	26		14		1		41	

The distribution of mesothelioma by commodity and population group is presented in Table 7.2. Sixty six percent of the miners had worked in asbestos mining at some stage in their careers.

TABLE 7-2 NUMBER AND PROPORTION OF MESOTHELIOMA CASES BY COMMODITY AND POPULATION GROUP (2005)

Commodity	Black		White		Coloured		Total	
	N	%	N	%	N	%	N	%
Asbestos	16	61	2	14	1	100	19	46
Gold	1	4	6	43	0	-	7	17
Platinum	1	4	0	-	0	-	1	2
Copper	2	8	1	7	0	-	3	7
Manganese	2	8	0	-	0	-	2	5
Industry	1	4	3	21	0	-	4	10
Other	3	11	1	7	0	-	4	10
Unknown	0	-	1	7	0	-	1	2
Total	26		14		1		41	

SECTION 8 – PRIMARY LUNG CANCER

Sixty nine cases of primary lung cancer were found at autopsy, 29% of which were in black, 63.8% in white and 4.3% in coloured men. Most of the cases were large adenocarcinomas (39.1%; n = 27), followed by squamous cell type (27.5%; n = 19), small cell lung carcinoma (17.4%; n=12) and large cell lung carcinoma (15.9%; n = 11).

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

TABLE 8-1 NUMBERS OF CASES AND PREVALENCE OF PRIMARY LUNG CANCER BY AGE AND POPULATION GROUP (2005)

Age group (years)	Black		White		Coloured		Unknown		Total	
	N	Rate	N	Rate	N	Rate	N	Rate	N	Rate
30-39	2	7	0	-	0	-	0	-	2	7
40-49	5	9	2	31	0	-	0	-	7	11
50-59	6	22	8	71	2	400	0	-	16	41
60-69	5	111	15	96	1	333	0	-	21	103
70-79	1	71	16	113	0	-	0	-	17	105
80+	1	77	3	48	0	-	0	-	4	52
Unknown	0	-	0	-	0	-	2	125	2	57
Total	20	16	44	78	3	136	2	111	69	37

The distribution of primary lung cancer by commodity and population group is presented in Table 8-2. 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 (2005)

Commodity	Black		White		Coloured		Unknown		Total	
	N	Rate	N	Rate	N	Rate	N	Rate	N	Rate
Gold	6	7	31	72	0	-	0	-	37	29
Platinum	3	12	1	42	0	-	0	-	4	14
Coal	2	57	0	-	0	-	0	-	2	29
Asbestos	6	79	4	235	3	188	0	-	13	119
Diamond	1		1		0		0		2	
Copper	0		1		0		0		1	
Other	2		5		0		0		7	
Unknown	0		1		0		2		3	
Total	20	16	44	78	3	136	2	111	69	37

SECTION 9 – CLINICAL CAUSES OF DEATH

Table 9-1 and Figure 9-1 show the clinical cause of death stated in the accompanying documents submitted with the cardio-respiratory organs, by population group. Diseases of the respiratory system were the most frequent (38.2%) overall. Black men had the highest proportion of unnatural causes of death (11.6%) increasing from 10.2% in 2004. In 15.7% of all cases the cause of death was not stated.

TABLE 9-1 CLINICAL CAUSES OF DEATH BY POPULATION GROUP (2005)

System	Black		White		Coloured		Unknown		Total	
	N	%	N	%	N	%	N	%	N	%
Respiratory	589	46.2	116	20.6	12	54.5	0	-	717	38.2
Cardio-vascular	42	3.3	90	16.0	4	18.2	0	-	136	7.2
Central Nervous System	139	10.9	20	3.6	0	-	0	-	159	8.5
Gastro intestinal	69	5.4	17	3.0	0	-	0	-	86	4.6
Genito urinary	17	1.3	9	1.6	0	-	0	-	26	1.4
Haematological	8	0.6	0	-	0	-	0	-	8	0.4
Unnatural	148	11.6	50	8.9	1	4.5	0	-	199	10.6
Miscellaneous	153	12.0	96	17.1	2	9.1	0	-	251	13.4
Not stated	109	8.6	164	29.2	3	13.6	18	100.0	294	15.7
Total	1 274		562		22		18		1 876	

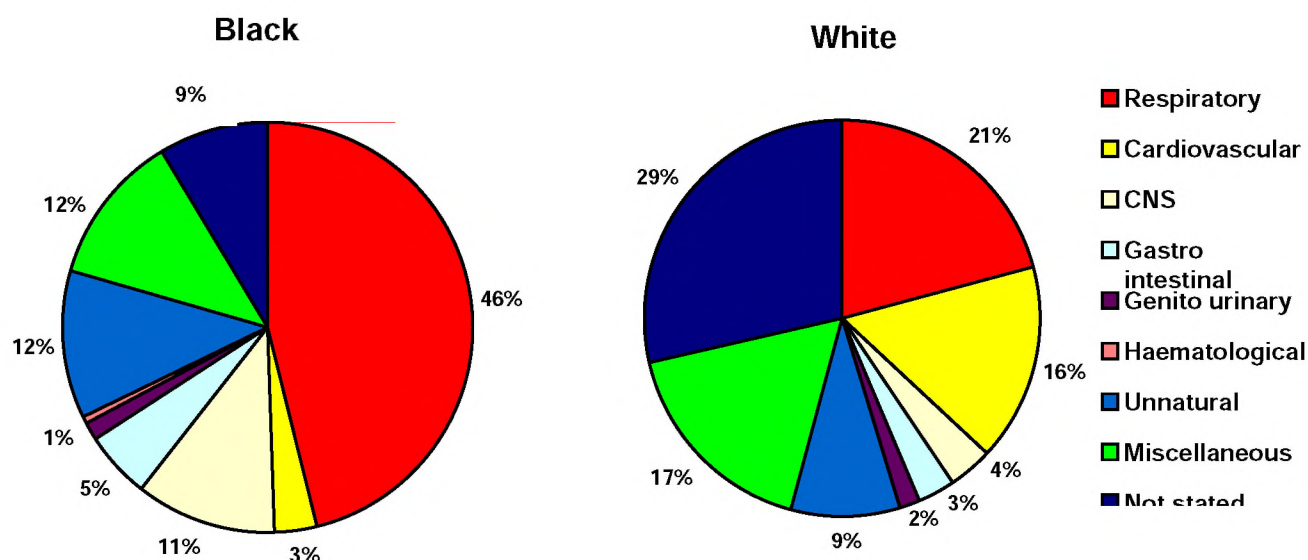


FIGURE 9-1 CLINICAL CAUSE OF DEATH AS STATED BY THE CLINICIANS WHO SUBMIT THE ORGANS TO THE NIOH (2005)

SECTION 10 – AUTOPSY FINDINGS IN WOMEN

There has been an increase in the numbers of cases of women submitted for autopsy. Of the 1 876 cases examined in 2005, 43 (2.3%) were women. Of these 35 (81%) were black, 3 (7%) were white and 5 (12%) were coloured. The mean age at autopsy for black women (58.3 years) was higher than that for black men (44.8 years).

TABLE 10.1 NUMBER AND PROPORTION OF AUTOPSIES IN FEMALES BY AGE AND POPULATION GROUP (2005)

Age group (years)	Black		White		Coloured		Total	
	N	%	N	%	N	%	N	%
30-39	3	8.6	0	-	0	-	3	7.0
40-49	7	20.0	1	33.3	0	-	8	18.6
50-59	9	25.7	1	33.3	1	20.0	11	25.6
60-69	8	22.9	1	33.3	0	-	9	20.9
70-79	1	2.9	0	-	3	60.0	4	9.3
80+	6	17.1	0	-	1	20.0	7	16.3
Unknown	1	2.9	0	-	0	-	1	2.3
Total	35		3		5		43	

Table 10.2 summarises the distribution of autopsies in women by commodity and population group. The majority of the women (70%) had most exposure to asbestos. The second highest exposure was to gold (19%).

TABLE 10.2 NUMBER AND PROPORTION OF AUTOPSIES IN FEMALES BY COMMODITY AND POPULATION GROUP (2005)

Commodity	Black		White		Coloured		Total	
	N	%	N	%	N	%	N	%
Gold	8	22.9	0	-	0	-	8	18.6
Platinum	1	2.9	0	-	0	-	1	2.3
Coal	1	2.9	0	-	0	-	1	2.3
Asbestos	24	68.6	1	33.3	5	100.0	30	69.8
Copper	0	-	1	33.3	0	-	1	2.3
Other	1	2.9	0	-	0	-	1	2.3
Unknown	0	-	1	33.3	0	-	1	2.3
Total	35		3		5		43	

The predominant diseases in women were related to asbestos exposure. There were 8 cases of asbestosis and 9 of mesothelioma.

APPENDIX 1: DISTRIBUTION OF AUTOPSIES ACCORDING TO THE LAST MINE WHERE THE DECEASED WORKED (2005)

Commodity	Last mine worked	Black	White	Coloured	Unknown	Total
Asbestos	African Chrysolite Asbestos		1			1
	Asbestos Mine	3	1	1		5
	Black Rock Asbestos Mine		1			1
	Bretby Asbestos	3				3
	Cape Blue	3	1	1		5
	Danielskuil Asbestos Mine	2	1	2		5
	Dublin Asbestos Mine		1			1
	Everite		1			1
	Gefco	73	3	1		77
	Koegas		3	5		8
	Mamoesa Asbestos Mine		1			1
	Penge Asbestos		1			1
	Pomfret Asbestos Mine	1		2		3
	Total from asbestos mines	85	15	12	0	112
Chrome	Chrome Mine		2			2
	Marble Lime Chrome	1				1
	Samancor Western Chrome		1			1
Total from chrome mines		1	3	0	0	4
Coal	Arnot Colliery	1				1
	Bank Colliery	4				4
	Black Wattle Colliery	2				2
	Cornelia Colliery		1			1
	Coronation Colliery		1			1
	Delmas Colliery		1			1
	Douglas Colliery		1			1
	Duiker Colliery		1			1
	Durnacol Mine		2			2
	Duvha Opencast		1			1
	Goedehoop Colliery	4	3			7
	Greenside Colliery	3				3
	Kleinkopje Colliery	4				4
	Klipfontein		1			1
	Kriel Colliery	3	2			5
	Matla Coal	6	1			7
	Middlebult Coal Mine		1			1
	New Denmark	1	1			2
	New Vaal Colliery		1			1
	Newcastle Coal Mine		1			1
	Optimum Colliery	1	3			4
	Phoenix Colliery		3			3
	Rooifontein Coal Mine	1				1

Commodity	Last mine worked	Black	White	Coloured	Unknown	Total
Coal (continued)	Sasol Coal Mine	1	1			2
	S A Coal Estates		1			1
	Savemore Colliery		1			1
	Secunda Colliery	1	2			3
	Slater Coal Mine	4				4
	Spitzkop		1			1
	Springfield Colliery		1			1
	Springlake Colliery			1		1
	Tavistok Colliery		1			1
	Tweefontein		2			2
	Vryheid Coronation		1			1
Total from coal mines		36	36	1	0	73
Copper	Copper Mine			1		1
	Messina Copper		1			1
	O'Kiep Copper		1	1		2
	Phalaborwa	2				2
	Prieska	1	1			2
Total from copper mines		3	3	2	0	8
Diamond	Cullinan Diamond Mine	7	1			8
	De Beers Consolidated		4			4
	Loxton Exploration	2				2
	Messina Diamond Mine	1				1
	Premier Diamond		2			2
	Star Diamond		1			1
Total from diamond mines		10	8	0	0	18
Gold	African Rainbow Minerals & Exploration	8				8
	Afrikaner GM	2				2
	Angilon GM	1				1
	Anglogold Business Service	6				6
	Anglogold Great Noligwa GM	11				11
	Anglogold Health Service (Free State)		1			1
	Anglogold Vaal River Operation	49	8			57
	Bambanani GM	17	1			18
	Barberton GM		2			2
	Beatrix Gold	98	5			103
	BernetCo GM	1				1
	Blyvoorquizecht		10			10
	Bracken Mines		2			2
	Buffelsfontein Gold	5	20			25
	Cementation	2	4			6
	City Deep		2			2
	Crown Mines		1			1

Commodity	Last mine worked	Black	White	Coloured	Unknown	Total
Gold (continued)	Daggasfontein		3			3
	Deelkraal		6			6
	Doornfontein		2			2
	Doringkop GM		1			1
	Driefontein Cons GM	58	3			61
	Durban Roodepoort Deep	1	5			6
	East Driefontein	3	13			16
	East Geduld	1				1
	East Rand Gold & Uranium	1	1			2
	East Rand Prop	2	15			17
	Eastern Transvaal Consolidated		1			1
	EGGO Sands GM	1	2			3
	Elandsrand	2	4			6
	Evander GM	20	1			21
	Freddies Gold	11	1			12
	Free State Geduld	1	8			9
	Free State Saaiplaas	1	1			2
	Goldfields	2	3			5
	Grootvlei Prop	2	9			11
	Harmony	120	26			146
	Hartebeesfontein	33	15			48
	J.I.C. Gold Mine	4	5			9
	Joel	3	1			4
	Kinross	15		1		16
	Kloof	65	19			84
	Kopanang GM	1	0			1
	Kuikenspoort GM		1			1
	Leeudoorn		2			2
	Leslie	1	5			6
	Libanon	5	8			13
	Loraine	1	9			10
	Luipaardsvlei Estate GM		1			1
	Marievale GM		1			1
	Masimong Gold Mine	13				13
	Matjabeng Gold Mine	2				2
	Merriespruit GM	2				2
	Oryx	43	2			45
	Placer Dome GM	6				6
	President Brand		5			5
	President Steyn	7	10			17
	Primrose GM		1			1
	Randfontein	23	18			41
	Sallies		2			2

Commodity	Last mine worked	Black	White	Coloured	Unknown	Total
Gold (continued)	SAMAT GM	1				1
	Savuka GM	1				1
	Simmer & Jack GM		1			1
	Sonpan GM		1			1
	South Roodepoort		2			2
	St Helena	7	5			12
	State GM	1				1
	Stilfontein	1	7			8
	Sub Nigel		1			1
	Target Gold Mine		1			1
	Tshepone GM	4				4
	Ubuntu Small Scale GM	1				1
	Unisel GM		2			2
	Vaal Reefs	100	32			132
	Ventersport		8			8
	Vlakfontein		4			4
	Welkom GM	1	5			6
	West Driefontein	5	13			18
	West Rand Consolidation		8			8
	West Witwatersrand		2			2
	Western Areas	1	16			17
	Western Deep Levels	52	23			75
	Western Holdings	4	10			14
	Western Reef GM		1			1
	Winkelhaak	2	4			6
	Zandpan GM		1			1
Total from gold mines		831	413	1	0	1245
Platinum	Atok Platinum	2				2
	Bafokeng	2				2
	Eastern Platinum Mine		1			1
	Impala Platinum	113	14	1		128
	Impala Platinum Refinery		1			1
	Kroondal Mine	1	1			2
	Lebowa Platinum	3	1			4
	Messina Platinum Mine		1			1
	Modikwa Platinum Mine	3	1			4
	Northam Platinum	14				14
	Rustenburg Platinum	130	15			145
	San Labour Hire (contract)	1				1
	Unknown Platinum	1	1			2
	Western Platinum	4	1			5
	Wildebeestfontein	3				3
	Zondereinde Platinum	2				2
Total from platinum		279	37	1	0	317

Commodity	Last mine worked	Black	White	Coloured	Unknown	Total
Iron	Boeshoek Iron Mine	3				3
	Iron Ore Mine		1			1
	Sishen Iron Mine	2				2
Total from iron mines		5	1	0	0	6
Manganese	Hotazel Manganese Mine	2	2			4
	Manganese Mine	1				1
	S A Manganese	1	1			2
Total from manganese mines		4	3	0	0	7
Emerald	Gravelotte		1			1
Iron & Manganese	Associated Manganese	4				4
Lead & Minerals	Blackmountain			1		1
Lime	Lime Acres		1			1
Quarries	Bon Accord Quarry	4				4
	Hippo Quarries		1			1
	Marikana Granite		1			1
	Quarry Mine	2				2
Sinkers	Shaft Sinkers	1	1			2
Steel	Highveld Steel and Vanadium		1			1
Steel & Iron	Iskor	1	16			17
Non-Miner	Industry	3	7			10
	NCOH (NIOH)		1			1
	Non-miner		1	2		3
	Transnet		1			1
Unknown	Unknown	5	10	2	18	35
TOTAL		1 274	562	22	18	1 875

APPENDIX 2: PATHAUT PUBLICATIONS AND ACTIVITIES (2005)

Journal articles

Published:

Naidoo RN, Robins TG, Murray J, Green FHY, Vallyathan V. Validation of autopsy data for epidemiologic studies of coal miners. *Am J Ind Med* 2005; 47: 83-90.

Manfredi JJ, Dong J, Liu W-j, Resnick-Silverman L, Qiao R, Chahinian P, Saric M, Gibbs AR, Phillips JI, Murray J, Axten CW, Nolan RP, Aaronson SA. Evidence against a role for SV40 in human mesothelioma. *Cancer Res* 2005; 65 (7): 2602-2609.

Murray J, Nelson G, Ndlovu N, Ross M, Shearer S, Barnes D. Occupational diseases in South African miners (letter to the editor). *Occup Health Southern Africa* 2005; 11(2):4.

Naidoo RN, Robins TG, Murray J. Respiratory outcomes among South African coal miners at autopsy. *Am J Ind Med* 2005; 48: 217-224.

Submitted:

Ndlovu N, Murray J, Candy G, Nelson G. Occupational lung diseases in South African miners at autopsy: Surveillance report 2004. (Submitted *Occup Health Southern Africa*, October 2005)

Reports

Ndlovu N, Murray J, Candy G, Nelson G. Pathology Division Report: Demographic data and disease rates in January to December 2004. NIOH Report 15/2005 ISSN 1812-7681. National Institute for Occupational Health, National Health Laboratory Services, South Africa.

Congresses

Murray J, Hnizdo E. Development of radiological and autopsy silicosis in a cohort of South African gold miners. International Symposium on Environmental Monitoring and Silica Dust Exposure Assessment. 14-17 April 2005. Wuhan, China

Murray J, Hnizdo E. Development of silicosis in a cohort of South African gold miners- radiological and autopsy based study. The 10th International Conference on Occupational Respiratory Diseases. 19-22 April 2005. Beijing, China

Nelson G, Murray J, Ross M. Silicosis in South African platinum miners - case control study. The 10th International Conference on Occupational Respiratory Diseases. 19-22 April 2005. Beijing, China

Ndlovu N, Seopela S. Autopsy database? Is this a useful tool for disease surveillance? MMOA 8th Annual Congress. 6 May 2005. Hannah Lodge, Ohristad.

Ndlovu N, Murray J, Candy G, Nelson G. PATHAUT as a tool for surveillance in the South African mining industry. The International Occupational Hygiene Association (IOHA) Conference. 19 - 23 Sept 2005. Pilanesburg.

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