



NATIONAL INSTITUTE FOR OCCUPATIONAL HEALTH

**Pathology Division
Surveillance Report:
Demographic Data and
Disease Rates for
January to December
2009**

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**NATIONAL HEALTH
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EXECUTIVE SUMMARY

During 2009, 1 662 deceased cases were examined at the NIOH. Of these, 68.5% were black, 30.1% were white, 1.0% were coloured and 0.5% were submitted without information on population group.

The overall disease rates (per 1000 autopsies) for 2009 are shown in Figure 1.

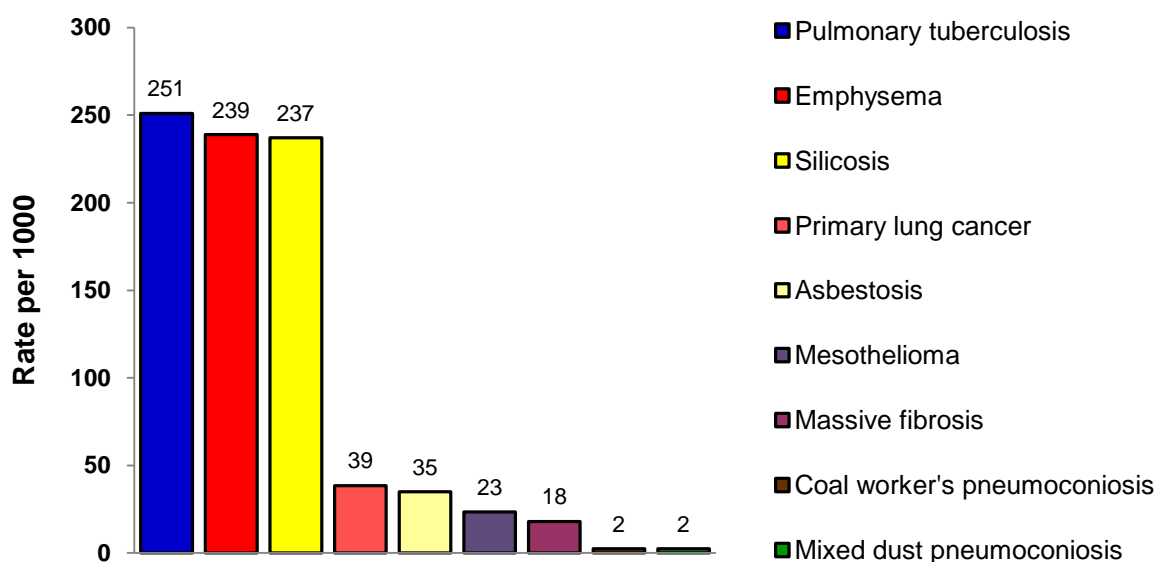


FIG.1 OVERALL DISEASE RATES FOR 2009

The overall rate of pulmonary tuberculosis (PTB) in 2009 (251/1000) was lower than that in 2008 (256/1000). The rate in black gold miners which has increased annually from 379/1000 in 2006 to 437/1000 in 2008, decreased to 356/1000 in 2009. The rate in black platinum miners increased from 315/1000 in 2008 to 360/1000 in 2009.

From 2006 to 2008, the overall silicosis rates decreased from 237/1000 to 216/1000. In 2009, the overall rate increased to 237/1000. In the same period, the rates in black gold miners increased from 327/1000 in 2006 to 338/1000 in 2007 to 378/1000 in 2008. The rate in black gold miners decreased to 354/1000 in 2009.

In 2009, 580 cases (34.9%) were ex-miners, 1 016 (61.1%) were current miners and 66 cases (4.0%) could not be classified.

Twenty four women came to autopsy in 2009, 41.7% of whom had diseases related to asbestos exposure in mining or in the environment.

The type (commodity) and duration exposure was not provided for 25 (1.5%) and 62 (3.7%) cases respectively. For 31 (1.9%) of the cases, the last mine worked was not provided.

In recognition of the annual decrease in the numbers of cardio-respiratory organs submitted for autopsy (Table 2-1), the Pathology Division launched a programme in 2006 to inform miners and ex-miners of their rights to autopsy examination. The Division has continued to engage occupational health units on the mines, union representatives, undertakers, state hospitals and forensic laboratories.

During 2009, one journal article utilising PATHAUT data was published on-line (see Appendix 2). Research findings were presented at a number of fora and the PATHAUT data were also used for an ongoing PhD study (University of the Witwatersrand).

TABLE OF CONTENTS

EXECUTIVE SUMMARY	i
GLOSSARY	v
SECTION 1: BACKGROUND	1
SECTION 2: DEMOGRAPHIC DATA	2
SECTION 3: ACTIVE TUBERCULOSIS	8
SECTION 4: SILICOSIS	11
SECTION 5: OTHER PNEUMOCONIOSES	
Massive Fibrosis	13
Coal Workers' Pneumoconiosis	13
Mixed Dust Pneumoconiosis	13
Asbestosis and pleural plaques	13
SECTION 6: EMPHYSEMA	14
SECTION 7: MESOTHELIOMA	16
SECTION 8: PRIMARY LUNG CANCER	17
SECTION 9: CLINICAL CAUSES OF DEATH	18
SECTION 10: AUTOPSY FINDINGS IN WOMEN	19

LIST OF TABLES

Table 2.1	Distribution of autopsies by year and population group (1975-2009)	2
Table 2.2	Number and proportion of autopsies by type and population group (2009)	3
Table 2.3	Number and proportion of autopsies by age and population group (2009)	3
Table 2.4	Number and proportion of autopsies by commodity and population group (2009)	5
Table 2.5	Number and proportion of autopsies by years of service and population group (2009)	6
Table 2.6	Mean age by commodity and population group (2009)	7
Table 2.7	Mean duration of service by commodity and population group (2009)	7
Table 3.1	Number of cases and prevalence of active PTB by commodity and population group (2009)	9
Table 3.2	Number of cases and prevalence of active PTB by age and population group (2009)	10
Table 4.1	Number of cases and prevalence of silicosis by commodity and population group (2009)	11
Table 4.2	Number of cases and prevalence of silicosis in the gold mining industry, by age and population group (2009)	12
Table 4.3	Number of cases and prevalence of silicosis in the gold mining industry, by years of service and population group (2009)	12
Table 5.1	Number of cases and prevalence of asbestosis by age and population group (2009)	13

Table 6.1	Number of cases and prevalence of emphysema by age and population group (2009)	14
Table 6.2	Number of cases and prevalence of emphysema by commodity and population group (2009)	14
Table 6.3	Number of cases and prevalence of emphysema by years of service and population group (2009)	15
Table 7.1	Number and proportion of mesothelioma cases by age and population group (2009)	16
Table 7.2	Number and proportion of mesothelioma cases by commodity and population group (2009)	16
Table 8.1	Number of cases and prevalence of primary lung cancer by age and population group (2009)	17
Table 8.2	Number of cases and prevalence of primary lung cancer by commodity and population group (2009)	17
Table 9.1	Clinical causes of death by population group (2009)	18
Table 10.1	Number and proportion of autopsies in women by age and population group (2009)	19
Table 10.2	Number and proportion of autopsies in women by commodity and population group (2009)	19
Table 10.3	Number and proportion of diseases in women (2009)	20

LIST OF FIGURES

Figure 1	Overall disease rates for 2009	i
Figure 2.1	Distribution of autopsies by age and population group (2009)	4
Figure 2.2	Distribution of autopsies by commodity and population group (2009)	5
Figure 2.3	Distribution of autopsies by years of service and population group (2009)	6
Figure 3.1	Distribution of active TB by site (2009)	8
Figure 3.2	Active PTB rates in all black miners at autopsy (1975 to 2009)	9
Figure 9.1	Clinical cause of death as given by the clinicians who submit the organs to the NIOH (2009)	18

APPENDICES

Appendix 1:	Distribution of autopsies according to the last mine where the deceased worked (2009)	21
Appendix 2:	Publications and Activities Emanating from PATHAUT Data (2009)	25

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 dust pneumoconiosis	Lung fibrosis caused by simultaneous exposure to multiple dust types
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 adverse health outcomes
Environmental asbestos exposure	This is non-occupational asbestos exposure. Such cases are examined at the NIOH but are not submitted to the MBOD for compensation.

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 v9.2.

This is the thirteenth consecutive annual report and describes autopsy cases examined during the year 2009. Some of the earlier reports and this report can be accessed at http://www.nioh.ac.za/publications/publications_pathaut_reports.htm.

Throughout this report the term 'men' and all data include both men and women, with the exception of Section 10 which reports findings in women only.

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 - 2009)

Year of autopsy	Black		White		Coloured		Indian		Unknown		Total N
	N	%	N	%	N	%	N	%	N	%	
1975	2 190	71.0	854	28.0	32	1.0					3 076
1976	2 335	68.0	1 072	31.0	27	1.0					3 434
1977	2 351	69.0	1 039	30.0	33	1.0					3 423
1978	2 245	67.0	1 090	32.0	32	1.0					3 367
1979	2 118	66.0	1 026	33.0	45	1.0					3 189
1980	2 338	64.0	1 274	35.0	46	1.0					3 658
1981	2 209	66.0	1 117	33.0	33	1.0					3 359
1982	2 312	63.0	1 302	36.0	44	1.0					3 658
1983	2 096	65.0	1 109	34.0	41	1.0					3 246
1984	1 966	64.0	1 098	36.0	28	1.0					3 092
1985	2 275	64.0	1 200	34.0	66	2.0					3 541
1986	2 456	68.0	1 125	31.0	45	1.0					3 626
1987	2 594	68.0	1 168	30.0	78	2.0					3 840
1988	2 518	67.0	1 165	31.0	77	2.0					3 760
1989	2 138	65.0	1 090	33.0	60	2.0					3 288
1990	2 172	64.0	1 155	34.0	51	2.0					3 378
1991	2 143	65.0	1 080	33.0	66	2.0					3 289
1992	2 144	66.0	1 049	32.0	70	2.0					3 263
1993	1 863	65.0	956	33.0	65	2.0					2 884
1994	1 737	61.0	1 021	36.0	94	3.0					2 852
1995	2 830	71.0	1 059	27.0	99	2.0					3 988
1996	2 154	66.5	960	29.6	56	1.7			69	2.1	3 239
1997	2 223	69.0	897	28.0	70	2.0			18	0.6	3 208
1998	1 977	69.0	836	29.0	49	2.0	1		17	0.6	2 880
1999	1 656	65.0	832	33.0	29	1.0			12	0.5	2 529
2000	1 798	69.0	761	29.0	41	2.0			8	0.3	2 608
2001	1 690	67.0	813	32.0	13	1.0			13	0.5	2 529
2002	1 677	67.0	763	30.0	50	2.0			28	1.1	2 518
2003	1 536	66.0	745	32.0	23	1.0	1		13	0.6	2 318
2004	1 428	69.0	596	29.0	22	1.0	1		8	0.4	2 055
2005	1 274	68.0	562	30.0	22	1.0			18	1.0	1 876
2006	1 165	67.7	535	31.1	11	0.6			9	0.5	1 720
2007	1 144	66.4	539	31.3	21	1.2			20	1.2	1 724
2008	1 185	65.8	556	30.9	11	0.6			48	2.7	1 800
2009	1 138	68	500	29	16	0.9			8	0.5	1 662
Total	69 075	69	32 947	33	1 566	1.6	3		301	0.3	103 892

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 148 832 in 2009.

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 2009. Autopsies of only the cardio-respiratory organs comprised 98.5% of all examinations.

TABLE 2-2 NUMBER AND PROPORTION OF AUTOPSIES BY TYPE AND POPULATION GROUP (2009)

Autopsy type	Black		White		Coloured		Unknown		Total	
	N	%	N	%	N	%	N	%	N	%
Cardio-respiratory organs only	1 137	99.9	476	95.2	16	100	8	100	1 637	98.5
Full autopsy	1	0.1	24	4.8	0	-	0	-	25	1.5
Total	1 138		500		16		8		1 662	

The age distribution of autopsies for 2009 is shown in Table 2-3 and Figure 2-1. The mean age at autopsy of black men was 46.6 years, lower than it was in 2008 (48.0 years). The mean age of white men at autopsy decreased to 64.5 years from 66.0 years in 2008.

TABLE 2-3 NUMBER AND PROPORTION OF AUTOPSIES BY AGE AND POPULATION GROUP (2009)

Age group (years)	Black		White		Coloured		Unknown		Total	
	N	%	N	%	N	%	N	%	N	%
20-29	42	3.7	1	0.2	0	-	0	-	43	2.6
30-39	200	17.6	14	2.8	3	18.8	0	-	217	13.1
40-49	477	41.9	51	10.2	2	12.5	0	-	530	31.9
50-59	334	29.3	98	19.6	2	12.5	0	-	434	26.1
60-69	53	4.7	148	29.6	8	50.0	0	-	209	12.6
70-79	20	1.8	125	25.0	1	6.3	0	-	146	8.8
80+	9	0.8	61	12.2	0	-	0	-	70	4.2
Unknown	3	0.3	2	0.4	0	-	8	100.0	13	0.8
Total	1 138		500		16		8		1 662	

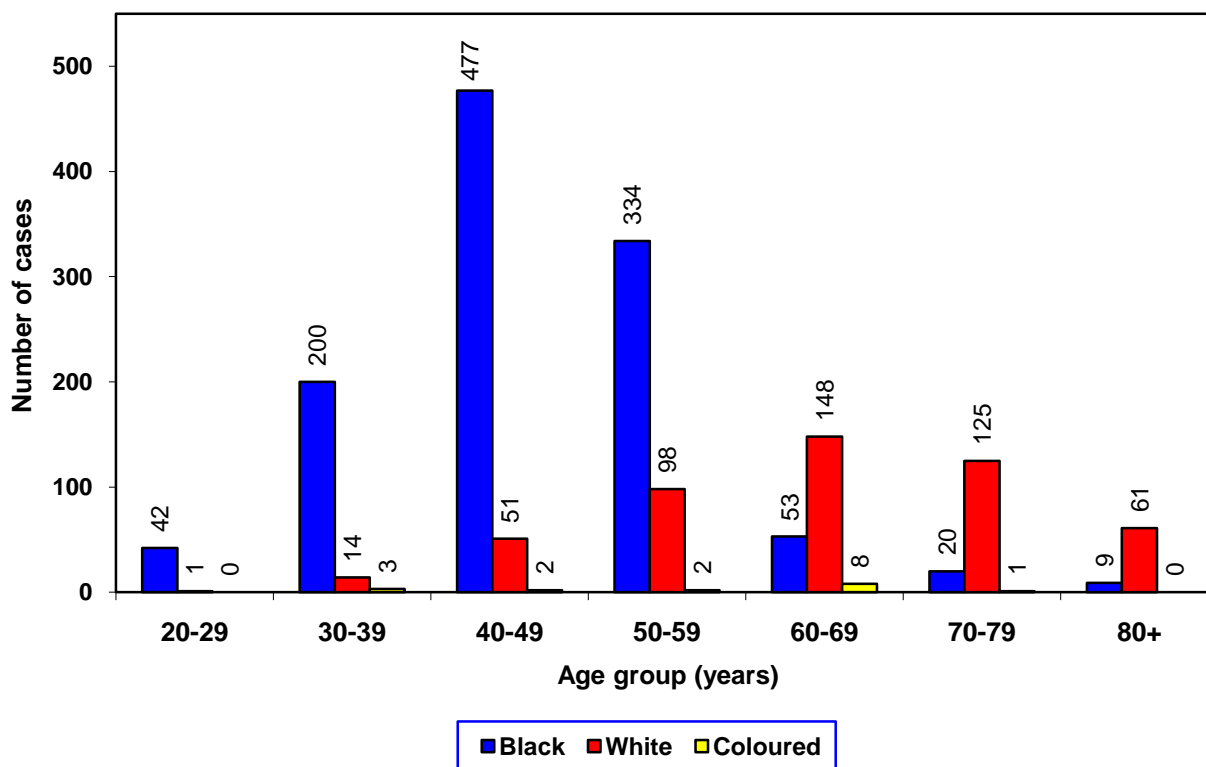


FIG 2-1 DISTRIBUTION OF AUTOPSIES BY AGE AND POPULATION GROUP (2009)

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).

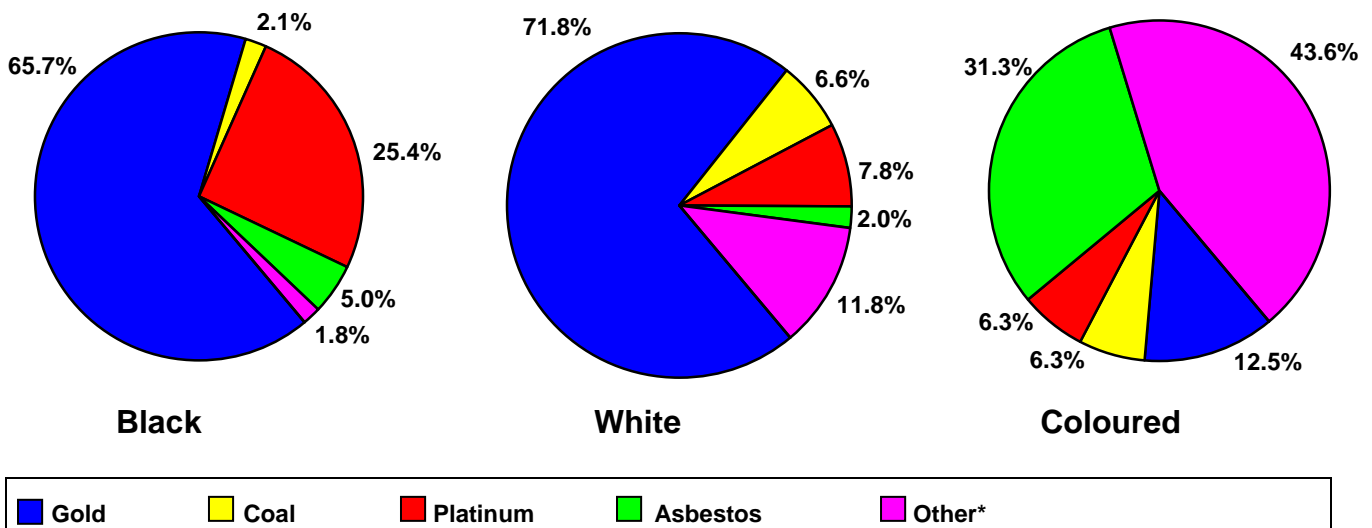
In 2006, a new category called ‘environmental asbestos’ exposure was introduced on the database. Cases with this exposure have been grouped under ‘other’ exposure for analysis and in 2009, comprise one case in whites and one in coloureds.

Table 2-4 and Figure 2-2 show the distributions of autopsies by commodity and population group for 2009. The percentage of autopsies received from the gold mining industry was 66.7% compared to 56.3% in 2008. The percentage of autopsies from the platinum industry has increased over the years, from 8.3% in 1999 to 19.8% in 2009. As in previous years, most of the coloured people who came to autopsy had been exposed to asbestos: 5 (31.1%) in the asbestos mines and 1 (6.3%) in the environment.

TABLE 2-4 NUMBER AND PROPORTION OF AUTOPSIES BY COMMODITY AND POPULATION GROUP (2009)

Commodity	Black		White		Coloured		Unknown		Total	
	N	%	N	%	N	%	N	%	N	%
Gold	748	65.7	359	71.8	2	12.5	0	-	1 109	66.7
Platinum	289	25.4	39	7.8	1	6.3	0	-	329	19.8
Coal	24	2.1	33	6.6	1	6.3	0	-	58	3.5
Asbestos	57	5.0	10	2.0	5	31.3	0	-	72	4.3
Iscor	2	0.2	14	2.8	0	-	0	-	16	1.0
Diamond	1	0.1	9	1.8	1	6.3	0	-	11	0.7
Copper	1	0.1	4	0.8	3	18.8	0	-	8	0.5
Manganese	4	0.4	0	-	0	0.0	0	-	4	0.2
Industry	0	-	6	1.2	1	6.3	0	-	7	0.4
Other	6	0.5	15	3.0	2	12.5	0	-	23	1.4
Unknown	6	0.5	11	2.2	0	-	8	100.0	25	1.5
Total	1 138		500		16		8		1 662	

Note: this table shows only those commodities where a total of 4 or more cases were received



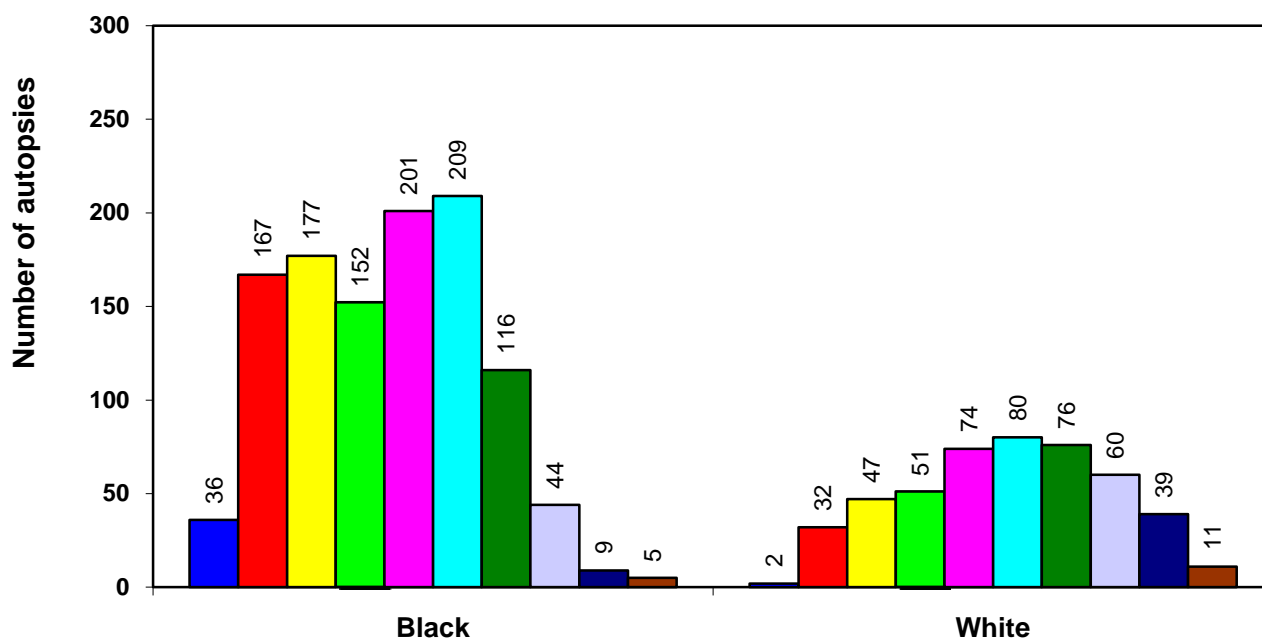
* Includes copper, diamond, environmental asbestos, industry, iron, Iscor, lead, manganese, quarry, railways, silica, steel, vanadium, zinc, chrome, phosphate as well as cases where service histories were not obtained.

FIG 2-2 DISTRIBUTION OF AUTOPSIES BY COMMODITY AND POPULATION GROUP (2009)

Detailed information about the years in mining service by population group is presented in Table 2-5 and Figure 2-3. In 2009, the duration of service was obtained for all but 3.7% of the cases. This figure is lower than that for 2008 (9.3%).

TABLE 2-5 NUMBER AND PROPORTION OF AUTOPSIES BY YEARS OF SERVICE AND POPULATION GROUP (2009)

Years of service	Black		White		Coloured		Unknown		Total	
	N	%	N	%	N	%	N	%	N	%
<1	36	3.2	2	0.4	0	-	0	-	38	2.3
1-5	167	14.7	32	6.4	5	31.3	0	-	204	12.3
6-10	177	15.6	47	9.4	2	12.5	0	-	226	13.6
11-15	152	13.4	51	10.2	0	-	0	-	203	12.2
16-20	201	17.7	74	14.8	1	6.3	0	-	276	16.6
21-25	209	18.4	80	16.0	2	12.5	0	-	291	17.5
26-30	116	10.2	76	15.2	1	6.3	0	-	193	11.6
31-35	44	3.9	60	12.0	1	6.3	0	-	105	6.3
36-40	9	0.8	39	7.8	0	-	0	-	48	2.9
41+	5	0.4	11	2.2	0	-	0	-	16	1.0
Unknown	22	1.9	28	5.6	4	25.0	8	100	62	3.7
Total	1 138		500		16		8		1 662	



Years of service:

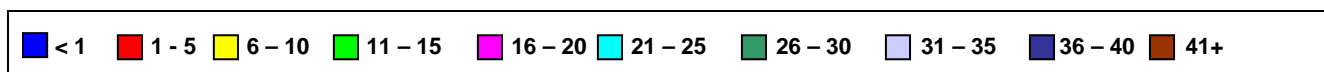


FIG 2-3 DISTRIBUTION OF AUTOPSIES BY YEARS OF SERVICE AND POPULATION GROUP (2009)

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 (2009)

Commodity	Black			White		
	N	Mean (years)	SD*	N	Mean (years)	SD*
Gold	745	46	9	359	65	13
Platinum	289	44	9	39	59	13
Coal	24	53	12	33	64	14
Asbestos	57	63	11	10	73	11
Iscor	2	51	2	14	71	9
Diamond	1	51	-	9	60	14
Copper	1	64	-	4	72	8
Manganese	4	59	6	0	-	-
Industry	0	-	-	6	72	10
Other	6	45	12	15	62	11
Unknown	6	59	6	9	58	13
Total	1 135	47	10	498	65	13

* Standard deviation

TABLE 2-7 MEAN DURATION OF SERVICE BY COMMODITY AND POPULATION GROUP (2009)

Commodity	Black			White		
	N	Mean (years)	SD*	N	Mean (years)	SD*
Gold	743	18	10	353	24	10
Platinum	280	14	9	36	14	9
Coal	21	17	12	31	20	7
Asbestos	56	7	9	8	11	9
Iscor	2	5	6	13	25	11
Diamond	1	2	-	9	20	16
Copper	1	31	-	4	23	14
Manganese	4	12	15	0	-	-
Industry	0	-	-	5	15	7
Other	6	11	14	13	20	9
Total	1 116	16	10	472	23	11

*Standard deviation

SECTION 3 – ACTIVE TUBERCULOSIS

The distribution of active tuberculosis (TB) by anatomical site is presented in Figure 3-1 (n=483). Active pulmonary TB (PTB) was diagnosed in 25.1% (417) of all cases autopsied in 2009, compared to 16.4% (416) in 2000. Most of the men with PTB were black (92.6%; 386 cases), 6.0% (25 cases) were white, 0.7% (3 cases) were coloured and in 0.7% (3 cases) the population group was unknown.

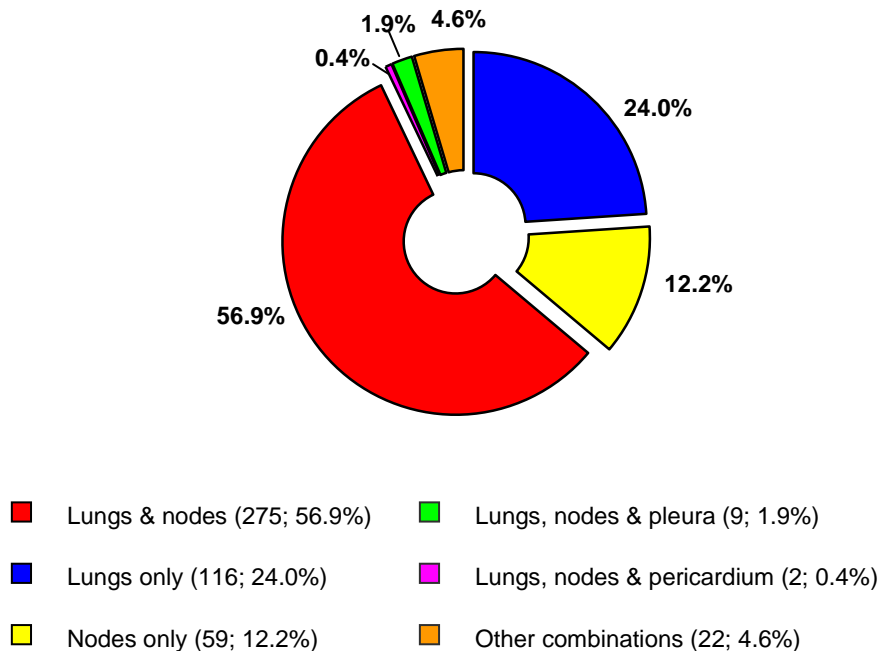


FIG 3-1 DISTRIBUTION OF ACTIVE TB BY SITE (2009)

The rates in subsequent tables and figures are expressed per 1000.

In previous years, annual increases in PTB rates were observed and these were attributed to the increased rates in black men. For the second year in a row, the overall rate of PTB decreased: 274/1000 in 2007 to 256/1000 in 2008 and 251/1000 in 2009 (Fig 3-2). A decreased PTB rate was observed in black men (339/1000 in 2009 compared to 359/1000 in 2008) and the rate in white men increased (50/1000 compared to 43/1000 in 2008). The rate in black gold miners decreased (356/1000 in 2009 from 437/1000 in 2008), but increased in black platinum miners (360/1000 in 2009 from 315/1000 in 2008).

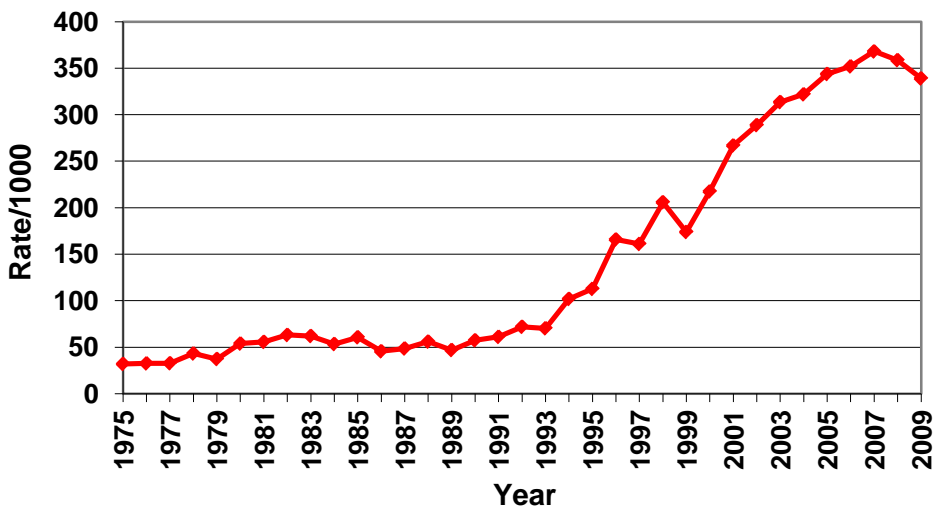


FIG 3-2 ACTIVE PTB RATES IN BLACK MINERS AT AUTOPSY (1975 to 2009)

The distribution of active PTB cases by commodity is shown in Table 3-1. The majority of active PTB cases (69.1%) came from the gold mining industry (66.7% of all autopsy cases came from that commodity).

TABLE 3-1 NUMBER OF CASES AND PREVALENCE OF ACTIVE PTB BY COMMODITY AND POPULATION GROUP (2009)

Commodity	Black		White		Coloured		Unknown		Total	
	N	Rate	N	Rate	N	Rate	N	Rate	N	Rate
Gold	266	356	22	61	0	-	0	-	288	260
Platinum	104	360	1	26	0	-	0	-	105	319
Coal	2	83	0	-	0	-	0	-	2	34
Asbestos	9	158	0	-	1	200	0	-	10	139
Copper	0		0		1		0		1	
Diamond	0		1		0				1	
Manganese	1		0		0		0		1	
Other	2		1		1		0		4	
Unknown	2		0		0		3		5	
Total	386	339	25	50	3	188	3	375	417	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 of the PTB cases (n=179; 33.8%) were in the age group 40-49 years, followed by those in the 50-59 year age group (n=105; 24.2%).

TABLE 3-2 NUMBER OF CASES AND PREVALENCE OF ACTIVE PTB BY AGE AND POPULATION GROUP (2009)

Age group (years)	Black		White		Coloured		Unknown		Total	
	N	Rate	N	Rate	N	Rate	N	Rate	N	Rate
20-29	14	333	0	-	0	-	0	-	14	326
30-39	85	425	1	71	0	-	0	-	86	396
40-49	175	367	3	59	1	500	0	-	179	338
50-59	98	293	6	61	1	500	0	-	105	242
60-69	8	151	10	68	1	125	0	-	19	91
70-79	3	150	4	32	0	-	0	-	7	48
80+	1	111	1	16	0	-	0	-	2	29
Unknown	2	667	0	-	0	-	3	375	5	385
Total	386	339	25	50	3	188	3	375	417	251

SECTION 4 – SILICOSIS

Silicotic nodules were found in the lungs of 394 cases (23.7% of all autopsies), 90.1% of which came from the gold mining industry. Of all cases of silicosis, occasional silicotic nodules were found in 185 (46.9%) of cases, a few in 72 (18.3%), a moderate number in 117 (29.7%) and a large number in 20 (5.1%).

The distribution of cases with silicosis by commodity and population group is presented in Table 4-1.

TABLE 4-1 NUMBER OF CASES AND PREVALENCE OF SILICOSIS BY COMMODITY AND POPULATION GROUP (2009)

Commodity	Black		White		Coloured		Unknown		Total	
	N	Rate	N	Rate	N	Rate	N	Rate	N	Rate
Gold	265	354	90	251	0	-	0	-	355	320
Platinum	19	66	6	154	0	-	0	-	25	76
Coal	2	83	1	30	0	-	0	-	3	52
Asbestos	4	70	0	-	1	200	0	-	5	69
Copper	1		0		0		0		1	
Iscor	0		2		0		0		2	
Other	0		1		0		0		1	
Unknown	2		0		0		0		2	
Total	293	257	100	200	1	63	0	-	394	237

Note: rates have not been calculated where numbers are small

Silicosis in gold miners is shown in the following tables. The rate of silicosis in gold miners decreased from 329/1000 in 2008 to 320/1000 in 2009. 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). In black men, silicosis was diagnosed among younger men (<40 years) and in those who were exposed to silica for only a few years (< 10 years) (Table 4-3).

TABLE 4-2 NUMBER OF CASES AND PREVALENCE OF SILICOSIS IN THE GOLD MINING INDUSTRY, BY AGE AND POPULATION GROUP (2009)

Age group (years)	Black		White		Coloured		Unknown		Total	
	N	Rate	N	Rate	N	Rate	N	Rate	N	Rate
20-29	3	130	0	-	0	-	0	-	3	125
30-39	9	65	0	-	0	-	0	-	9	61
40-49	113	334	3	94	0	-	0	-	116	314
50-59	128	582	21	300	0	-	0	-	149	514
60-69	7	467	22	204	0	-	0	-	29	234
70-79	3	429	24	261	0	-	0	-	27	270
80+	1	250	20	426	0	-	0	-	21	412
Unknown	1	333	0	-	0	-	0	-	1	333
Total	265	354	90	251	0	-	0	-	355	320

TABLE 4-3 NUMBER OF CASES AND PREVALENCE OF SILICOSIS IN THE GOLD MINING INDUSTRY, BY YEARS OF SERVICE AND POPULATION GROUP (2009)

Years of service	Black		White		Coloured		Unknown		Total	
	N	Rate	N	Rate	N	Rate	N	Rate	N	Rate
1-5	9	216	1	59	0	-	0	-	10	110
6-10	16	208	3	107	0	-	0	-	19	142
11-15	22	571	3	97	0	-	0	-	25	175
16-20	64	567	9	180	0	-	0	-	73	351
21-25	89	270	20	303	0	-	0	-	109	484
26-30	43	171	20	313	0	-	0	-	63	432
31-35	14	222	16	327	0	-	0	-	30	395
36-40	6	143	13	351	0	-	0	-	19	432
41+	1	200	3	333	0	-	0	-	4	286
Unknown	1	200	2	333	0	-	0	-	3	250
Total	265	354	90	251	0	-	0	-	355	320

SECTION 5 – OTHER PNEUMOCONIOSES

MASSIVE FIBROSIS

There were 30 (1.8%) cases of massive fibrosis (22 black, 8 white). Twenty five were from the gold mining industry, two from platinum, one from Iscor and in two cases the exposure was not stated.

COAL WORKERS' PNEUMOCONIOSIS

There were 4 (0.2%) cases of coal workers' pneumoconiosis. Three were from coal and one was from the gold mining industry.

MIXED DUST PNEUMOCONIOSIS

There were 4 (0.2%) cases of mixed dust pneumoconiosis. Two were from gold, one from copper and one had unknown mining service.

ASBESTOSIS AND PLEURAL PLAQUES

There were 58 cases of asbestosis similar to the number in 2006 and 2007, (56 and 52 cases, respectively). In 2008 the number of asbestosis cases was much higher (152) because of the large consignment that was received from Kuruman. Of the asbestosis cases, 58.6% (n=34) had slight, 24.1% (n=14) moderate and 17.2% (n=10) marked fibrosis. Forty (69.0%) of these cases had worked in the asbestos mining industry at some time in their lives and none had been exposed to asbestos in the environment.

There were 41 cases with asbestos plaques and of these 4 had asbestosis. 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.

TABLE 5-1 NUMBER OF CASES AND PREVALENCE OF ASBESTOSIS BY AGE AND POPULATION GROUP (2009)

Age group (years)	Black		White		Coloured		Unknown		Total	
	N	Rate	N	Rate	N	Rate	N	Rate	N	Rate
40-49	4	8	0	-	0	-	0	-	4	8
50-59	13	39	1	10	0	-	0	-	14	32
60-69	14	264	2	14	3	375	0	-	19	91
70-79	10	500	4	32	0	-	0	-	14	96
80+	4	444	1	16	0	-	0	-	5	71
Unknown	0	-	0	-	0	-	2	250	2	154
Total	45	40	8	16	3	188	2	250	58	35

SECTION 6 – EMPHYSEMA

There were 397 cases of emphysema, the extent of which was mild in 85.9% (n=341), moderate in 11.8% (n=47) and marked in 2.3% (n=9). The overall rate of emphysema (239/1000) was lower than that in 2008 (282/1000). 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 (2009)

Age group (years)	Black		White		Coloured		Unknown		Total	
	N	Rate	N	Rate	N	Rate	N	Rate	N	Rate
20-29	3	71	0	-	0	-	0	-	3	70
30-39	10	50	2	143	0	-	0	-	12	55
40-49	70	147	8	157	0	-	0	-	78	147
50-59	83	249	32	327	1	500	0	-	116	267
60-69	17	321	64	432	2	250	0	-	83	397
70-79	7	350	62	496	1	1000	0	-	70	479
80+	1	111	29	475	0	-	0	-	30	429
Unknown	0	-	1	500	0	-	4	500	5	385
Total	191	168	198	396	4	250	4	500	397	239

Most of the black and white men with emphysema were from the gold mining industry (n=274, 57.7%) (Table 6-2).

TABLE 6-2 NUMBER OF CASES AND PREVALENCE OF EMPHYSEMA BY COMMODITY AND POPULATION GROUP (2009)

Commodity	Black		White		Coloured		Unknown		Total	
	N	Rate	N	Rate	N	Rate	N	Rate	N	Rate
Gold	134	179	138	384	2	1000	0	-	274	247
Platinum	30	104	16	410	0	-	0	-	46	140
Coal	11	458	17	515	0	-	0	-	28	483
Asbestos	12	211	4	400	1	200	0	-	17	236
Diamond	1		3		0		0		4	
Copper	0		1		1		0		2	
Iscor	0		7		0		0		7	
Manganese	2		0		0		0		2	
Industry	0		3		0		0		3	
Other	0		4		0		0		4	
Unknown	1		5		0		4		10	
Total	191	168	198	396	4	250	4	500	397	239

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 (2009)

Years of service	Black		White		Coloured		Unknown		Total	
	N	Rate	N	Rate	N	Rate	N	Rate	N	Rate
<1	4	111	0	-	0	-	0	-	4	105
1 - 5	20	120	13	406	1	200	0	-	34	167
6-10	20	96	18	383	0	-	0	-	38	168
11-15	17	257	18	353	0	-	0	-	35	172
16-20	39	244	29	392	1	1000	0	-	69	250
21-25	49	120	37	463	1	500	0	-	87	299
26-30	25	95	25	329	0	-	0	-	50	259
31-35	11	23	24	400	0	-	0	-	35	333
36-40	1	111	15	385	0	-	0	-	16	333
41+	1	800	5	455	0	-	0	-	6	375
Unknown	4	8682	14	500	1	250	4	500	23	371
Total	191	336	198	396	4	250	4	500	397	239

SECTION 7 – MESOTHELIOMA

There were 39 of cases of mesothelioma in 2009.

TABLE 7-1 NUMBER AND PROPORTION OF MESOTHELIOMA CASES BY AGE AND POPULATION GROUP (2009)

Age group (years)	Black		White		Coloured		Unknown		Total	
	N	%	N	%	N	%	N	%	N	%
40-49	7	30	0	-	0	-	0	-	7	18
50-59	8	35	3	23	0	-	0	-	11	28
60-69	4	17	4	31	1	100	0	-	9	23
70-79	2	9	3	23	0	-	0	-	5	13
80+	2	9	3	23	0	-	0	-	5	13
Unknown	0	-	0	-	0	-	2	100	2	5
Total	23		13	100	1	100	2	100	39	100

The distribution of mesothelioma by commodity and population group is presented in Table 7.2. Sixteen (41.0%) of the miners had worked in asbestos mines at some stage in their careers and none had been exposed to asbestos in the environment.

TABLE 7-2 NUMBER AND PROPORTION OF MESOTHELIOMA CASES BY COMMODITY AND POPULATION GROUP (2009)

Commodity	Black		White		Coloured		Unknown		Total	
	N	%	N	%	N	%	N	%	N	%
Asbestos	13	57	2	15	1	100	0	-	16	41
Gold	2	9	4	31	0	-	0	-	6	15
Platinum	5	22	0	-	0	-	0	-	5	13
Coal	0	-	1	8	0	-	0	-	1	3
Iscor	1	4	2	15	0	-	0	-	3	8
Diamond	0	-	1	8	0	-	0	-	1	3
Manganese	1	4	0	-	0	-	0	-	1	3
Industry	0	-	1	8	0	-	0	-	1	3
Other	1	4	2	15	0	-	0	-	3	8
Unknown	0	-	0	-	0	-	2	100	2	5
Total	23		13		1		2		39	

SECTION 8 – PRIMARY LUNG CANCER

Sixty four cases of primary lung cancer were found at autopsy, 34.4% of which were in black, 62.5% in white, 1.6% in coloureds and 1.6% in men whose population group was not known. Most of the cases were large cell lung carcinomas (n = 18; 28.2%), and adenocarcinomas (n = 18; 28.2%) followed by squamous cell lung carcinomas (n = 16; 25.0%), small cell lung carcinomas (n = 11; 17.2%) and one (1.6%) broncho-alveolar carcinoma.

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 (2009)

Commodity	Black		White		Coloured		Unknown		Total	
	N	Rate	N	Rate	N	Rate	N	Rate	N	Rate
30-39	1	5	0	-	0	-	0	-	1	5
40-49	6	13	2	39	0	-	0	-	8	15
50-59	10	30	7	71	0	-	0	-	17	39
60-69	4	75	19	128	1	125	0	-	24	115
70-79	1	50	11	88	0	-	0	-	12	82
80+	0	-	1	16	0	-	0	-	1	14
Unknown	0	-	0	-	0	-	1	125	1	77
Total	22	19	40	80	1	63	1	125	64	39

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 (2009)

Commodity	Black		White		Coloured		Unknown		Total	
	N	Rate	N	Rate	N	Rate	N	Rate	N	Rate
Gold	6	8	29	81	0	-	0	-	35	32
Platinum	8	28	1	26	0	-	0	-	9	27
Coal	2	83	2	61	0	-	0	-	4	69
Asbestos	6	105	0	-	1	200	0	-	7	97
Industry	0		3		0		0		3	
Other	0		4		0		0		4	
Unknown	0		1		0		1		2	
Total	22	19	40	80	1	63	1	125	64	39

SECTION 9 – CLINICAL CAUSES OF DEATH

Table 9-1 and Figure 9-1 show the clinical causes of death as stated in the accompanying documents submitted with the cardio-respiratory organs, by population group. Diseases of the respiratory system were the most frequent (40.3%) overall. The proportion of unnatural deaths increased from 5.6% in 2008 to 6.9% in 2009. The clinical cause of death was not stated in 14.1% of all cases.

TABLE 9-1 CLINICAL CAUSES OF DEATH BY POPULATION GROUP (2009)

System	Black		White		Coloured		Unknown		Total	
	N	%	N	%	N	%	N	%	N	%
Respiratory	545	47.9	116	23.2	6	37.5	2	25.0	669	40.3
Cardio-vascular	40	3.5	70	14.0	0	-	0	-	110	6.6
Central Nervous System	100	8.8	22	4.4	0	-	0	-	122	7.3
Gastro-intestinal	60	5.3	17	3.4	1	6.3	0	-	78	4.7
Genito-urinary	43	3.8	11	2.2	0	-	0	-	54	3.2
Haematological	15	1.3	5	1.0	0	-	0	-	20	1.2
Unnatural	79	6.9	33	6.6	2	12.5	0	-	114	6.9
Miscellaneous	169	14.9	89	17.8	3	18.8	0	-	261	15.7
Not stated	87	7.6	137	27.4	4	25.0	6	75.0	234	14.1
Total	1 138		500		16		8		1 662	

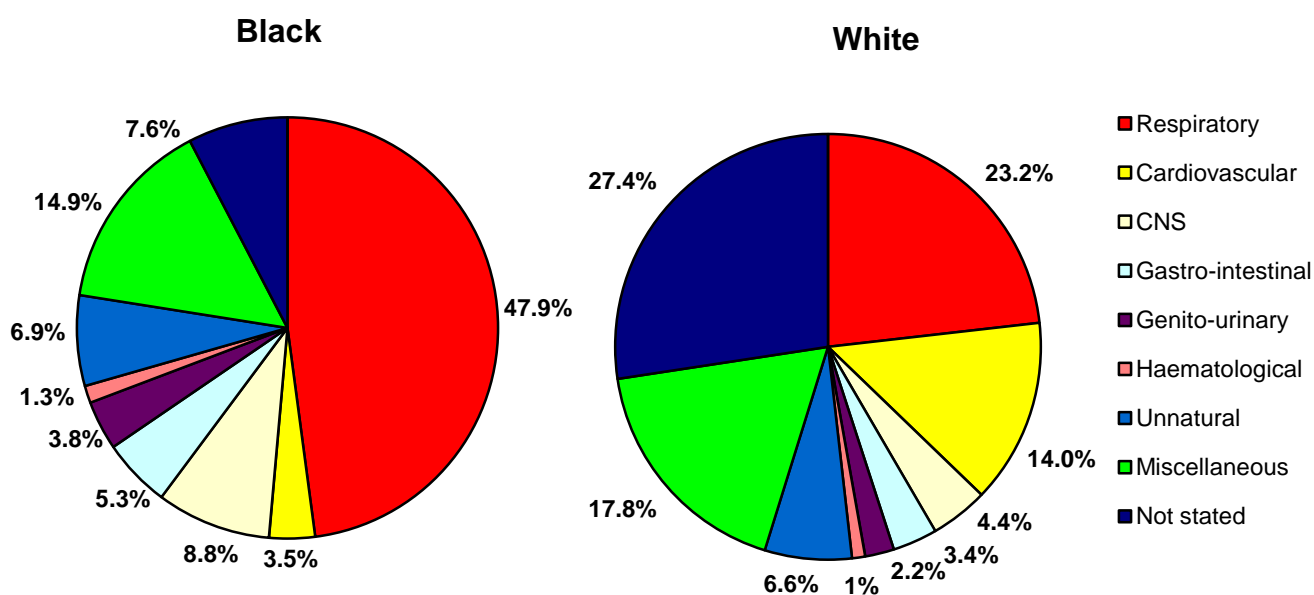


FIGURE 9-1 CLINICAL CAUSE OF DEATH AS STATED BY THE CLINICIANS WHO SUBMIT THE ORGANS OF THE DECEASED TO THE NIOH (2009)

SECTION 10 – AUTOPSY FINDINGS IN WOMEN

Of the 1 622 cases examined in 2009, 24 (1.4%) were women, compared to 41(2.3%) in 2008. Of these, 19 (79.2%) were black, 2 (8.3%) were white and 3 (12.5%) were coloured. The women who were autopsied were, on average, younger than the men (47.3 years versus 52.2 years).

TABLE 10.1 NUMBERS AND PROPORTIONS OF AUTOPSIES IN WOMEN BY AGE AND POPULATION GROUP (2009)

Age group (years)	Black		White		Coloured		Total	
	N	%	N	%	N	%	N	%
20-29	5	26.3	0	-	0	-	5	20.8
30-39	4	21.1	0	-	1	33.3	5	20.8
40-49	2	10.5	0	-	1	33.3	3	12.5
50-59	4	21.1	0	-	1	33.3	5	20.8
60-69	2	10.5	1	50.0	0	-	3	12.5
70-79	2	10.5	0	-	0	-	2	8.3
80+	0	-	1	50.0	0	-	1	4.2
Total	19		2		3		24	

Table 10.2 summarises the distribution of autopsies in women by commodity and population group. Most of the women (10 cases; 41.7%) had been exposed to asbestos, with 9 (90.0%) of these exposed on the mines and one (10.0%) having had environmental exposure.

TABLE 10.2 NUMBER AND PROPORTION OF AUTOPSIES IN WOMEN BY COMMODITY AND POPULATION GROUP (2009)

Commodity	Black		White		Coloured		Total	
	N	%	N	%	N	%	N	%
Gold	6	31.6	1	50.0	0	-	7	29.2
Platinum	3	15.8	0	-	0	-	3	12.5
Coal	2	10.5	0	-	1	33.3	3	12.5
Asbestos	7	36.8	1	50.0	1	33.3	9	37.5
Environmental asbestos	0	-	0	-	1	33.3	1	4.2
Unknown	1	5.3	0	-	0	-	1	4.2
Total	19		2		3		24	

There were three cases of asbestosis and two of mesothelioma (Table 10.3). One of the asbestosis cases had asbestos plaques.

TABLE 10.3 NUMBER AND PROPORTION OF DISEASES IN WOMEN (2009)

Disease	N	%
PTB	7	29.2
Silicosis	1	4.2
Emphysema	3	12.5
Asbestosis	3	12.5
Mesothelioma	2	8.3
No lung disease	8	33.3
Total	24	

APPENDIX 1: DISTRIBUTION OF AUTOPSIES ACCORDING TO THE LAST MINE WHERE THE DECEASED WORKED (2009)

Commodity	Last mine worked	Black	White	Coloured	Unknown	Total
Asbestos	African Chrysotile Asbestos		1			1
	Cape Blue	5	1	1		7
	Danielskuil Asbestos mine		1			1
	Everite		1			1
	Gefco	39	4	1		44
	Koegas			1		1
	Penge Asbestos	1	2			3
	Pomfret Asbestos Mine	5		1		6
	Wandrag Asbestos Mine		1			1
Total from asbestos mines		50	11	4	0	65
Chrome	Chrome Mine	1				1
	Dilokong Chrome Mine		1			1
Total from chrome mines		1	1	0	0	2
Coal	Amcoal Colliery	2	2			4
	Arnot Colliery	2				2
	Blinkpan Colliery		1			1
	Coal Mine	1	1			2
	Delmas Colliery		1			1
	Douglas Colliery		4			4
	Ermelo Coal		1			1
	Goedehoop Colliery	3	1			4
	Greenside Colliery	1	3			4
	Kleinkopje Colliery	1				1
	Klipfontein			1		1
	Koornfontein Coal		3			3
	Kriel Colliery		1			1
	Khutala Colliery		3			3
	Leeufontein Colliery	1				1
	Matla Coal	6	3			9
	Navigation Colliery		2			2
	Optimum Colliery	2	3			5
	Sasol Coal Mine		2			2
	Slater Coal Mine	1				1
	Springbok Colliery	1				1
	Vierfontein Colliery		1			1
	Welgedacht		1			1
	Witbank Collieries	1	4			5
Total from coal mines		22	37	1	0	60

Commodity	Last mine worked	Black	White	Coloured	Unknown	Total
Copper	Copper Mine		1			1
	O`Kiep Copper		2	3		5
	Phalaborwa		1			1
	Prieska	1				1
Total from copper mines		1	4	3	0	8
Diamond	Cullinan Diamond Mine		1			1
	De Beers Consolidated	1	3	1		5
	Diamond Mine	1	1			2
	Premier Diamond		1			1
Total from diamond mines		2	6	1	0	9
Gold	African Rainbow Minerals & Exploration	1				1
	Anglogold Ashanti GM	1	1			2
	Anglogold Health Service (Free State)	1				1
	Bambanani GM	1				1
	Barberton GM		1			1
	Beatrix Gold	98	8			106
	Blyvooruitzicht	2	10			12
	Bracken Mines		2			2
	Buffelsfontein Gold	4	17			21
	City Deep		1			1
	Consolidated Murchison		2			2
	Crown Mines		2			2
	Daggafontein		2			2
	Deelkraal	1	3			4
	Doornfontein		7			7
	Driefontein Consolidated GM	11	4			15
	Durban Roodepoort Deep	4	9			13
	East Driefontein	2	10	1		13
	East Rand Prop		9			9
	Eastern Transvaal Consolidated		1			1
	Elandsrand	3	3	1		7
	Evander GM	14	1			15
	Freddies Gold	2				2
	Free State Geduld	1	11			12
	Free State Saaiplaas		2			2
	Gencor	16				16
	Gold Mine	1	2			3
Goldfields		3			3	
Grootvlei Prop	2	1			3	
Harmony		300	39			339

Commodity	Last mine worked	Black	White	Coloured	Unknown	Total
Gold (contd.)	Hartebeesfontein	2	15			17
	J.C.I. Gold Mine	1	2			3
	Joel	1	1			2
	Kinross	11	2			13
	Kloof	23	11			34
	Kopanong GM	2				2
	Libanon		5			5
	Lorraine	1	4			5
	Luipaardsvlei Estate GM		1			1
	Marievale		1			1
	Moab Khotsong GM		1			1
	New Consort		1			1
	Nigel GM		1			1
	Oryx	23	3			26
	President Brand	1	7			8
	President Steyn	7	10			17
	Primrose GM	1				1
	Rand Mines	2	1			3
	Randfontein	9	11			20
	Roodekop GM		1			1
	Simmer & Jack GM	34	1			35
	South Deep GM		1			1
	St Helena		3			3
	Stilfontein	1	13			14
	Tautona GM	1				1
	Target Gold Mine		1			1
	Ubuntu Small Scale GM	1				1
	Unisel GM	2				2
	Vaal Reefs	123	40			163
	Venterspost	1	2			3
	Vlakfontein		2			2
	Welkom GM	1	2			3
	West Driefontein	2	6			8
	West Rand Consolidated	1	1			2
	West Witwatersrand		2			2
	Western Areas	4	5			9
	Western Deep Levels	3	13			16
	Western Holdings	3	5			8
	Winkelhaak	2	2			4
	Wit Nigel GM		1			1
Total from gold mines		728	329	2	0	1 059
Platinum	Eastern Platinum Mine	24				24
	Impala Platinum	138	15	1		154

Commodity	Last mine worked	Black	White	Coloured	Unknown	Total
Platinum (contd.)	Impala Platinum Refinery		1			1
	Karee Platinum	17	2			19
	Lebowa Platinum	2				2
	Lonmin Platinum	9	2			11
	Northam Platinum	16	1			17
	Rustenburg Platinum	96	20			116
	Swartklip Platinum	3				3
	Unknown Platinum		1			1
	Waterval Platinum	1	1			2
	Western Platinum	12	3			15
	Wildebeestfontein	1				1
Total from platinum mines		319	49	1	0	369
Cementation	Cementation		1			1
Iron & Manganese	S A Manganese	2				2
Lead & Minerals	Blackmountain		2			2
Emerald	Gravelotte		2			2
Minerals	Dominion Reefs Uranium	1	1			2
	Nickel Mine			1		1
Quarries	Quarry Mine		1	1		2
Tin	Rooiberg Tin Mine		1			1
Silicon	Silicon Smelters	1	1			2
Sinkers	Shaft Sinkers	1	2			3
Steel & Vanadium	Highveld		4			4
Steel & Iron	Iscor	1	17			18
Zinc	Zinc Corporation	1	2			3
Non-Miner	Chamber of Mines		1			1
	Environmental		2			2
	Eskom		1			1
	Industry	1	7	1		9
	Kuruman			1		1
	Non-miner		1			1
	Spoornet		1			1
Unknown	Unknown	7	16		8	31
TOTAL		1 138	500	16	8	1 662

APPENDIX 2: PUBLICATIONS AND ACTIVITIES EMANATING FROM PATHAUT DATA OR AUTOPSY SERVICE (2009)

Journal articles

Nelson G, Girdler-Brown B, Ndlovu N, Murray J. Three Decades of Silicosis: Disease Trends at Autopsy in South African Gold Miners. *Environ Health Perspectives* 2010; 18: 421-426.

Phillips J, Norman G, Renton K. Asbestos in soil around dwellings in Soweto. *Occup Health Southern Africa* 2009; 15(2): 24-27.

Reports

Ndlovu N, Murray J, Davies JA, Nelson G. Pathology Division Report: Demographic data and disease rates for January-December 2008. NIOH Report 8/2009. ISSN 1812-7681. National Institute for Occupational Health, National Health Laboratory Service, South Africa, 2009.

Congresses

Dowdeswell RJ, Murray J, Glynn JR, Sonnenberg P. The impact of HIV/AIDS on mortality in South African platinum miners prior to the introduction of ART. 18th International Society for Sexually Transmitted Disease Research (ISSTD), 28 June-1 July 2009, London.

Murray J, Ehrlich R. Silica, silicosis and tuberculosis. International Conference on Occupational Health (ICOH), 23-27 March 2009, Cape Town, South Africa.

Murray J, Ndlovu N. The burden of silicosis and tuberculosis in the mines and labour sending areas. 2 April 2009, Safety Audit in Mining Conference and Exhibitions, Johannesburg, South Africa.

Murray J. The NIOH miners' autopsy program: from compensation to research. 7 August 2009. Harborview Medical Center, University of Washington, Seattle, USA

Ndlovu N, Murray J, Davies A. Damaged goods return to sender. A review of the records of migrant gold miners in South Africa, 1904-1913. International Conference on Occupational Health (ICOH), 23 -27 March 2009, Cape Town, South Africa.

Nelson G, Murray J. Silicosis trends in South African gold miners: 1975-2007. European Respiratory Society Annual Congress, 12-16 September 2009, Vienna, Austria

Nelson G, Ndlovu N, Murray J, Girdler-Brown B. Silicosis at autopsy in South African gold miners. 23-27 March 2009, International Conference on Occupational Health (ICOH), Cape Town, South Africa.

Nelson G. Diamond Mining: The Inclusion of Asbestos. University of the Witwatersrand Postgraduate Symposium, 20-21 October 2009, University of Witwatersrand, Johannesburg, South Africa.

Nelson G. Occupational respiratory diseases: rates, trends and risks in miners coming to autopsy from 1975 to 2004. School of Public Health Interdisciplinary Doctoral Programme interim seminar and review. 4 December 2009, University of the Witwatersrand Medical School, Johannesburg, South Africa.

Nelson G. Three decades of silicosis in the SA gold mining industry. Mine Medical Professionals' Association 12th Annual Congress, 2-4 October 2009, Glenburn Lodge, Magaliesburg, South Africa.

Sonnenberg P, Copas AJ, Glynn JR, Bester A, Nelson G, Shearer S, Murray J. The effect of HIV infection on time off work in a large cohort of gold miners with known dates of seroconversion. 18th International Society for Sexually Transmitted Disease Research (ISSTD), 28 June-1 July 2009, London, UK.

Outreach Programme Activities

ACTIVITY	DATE	VENUE	PERSON
Wits Occupational Health Nurses - Presentation and walk through of department	3 Feb 2009	NIOH	Mrs J Mthombeni
Presentation to Forensic Officers	11 Feb 2009	Tonga, Mpumalanga	Mrs J Mthombeni
Stand at Funeral Expo (National Funeral Directors Association)	10-13 Feb 2009	Vanderbijlpark	Mrs J Mthombeni Mrs N Ndlovu Ms J Buthelezi
Meeting with AVBOB management	5 Feb 2009	Pretoria	Mrs J Mthombeni Mrs N Ndlovu
Presentation at NUM workshop	6 May 2009	Elijah Barayi Memorial Training Centre, Johannesburg	Mrs J Mthombeni
Training on lung removal Presentation to medical staff	15-18 May 2009	Rustenburg Platinum Mine Hospital	Mrs J Mthombeni
UASA – meeting and walk through of department	20 May 2009	NIOH	Mrs J Mthombeni
NUM health and safety officers – walk through of department	20 May 2009	NIOH	Mrs J Mthombeni
Training on lung removal	27 May 2009	Avbob, Harrismith	Mrs J Mthombeni
Presentation at NUM National Workshop 2: Health And Safety	7 July 2009	Elijah Barayi Memorial Training Centre, Johannesburg	Mrs N Ndlovu
Meeting with Deputy Director-General (Strategic Health Programmes) and Cluster Manager (Non-Communicable Diseases Cluster)	23 July 2009	National Department of Health, Pretoria	Dr B Kistnasamy Prof J Murray Mrs N Ndlovu
Meetings with Forensic Services and NHLS Histopathology Lab manager	8 September 2009	Inkosi Albert Luthuli Hospital, Durban	Mrs J Mthombeni
Meeting with Ex-mine workers Project staff; hospital CEO and personnel manager; and Forensic Service manager	9 September 2009	St Benedictine Hospital, Nongoma	Mrs J Mthombeni
Presentation at Slatter Coal Mine	10 – 11 Sept 2009	Slatter Coal Mine, Dundee	Mrs J Mthombeni

ACTIVITY	DATE	VENUE	PERSON
Visit to NUM Regional Office Presentation to NUM Health and Safety Officers	13 October 2009	Welkom	Mrs J Mthombeni
Meeting with Lesotho Consular Attaché and representative of the Ministry of Labour Visit to St Helena Hospital, Healthshare Centre and Doves Welkom	14 October 2009	Welkom	Mrs J Mthombeni
Visit to occupational health practitioner, Ernest Oppenheimer Hospital, and Avbob Welkom.	15 October 2009	Welkom	Mrs J Mthombeni
Visit to Leslie William's Hospital and Kloof Gold Mine	21 October 2009	Carletonville	Mrs J Mthombeni
Presentation to Lusikisiki Integrated Community Development Programme (LICDP)	28 October 2009	Lusikisiki	Mrs J Mthombeni
Presentation to Lusikisiki Community (miners and ex-miners)	29 October 2009	Lusikisiki	Mrs J Mthombeni

Degrees

Gill Nelson, PhD, School of Public Health, University of the Witwatersrand, Occupational respiratory diseases: rates, trends and risks in platinum and diamond miners coming to autopsy from 1975 to 2008.