



**NATIONAL HEALTH
LABORATORY SERVICE**

NATIONAL INSTITUTE FOR OCCUPATIONAL HEALTH

Pathology Division Surveillance Report

Demographic Data and Disease Rates for January to December 2013

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EXECUTIVE SUMMARY

During 2013, 1 188 deceased cases were examined at the NIOH. Of these, 62.6% were black, 35.4% were white, 0.6% were coloured and 1.4% were submitted without information on population group. Of the cases submitted, 46.5 % (n=552) cases were ex-miners, 46.6% (n=554) current miners and 6.9% (n=82) cases could not be classified.

The overall disease rates (per 1000 autopsies) for 2013 are shown in Figure 1.

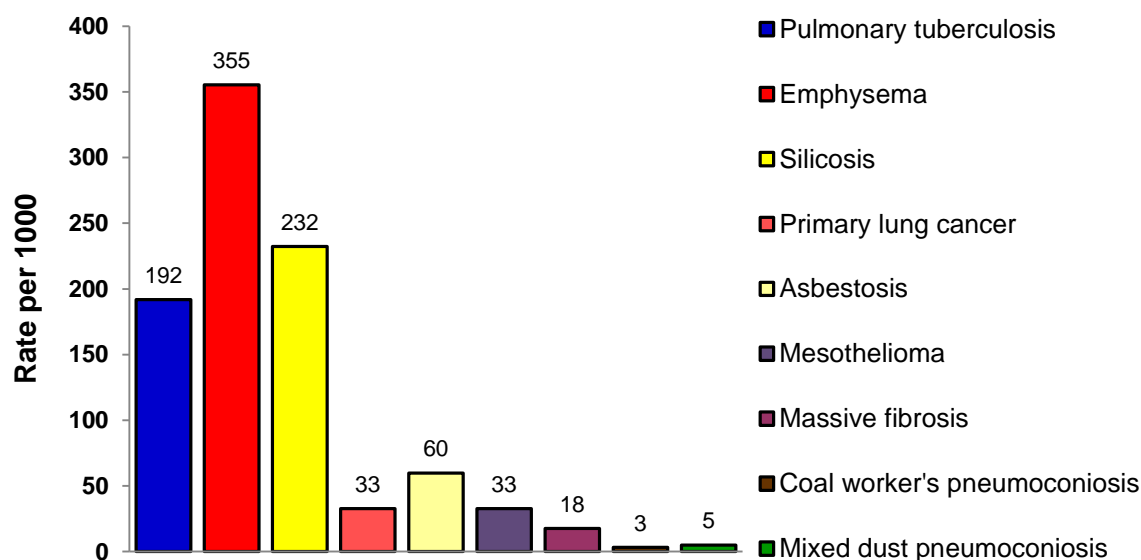


FIG.1 OVERALL DISEASE RATES FOR 2013

The overall rate of pulmonary tuberculosis (PTB) in 2013 (192/1000) remained the same as that in that in 2012 (192/1000). The rate in black gold miners decreased from 352/1000 in 2012 to 265/1000 in 2013. In black platinum miners, the PTB rate decreased further from 235/1000 in 2012 to 199/1000.

The overall silicosis rate in 2013 (232/1000) was similar to that in 2012 (234/1000). The rate in black gold miners, decreased from 396/1000 in 2012 to 361/1000.

Thirty two women came to autopsy in 2013, 28.1% (n=9) of whom had diseases related to asbestos exposure.

Some cases were received with incomplete exposure information. The type (commodity), duration of service and last mine worked were not provided for 44 (3.7%), 82 (6.9%) and 46 (3.9%) of the cases respectively.

Since 2010, the province or foreign country from which the organs were sent has been recorded on the PATHAUT database. Table 1 shows the distribution of cases by province or country and population group. Most cases originated from the North West (33.0%), Gauteng (23.1%) and Free State (22.6%) provinces. Twenty three cases were received from Lesotho and two from Botswana.

TABLE 1-1 DISTRIBUTION OF AUTOPSY CASES BY PROVINCE/COUNTRY AND POPULATION GROUP (2013)

Province or country	Black		White		Coloured		Unknown		Total	
	N	%	N	%	N	%	N	%	N	%
Eastern Cape	2	0.3	4	1.0	0	-	0	-	6	0.5
Free State	224	30.1	45	10.7	0	-	0	-	269	22.6
Gauteng	68	9.1	204	48.5	0	-	2	12.5	274	23.1
Kwazulu-Natal	2	0.3	7	1.7	0	-	0	-	9	0.8
Limpopo	8	1.1	7	1.7	0	-	2	12.5	17	1.4
Mpumalanga	37	5.0	45	10.7	0	-	1	6.3	83	7.0
Northern Cape	90	12.1	8	1.9	7	100.0	0	-	105	8.8
North West	287	38.6	94	22.3	0	-	11	68.8	392	33.0
Western Cape	1	0.1	7	1.7	0	-	0	-	8	0.7
Lesotho	23	3.1	0	-	0	-	0	-	23	1.9
Botswana	2	0.3	0	-	0	-	0	-	2	0.2
Total	744		421		7		16		1 188	

In recent years, the Pathology Division has scaled down its outreach activities. In 2013, in addition to activities outlined in Appendix 2, the Division participated in the MBOD/CCOD/NIOH initiative to provide compensation services, including autopsies, to ex-miners.

Five journal articles using the autopsy data were published and research findings were presented at several fora (Appendix 2). There are two ongoing PhD studies utilising the PATHAUT data (University of the Witwatersrand).

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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 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 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	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 v9.3.

This report describes autopsy cases examined during the year 2013. 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 refers to 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 numbers of autopsies performed annually since 1975 are presented in Table 2-1.

**TABLE 2-1 DISTRIBUTION OF AUTOPSIES BY YEAR AND POPULATION GROUP
(1975 - 2013)**

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			1		3 659
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			12	0.3	4 003
1996	2 154	67	960	30	56	2			69	2.1	3 239
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	1 876
2006	1 165	68	535	31	11	1			9	0.5	1 720
2007	1 144	66	539	31	21	1			20	1.2	1 724
2008	1 185	69	556	32	11	1			48	2.7	1 800
2009	1 138	68	500	29	16	1			8	0.5	1 662
2010	960	64	521	35	15	1			6	0.4	1 502
2011	847	64	453	34	11	1			18	1.4	1 329
2012	706	61	445	38	7	1			6	0.5	1 164
2013	744	63	421	35	7	1			16	1	1 188
Total	72 332	67	34 787	32	1 606	1	3		348	0.3	109 076

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 120 202 in 2013.

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 2013. Autopsies of the cardio-respiratory organs only comprised 97.4% of all examinations.

TABLE 2-2 NUMBER AND PROPORTION OF AUTOPSIES BY TYPE AND POPULATION GROUP (2013)

Autopsy type	Black		White		Coloured		Unknown		Total	
	N	%	N	%	N	%	N	%	N	%
Cardio-respiratory organs only	744	100.0	390	92.6	7	100.0	16	100.0	1 157	97.4
Full autopsy	0	-	31	7.4	0	-	0	-	31	2.6
Total	744		421		7		16		1 188	

The age distribution of cases for 2013 is shown in Table 2-3 and Figure 2-1. The mean age at autopsy of black men was 49.5 years, higher than that in 2012 (48.4 years). The mean age of white men at autopsy was 68.1 years in 2013, similar to 68.0 years in 2012.

TABLE 2-3 NUMBER AND PROPORTION OF AUTOPSIES BY AGE AND POPULATION GROUP (2013)

Age group (years)	Black		White		Coloured		Unknown		Total	
	N	%	N	%	N	%	N	%	N	%
20-29	26	3.5	0	-	0	-	0	-	26	2.2
30-39	121	16.3	9	2.1	0	-	0	-	130	10.9
40-49	213	28.6	22	5.2	0	-	0	-	235	19.8
50-59	281	37.8	74	17.6	2	28.6	0	-	357	30.1
60-69	60	8.1	113	26.8	2	28.6	0	-	175	14.7
70-79	23	3.1	128	30.4	2	28.6	0	-	153	12.9
80+	15	2.0	75	17.8	1	14.3	0	-	91	7.7
Unknown	5	0.7	0	-	0	-	16	100.0	21	1.8
Total	744		421		7		16		1 188	

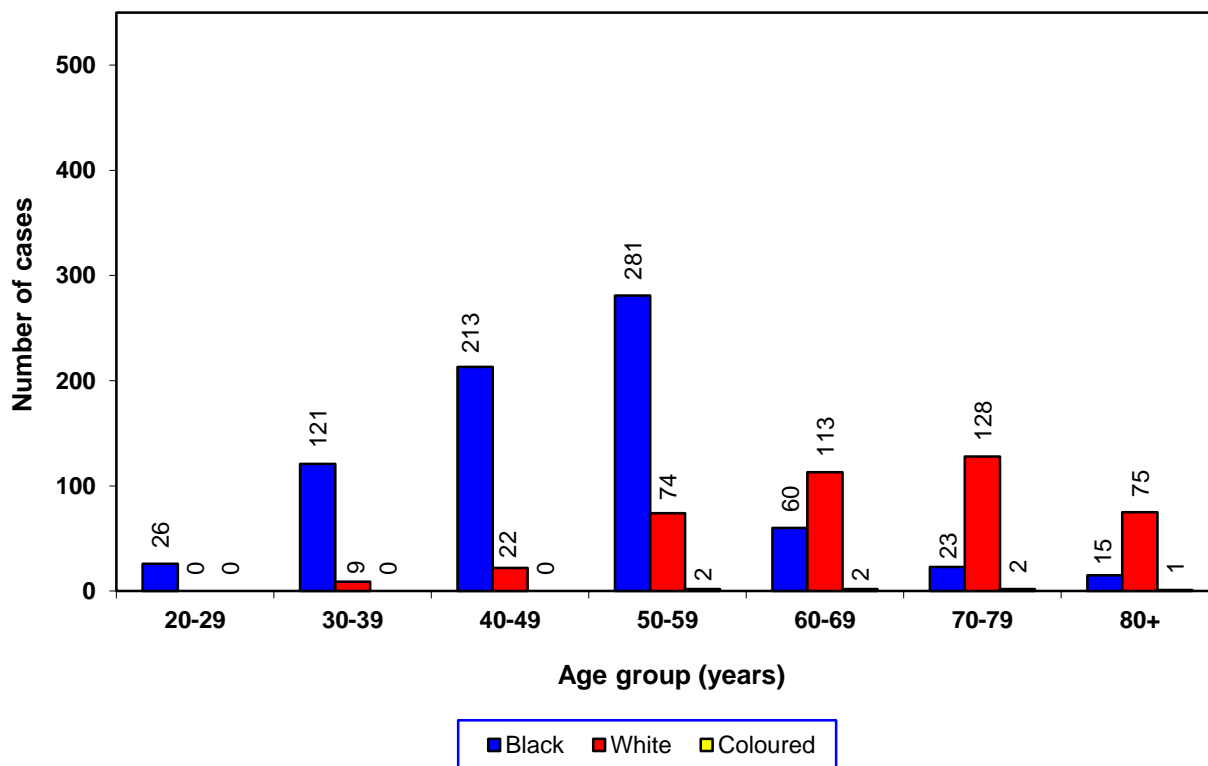


FIG 2-1 DISTRIBUTION OF AUTOPSIES BY AGE AND POPULATION GROUP (2013)

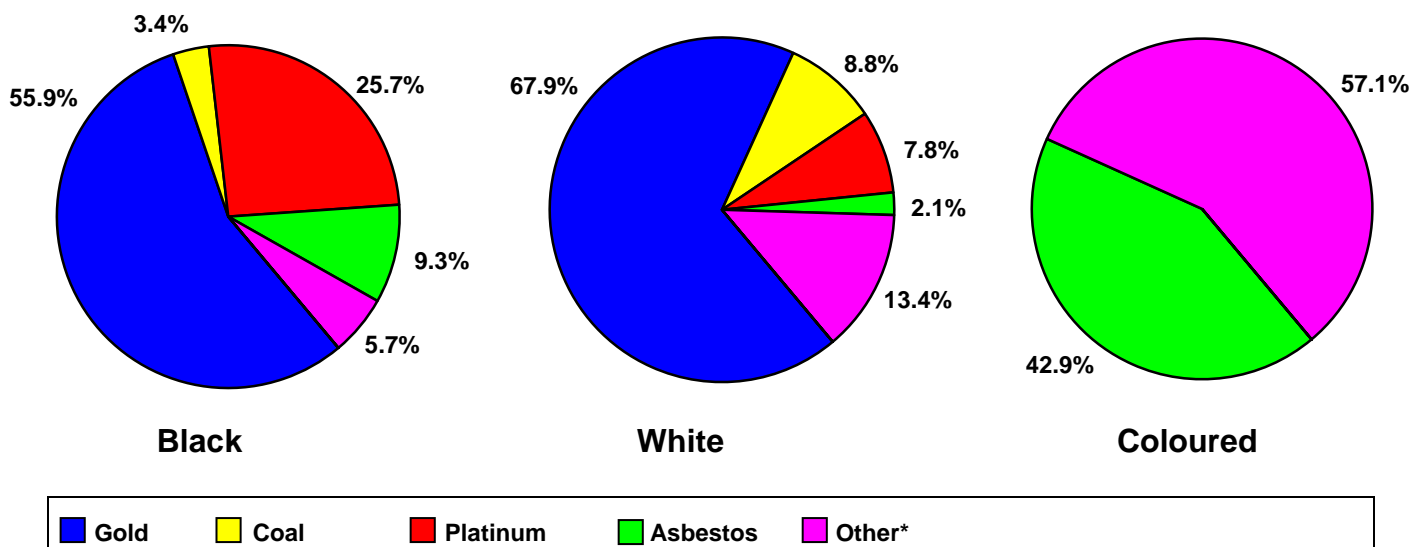
Cases were placed in categories according to the commodity in which they had worked for the longest duration (most exposure). Many men, however, worked in a number of different mining commodities during their lifetimes and had “mixed” exposures. This was not taken into account in the analysis of exposure type (commodity).

Table 2-4 and Figure 2-2 show the distributions of autopsies by commodity and population group for 2013. Of the cases received, 59.1% were from the gold mining industry, similar to that in 2012 (60.5%). The proportion of autopsies from the platinum mining industry has increased over the years, from 8.3% in 1999 to 18.9% in 2013. Of the coloured cases autopsied, three had been exposed to asbestos in the mining industry.

TABLE 2-4 NUMBER AND PROPORTION OF AUTOPSIES BY COMMODITY AND POPULATION GROUP (2013)

Commodity	Black		White		Coloured		Unknown		Total	
	N	%	N	%	N	%	N	%	N	%
Gold	416	55.9	286	67.9	0	-	0	-	702	59.1
Platinum	191	25.7	33	7.8	0	-	0	-	224	18.9
Coal	25	3.4	37	8.8	0	-	0	-	62	5.2
Asbestos	69	9.3	9	2.1	3	42.9	0	-	81	6.8
Iscor	4	0.5	10	2.4	0	-	0	-	14	1.2
Diamond	4	0.5	5	1.2	2	28.6	0	-	11	0.9
Copper	0	-	4	1.0	2	28.6	0	-	6	0.5
Manganese	8	1.1	3	0.7	0	-	0	-	11	0.9
Industry	0	-	10	2.4	0	-	0	-	10	0.8
Other	10	1.3	13	3.1	0	-	0	-	23	1.9
Unknown	17	2.3	11	2.6	0	-	16	100.0	44	3.7
Total	744		421		7		16		1 188	

Note: this table shows only those commodities where a total of 6 or more cases were received



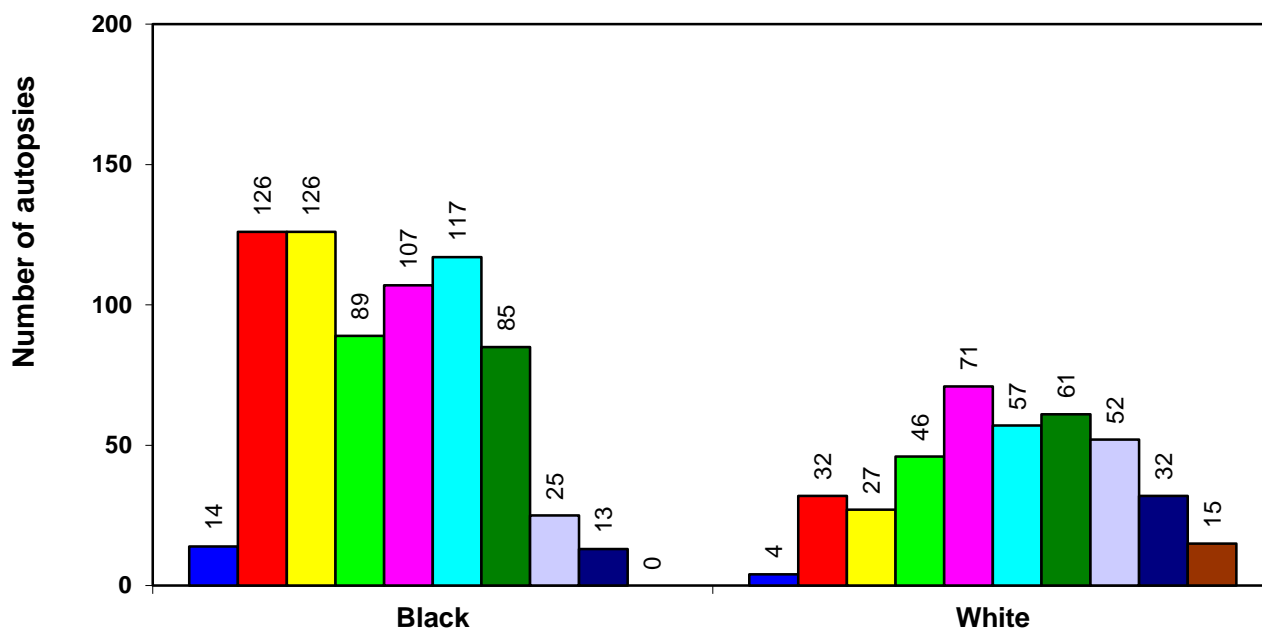
* Includes cement, copper, chrome, diamond, environmental asbestos, industry, iron, Iscor, lime, manganese, phosphate, railways, silica, as well as cases where service histories could not be obtained

FIG 2-2 DISTRIBUTION OF AUTOPSIES BY COMMODITY AND POPULATION GROUP (2013)

Detailed information about the years in mining service by population group is presented in Table 2-5 and Figure 2-3. In 2013, the duration of service was obtained for all but 6.9% of cases. This figure is higher than that for 2012 (5.6%).

TABLE 2-5 NUMBER AND PROPORTION OF AUTOPSIES BY YEARS OF SERVICE AND POPULATION GROUP (2013)

Years of service	Black		White		Coloured		Unknown		Total	
	N	%	N	%	N	%	N	%	N	%
<1	14	1.9	4	1.0	0	-	0	-	18	1.5
1-5	126	16.9	32	7.6	1	14.3	0	-	159	13.4
6-10	126	16.9	27	6.4	0	-	0	-	153	12.9
11-15	89	12.0	46	10.9	2	28.6	0	-	137	11.5
16-20	107	14.4	71	16.9	0	-	0	-	178	15.0
21-25	117	15.7	57	13.5	0	-	0	-	174	14.6
26-30	85	11.4	61	14.5	1	14.3	0	-	147	12.4
31-35	25	3.4	52	12.4	2	28.6	0	-	79	6.6
36-40	13	1.7	32	7.6	1	14.3	0	-	46	3.9
41+	0	-	15	3.6	0	-	0	-	15	1.3
Unknown	42	5.6	24	5.7	0	-	16	100.0	82	6.9
Total	744		421		7		16		1 188	



Years of service:

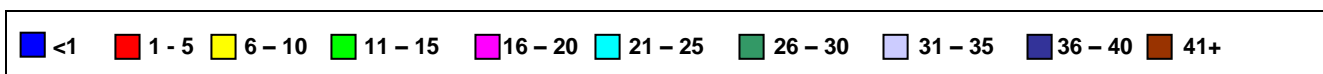


FIG 2-3 DISTRIBUTION OF AUTOPSIES BY YEARS OF SERVICE AND POPULATION GROUP (2013)

The mean age and duration of service by commodity 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 (2013)

Commodity	Black			White		
	N	Mean (Years)	SD*	N	Mean (Years)	SD*
Gold	416	48	9	286	69	12
Platinum	189	45	9	33	61	13
Coal	25	50	9	37	66	15
Asbestos	69	63	11	9	68	9
Iscor	4	59	9	10	73	11
Diamond	4	61	8	5	66	12
Copper	0	-	-	4	66	12
Manganese	8	64	9	3	58	6
Industry	0	-	-	10	71	10
Other	10	65	15	13	69	10
Unknown	14	54	19	11	63	15
Total	739	49	11	421	68	12

* Standard deviation

TABLE 2-7 MEAN DURATION OF SERVICE BY COMMODITY AND POPULATION GROUP (2013)

Commodity	Black			White		
	N	Mean (Years)	SD*	N	Mean (Years)	SD*
Gold	414	18	9	283	25	10
Platinum	176	13	8	31	13	9
Coal	25	22	10	32	23	12
Asbestos	64	7	8	9	12	9
Iscor	4	16	16	9	19	9
Diamond	4	14	14	5	22	10
Copper	0	-	-	4	16	4
Manganese	8	20	8	3	15	11
Industry	0	-	-	10	20	13
Other	7	18	9	11	16	8
Total	702	16	10	397	23	11

*Standard deviation

SECTION 3 – ACTIVE TUBERCULOSIS

The distribution of active tuberculosis (TB) by anatomical site is presented in Figure 3-1 (n=253). Active pulmonary TB (PTB) was diagnosed in 19.2% (n=228) of all cases autopsied in 2013, compared to 27.4% (n=472) in 2007. Most of the men with PTB were black (n=197; 86.4%), 26 were white (11.4%), four were coloured (1.8%) and for one case (0.4%) the population group was not known.

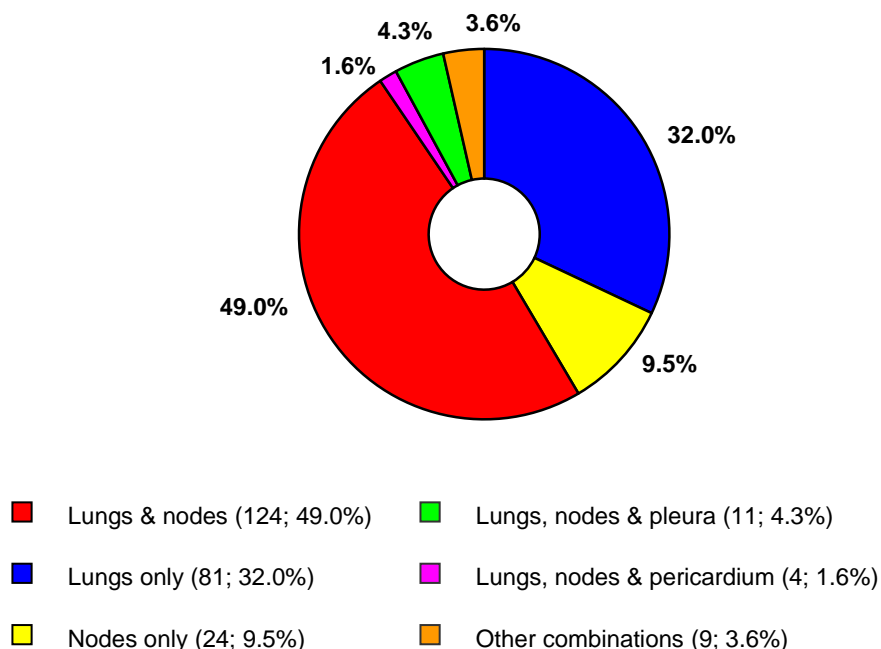


FIG 3-1 DISTRIBUTION OF ACTIVE TB BY SITE (2013)

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

In 2013, the overall PTB rate was 192/1000. In black miners, PTB rates increased from the early 1990s to 2007 (368/1000) and have declined annually to 265/1000 in 2013 (Fig 3-2). The rate in white men remained lower than that in black men, but increased from 43/1000 in 2012 to 62/1000 in 2013.

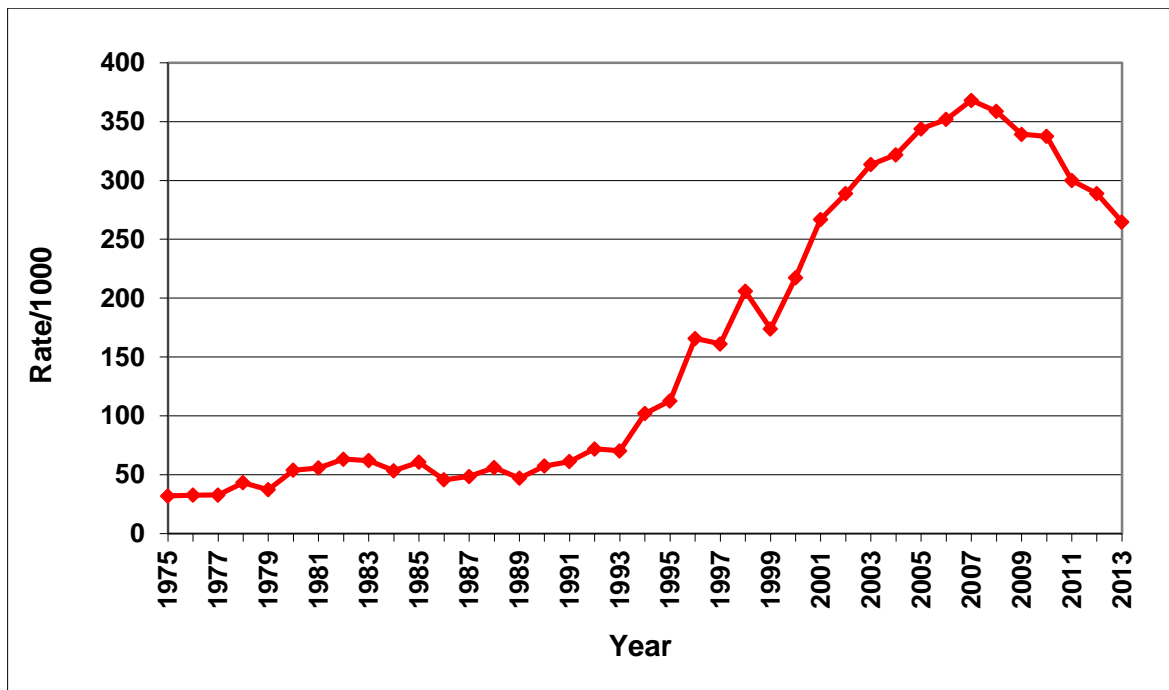


FIG 3-2 ACTIVE PTB RATES IN BLACK MINERS AT AUTOPSY (1975 to 2013)

The distribution of active PTB cases by commodity is shown in Table 3-1. Most cases of active PTB (69.3%) were from the gold (59.1% of all autopsy cases came from that commodity) and platinum (17.1%) mining industries.

TABLE 3-1 NUMBER OF CASES AND PREVALENCE OF ACTIVE PTB BY COMMODITY AND POPULATION GROUP (2013)

Age group (years)	Black		White		Coloured		Unknown		Total	
	N	Rate	N	Rate	N	Rate	N	Rate	N	Rate
Gold	134	322	24	84	0	-	0	-	158	225
Platinum	38	199	1	-	0	-	0	-	39	174
Coal	8	320	0	-	0	-	0	-	8	129
Asbestos	12	174	0	-	2	-	0	-	14	173
Diamond	0	-	0	-	1	-	0	-	1	-
Copper	0	-	0	-	1	-	0	-	1	-
Manganese	1	-	0	-	0	-	0	-	1	-
Other	1	-	1	-	0	-	0	-	2	-
Unknown	3	-	0	-	0	-	1	-	4	-
Total	197	265	26	62	4		1		228	192

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=82; 36.0%) were in the age group 50-59 years, followed by those in the 40-49 year age group (n=67; 29.4%).

TABLE 3-2 NUMBER OF CASES AND PREVALENCE OF ACTIVE PTB BY AGE AND POPULATION GROUP (2013)

Age group (years)	Black		White		Coloured		Unknown		Total	
	N	Rate	N	Rate	N	Rate	N	Rate	N	Rate
20-29	7	269	0	-	0	-	0	-	7	269
30-39	32	264	0	-	0	-	0	-	32	246
40-49	64	300	3	-	0	-	0	-	67	285
50-59	76	270	4	-	2	-	0	-	82	230
60-69	13	217	7	62	0	-	0	-	20	114
70-79	3	-	10	78	1	-	0	-	14	92
80+	2	-	2	-	1	-	0	-	5	-
Unknown	0	-	0	-	0	-	1	-	1	-
Total	197	265	26	62	4		1		228	192

Note: rates have not been calculated where numbers are small

SECTION 4 – SILICOSIS

Silicotic nodules were found in the lungs of 276 cases (23.2% of all autopsies), 84.8% of which came from the gold mining industry. Of all cases of silicosis, occasional silicotic nodules were found in 96 (34.8%) of cases, a few in 76 (27.5%), a moderate number in 83 (30.1%) and a large number in 21 (7.6%) cases.

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 (2013)

Age group (years)	Black		White		Coloured		Unknown		Total	
	N	Rate	N	Rate	N	Rate	N	Rate	N	Rate
Gold	150	361	84	294	0	-	0	-	234	333
Platinum	18	94	2	-	0	-	0	-	20	89
Coal	3	-	1	-	0	-	0	-	4	-
Asbestos	3	-	0	-	0	-	0	-	3	-
Diamond	0	-	0	-	1	-	0	-	1	-
Manganese	2	-	0	-	0	-	0	-	2	-
Other	2	-	1	-	0	-	0	-	3	-
Unknown	6	353	1	-	0	-	2	-	9	205
Total	184	247	89	211	1	143	2	125	276	232

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 has increased annually from 320/1000 in 2009 to 368/1000 in 2012 and decreased to 333/1000 in 2013. Although the silicosis rates increased with increasing age in both black and white men, the age distribution of cases differed between the two population groups (Table 4-2). In black men, silicosis was also diagnosed among younger men (<40 years) (Table 4-2).

TABLE 4-2 NUMBER OF CASES AND PREVALENCE OF SILICOSIS IN THE GOLD MINING INDUSTRY, BY AGE AND POPULATION GROUP (2013)

Age group (years)	Black		White		Coloured		Unknown		Total	
	N	Rate	N	Rate	N	Rate	N	Rate	N	Rate
20-29	0	-	0	-	0	-	0	-	0	-
30-39	3	-	0	-	0	-	0	-	3	-
40-49	34	246	2	-	0	-	0	-	36	237
50-59	98	563	10	227	0	-	0	-	108	495
60-69	11	500	19	235	0	-	0	-	30	291
70-79	3	-	26	299	0	-	0	-	29	315
80+	1	-	27	482	0	-	0	-	28	483
Unknown	0	-	0	-	0	-	0	-	0	-
Total	150	361	84	294	0		0		234	333

Note: rates have not been calculated where numbers are small

TABLE 4-3 NUMBER OF CASES AND PREVALENCE OF SILICOSIS IN THE GOLD MINING INDUSTRY, BY YEARS OF SERVICE AND POPULATION GROUP (2013)

Years of service	Black		White		Coloured		Unknown		Total	
	N	Rate	N	Rate	N	Rate	N	Rate	N	Rate
<1	0	-	0	-	0	-	0	-	0	-
1-5	1	-	0	-	0	-	0	-	1	-
6-10	6	100	5	313	0	-	0	-	11	145
11-15	13	260	6	200	0	-	0	-	19	238
16-20	27	380	12	245	0	-	0	-	39	325
21-25	39	500	14	350	0	-	0	-	53	449
26-30	41	586	18	353	0	-	0	-	59	488
31-35	15	938	15	341	0	-	0	-	30	500
36-40	8	800	10	370	0	-	0	-	18	486
>41	0	-	4	-	0	-	0	-	4	-
Unknown	0	-	0	-	0	-	0	-	0	-
Total	150	361	84	294	0		0		234	333

Note: rates have not been calculated where numbers are small

SECTION 5 – OTHER PNEUMOCONIOSES

MASSIVE FIBROSIS

There were 21 (1.8%) cases of massive fibrosis (10 black, 9 white, 1 coloured and 1 unknown). Sixteen were from the gold, one from the platinum and one from the diamond mining industries and in three cases the commodity was not known.

COAL WORKERS' PNEUMOCONIOSIS

There were 4 (0.3%) cases of coal workers' pneumoconiosis. Two were from the coal, one was from the gold and another was from the copper mining industries.

MIXED DUST PNEUMOCONIOSIS

There were 6 (0.5%) cases of mixed dust pneumoconiosis. Five were from the gold and one was from the diamond mining industry.

ASBESTOSIS AND PLEURAL PLAQUES

There were 71 cases of asbestosis. Of these, 39.4% (n=28) had slight, 33.8% (n=24) moderate and 26.8% (n=19) marked fibrosis. Fifty eight (81.7%) of these cases had worked in the asbestos mining industry at some time in their lives and three had been exposed to asbestos in the environment.

There were 37 cases with asbestos plaques and of these 21 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 (2013)

Age group (years)	Black		White		Coloured		Unknown		Total	
	N	Rate	N	Rate	N	Rate	N	Rate	N	Rate
40-49	1	-	0	-	0	-	0	-	1	-
50-59	12	43	1	-	1	-	0	-	14	39
60-69	17	283	6	53	0	-	0	-	23	131
70-79	13	565	6	47	0	-	0	-	19	124
80+	10	667	4	-	0	-	0	-	14	154
Total	53	71	17	40	1	143	0		71	60

Note: rates have not been calculated where numbers are small

SECTION 6 – EMPHYSEMA

There were 422 cases of emphysema, the extent of which was mild in 74.4% (n=314), moderate in 22.0% (n=93) and marked in 3.6% (n=15). The overall rate of emphysema has increased annually from 250/1000 in 2010 to 355/1000 in 2013. 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 (2013)

Age group (years)	Black		White		Coloured		Unknown		Total	
	N	Rate	N	Rate	N	Rate	N	Rate	N	Rate
20-29	0	-	0	-	0	-	0	-	0	-
30-39	9	74	1	-	0	-	0	-	10	77
40-49	44	207	7	318	0	-	0	-	51	217
50-59	88	313	31	419	1	-	0	-	120	336
60-69	22	367	70	619	0	-	0	-	92	526
70-79	10	435	69	539	2	-	0	-	81	529
80+	10	667	48	640	1	-	0	-	59	648
Unknown	1	-	0	-	0	-	8	500	9	429
Total	184	247	226	537	4		8	500	422	355

Note: rates have not been calculated where numbers are small

Most of the black and white men with emphysema were from the gold mining industry (n=270, 64.0%) (Table 6-2).

TABLE 6-2 NUMBER OF CASES AND PREVALENCE OF EMPHYSEMA BY COMMODITY AND POPULATION GROUP (2013)

Age group (years)	Black		White		Coloured		Unknown		Total	
	N	Rate	N	Rate	N	Rate	N	Rate	N	Rate
Gold	109	262	161	563	0	-	0	-	270	385
Platinum	30	157	10	303	0	-	0	-	40	179
Coal	8	320	20	541	0	-	0	-	28	452
Asbestos	20	290	5	-	1	-	0	-	26	321
Iscor	2	-	7	700	0	-	0	-	9	643
Diamond	2	-	2	-	1	-	0	-	5	-
Copper	0	-	4	-	2	-	0	-	6	1000
Manganese	5	-	1	-	0	-	0	-	6	545
Industry	0	-	7	700	0	-	0	-	7	700
Other	5	-	5	-	0	-	0	-	10	435
Unknown	3	-	4	-	0	-	8	500	15	341
Total	184	247	226	537	4		8	500	422	355

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 (2013)

Years of service	Black		White		Coloured		Unknown		Total	
	N	Rate	N	Rate	N	Rate	N	Rate	N	Rate
<1	3	-	2	-	0	-	0	-	5	-
1 - 5	28	222	17	531	0	-	0	-	45	283
6-10	15	119	15	556	0	-	0	-	30	196
11-15	20	225	28	609	1	-	0	-	49	358
16-20	29	271	36	507	0	-	0	-	65	365
21-25	27	231	36	632	0	-	0	-	63	362
26-30	31	365	28	459	0	-	0	-	59	401
31-35	13	520	30	577	2	-	0	-	45	570
36-40	6	462	17	531	1	-	0	-	24	522
41+	0	-	9	600	0	-	0	-	9	600
Unknown	12	286	8	333	0	-	8	500	28	341
Total	184	247	226	537	4	-	8	500	422	355

Note: rates have not been calculated where numbers are small

SECTION 7 – MESOTHELIOMA

There were 39 of cases of mesothelioma in 2013.

TABLE 7-1 NUMBER AND PROPORTION OF MESOTHELIOMA CASES BY AGE AND POPULATION GROUP (2013)

Age group (years)	Black		White		Coloured		Unknown		Total	
	N	%	N	%	N	%	N	%	N	%
40-49	1	3.4	0	-	0	-	0	-	1	2.6
50-59	13	44.8	0	-	0	-	0	-	13	33.3
60-69	10	34.5	1	10	0	-	0	-	11	28.2
70-79	3	10.3	8	80	0	-	0	-	11	28.2
80+	2	6.9	1	10	0	-	0	-	3	7.7
Total	29		10		0		0		39	

The distribution of mesothelioma by commodity and population group is presented in Table 7.2.

Twenty eight (71.8%) of the cases had worked in asbestos mines at some stage in their careers and two (5.1%) had been exposed to asbestos in the environment.

TABLE 7-2 NUMBER AND PROPORTION OF MESOTHELIOMA CASES BY COMMODITY AND POPULATION GROUP (2013)

Commodity	Black		White		Coloured		Unknown		Total	
	N	%	N	%	N	%	N	%	N	%
Asbestos	21	72.4	0	-	0	-	0	-	21	53.8
Gold	0	-	4	40.0	0	-	0	-	4	10.3
Coal	0	-	3	30.0	0	-	0	-	3	7.7
Platinum	3	10.3	0	-	0	-	0	-	3	7.7
Iscor	0	-	0	-	0	-	0	-	0	-
Manganese	2	6.9	0	-	0	-	0	-	2	5.1
Industry	0	-	2	20.0	0	-	0	-	2	5.1
Other	3	10.3	1	10.0	0	-	0	-	4	10.3
Unknown	0	-	0	-	0	-	0	-	0	-
Total	29		10		0		0		39	

SECTION 8 – PRIMARY LUNG CANCER

Thirty nine cases of primary lung cancer were found at autopsy, 38.5% (n=15) of which were in black, 56.4% (n=22) in white and 2.6% (n=1) in coloured and miners for whom commodity was not known, respectively. Most of the cases had squamous cell lung carcinoma (n = 21; 53.8%) followed by small cell lung carcinoma (n = 8; 20.5%), adenocarcinoma (n = 8; 20.5%) and broncho-alveolar carcinoma (n = 2; 5.1%).

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 (2013)

Commodity	Black		White		Coloured		Unknown		Total	
	N	Rate	N	Rate	N	Rate	N	Rate	N	Rate
40-49	4	14	3	41	0	-	0	-	7	20
50-59	6	100	7	62	1	500	0	-	14	80
60-69	4	174	6	47	0	-	0	-	10	65
70-79	1	67	6	80	0	-	0	-	7	77
80+	0	-	0	-	0	-	1	63	1	48
Total	15	20	22	52	1	143	1	63	39	33

Note: rates have not been calculated where numbers are small

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 (2013)

Age group (years)	Black		White		Coloured		Unknown		Total	
	N	Rate	N	Rate	N	Rate	N	Rate	N	Rate
Gold	8	19	11	38	0	-	0	-	19	27
Platinum	1	5	3	91	0	-	0	-	4	18
Coal	0	-	1	27	0	-	0	-	1	16
Asbestos	4	58	1	111	1	333	0	-	6	74
Iscor	1	250	0	-	0	-	0	-	1	71
Diamond	0	-	1	200	0	-	0	-	1	167
Copper	0	-	1	250	0	-	0	-	1	167
Industry	0	-	1	100	0	-	0	-	1	100
Other	1	100	3	231	0	-	0	-	4	174
Unknown	0	-	0	-	0	-	1	62.5	1	23
Total	15	20	22	52	1	143	1	63	39	33

Note: rates have not been calculated where numbers are small

SECTION 9 – CLINICAL CAUSE OF DEATH

Table 9-1 and Figure 9-1 show the clinical cause 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 (31.4% overall). The proportion of unnatural deaths decreased from 8.1% in 2012 to 7.8% in 2013. The clinical cause of death was not stated for 20.0% of the cases.

TABLE 9-1 CLINICAL CAUSE OF DEATH BY POPULATION GROUP (2013)

System	Black		White		Coloured		Unknown		Total	
	N	%	N	%	N	%	N	%	N	%
Respiratory	252	33.9	116	27.6	5	71.4	0	-	373	31.4
Cardio-vascular	28	3.8	51	12.1	0	-	0	-	79	6.6
Central Nervous System	36	4.8	16	3.8	0	-	0	-	52	4.4
Gastro-intestinal	30	4.0	7	1.7	0	-	0	-	37	3.1
Genito-urinary	23	3.1	8	1.9	0	-	0	-	31	2.6
Haematological	10	1.3	3	0.7	0	-	0	-	13	1.1
Unnatural	65	8.7	28	6.7	0	-	0	-	93	7.8
Miscellaneous	182	24.5	88	20.9	2	28.6	0	-	272	22.9
Not stated	118	15.9	104	24.7	0	-	16	100.0	238	20.0
Total	744		421		7		16		1 188	

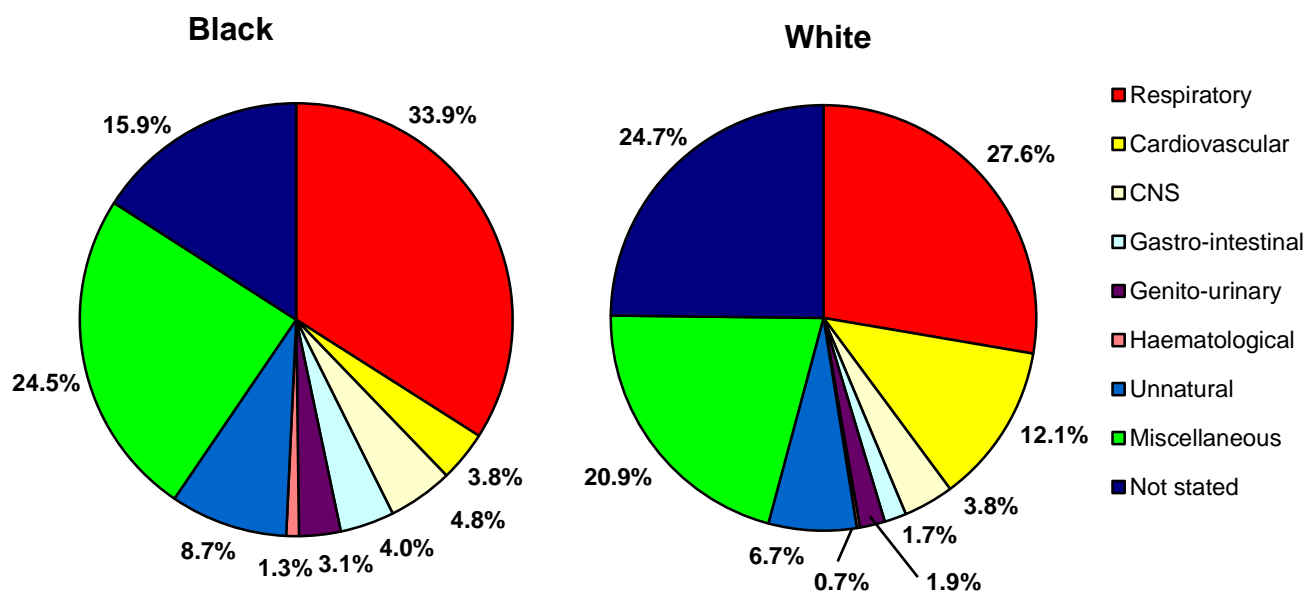


FIGURE 9-1 CLINICAL CAUSES OF DEATH (2013)

SECTION 10 – AUTOPSY FINDINGS IN WOMEN

Of the 1 188 cases examined in 2013, 32 (2.7%) were women, compared to 58 (5.0%) in 2012 and 45 (3.4%) in 2011. Of these, 29 (90.6%) were black, 2 (6.3%) were white and 1 (3.1%) was coloured. The mean ages of the women and men were similar (52.2 years and 56.4 years respectively).

TABLE 10-1 NUMBER AND PROPORTION OF AUTOPSIES IN WOMEN BY AGE AND POPULATION GROUP (2013)

Age group (years)	Black		White		Coloured		Total	
	N	%	N	%	N	%	N	%
20-29	2	6.9	0	-	0	-	2	6.3
30-39	4	13.8	0	-	0	-	4	12.5
40-49	9	31.0	1	50.0	0	-	10	31.3
50-59	6	20.7	0	-	0	-	6	18.8
60-69	4	13.8	1	50.0	1	100.0	6	18.8
70-79	2	6.9	0	-	0	-	2	6.3
80+	2	6.9	0	-	0	-	2	6.3
Total	29		2		1		32	

Table 10.2 summarises the distribution of autopsies in women by commodity and population group. Most of the women (13 cases; 40.6%) had been exposed to asbestos, with 11 (34.3%) of these exposed on the mines and 2 (6.3%) having had environmental exposure.

TABLE 10-2 NUMBER AND PROPORTION OF AUTOPSIES IN WOMEN BY COMMODITY AND POPULATION GROUP (2013)

Commodity	Black		White		Coloured		Total	
	N	%	N	%	N	%	N	%
Gold	15	51.4	0	-	0	-	15	46.9
Platinum	1	3.4	1	50.0	0	-	2	6.3
Asbestos	10	34.5	0	-	1	100.0	11	34.4
Other	2	6.9	1	50.0	0	-	3	9.4
Unknown	1	3.4	0	-	0	-	1	3.1
Total	29		2		1		32	

There were 9 cases of asbestos-related disease: 4 had asbestosis and 5 had mesothelioma (Table 10.3).

TABLE 10-3 NUMBER AND PROPORTION OF DISEASES IN WOMEN (2013)

Disease	N	%
PTB	6	18.8
Silicosis	0	-
Emphysema	3	9.4
Asbestosis	4	12.5
Mesothelioma	5	15.6
Lung cancer	1	3.1
No lung disease	13	40.6
Total	32	

APPENDIX 1: DISTRIBUTION OF AUTOPSIES ACCORDING TO THE LAST MINE WHERE THE DECEASED WORKED (2013)

Commodity	Last mine worked	Black	White	Coloured	Unknown	Total
Asbestos	African Chrysotile Asbestos		2			2
	Asbestos Mine	3				3
	Black Rock Asbestos Mine	1	1			2
	Cape Blue	8	1			9
	Danielskuil Asb Mine		1			1
	Gefco	42				42
	Kliphuis			1		1
	Koegas	1		2		3
	Penge Asbestos	1	1			2
	Pomfret Asb Mine	3	2			5
	Wandrag Asbestos Mine	1				1
	Total from asbestos mines		60	8	3	0
Cementation	Cementation		1			1
	Ulco Cement	1				1
Total from cement mines		1	1	0	0	2
Chrome	Chrome Mine		3			3
	Eastern Chrome Mine		1			1
Total from chrome mines		0	4	0	0	4
Coal	Alpha Anthracite Colliery	1				1
	Amcoal Colliery		2			2
	Arnot Colliery	1				1
	Bank Colliery		1			1
	Bosjesspruit Clliery		1			1
	Coal Mine		1			1
	Coalbrook Colliery		1			1
	Cornelia Colliery	1	1			2
	Delmas Colliery		1			1
	Douglas Colliery	1	3			4
	Durban Navigation Colliery		1			1
	Goedehoop Colliery	2	1			3
	Greenside Colliery		1			1
	Khutala Colliery		4			4
	Kleinkopje Colliery	1	1			2
	Koornfontein Coal		2			2

Commodity	Last mine worked	Black	White	Coloured	Unknown	Total
Coal (continued)	Kriel Colliery	1				1
	Matla Coal	16	5			21
	New Denmark	2	1			3
	New Largo Colliery		1			1
	S A Coal Estates		2			2
	Sasol Coal Mine		4			4
	Secunda Colliery		1			1
	Syferfontein Coal		1			1
	Transvaal Navigation Colliery	1	1			2
	Usutu Colliery		1			1
	Vierfontein Colliery		1			1
	Vryheid Coronation		1			1
Total from coal mines		27	40	0	0	67
Copper	O'Kiep Copper		2	2		4
	Phalaborwa		1			1
Total from copper mines		0	3	2	0	5
Diamond	Dancarl Diamond Mine			1		1
	De Beers Consolidated	1	3			4
	Diamond Mine			1		1
	Finch Diamond Mine	2				2
	Premier Diamond		1			1
Total from diamond mines		3	4	2	0	9
Emeralds	Gravelotte		1			1
Gold	Anglogold Ashanti GM	20	4			24
	Barberton GM		2			2
	Beatrix Gold	51	3			54
	Blyvoorquizicht	3	8			11
	Buffelsfontein Gold	2	10			12
	City Deep		1			1
	Consolidation Modderfontein		1			1
	Consolidated Murchison		1			1
	Deelkraal		2			2
	Doornfontein		1			1
	Doringkop GM	1				1
	Driefontein Cons GM	6	5			11
	Durban Roodepoort Deep		6			6

Commodity	Last mine worked	Black	White	Coloured	Unknown	Total
Gold (contd)	East Driefontein		4			4
	East Rand Gold and Uranium		1			1
	East Rand Prop		9			9
	Elandsrand		6			6
	Elsburg GM		1			1
	Evander GM	2				2
	Ezulwini Gold Mine	1	2			3
	Freddies Gold	2				2
	Free State Geduld	3	11			14
	Free State Saaiplaas	2	2			4
	Gencor	5	1			6
	Goldfields		3			3
	Grinaker GM	1				1
	Grootvlei Prop		1			1
	Harmony	189	18			207
	Hartebeesfontein		10			10
	J.I.C. Gold Mine	1	1			2
	Joel		1			1
	Kinross	1	1			2
	Kloof	20	9			29
	Kopanang Gold Mine	1				1
	Leeudoorn		4			4
	Leslie		2			2
	Libanon		7			7
	Loraine	1				1
	Marievale		2			2
	Oryx	2	1			3
	Pamodzi Mine		1			1
	President Brand		5			5
	President Steyn	2	5			7
	Rand Uranium Gold Mine	5	1			6
	Randfontein	1	11			12
	Robinson Gold Mine		2			2
	S A Land		1			1
	Saaiplaas GM		1			1
	Sallies		2			2
	Savuka GM	1	1			2

Commodity	Last mine worked	Black	White	Coloured	Unknown	Total
Gold (contd)	Sheba		1			1
	Simmer & Jack GM	3				3
	South Deep GM	1	4			5
	St Helena	1	4			5
	Stilfontein		6			6
	Target Gold Mine		1			1
	Tshepone GM	1				1
	Unisel GM		1			1
	Vaal Reefs	44	22			66
	Vogelstruisbult		1			1
	Welkom GM	1	1			2
	West Driefontein	1	8			9
	West Rand Consolidation		7			7
	West Witwatersrand	3				3
	Western Areas	2	6			8
	Western Deep Levels	8	20			28
	Western Holdings		6			6
	Winkelhaak		3			3
	Wit Nigel GM		3			3
Total from gold mines		388	265	0	0	653
Iron	Iron Ore Mine	2	1			3
Lead & Minerals	Blackmountain		1			1
Lime	Lime Acres	1				1
Manganese	Associated Manganese	1	2			3
	Hotazel Manganese Mine	6				6
	S A Manganese	1				1
Total from manganese mines		8	2	0	0	10
Platinum	Amadelbult Platinum (Rustenburg)	3				3
	Atok Platinum	2				2
	Bafokeng	2	1			3
	Eastern Platinum Mine	43	2			45
	Impala Platinum	68	12			80
	Karee Platinum	37	1			38
	Lebowa Platinum Mine		1			1
	Lonmin Platinum	1	3			4

Commodity	Last mine worked	Black	White	Coloured	Unknown	Total
Platinum (contd.)	Northam Platinum	5	5			10
	Rustenburg Platinum	15	15			30
	Two Rivers Platinum Mine		1			1
	Union Platinum	1				1
	Unknown Plantinum	6	3			9
	Western Platinum	41	3			44
Total from platinum mines		224	47	0	0	271
Silicon	Silicon Smelters	2				2
Shaft sinkers	Shaft Sinkers	1	4			5
	Master Drilling		1			1
Total from shaft sinkers		1	5	0	0	6
Steel & Iron	Iscor	4	9			13
Steel & Vanadium	Highveld Steel and Vanadium		1			1
Non-miner	Barplats Refinery (Platinum)		2			2
	Environmental	5	3			8
	Eskom		1			1
	Industry		6			6
	Non Miner	1				1
	Transnet		2			2
Total for non-miners		6	14	0	0	20
Tin	Rooiberg Tin Mine		1			1
Unknown	Unknown	17	13		16	46
Zinc	Pering Zinc mine		1			1
TOTAL		744	421	7	16	1 188

APPENDIX 2: PUBLICATIONS AND ACTIVITIES EMANATING FROM PATHAUT DATA OR AUTOPSY SERVICE (2013)

Journal articles

Ndlovu N, Murray J. The health of the South African mining workforce: trends, progress and challenges. *Adler Museum Bulletin* 2013; 39(2): 3-8.

Milne SJ, Pretorius CJ, Phillips JI, Murray J. Comparison of methods to digest midsagittal sections of lung tissue and an evaluation of their effect on the composition of standard silica. *American Society for Testing Materials, Selected Technical Publications* 1565, 2013. www.astm.org. DOI:10.1520/STP156520130011

Naidoo RN. Invited Commentary. Mining: South Africa's legacy and burden in the context of occupational respiratory diseases. *Glob Health Action* 2013; 6: 1-3.

Nelson G. PhD Review: Occupational respiratory diseases in the South African mining industry. *Global Health Action* 2013; 6: 89-98.

Nelson G, Murray J. Silicosis at autopsy in platinum mine workers. *Occup Med (Lond)* 2013; 63(3):196-202.

Reports

Ndlovu N, Davies JA, Murray J, Vorajee N. Pathology Division Report: Demographic data and disease rates for January to December 2012. NIOH Report 1/2013, ISSN 1812-7681. National Institute for Occupational Health, National Health Laboratory Services, South Africa. http://www.nioh.ac.za/?page=pathology_disease_surveillance_reports&id=162

Congresses

Nelson G, Murray J, Gonzales L, Zhang J, Checkoway H, Racette BA. Neuropathology of chronic manganese exposure. The 12th International Symposium on Neurobehavioral Methods and Effects in Occupational and Environmental Health, 24 – 27 March 2013, Cape Town, South Africa.

Vorajee N, Pathological challenges in the diagnosing mesothelioma. Asbestos Relief Trust Seminar - Celebrating 10 years of the ART, 17 September 2013, Johannesburg, South Africa.

Murray J, Lung Disease in South Africa, Bushpath Diagnostic Surgical Pathology Congress, 21-24 March 2013, Waterberg, South Africa.

Ndlovu N, Park SK, Murray J. The use of an autopsy compensation database for surveillance of pulmonary tuberculosis in the South African mining industry: 1975 – 2011, 23rd Conference on Epidemiology in Occupational Health, 18-21 June 2013, Utrecht, The Netherlands.

teWaterNaude J, **Jill Murray J, Ndlovu N.** Clinico-autopsy accuracy in asbestos disease - how well are we doing? Asbestos Relief Trust Seminar - Celebrating 10 years of the ART, 17 September 2013, University of the Witwatersrand, School of Public Health, Johannesburg, South Africa.

Murray J, Ndlovu N. Unsafe Air: Where does it happen, how should it be managed, what are the ethical implications? Air safety in work places: South Africa Gold Mines. 44th Union World Conference on Lung Health, 30 October- 3 November 2013, Paris, France.

Murray J. Autopsy Studies in South African Miners with Tuberculosis. United States and Canadian Academy of Pathology 2013 Annual Meeting, 2-8 March 2013, Baltimore, USA.

Degrees

Milne Simon, PhD (registered in September 2011), School of Public Health, University of the Witwatersrand, The relation between silicosis and silica dust in the lung.

Ndlovu Ntombizodwa, PhD (registered in September 2011), School of Public Health, University of the Witwatersrand, Evaluation of autopsy data for occupational lung disease surveillance.

Outreach Programme Activities

ACTIVITY	DATE	VENUE	PERSON
NUM workshop for shop stewards	25 April 2013	Carletonville & Randfontein	Mr D Afrika Imtatia Ngcakaza
NUM safety meeting	13 June 2013	Carletonville	Mr D Afrika Imtatia Ngcakaza
NUM workshop for health and safety representatives	12 November 2013	Carletonville	Mr D Afrika
NUM workshop for health and safety representatives	6 Dec 2013	Klerksdorp Recreation Hall	Mr D Afrika