NATIONAL INSTITUTE FOR OCCUPATIONAL HEALTH

Division of the National Health Laboratory Service

Pathology Division Surveillance Report

Demographic Data and Disease Rates for January to December 2022

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EXECUTIVE SUMMARY

The NIOH examined the cardiorespiratory organs of 410 deceased individuals in 2022, a decline of 24.9% from 2021 (n=546). The lower numbers may reflect the logistical issues, as well as health and safety issues attributable to the COVID pandemic. Of the individuals examined, 54.4% were black, 45.6% were white. There were no coloured or asian individuals. Of the cases submitted, 70.2% (n=288) were ex-miners, 24.9% (n=102) current miners and 4.9% (n=20) cases could not be classified.

The overall disease rates (per 1000 autopsies) for 2022 are shown in Figure 1.

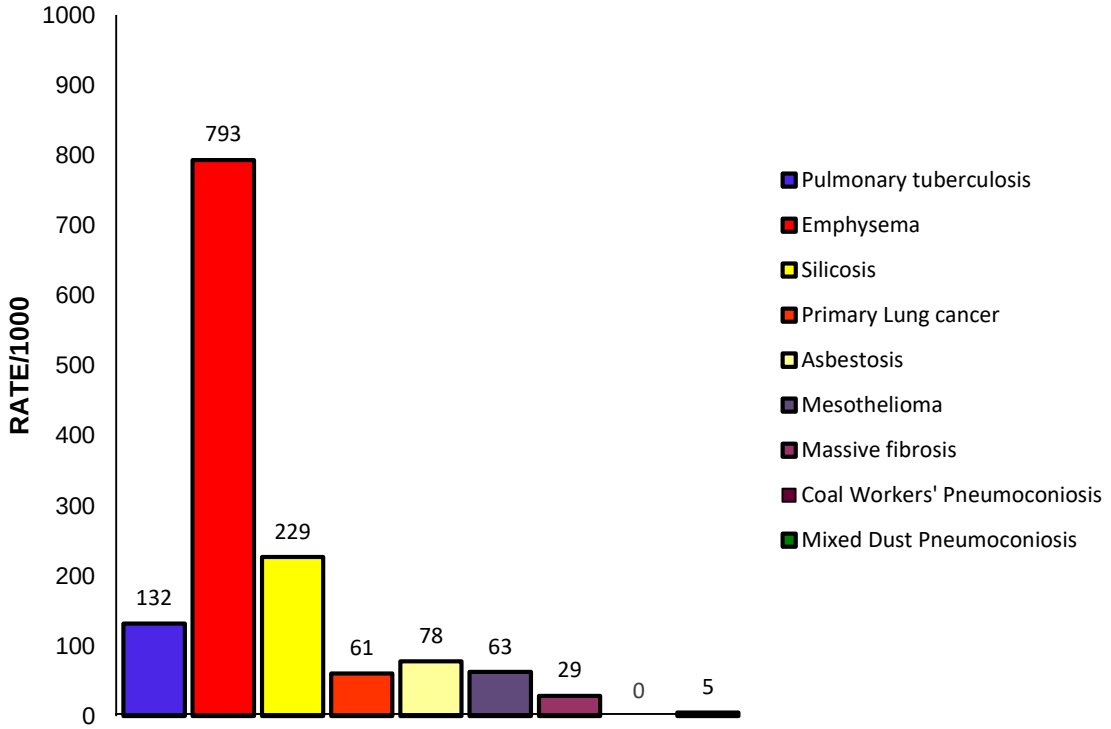

FIG. 1 OVERALL DISEASE RATES FOR 2022

The overall rate of pulmonary tuberculosis (PTB) remained similar at 137/1000 in 2021 to 132/1000 in 2022. The rate of PTB in black gold miners remained stable at 204/1000 in 2021 to 206/1000 in 2022 and increased slightly in platinum miners from 114/1000 in 2021 to 120/1000 in 2022 (Table 3-1).

The overall rate of silicosis increased from 192/1000 in 2021 to 229/1000 in 2022. The rate of silicosis in black gold miners increased in 2022 compared to 2021 while white gold miner's silicosis rates remained similar to 2021 (Table 4-1).

The organs of 30 women were submitted for examination, with 5 (16.7%) having a history of working in the gold mining industry, 21 (70%) in the asbestos industry and 4 (13.3%) in platinum mining. Nine women (30%) had diseases related to asbestos exposure which was higher than last year (21.2% in 2021).

Some cases were received with incomplete exposure information. Continued active follow-up of cases received has improved the completeness of the information obtained. However, in 2022 information could not be obtained for the following: commodity (mine type) 12 (2.9%), duration of service 18 (4.4%) and last mine worked 10 (2.4%).

Since 2010, the province or foreign country from which the organs were sent has been recorded on the PATHAUT database. Of note, the province is indicative of the province where the miner died, and not necessarily where he worked. Table 1-1 shows the distribution of cases by province and population group. Most cases originated from the North West (28.0%), Gauteng (25.6%) and Free State (20.7%) and Northern Cape (19.3%) provinces. No cases were received from miners outside South Africa.

TABLE 1-1 DISTRIBUTION OF AUTOPSY CASES BY PROVINCE AND POPULATION GROUP (2022)

Province	Black		White		Total	
	N	%	N	%	N	%
Eastern Cape	4	1.7	0	-	4	1.0
Free State	55	24,7	30	16	85	20.7
Gauteng	29	13.0	76	40.6	105	25.6
Kwazulu-Natal	0	-	3	1.6	3	0.7
Limpopo	1	0.4	0	-	1	0.2
Mpumalanga	2	0.9	13	7.0	15	3.7
North West	56	25.1	59	31.6	115	28.0
Northern Cape	76	34.1	3	1.6	79	19.3
Western Cape	0	-	3	1.6	3	0.7
Total	223		187		410	

The Pathology division returned to outreach activities in 2022 and continues to engage with stakeholders. These include occupational health units on the mines, union representatives, undertakers and occupational hygiene departments.

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GLOSSARY

Asbestosis	Lung fibrosis caused by exposure to asbestos fibres
Coal workers' pneumoconiosis	Lung fibrosis caused by exposure to coal dust
Emphysema	Lung disease caused by the destruction of the alveolar walls
Environmental asbestos exposure	Non-occupational asbestos exposure. Cases with such exposure are examined by the NIOH but are not submitted to the MBOD for compensation
Massive fibrosis	Lung fibrosis caused by exposure to dust and measuring more than 1 cm in diameter
Mesothelioma	A malignant tumour of the mesothelial tissues of the lungs and/or heart
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
Standard deviation	Standard deviation (SD) is an indication of how widely scattered the data is in relation to the mean.
Surveillance	The ongoing and systematic collection, analysis, interpretation and dissemination of information related to adverse health outcomes for action

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. Approval to retrospectively review routinely collected autopsy data for reporting on disease prevalence's, time trends and associated factors was obtained from the Human Research Ethics Committee (Medical) at the University of the Witwatersrand (Clearance number M220564).

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 Enterprise Guide v7.1. This report describes autopsy cases examined during the year 2022. This report along with previous reports can be accessed at https://www.nioh.ac.za/pathology-disease-surveillance-reports/

Since 2005, gender has been recorded on the PATHAUT database. To maintain consistency with previous reports, the term 'men' and all data refers to both men and women throughout this report, 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 mining 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 (1975-2022)

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	1 062	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
2014	627	59	432	41	5	1	1		1		1 066
2015	539	59	358	39	9	1			3		909
2016	521	61	323	38	6	1					850
2017	473	59	313	39	9	1	1	0	5	1	801
2018	446	58	321	41	6	0.7			2	0.3	775
2019	445	59	307	40	5	1			2		759
2020	304	55	251	44	2	1					557
2021	303	55	241	44	2	1					546
2022	223	54	187	46							410
Total	76 213	66	37520	32	1650	1	5		361		115 749

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 retired white miners are autopsied. The number of autopsies has decreased steadily over the years, probably reflecting the concomitant decrease in the number of miners employed in the industry. In 1994, there were around 344 000 people employed in the gold mining industry compared to approximately 93,841 in 2022 (Minerals Council South Africa, https://www.mineralscouncil.org.za/industry-news/publications/facts-and-figures).

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 may be undertaken on men who die close to Johannesburg.

Table 2-2 shows the distribution of autopsies by population group for 2022. The vast majority (98.3%) of autopsy examinations were performed on the cardio-respiratory organs only.

TABLE 2-2 NUMBER AND PROPORTION OF AUTOPSIES BY TYPE AND POPULATION GROUP (2022)

Autopsy type	Black		White		Coloured		Total	
	N	%	N	%	N	%	N	%
Cardio-respiratory organs only	222	99.6	181	96.8	0	-	403	98.3
Full autopsy	1	0.4	6	3.2	0	-	7	1.7
Total	223		187		0		410	

The age distribution of cases for 2022 is shown in Table 2-3 and presented graphically in Figure 2-1. The mean age at autopsy of black men was 57.9 years in 2022, similar to that in 2021 (55.2 years). The mean age of white men at autopsy was 71.6 years in 2022, also similar to that of the previous year (69.4 years).

TABLE 2-3 NUMBER AND PROPORTION OF AUTOPSIES BY AGE AND POPULATION GROUP (2022)

Age group (years)	Black		White		Coloured		Total	
	N	%	N	%	N	%	N	%
20-29	5	2.2	0	-	0	-	5	1.2
30-39	17	7.6	1	0.5	0	-	18	4.4
40-49	47	21.1	2	1.1	0	-	49	12.0
50-59	53	23.8	16	8.6	0	-	69	16.8
60-69	55	24.7	60	32.1	0	-	115	28.0
70-79	32	14.3	65	34.8	0	-	97	23.7
80+	14	6.3	43	23.0	0	-	57	13.9
Total	223	100	187	100	0	0	410	100.0

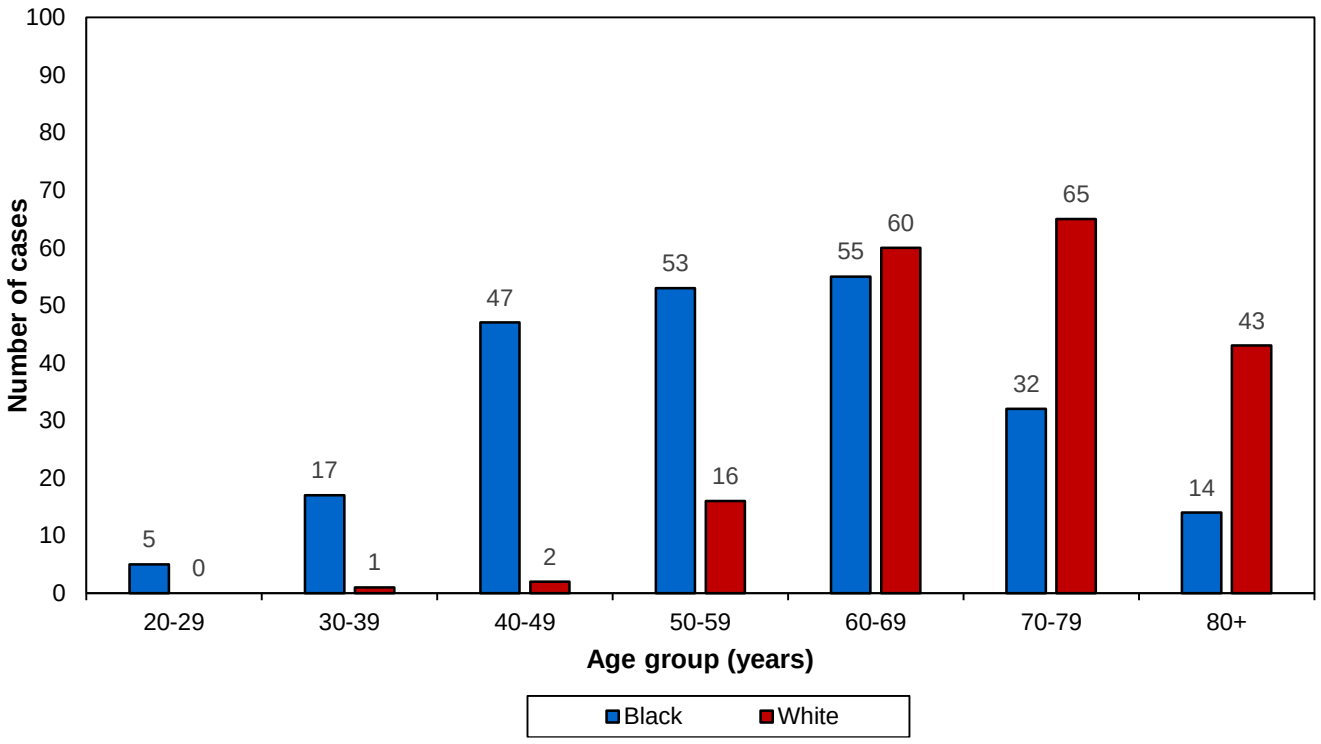


FIG 2-1 DISTRIBUTION OF AUTOPSIES BY AGE AND POPULATION GROUP (2022)

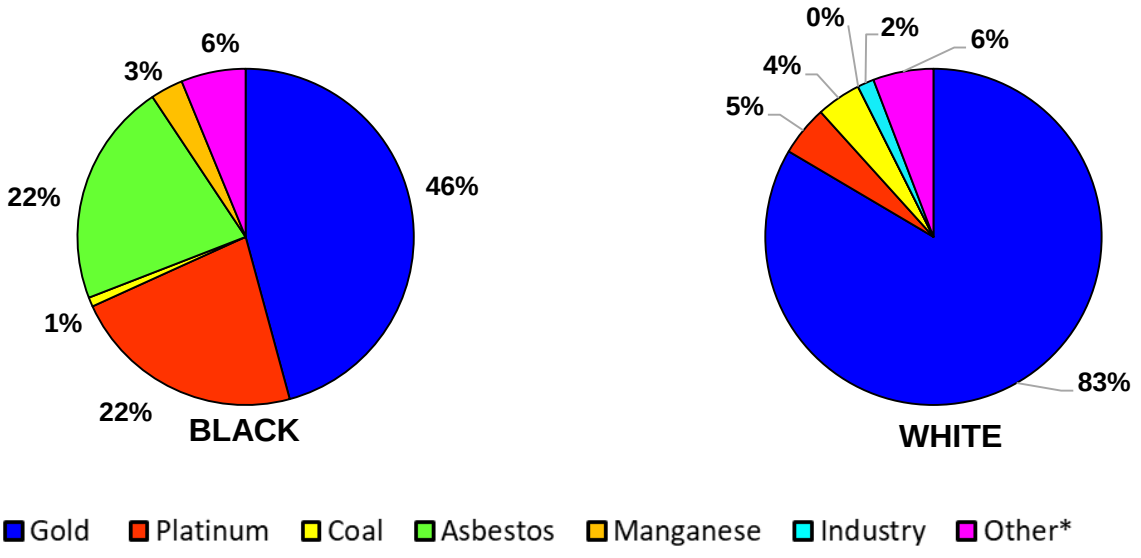
There are men who worked in a number of different mining commodities during their lifetimes and had "mixed" exposures. This was not taken into account in the analysis of exposure type (commodity). Cases were placed in categories according to the commodity in which they had worked for the longest duration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

Table 2-4 and Figure 2-2 show the distributions of autopsies by commodity and population group for 2022. The majority of autopsies (62.9%) were on men from the gold mining industry, which is similar to 2020 (60.1%) and 2021 (61.7%). The proportion of autopsies from the platinum mining industry is 14.4% in 2022, similar to that seen in 2021 (15.9%).

TABLE 2-4 NUMBER AND PROPORTION OF AUTOPSIES BY COMMODITY AND POPULATION GROUP (2022)

Commodity	Black		White		Total	
	N	%	N	%	N	%
Gold	102	45.7	156	83.4	258	62.9
Platinum	50	22.4	9	4.8	59	14.4
Coal	2	0.9	8	4.3	10	2.4
Asbestos	48	21.5	0	-	48	11.7
Iscor (Steel)	2	0.9	1	0.5	3	0.7
Copper	0	-	1	0.5	1	0.2
Manganese	7	3.1	1	0.5	8	2.0
Industry	3	1.3	3	1.6	6	1.5
Other*	2	0.9	3	1.6	5	1.2
Unknown	7	3.1	5	2.7	12	2.9
Total	223		187		410	

*** Environmental asbestos, chrome, steel, vanadium and SA Railways**



*Includes copper, Iscor(steel) and works as well as cases where service histories could not be obtained

FIG 2-2 DISTRIBUTION OF AUTOPSIES BY COMMODITY AND POPULATION (2022)

Detailed information about the years in mining service by population group is shown in Table 2-5 and displayed graphically in Figure 2-3. In 2022, the duration of service was obtained for all but 4.3% (n=18) of cases.

TABLE 2-5 NUMBER AND PROPORTION OF AUTOPSIES BY YEARS OF SERVICE AND POPULATION GROUP (2022)

Years of service	Black		White		Total	
	N	%	N	%	N	%
<1	12	5.4	2	1.1	14	3.4
1-5	45	20.2	11	5.9	56	13.7
6-10	35	15.7	16	8.6	51	12.4
11-15	36	16.1	12	6.4	48	11.7
16-20	30	13.5	23	12.3	53	12.9
21-25	22	9.9	22	11.8	44	10.7
26-30	12	5.4	41	21.9	53	12.9
31-35	15	6.7	35	18.7	50	12.2
36-40	5	2.2	15	8.0	20	4.9
41+	-	-	3	1.6	3	0.7
Unknown	11	4.9	7	3.7	18	4.4
Total	223	100	187	100	410	100

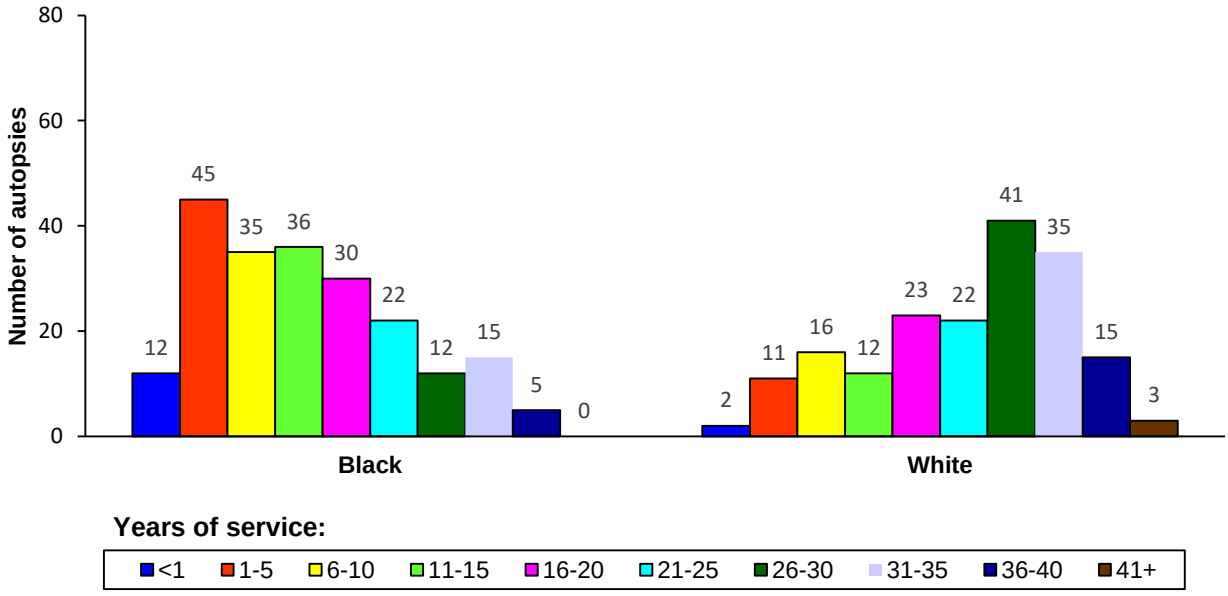


FIG 2-3 DISTRIBUTION OF AUTOPSIES BY YEARS OF SERVICE AND POPULATION GROUP (2022)

The mean age and duration of service by commodity and population group are shown in Tables 2-6 and 2-7.

TABLE 2-6 MEAN AGE BY COMMODITY AND POPULATION GROUP (2022)

Commodity	Black			White		
	N	Mean (Years)	SD*	N	Mean (Years)	SD*
Gold	102	53	12	156	72	10
Platinum	50	51	12	9	62	7
Coal	2	52	9	8	70	8
Asbestos	48	73	9	0	-	-
Iscor	2	67	9	1	86	-
Copper	0	-	-	1	76	-
Manganese	7	58	9	1	69	-
Industry	3	77	8	3	77	10
Other	2	54	12	3	72	7
Unknown	7	67	17	5	75	12
Total	**223**	**58**	**14**	**187**	**72**	**10**

* Standard deviation: A small SD compared to the mean value shows that the majority of data are found close to the mean, and a large, SD indicates data are more dispersed.

TABLE 2-7 MEAN DURATION OF SERVICE BY COMMODITY AND POPULATION GROUP (2022)

Commodity	Black			White		
	N	Mean (Years)	SD*	N	Mean (Years)	SD*
Gold	102	19	9	156	24	10
Platinum	49	16	10	8	17	9
Coal	2	21	16	7	25	14
Asbestos	47	3	3	0	-	-
Iscor	2	7	2	1	40	-
Copper	0	-	-	1	34	-
Manganese	7	21	12	1	8	-
Industry	2	7	1	3	24	15
Other	1	11	-	3	24	11
Total	212	15	10	180	24	10

*Standard deviation: A small SD compared to the mean value shows that the majority of data are found close to the mean, and a large, SD indicates data are more dispersed.

SECTION 3 – ACTIVE TUBERCULOSIS

The distribution of active tuberculosis (TB) by anatomical site is presented in Figure 3-1 (n=97). Active pulmonary TB (PTB) was diagnosed in 13.2% (n=54) of all autopsies in 2022, similar to 13.7% (n=75) in 2021. Most of the men with PTB were black (n=34; 63.0%) and 20 (37.0%) were white miners.

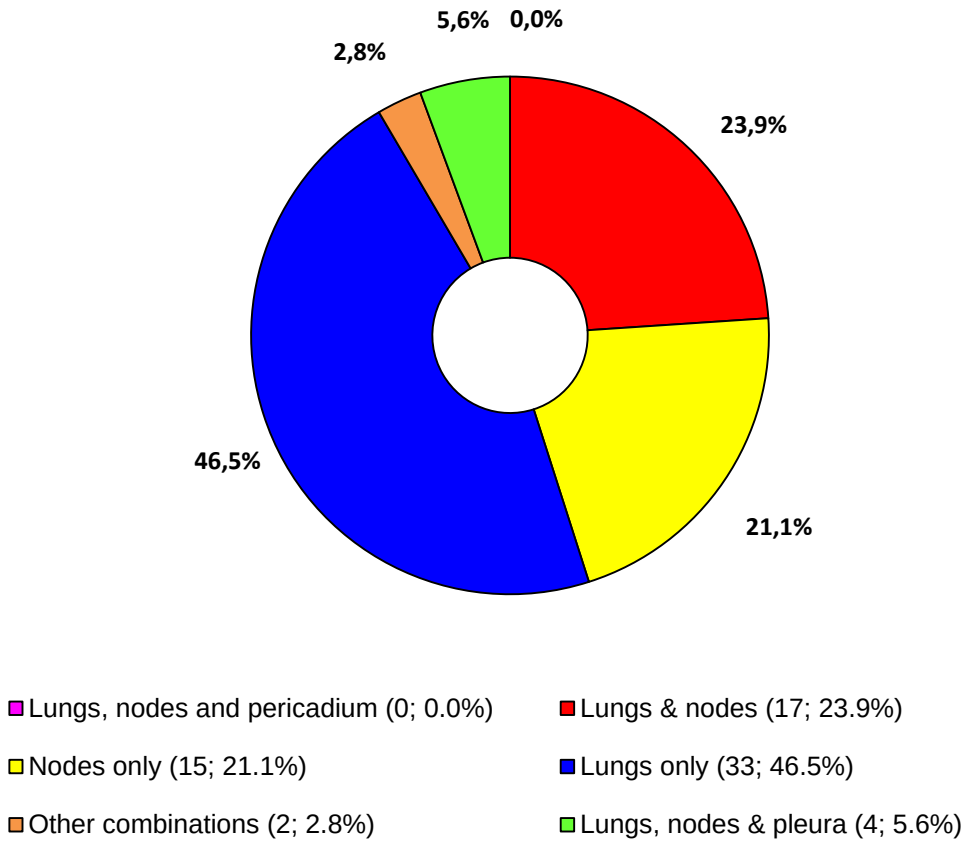


FIG 3-1 DISTRIBUTION OF ACTIVE TB BY SITE (2022)

Disease rates in subsequent tables and figures are expressed per 1000 miners. In 2022, the overall PTB rate was 132/1000. In black miners, the rate of PTB has declined slightly in 2022 to 152/1000 from 155/1000 in 2021, the lowest rate since 1997 (Fig 3-2). The rate in white miners was lower than that in black miners at 107/1000 (2022), and also declined compared to the rate in 2021 (112/1000).

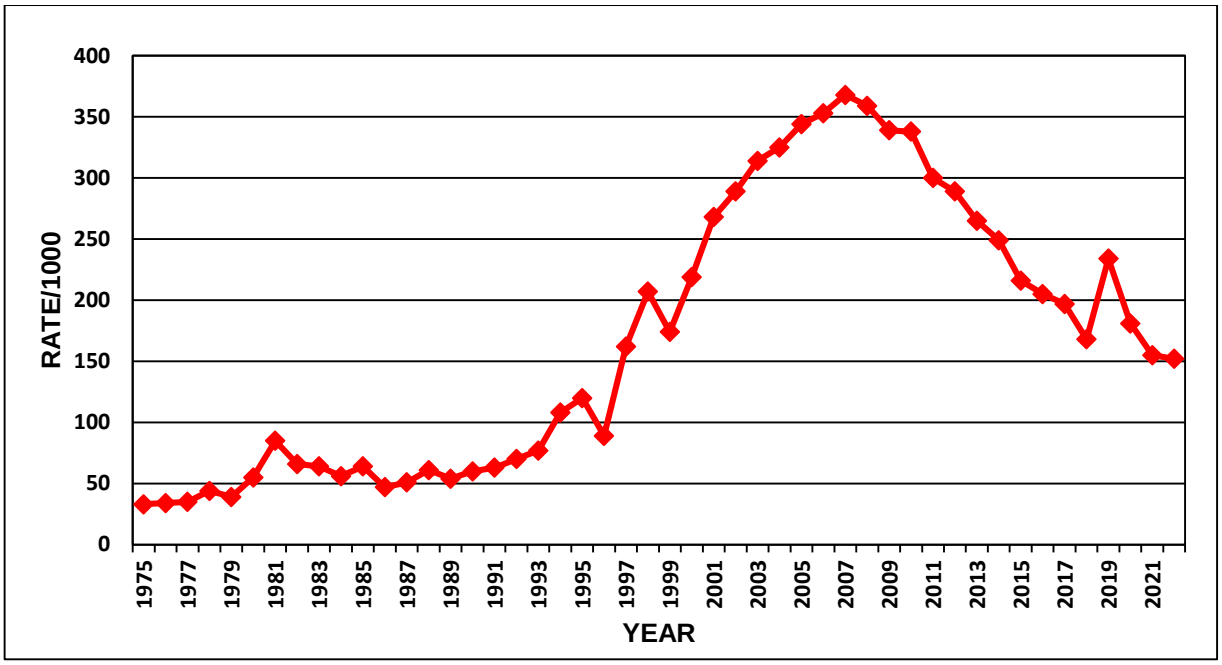


FIG 3-2 ACTIVE PTB RATES IN BLACK MINERS AT AUTOPSY (1975-2022)

The distribution of active PTB cases by commodity is shown in Table 3-1. Most cases of active PTB (75.9%) were from gold (62.9% of all autopsy cases came from that commodity) followed by the platinum (11.1% of cases) and the asbestos (11.1% of cases) mining industries. However, the overall rate of PTB was slightly higher in the asbestos miners (125/1000) as compared to the platinum miners (102/1000).

TABLE 3-1 NUMBER OF CASES AND PREVALENCE OF ACTIVE PTB BY COMMODITY AND POPULATION GROUP (2022)

Commodity	Black		White		Total	
	N	Rate	N	Rate	N	Rate
Gold	21	206	20	128	41	159
Platinum	6	120	0	-	6	102
Coal	1	-	0	-	1	-
Asbestos	6	125	0	-	6	125
Copper	0	-	0	-	0	-
Iscor	0	-	0	-	0	-
Other	0	-	0	-	0	-
Unknown	0	-	0	-	0	-
Total	34	152	20	107	54	132

Note: rates have not been calculated where there are fewer than 6 cases

The age distribution of cases with active PTB is shown in Table 3-2. Most of the PTB cases (n=16; 27.1%) were in the age group 60-69 years, followed by those in the 50-59 years age group (n=14; 23.7%). The highest rate was seen in black miners aged 50-59 (245/1000).

TABLE 3-2 NUMBER OF CASES AND PREVALENCE OF ACTIVE PTB BY AGE AND POPULATION GROUP (2022)

Age group	Black		White		Total	
(years)	N	Rate	N	Rate	N	Rate
20-29	0	-	0	-	0	-
30-39	2	-	0	-	2	-
40-49	5	-	0	-	5	-
50-59	13	245	1	-	14	203
60-69	8	145	8	133	16	139
70-79	2	-	10	154	12	124
80+	4	-	1	-	5	-
Total	34	152	20	107	54	132

Note: rates have not been calculated where there are fewer than 6 cases

SECTION 4 – SILICOSIS

Silicotic nodules were found in the lungs of 94 cases (22.9% of all autopsies), 85.1% of which came from the gold mining industry. Of all cases with silicosis, occasional silicotic nodules were found in 31 (33%), a few in 22 (23%), a moderate number in 26 (28%) and a large number in 15 (16%) 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 (2022)

Commodity	Black		White		Total	
	N	Rate	N	Rate	N	Rate
Gold	33	324	47	301	80	310
Platinum	5	-	1	-	6	102
Coal	0	-	1	-	1	-
Asbestos	2	-	0	-	2	-
Industry	0	-	1	-	1	-
Copper	0	-	1	-	1	-
Unknown	1	-	2	-	3	-
Total	41	184	53	283	94	229

Note: rates have not been calculated where there are fewer than 6 cases

The rate of silicosis in black gold miners is presented in Fig 4-1. The silicosis rates in black gold miners increased from 39/1000 in 1975, peaked at 403/1000 in 2016 and is now 324/1000. The rate in white gold miners also increased since 1997 from 176/1000 to 328/1000 in 2020. However, a decline in silicosis rates has been noted in white miners, and is now 301/1000 in 2022, a slight increase compared to 2021 (289/1000).

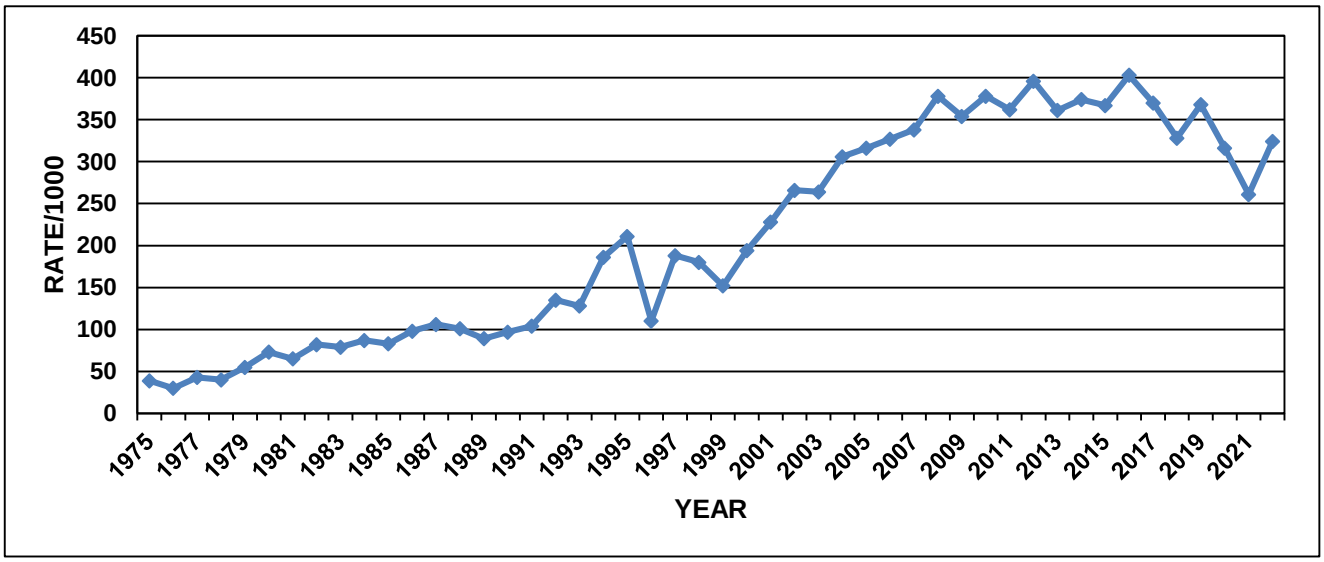


FIG 4-1 SILICOSIS IN BLACK MINERS AT AUTOPSY (1975-2022)

Silicosis in gold miners is shown in tables, 4-2 and 4-3. The rate of silicosis in all gold miners in 2022 (306/1000) is higher than that of 2021 (276/1000). The age distribution of silicosis differed between the black and white men (Table 4-2). In black men, majority of those diagnosed with silicosis were between the 50 to 69 years age category, whilst the majority of white men diagnosed with the same disease were older than 60 years (Table 4-2). A total of five cases of silicosis were detected amongst those who reported 1-5 years of service (Table 4-3).

TABLE 4-2 NUMBER OF CASES AND PREVALENCE OF SILICOSIS IN THE GOLD MINING INDUSTRY, BY AGE AND POPULATION GROUP (2022)

Age group (years)	Black		White		Total	
	N	Rate	N	Rate	N	Rate
30-39	0	-	0	-	0	-
40-49	2	-	1	-	3	-
50-59	14	412	5	-	19	422
60-69	13	565	11	234	24	343
70-79	3	-	14	246	17	274
80+	1	-	16	421	17	436
Total	33	324	47	301	80	310

Note: rates have not been calculated where there are fewer than 6 cases

TABLE 4-3 NUMBER OF CASES AND PREVALENCE OF SILICOSIS IN THE GOLD MINING INDUSTRY BY YEARS OF SERVICE AND POPULATION GROUP (2022)

Years of service	Black		White		Total	
	N	Rate	N	Rate	N	Rate
<1	0	-	0	-	0	-
1-5	3	-	2	-	5	-
6-10	1	-	1	-	2	-
11-15	4	-	2	-	6	214
16-20	9	429	9	429	18	429
21-25	6	353	6	286	12	316
26-30	3	-	10	263	13	277
31-35	5	-	12	400	17	447
36-40	2	-	4	-	6	353
41+	0	-	1	-	1	-
Total	33	324	47	301	80	310

Note: rates have not been calculated where there are fewer than 6 cases; cases with low years of service may have incomplete work histories

SECTION 5 – OTHER PNEUMOCONIOSES

MASSIVE FIBROSIS

There were 12 (2.9%) cases of massive fibrosis: six in black and six in white miners. Eleven were from the gold mining industry and one from the copper mining industry.

Note: There was a change in the definition of massive fibrosis from lung fibrosis measuring 2 cm and more to lung fibrosis measuring 1 cm and more in 2019. The reason for the change was to align the pathology diagnosis with the International Labour Organisation (ILO) radiological measurements.

COAL WORKERS' PNEUMOCONIOSIS

There were no cases of coal workers' pneumoconiosis in cases examined in 2022.

MIXED DUST PNEUMOCONIOSIS

There were two (0.5%) cases of mixed dust pneumoconiosis in cases examined in 2022. The two cases were from the gold and asbestos mining industries.

ASBESTOSIS AND PLEURAL PLAQUES

There were 32 cases of asbestosis. Of these, 50.0% (n=16) had slight, 34.4% (n=11) had moderate and 15.6% (n=5) had marked fibrosis. Twenty-five (78.1%) had worked in the asbestos mining industry and none reported environmental asbestos exposure.

There were 9 cases with asbestos plaques and of these 6 had asbestosis. However, in many autopsies the parietal pleura (the site where plaque formation usually occurs) is seldom submitted with the lungs thus the number of plaques may be higher.

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 (2022)

Age group	Black		White		Total	
(years)	N	Rate	N	Rate	N	Rate
50-59	2	-	0	-	2	-
60-69	9	164	1	-	10	87
70-79	13	406	0	-	13	134
80+	5	-	2	-	7	123
Total	29	130	3	-	32	78

Note: rates have not been calculated where there are fewer than 6 cases

SECTION 6 – EMPHYSEMA

There were 325 cases of emphysema (80% of all autopsies an increase from 38% in 2021). The extent of emphysema was mild in 81.5% (n=265), moderate in 15.1% (n=49) and marked in 3.4% (n=11) cases. The overall rate of emphysema increased from 382/1000 in 2020 and 383/1000 in 2021 to 793/1000 in 2022. The distribution of emphysema by age and population group is presented in Table 6-1. Emphysema rates increased with age group in white miners but were stable in black miners, with highest rates seen in black miners aged 50 to 79 and 80+ in white miners.

TABLE 6-1 NUMBER OF CASES AND PREVALENCE OF EMPHYSEMA BY AGE AND POPULATION GROUP (2022)

Age group	Black		White		Total	
(years)	N	Rate	N	Rate	N	Rate
20-29	2	-	0	-	2	-
30-39	7	412	1	-	8	444
40-49	24	511	0	-	24	490
50-59	45	849	14	875	59	855
60-69	46	836	53	883	99	861
70-79	27	844	56	862	83	856
80+	10	714	40	930	50	877
Total	161	722	164	877	325	793

Note: rates have not been calculated where there are fewer than 6 cases

Most men with emphysema were from the gold mining industry (n=215, 83%) and all men from the manganese industry had emphysema (Table 6-2).

TABLE 6-2 NUMBER OF CASES AND PREVALENCE OF EMPHYSEMA BY COMMODITY AND POPULATION GROUP (2022)

Commodity	Black		White		Total	
	N	Rate	N	Rate	N	Rate
Gold	75	735	140	897	215	833
Platinum	31	620	7	778	38	644
Coal	1	-	7	875	8	800
Asbestos	36	750	0	-	36	750
Iscor	2	-	1	-	3	-
Copper	0	-	1	-	1	-
Manganese	7	1000	1	-	8	1000
Industry	2	-	3	-	5	-
Other	2	-	2	-	4	-
Unknown	4	-	3	-	7	583
Total	160	717	165	882	325	793

Note: rates have not been calculated where there are fewer than 6 cases

TABLE 6-3 NUMBER OF CASES AND PREVALENCE OF EMPHYSEMA BY YEARS OF SERVICE AND POPULATION GROUP (2022)

Years of service	Black		White		Total	
	N	Rate	N	Rate	N	Rate
<1	10	833	1	-	11	786
1-5	28	622	10	909	38	679
6-10	24	686	11	688	35	686
11-15	23	639	11	917	34	708
16-20	22	733	20	870	42	792
21-25	20	909	20	909	40	909
26-30	9	750	37	902	46	868
31-35	14	933	32	914	46	920
36-40	3	-	14	933	17	850
41+	0	-	3	-	3	-
Unknown	8	727	5	-	13	722
Total	161	722	164	877	325	793

Note: rates have not been calculated where there are fewer than 6 cases

SECTION 7 – MESOTHELIOMA

There were 26 cases of mesothelioma in 2022.

TABLE 7-1 NUMBER AND PERCENTAGE OF MESOTHELIOMA CASES BY AGE AND POPULATION GROUP (2022)

Age group	Black		White		Total	
(years)	N	%	N	%	N	%
30-39	0	-	0	-	0	-
40-49	1	4.2	0	-	0	-
50-59	2	8.3	0	-	2	7.7
60-69	14	58.3	1	50.0	15	57.7
70-79	6	25.0	1	50.0	7	26.9
80+	1	4.2	0	-	1	3.8
Total	24		2		26	

The distribution of mesothelioma by commodity and population group is presented in Table 7-2. Nineteen (73.0%) of the cases had worked in asbestos mines at some stage in their careers. Twelve of the cases had their longest service in asbestos (most exposure) and seven had mixed exposures that included asbestos.

TABLE 7-2 NUMBER AND PERCENTAGE OF MESOTHELIOMA CASES BY COMMODITY AND POPULATION GROUP (2022)

Commodity	Black		White		Total	
	N	%	N	%	N	%
Asbestos	12	50.0	0	-	12	46.2
Platinum	6	25.0	0	-	6	23.1
Manganese	2	8.3	1	50.0	3	11.5
Gold	1	4.3	0	-	1	3.8
Iscor	2	8.3	0	-	2	7.7
Other*	1	4.3	1	50.0	2	7.7
Total	24		2		26	

*Includes non-miners from Transnet and Environmental

SECTION 8 – PRIMARY LUNG CANCER

Twenty-five cases of primary lung cancer were found at autopsy, 32.0% (n=8) of which were in black miners, and 68.0% (n=17) were in white miners. Most of the cases were adenocarcinoma (n=10; 40.0%), followed by those with squamous cell carcinoma (n=8; 32.0 %), a few had small cell carcinoma (n=5; 20%) and large cell carcinoma (n=2; 8%).

The distribution of primary lung cancer by age and population group is presented in Table 8-1. The highest rate was seen in miners aged 60-69 (104).

TABLE 8-1 NUMBER AND PROPORTION OF PRIMARY LUNG CANCER CASES BY AGE AND POPULATION GROUP (2022)

Age group (years)	Black		White		Total	
	N	Rate	N	Rate	N	Rate
40-49	0	-	0	-	0	-
50-59	5	-	0	-	5	-
60-69	2	-	10	167	12	104
70-79	1	-	6	92	7	72
80+	0	-	1	-	1	-
Total	8	36	17	91	25	61

Note: rates have not been calculated where there are fewer than 6 cases

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).

TABLE 8-2 NUMBER AND PROPORTION OF PRIMARY LUNG CANCER CASES BY COMMODITY AND POPULATION GROUP (2022)

Commodity	Black		White		Total	
	N	Rate	N	Rate	N	Rate
Gold	7	69	14	90	21	81
Coal	0	-	2	-	2	-
Asbestos	1	-	0	-	1	-
Steel & Iron	0	-	1	-	1	-
Total	8	36	17	91	25	61

Note: rates have not been calculated where there are fewer than 6 case

SECTION 9 – CLINICAL CAUSES 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. The majority of cases were only provided with natural causes as the clinical cause of death. Among those with specified causes diseases of the respiratory system were the most frequent (11%) but lower than the 15% seen in 2021. The proportion of unnatural deaths (11%) was lower than that in 2020 (12.6%). The clinical cause of death was not stated for 1.7% of the cases, an improvement in comparison to the previous year, 2021 (2.4%).

TABLE 9-1 CLINICAL CAUSE OF DEATH BY POPULATION GROUP (2022)

Commodity	Black		White		Total	
	N	%	N	%	N	%
Respiratory	20	8.9	25	13.4	45	11
Cardio-vascular	1	0.4	14	7.5	15	3.7
Central Nervous System	2	0.9	5	2.7	7	1.7
Gastro-intestinal	1	0.4	1	0.5	2	0.5
Genito-urinary	0	-	1	0.5	1	0.2
Unnatural	39	17.5	6	3.2	45	11
Natural	151	67.7	118	63.1	269	65.6
Miscellaneous	7	3.1	12	6.4	19	4.6
Not stated	2	0.9	5	2.7	7	1.7
Total	223		187		410	

* The metabolic system is included in miscellaneous along with those providing immediate cause of death only.

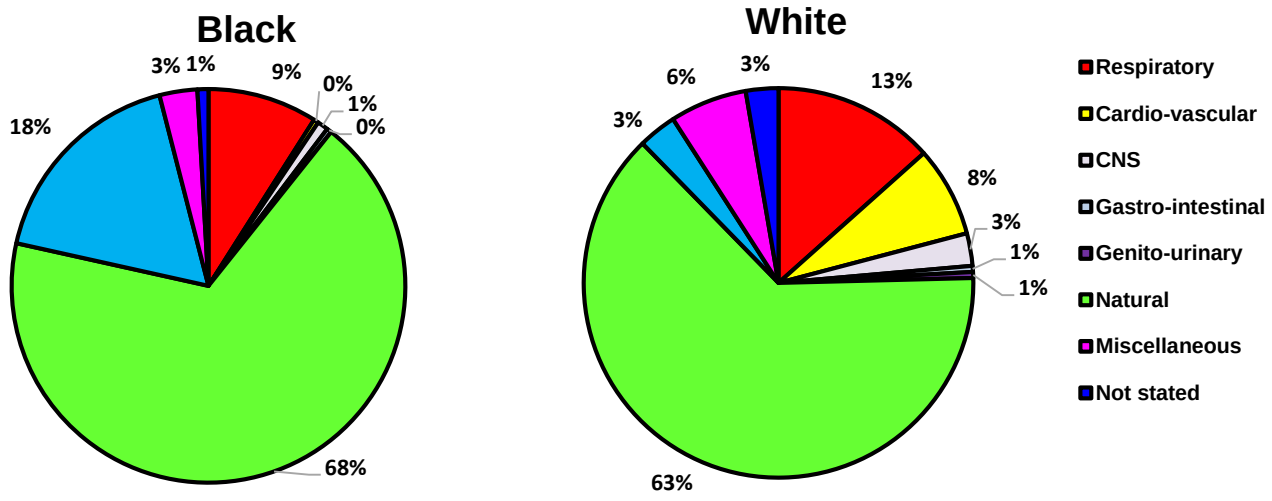


FIG 9-1 CLINICAL CAUSES OF DEATH (2022)

SECTION 10 – AUTOPSY FINDINGS IN WOMEN

Of the 410 cases examined in 2022, 30 (7.3%) were women compared to 33 (5.2%) in 2021, and 29 (5.2%) in 2020. All the female autopsies that were done in 2022 were on black females. On average, the women were of similar ages to the men (65.5 years and 64.1 years, respectively); a similar finding from the previous year's (2021) observation (women = 60.1 years and men = 61.6 years).

TABLE 10-1 NUMBER AND PROPORTION OF AUTOPSIES IN WOMEN BY AGE AND POPULATION GROUP (2022)

Age group (years)	Black		Total	
	N	%	N	%
30-39	2	6.7	2	6.7
40-49	6	20	6	20
50-59	1	3.3	1	3.3
60-69	5	16.7	5	16.7
70-79	10	33.3	10	33.3
80+	6	20	6	20
Total	30		30	

Table 10-2 summarises the distribution of autopsies in women by commodity and population group.

TABLE 10-2 NUMBER AND PROPORTION OF AUTOPSIES IN WOMEN BY COMMODITY AND POPULATION GROUP (2022)

Commodity	Black		Total	
	N	%	N	%
Gold	5	16.7	5	16.7
Asbestos	21	70	21	70
Platinum	4	13.3	4	13.3
Total	30		30	

Fourteen women had emphysema and nine had asbestos-related diseases: four had asbestosis and five had mesothelioma, whilst three women had PTB (Table 10-3).

TABLE 10-3 NUMBER AND PROPORTION OF DISEASES IN WOMEN (2022)

Disease	N	%
PTB	3	10
Silicosis	1	3.3
Emphysema	14	46.7
Asbestosis	4	13.3
Mesothelioma	5	16.7
Primary Lung Cancer	0	0.0
No lung disease	3	10
Total	30	

APPENDIX 1: DISTRIBUTION OF AUTOPSIES ACCORDING TO THE LAST MINE WHERE THE DECEASED WORKED (2022)

Commodity	Last mine worked	Black	White	Coloured	Unknown	Total
Asbestos	Cape Blue	3				3
	Gefco	31				31
	Pomfret Asb Mine	1				1
	Wandrag Asbestos Mine	1				1
Total from asbestos		**36**		**0**	**0**	**36**
Steel and Iron	Iscor	2	2			4
Total from iron and steel and iron		**2**	**2**	**0**	**0**	**4**
Coal	Goedehoop Colliery		1			1
	Coal Mine		2			2
	Kriel Colliery		1			1
	Tavistok Colliery		2			2
	Douglas Colliery		1			1
	Khutala Colliery	1				1
	Amcoal Colliery		1			1
	New Denmark	1				1
	Springfield Colliery		1			1
	Usuthu Colliery		1			1
Total from coal		**2**	**10**	**0**	**0**	**12**
Copper	O`Kiep Copper		1			1
Total from copper		**0**	**1**	**0**		**1**
Diamond	De Beers Consolidated		2			2
	Diamond Mine	1	2			3
	Finch Diamond Mine		1			1
Total from diamond		**1**	**5**			**6**
Gold	Anglo American GM		1			1
	Anglogold Ashanti GM	6	7			13
	Bambanani GM	1	1			2
	Barberton GM		1			1
	Beatrix Gold	24	4			28

Commodity	Last mine worked	Black	White	Coloured	Unknown	Total
Gold (contd)	Anglo American GM		1			1
	Blyvoorquizicht		6	0		6
	Buffelsfontein Gold	1	6			7
	Deel Kraal		1			1
	Doornfontein		1			1
	Driefontein Cons GM	8	4	0		12
	Durban Roodepoort Deep		2			2
	East Driefontein		1			1
	East Rand Prop		4			4
	Elandsrand		1			1
	Evander GM	1				1
	Free State Geduld	2	7			9
	Free State Saaiplaas		4			4
	Gold Mine	6	6			12
	Gencor	8				8
	Goldfields		1			1
	Grinaker GM	1				1
	Harmony	22	16			38
	Hartebeesfontein	2	6			8
	J.I.C Gold Mine	1				1
	Joel		1			1
	Kloof	11	10			21
	Leeudoorn		2			2
	Libanon		1			1
	Loraine	1	1			2
	Masimong Gold Mine	1				1
	Moab Khotsong GM	1				1
	New Kleinfontein GM		1			1
	President Brand		2			2
	President Steyn	1	3			4
	Randfontein		2			2
	Rand Uranium Gold Mine		1			1
	SA Land		1			1
	Simmer & Jack GM	2	2			4
	South Deep GM	2	2			4
	St Helena	1	2			3
	Stilfontein	2	2			4

Commodity	Last mine worked	Black	White	Coloured	Unknown	Total
Gold (contd)	Tautona GM	1	1			2
	Vaal Reefs	2	14			16
	Ventersport		3			3
	Village Main Reef	1				1
	Vlakfontein		1			1
	West Driefontein		5			5
	West Rand Consolidation		2			2
	Western Reef GM	1				1
	Western Deep Levels	1	7			8
Total from gold		**111**	**147**	1	**0**	258
Copper	O'Kiep Copper		1			1
Chrome	Samancor Western Chrome	1				1
Manganese	Associated Manganese	4				4
	Black Rock Asb Mine	1				1
	Hotazel Manganese Mine	4				4
	S A Manganese		1			1
Total from copper, chrome and manganese		**10**	**2**	**0**	**0**	**12**
Platinum	Bafokeng	1				1
	Eastern Platinum Mine		1			1
	Impala Platinum	41	5			46
	Karee Platinum	1				1
	Kroondal Mine, Rustenburg		1			1
	Kuruman	5				5
	Lonmin Platinum	1	1			2
	Modikwa Plat Mine		2			2
	Northam Platinum		2			2
	Rustenburg Platinum	1	2			3
	Western Platinum	1	2			3
	Unknown Platinum	3	2			5
Total from platinum		**49**	**18**	**0**	**0**	**67**
Shaft sinkers	Shaft sinkers		1			1
Total for shaft sinkers			**1**	**0**	**0**	**1**

Commodity	Last mine worked	Black	White	Coloured	Unknown	Total
Non-miner	Environmental	1				1
	Industry		1			1
	Transnet		1			1
Total for non-miners		**1**	**2**	**0**	**0**	**3**
Unknown	Unknown	1	1			2
Total for Unknown		**1**	**1**	0	**0**	**2**
TOTAL		**223**	**187**	**0**	**0**	**410**

APPENDIX 2: PUBLICATIONS AND ACTIVITIES EMANATING FROM PATHAUT DATA OR AUTOPSY SERVICE (2022)

Degrees

Manenzhe, Radzilani, MSc (ongoing), School of Pathology, Anatomical Pathology, University of Witwatersrand, The value of minimally invasive tissue sampling in the diagnosis of occupational lung disease in deceased South African Miners.

Mthombeni, Julian, PhD (ongoing), School of Public Health, University of Witwatersrand, Quantification and mapping of manganese deposition and associated histopathological correlates in the lungs of deceased South African miners.

Outreach Programme Activities

A journal article using autopsy data was published and research findings were presented at a conference (Appendix 2). There is an ongoing MSc and PhD study utilizing the PATHAUT data (registered with the University of the Witwatersrand).

ACTIVITY	DATE	VENUE	PERSON
Arcelor Mittal hosted their annual health and safety day at their Vanderbijlpark plant, Gauteng province. The NIOH in partnership with Gijima Occupational Hygiene created awareness on issues involving occupational hazards and diseases.	26 April 2022	Arcelor Mittal Vanderbijlpark plant, Gauteng	Dr. Delerise Fassom, Mr. Radzilani Manenzhe and Mrs. Tsabeng Mogaki
The NIOH Pathology Department conducted training for mortuary personnel, on how to conduct an autopsy.	02 June 2022	AVBOB Klerksdorp	Dr. Delerise Fassom, Mr. Radzilani Manenzhe
NUM union members held a gathering with the NIOH to discuss occupational health challenges and create awareness on occupational lung disease.	25 October 2022	NUM Welkom regional offices, Free State	Dr. Delerise Fassom, Mr. Radzilani Manenzhe and Mrs. Tsabeng Mogaki