



**NATIONAL HEALTH
LABORATORY SERVICE**

NATIONAL INSTITUTE FOR OCCUPATIONAL HEALTH

Pathology Division Surveillance Report

Demographic Data and Disease Rates for January to December 2012

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EXECUTIVE SUMMARY

During 2012, 1 164 deceased cases were examined at the NIOH. Of these, 60.7% were black, 38.2% were white, 0.6% were coloured and 0.5% were submitted without information on population group. Of the cases submitted, 45.1% (n=525) cases were ex-miners, 49.5% (n=576) current miners and 5.4% (n=63) cases could not be classified.

The overall disease rates (per 1000 autopsies) for 2012 are shown in Figure 1.

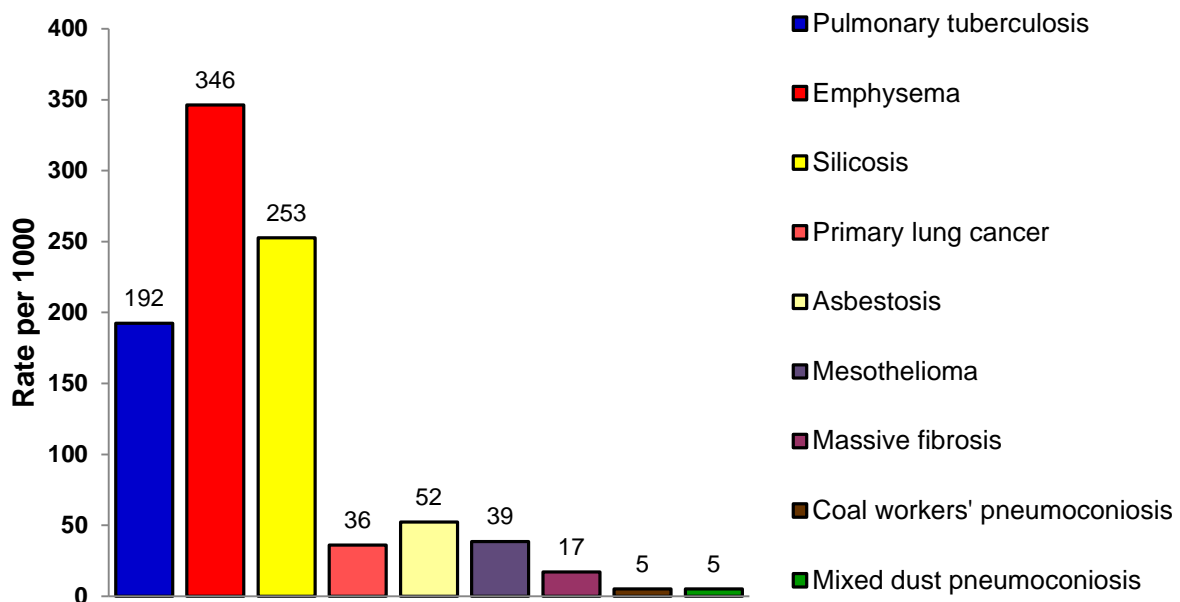


FIG.1 OVERALL DISEASE RATES FOR 2012

The overall rate of pulmonary tuberculosis (PTB) in 2012 (192/1000) was lower than that in 2011 (216/1000). The rate in black gold miners remains high (352/1000 in 2012). In black platinum miners, the PTB rate decreased further from 262/1000 in 2011 to 235/1000.

The overall silicosis rate in 2012 (234/1000) was lower than that in 2011 (226/1000). The rate in black gold miners, however, increased from 362/1000 in 2011 to 396/1000 in 2012.

Fifty eight women came to autopsy in 2012, 34.5% (n=20) 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 19 (1.6%), 65 (5.6%) and 23 (2.0%) 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 (30.1%), Gauteng (26.1%) and Free State (21.8%) provinces. No cases were received from outside South Africa.

TABLE 1 DISTRIBUTION OF AUTOPSY CASES BY PROVINCE/COUNTRY AND POPULATION GROUP (2012)

| Province or country | Black | | White | | Coloured | | Unknown | | Total | |
|---------------------|------------|------|------------|------|----------|-------|----------|------|--------------|------|
| | N | % | N | % | N | % | N | % | N | % |
| Eastern Cape | 4 | 0.6 | 3 | 0.7 | 0 | - | 0 | - | 7 | 0.6 |
| Free State | 200 | 28.3 | 53 | 11.9 | 0 | - | 1 | 16.7 | 254 | 21.8 |
| Gauteng | 89 | 12.6 | 212 | 47.6 | 0 | - | 3 | 50.0 | 304 | 26.1 |
| Kwazulu-Natal | 0 | - | 16 | 3.6 | 0 | - | 0 | - | 16 | 1.4 |
| Limpopo | 15 | 2.1 | 5 | 1.1 | 0 | - | 0 | - | 20 | 1.7 |
| Mpumalanga | 42 | 5.9 | 37 | 8.3 | 0 | - | 0 | - | 79 | 6.8 |
| Northern Cape | 111 | 15.7 | 12 | 2.7 | 7 | 100.0 | 0 | - | 130 | 11.2 |
| North West | 245 | 34.7 | 103 | 23.1 | 0 | - | 2 | 33.3 | 350 | 30.1 |
| Western Cape | 0 | - | 4 | 0.9 | 0 | - | 0 | - | 4 | 0.3 |
| Lesotho | 0 | - | 0 | - | 0 | - | 0 | - | 0 | - |
| Total | 706 | | 445 | | 7 | | 6 | | 1 164 | |

In 2012, the Pathology Division scaled down its outreach activities (Appendix 2). Five journal articles using the autopsy data were published and research findings were presented at a number of fora (Appendix 2). One PhD thesis was completed and 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 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 | 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 report describes autopsy cases examined during the year 2012. 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 - 2012)

| 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 | 1.0 | 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 |
| Total | 71 588 | 68 | 34 366 | 33 | 1 599 | 1 | 3 | | 332 | 0.3 | 107 888 |

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 130 973 in 2012.

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 2012. Autopsies of the cardio-respiratory organs only comprised 97.2% of all examinations.

TABLE 2-2 NUMBER AND PROPORTION OF AUTOPSIES BY TYPE AND POPULATION GROUP (2012)

| Autopsy type | Black | | White | | Coloured | | Unknown | | Total | |
|--------------------------------|-------|------|-------|------|----------|-------|---------|-------|-------|------|
| | N | % | N | % | N | % | N | % | N | % |
| Cardio-respiratory organs only | 705 | 99.9 | 413 | 92.8 | 7 | 100.0 | 6 | 100.0 | 1131 | 97.2 |
| Full autopsy | 1 | 0.1 | 32 | 7.2 | 0 | - | 0 | - | 33 | 2.8 |
| Total | 706 | | 445 | | 7 | | 6 | | 1 164 | |

The age distribution of cases for 2012 is shown in Table 2-3 and Figure 2-1. The mean age at autopsy of black men was 48.4 years, similar to that in 2011 (48.8 years). The mean age of white men at autopsy was 68.0 years in 2012, higher than 65.9 years in 2011.

TABLE 2-3 NUMBER AND PROPORTION OF AUTOPSIES BY AGE AND POPULATION GROUP (2012)

| Age group (years) | Black | | White | | Coloured | | Unknown | | Total | |
|----------------------|-------|------|-------|------|----------|------|---------|-------|-----------|------|
| | N | % | N | % | N | % | N | % | N | % |
| 20-29 | 32 | 4.5 | 3 | 0.7 | 0 | - | 0 | - | 35 | 3.0 |
| 30-39 | 124 | 17.6 | 5 | 1.1 | 0 | - | 0 | - | 129 | 11.1 |
| 40-49 | 231 | 32.7 | 30 | 6.7 | 0 | - | 0 | - | 261 | 22.4 |
| 50-59 | 222 | 31.4 | 66 | 14.8 | 1 | 14.3 | 0 | - | 289 | 24.8 |
| 60-69 | 60 | 8.5 | 126 | 28.3 | 1 | 14.3 | 0 | - | 187 | 16.1 |
| 70-79 | 22 | 3.1 | 140 | 31.5 | 3 | 42.9 | 0 | - | 165 | 14.2 |
| 80+ | 11 | 1.6 | 75 | 16.9 | 2 | 28.6 | 0 | - | 88 | 7.6 |
| Unknown | 4 | 0.6 | 0 | - | 0 | - | 6 | 100.0 | 10 | 0.9 |
| Total | 706 | | 445 | | 7 | | 6 | | 1 164 100 | |

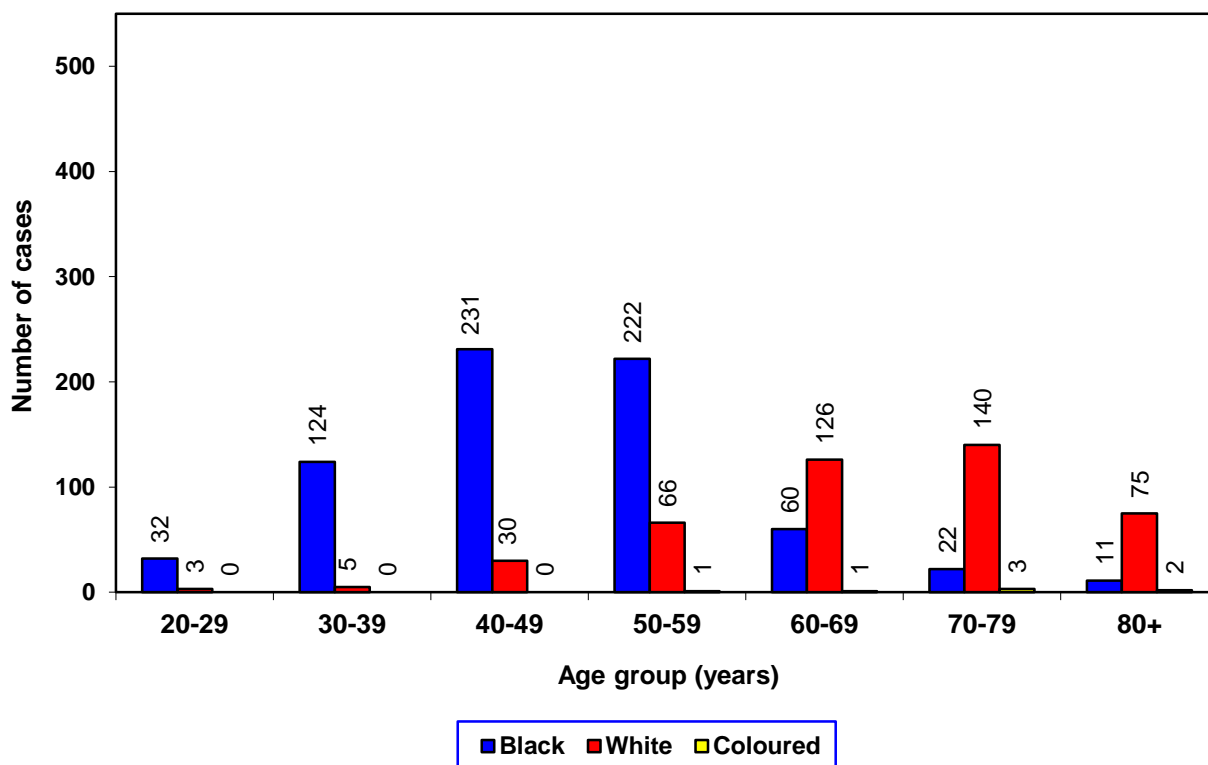


FIG 2-1 DISTRIBUTION OF AUTOPSIES BY AGE AND POPULATION GROUP (2012)

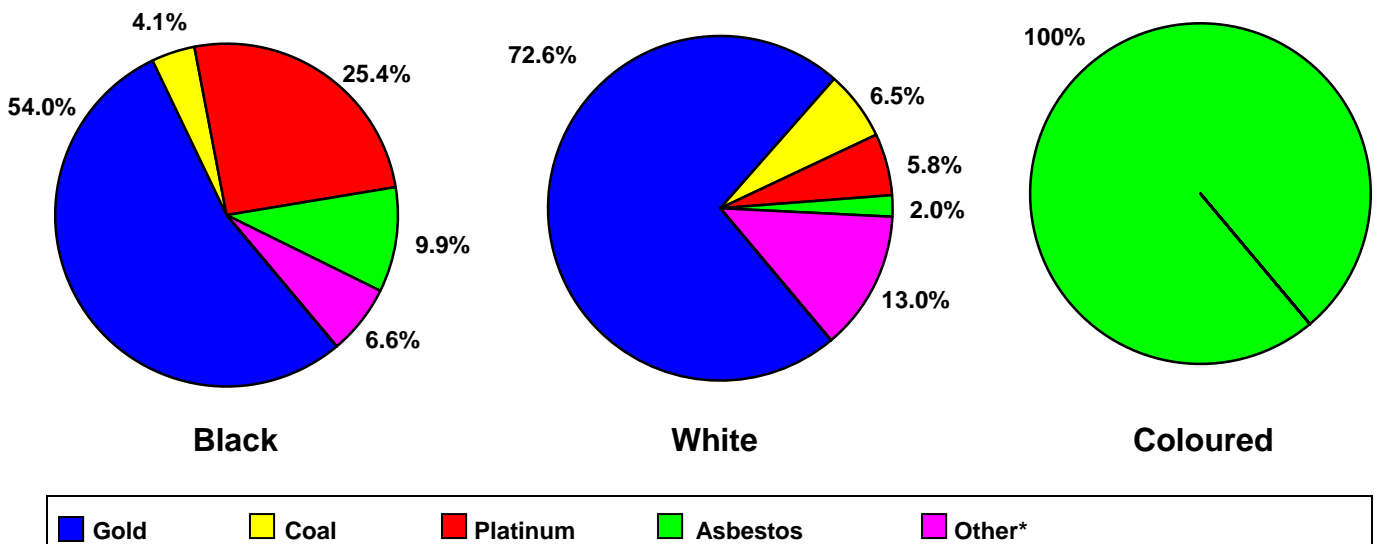
Cases were placed in categories according to the commodity in which they had worked for the longest duration (most exposure). Many men, however, worked in a number of different mining commodities during their lifetimes and had “mixed” exposures. This was not taken into account in the analysis of exposure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

Table 2-4 and Figure 2-2 show the distributions of autopsies by commodity and population group for 2012. Of the cases received, 60.5% were from the gold mining industry, similar to that in 2011 (60.7%). The proportion of autopsies from the platinum industry has increased over the years, from 8.3% in 1999 to 17.6% in 2012. All coloured cases autopsied (n=7) had been exposed to asbestos in the mining industry.

TABLE 2-4 NUMBER AND PROPORTION OF AUTOPSIES BY COMMODITY AND POPULATION GROUP (2012)

| Commodity | Black | | White | | Coloured | | Unknown | | Total | |
|--------------|------------|------|------------|------|----------|-------|----------|-------|--------------|------|
| | N | % | N | % | N | % | N | % | N | % |
| Gold | 381 | 54.0 | 323 | 72.6 | 0 | - | 0 | - | 704 | 60.5 |
| Platinum | 179 | 25.4 | 26 | 5.8 | 0 | - | 0 | - | 205 | 17.6 |
| Coal | 29 | 4.1 | 29 | 6.5 | 0 | - | 0 | - | 58 | 5.0 |
| Asbestos | 70 | 9.9 | 9 | 2.0 | 7 | 100.0 | 0 | - | 86 | 7.4 |
| Iscor | 1 | 0.1 | 16 | 3.6 | 0 | - | 0 | - | 17 | 1.5 |
| Diamond | 3 | 0.4 | 4 | 0.9 | 0 | - | 0 | - | 7 | 0.6 |
| Copper | 2 | 0.3 | 7 | 1.6 | 0 | - | 0 | - | 9 | 0.8 |
| Manganese | 18 | 2.5 | 2 | 0.4 | 0 | - | 0 | - | 20 | 1.7 |
| Industry | 0 | - | 3 | 0.7 | 0 | - | 0 | - | 3 | 0.3 |
| Other | 16 | 2.3 | 20 | 4.5 | 0 | - | 0 | - | 36 | 3.1 |
| Unknown | 7 | 1.0 | 6 | 1.3 | 0 | - | 6 | 100.0 | 19 | 1.6 |
| Total | 706 | | 445 | | 7 | | 6 | | 1 164 | |

Note: this table shows only those commodities where a total of 9 or more cases were received



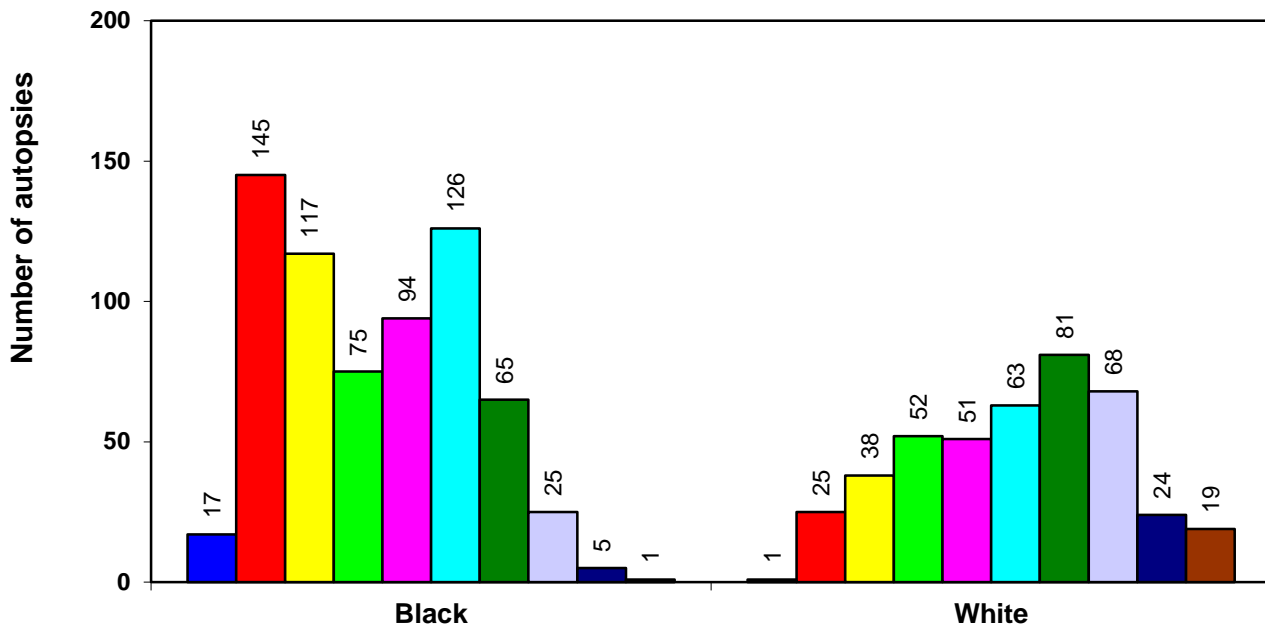
* Includes cement, copper, chrome, diamond, environmental asbestos, industry, iron, Iscor, lead, lime, manganese, phosphate, quarry, railways, silica, steel, vanadium as well as cases where service histories could not be obtained

FIG 2-2 DISTRIBUTION OF AUTOPSIES BY COMMODITY AND POPULATION GROUP (2012)

Detailed information about the years in mining service by population group is presented in Table 2-5 and Figure 2-3. In 2012, the duration of service was obtained for all but 5.6% of cases. This figure is higher than that for 2011 (3.4%).

TABLE 2-5 NUMBER AND PROPORTION OF AUTOPSIES BY YEARS OF SERVICE AND POPULATION GROUP (2012)

| Years of service | Black | | White | | Coloured | | Unknown | | Total | |
|------------------|-------|------|-------|------|----------|------|---------|-----|-------|------|
| | N | % | N | % | N | % | N | % | N | % |
| <1 | 17 | 2.4 | 1 | 0.2 | 2 | 28.6 | 0 | - | 20 | 1.7 |
| 1-5 | 145 | 20.5 | 25 | 5.6 | 0 | - | 0 | - | 170 | 14.6 |
| 6-10 | 117 | 16.6 | 38 | 8.5 | 2 | 28.6 | 0 | - | 157 | 13.5 |
| 11-15 | 75 | 10.6 | 52 | 11.7 | 0 | - | 0 | - | 127 | 10.9 |
| 16-20 | 94 | 13.3 | 51 | 11.5 | 2 | 28.6 | 0 | - | 147 | 12.6 |
| 21-25 | 126 | 17.8 | 63 | 14.2 | 0 | - | 0 | - | 189 | 16.2 |
| 26-30 | 65 | 9.2 | 81 | 18.2 | 1 | 14.3 | 0 | - | 147 | 12.6 |
| 31-35 | 25 | 3.5 | 68 | 15.3 | 0 | - | 0 | - | 93 | 8.0 |
| 36-40 | 5 | 0.7 | 24 | 5.4 | 0 | - | 0 | - | 29 | 2.5 |
| 41+ | 1 | 0.1 | 19 | 4.3 | 0 | - | 0 | - | 20 | 1.7 |
| Unknown | 36 | 5.1 | 23 | 5.2 | 0 | - | 6 | 100 | 65 | 5.6 |
| Total | 706 | | 445 | | 7 | | 6 | | 1 164 | |



Years of service:

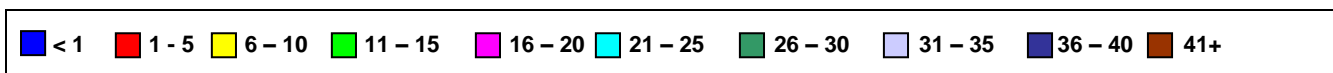


FIG 2-3 DISTRIBUTION OF AUTOPSIES BY YEARS OF SERVICE AND POPULATION GROUP (2012)

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 (2012)

| Commodity | Black | | | White | | |
|-----------|-------|--------------|-----|-------|--------------|-----|
| | N | Mean (years) | SD* | N | Mean (years) | SD* |
| Gold | 381 | 47 | 9 | 323 | 69 | 12 |
| Platinum | 177 | 42 | 10 | 26 | 65 | 12 |
| Coal | 29 | 52 | 13 | 29 | 66 | 15 |
| Asbestos | 69 | 66 | 12 | 9 | 73 | 8 |
| Iscor | 1 | 57 | - | 16 | 68 | 12 |
| Diamond | 3 | 58 | 18 | 4 | 68 | 7 |
| Copper | 2 | 61 | 4 | 7 | 70 | 7 |
| Manganese | 18 | 58 | 10 | 2 | 64 | 1 |
| Industry | 0 | - | - | 3 | 59 | 5 |
| Other | 16 | 53 | 12 | 20 | 66 | 13 |
| Unknown | 6 | 55 | 12 | 6 | 62 | 17 |
| Total | 702 | 48 | 12 | 445 | 68 | 12 |

* Standard deviation

TABLE 2-7 MEAN DURATION OF SERVICE BY COMMODITY AND POPULATION GROUP (2012)

| Commodity | Black | | | White | | |
|-----------|-------|--------------|-----|-------|--------------|-----|
| | N | Mean (years) | SD* | N | Mean (years) | SD* |
| Gold | 379 | 17 | 9 | 317 | 25 | 10 |
| Platinum | 167 | 12 | 8 | 25 | 18 | 10 |
| Coal | 28 | 20 | 11 | 26 | 19 | 11 |
| Asbestos | 65 | 7 | 7 | 9 | 13 | 11 |
| Iscor | 1 | 21 | - | 15 | 18 | 10 |
| Diamond | 3 | 15 | 11 | 4 | 18 | 5 |
| Copper | 2 | 12 | 7 | 6 | 18 | 9 |
| Manganese | 18 | 22 | 10 | 2 | 15 | 10 |
| Industry | 0 | - | - | 3 | 31 | 11 |
| Other | 7 | 17 | 12 | 15 | 22 | 12 |
| Total | 670 | 15 | 10 | 422 | 23 | 11 |

*Standard deviation

SECTION 3 – ACTIVE TUBERCULOSIS

The distribution of active tuberculosis (TB) by anatomical site is presented in Figure 3-1 (n=250). Active pulmonary TB (PTB) was diagnosed in 19.2% (n=224) of all cases autopsied in 2012, compared to 16.4% (n=416) in 2000. Most of the men with PTB were black (n=204; 91.1%), 19 were white (8.5%), and for one case (0.4%) the population group was not known.

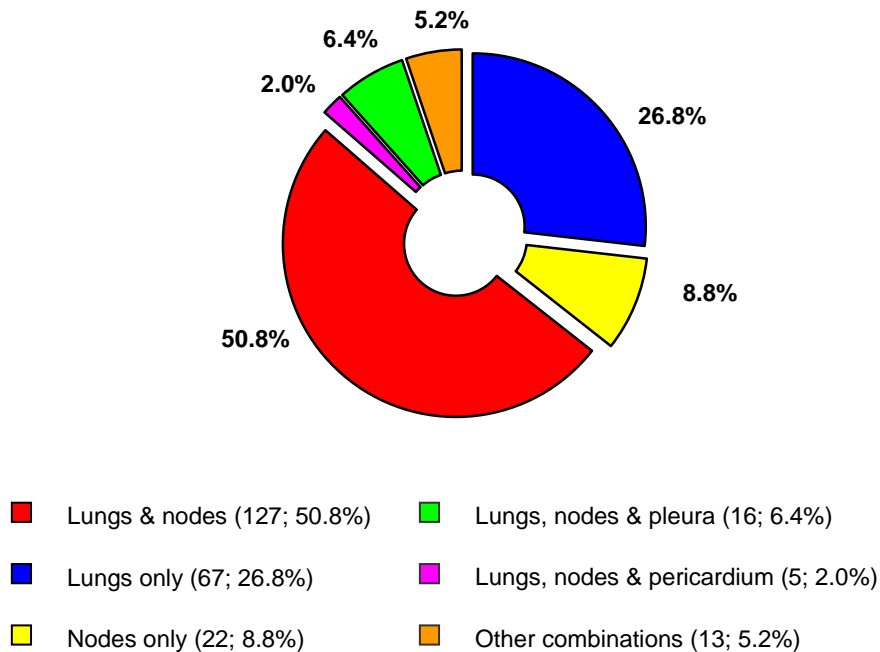


FIG 3-1 DISTRIBUTION OF ACTIVE TB BY SITE (2012)

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

In 2012, 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 289/1000 in 2012 (Fig 3-2). The rate in white men remained lower than that in black men, 43/1000 in 2012.

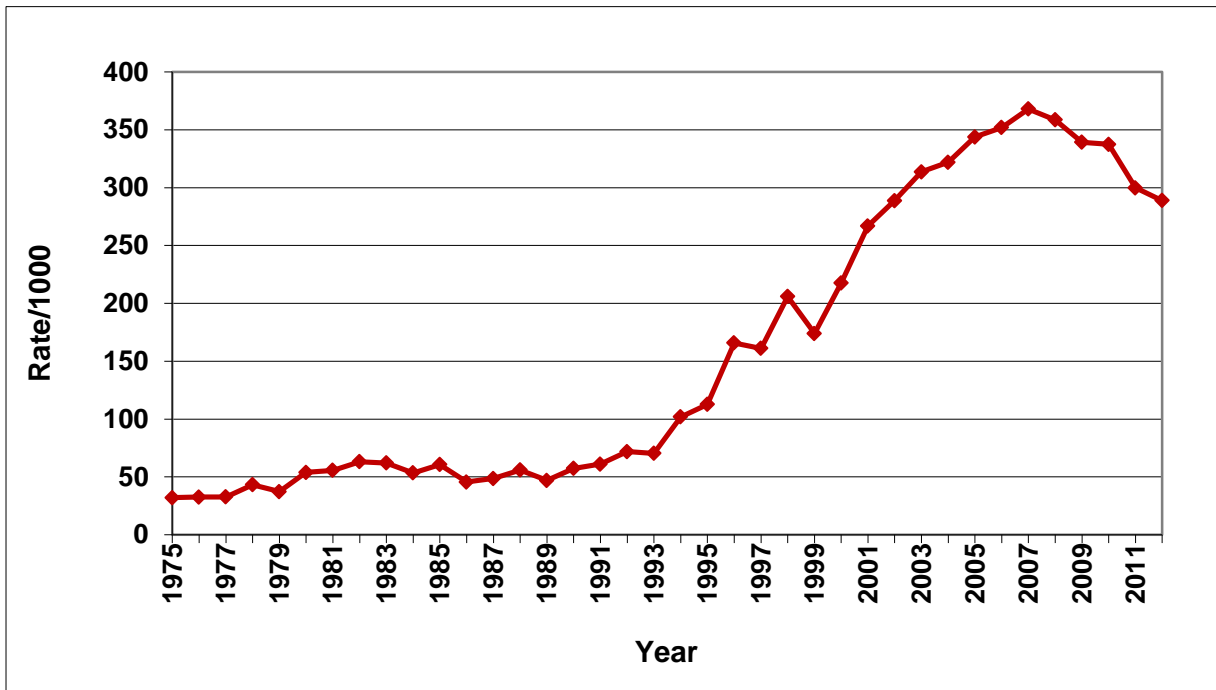


FIG 3-2 ACTIVE PTB RATES IN BLACK MINERS AT AUTOPSY (1975 to 2012)

The distribution of active PTB cases by commodity is shown in Table 3-1. Most cases of active PTB (65.6%) were from the gold (60.5% of all autopsy cases came from that commodity) and platinum (19.2%) mining industries.

TABLE 3-1 NUMBER OF CASES AND PREVALENCE OF ACTIVE PTB BY COMMODITY AND POPULATION GROUP (2012)

| Age group (years) | Black | | White | | Coloured | | Unknown | | Total | |
|-------------------|------------|------------|-----------|-----------|----------|------|----------|------|------------|------------|
| | N | Rate | N | Rate | N | Rate | N | Rate | N | Rate |
| Gold | 134 | 352 | 13 | 40 | 0 | - | 0 | - | 147 | 209 |
| Platinum | 42 | 235 | 1 | 38 | 0 | - | 0 | - | 43 | 210 |
| Coal | 7 | 241 | 0 | - | 0 | - | 0 | - | 7 | 121 |
| Asbestos | 8 | 114 | 2 | - | 0 | - | 0 | - | 10 | 116 |
| Diamond | 2 | - | 0 | - | 0 | - | 0 | - | 2 | - |
| Copper | 2 | - | 2 | - | 0 | - | 0 | - | 4 | - |
| Manganese | 5 | 278 | 1 | - | 0 | - | 0 | - | 6 | 300 |
| Other | 2 | - | 0 | - | 0 | - | 0 | - | 2 | - |
| Unknown | 2 | - | 0 | - | 0 | - | 1 | - | 3 | - |
| Total | 204 | 289 | 19 | 43 | 0 | | 1 | | 224 | 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=80; 35.7%) were in the age group 40-49 years, followed by those in the 50-59 year age group (n=71; 31.7%).

TABLE 3-2 NUMBER OF CASES AND PREVALENCE OF ACTIVE PTB BY AGE AND POPULATION GROUP (2012)

| Age group (years) | Black | | White | | Coloured | | Unknown | | Total | |
|-------------------|------------|------------|-----------|-----------|----------|------|----------|------|------------|------------|
| | N | Rate | N | Rate | N | Rate | N | Rate | N | Rate |
| 20-29 | 7 | 219 | 0 | - | 0 | - | 0 | - | 7 | 200 |
| 30-39 | 34 | 274 | 2 | - | 0 | - | 0 | - | 36 | 279 |
| 40-49 | 79 | 342 | 1 | - | 0 | - | 0 | - | 80 | 307 |
| 50-59 | 67 | 302 | 4 | - | 0 | - | 0 | - | 71 | 246 |
| 60-69 | 13 | 217 | 5 | 40 | 0 | - | 0 | - | 18 | 96 |
| 70-79 | 2 | - | 4 | - | 0 | - | 0 | - | 6 | 36 |
| 80+ | 2 | - | 3 | - | 0 | - | 0 | - | 5 | 57 |
| Unknown | 0 | - | 0 | - | 0 | - | 1 | - | 1 | - |
| Total | 204 | 289 | 19 | 43 | 0 | | 1 | | 224 | 192 |

Note: rates have not been calculated where numbers are small

SECTION 4 – SILICOSIS

Silicotic nodules were found in the lungs of 294 cases (25.3% of all autopsies), 88.1% of which came from the gold mining industry. Of all cases of silicosis, occasional silicotic nodules were found in 135 (45.9%) of cases, a few in 67 (22.8%), a moderate number in 74 (25.2%) and a large number in 18 (6.1%).

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 (2012)

| Age group (years) | Black | | White | | Coloured | | Unknown | | Total | |
|-------------------|------------|------------|------------|------------|----------|------|----------|------|------------|------------|
| | N | Rate | N | Rate | N | Rate | N | Rate | N | Rate |
| Gold | 151 | 396 | 108 | 334 | 0 | - | 0 | - | 259 | 368 |
| Platinum | 9 | 50 | 8 | 308 | 0 | - | 0 | - | 17 | 83 |
| Coal | 2 | 69 | 0 | - | 0 | - | 0 | - | 2 | - |
| Asbestos | 7 | 100 | 1 | - | 0 | - | 0 | - | 8 | 93 |
| Diamond | 0 | - | 1 | - | 0 | - | 0 | - | 1 | - |
| Copper | 0 | - | 2 | - | 0 | - | 0 | - | 2 | - |
| Other | 0 | - | 2 | - | 0 | - | 0 | - | 2 | - |
| Unknown | 1 | - | 0 | - | 0 | - | 2 | - | 3 | 158 |
| Total | 170 | 241 | 122 | 274 | 0 | | 2 | | 294 | 253 |

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. 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 (2012)

| Age group (years) | Black | | White | | Coloured | | Unknown | | Total | |
|-------------------|-------|------|-------|------|----------|------|---------|------|-------|------|
| | N | Rate | N | Rate | N | Rate | N | Rate | N | Rate |
| 30-39 | 3 | - | 0 | - | 0 | - | 0 | - | 3 | - |
| 40-49 | 62 | 403 | 2 | - | 0 | - | 0 | - | 64 | 376 |
| 50-59 | 75 | 543 | 15 | 306 | 0 | - | 0 | - | 90 | 481 |
| 60-69 | 9 | 692 | 27 | 303 | 0 | - | 0 | - | 36 | 353 |
| 70-79 | 2 | - | 39 | 375 | 0 | - | 0 | - | 41 | 387 |
| 80+ | 0 | - | 25 | 424 | 0 | - | 0 | - | 25 | 424 |
| Unknown | 0 | - | 0 | - | 0 | - | 0 | - | 0 | - |
| Total | 151 | 396 | 108 | 334 | 0 | | 0 | | 259 | 368 |

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 (2012)

| Years of service | Black | | White | | Coloured | | Unknown | | Total | |
|------------------|-------|------|-------|------|----------|------|---------|------|-------|------|
| | N | Rate | N | Rate | N | Rate | N | Rate | N | Rate |
| 1-5 | 4 | - | 0 | - | 0 | - | 0 | - | 4 | - |
| 6-10 | 5 | 111 | 6 | 261 | 0 | - | 0 | - | 11 | 162 |
| 11-15 | 13 | 250 | 6 | 171 | 0 | - | 0 | - | 19 | 218 |
| 16-20 | 36 | 537 | 11 | 324 | 0 | - | 0 | - | 47 | 465 |
| 21-25 | 49 | 538 | 19 | 404 | 0 | - | 0 | - | 68 | 493 |
| 26-30 | 34 | 680 | 27 | 397 | 0 | - | 0 | - | 61 | 517 |
| 31-35 | 7 | 700 | 20 | 328 | 0 | - | 0 | - | 27 | 380 |
| 36-40 | 2 | - | 11 | 550 | 0 | - | 0 | - | 13 | 565 |
| >41 | 1 | - | 7 | 438 | 0 | - | 0 | - | 8 | 471 |
| Unknown | 0 | - | 1 | - | 0 | - | 0 | - | 1 | - |
| Total | 151 | 396 | 108 | 334 | 0 | | 0 | | 259 | 368 |

Note: rates have not been calculated where numbers are small

SECTION 5 – OTHER PNEUMOCONIOSES

MASSIVE FIBROSIS

There were 20 (1.7%) cases of massive fibrosis (13 black, 7 white). Seventeen were from the gold and three were from the platinum mining industries.

COAL WORKERS' PNEUMOCONIOSIS

There were 6 (0.5%) cases of coal workers' pneumoconiosis. All were from the coal mining industry.

MIXED DUST PNEUMOCONIOSIS

There were 6 (0.5%) cases of mixed dust pneumoconiosis. Four were from the gold and two were from the manganese mining industry.

ASBESTOSIS AND PLEURAL PLAQUES

There were 61 cases of asbestosis. Of these, 41.0% (n=25) had slight, 34.4% (n=21) moderate and 24.6% (n=15) marked fibrosis. Fifty seven (93.4%) 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 35 cases with asbestos plaques and of these 18 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 (2012)

| 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 | 10 | 45 | 0 | - | 0 | - | 0 | - | 10 | 35 |
| 60-69 | 23 | 383 | 1 | - | 1 | - | 0 | - | 25 | 134 |
| 70-79 | 9 | 409 | 3 | - | 0 | - | 0 | - | 12 | 73 |
| 80+ | 8 | 727 | 3 | - | 2 | - | 0 | - | 13 | 148 |
| Total | 51 | 72 | 7 | 16 | 3 | | 0 | | 61 | 52 |

Note: rates have not been calculated where numbers are small

SECTION 6 – EMPHYSEMA

There were 403 cases of emphysema, the extent of which was mild in 76.7% (n=309), moderate in 16.9% (n=68) and marked in 6.4% (n=26). The overall rate of emphysema has increased annually from 250/1000 in 2010 to 264/1000 in 2011 to 346/1000 in 2012. 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 (2012)

| Age group (years) | Black | | White | | Coloured | | Unknown | | Total | |
|-------------------|------------|------------|------------|------------|----------|------|----------|------|------------|------------|
| | N | Rate | N | Rate | N | Rate | N | Rate | N | Rate |
| 20-29 | 2 | - | 1 | - | 0 | - | 0 | - | 3 | - |
| 30-39 | 10 | 81 | 0 | - | 0 | - | 0 | - | 10 | 78 |
| 40-49 | 46 | 199 | 7 | 233 | 0 | - | 0 | - | 53 | 203 |
| 50-59 | 62 | 279 | 28 | 424 | 0 | - | 0 | - | 90 | 311 |
| 60-69 | 29 | 483 | 67 | 532 | 0 | - | 0 | - | 96 | 513 |
| 70-79 | 9 | 409 | 84 | 600 | 2 | - | 0 | - | 95 | 576 |
| 80+ | 6 | 545 | 45 | 600 | 2 | - | 0 | - | 53 | 602 |
| Unknown | 0 | - | 0 | - | 0 | - | 3 | - | 3 | - |
| Total | 164 | 232 | 232 | 521 | 4 | | 3 | | 403 | 346 |

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=260, 64.5%) (Table 6-2).

TABLE 6-2 NUMBER OF CASES AND PREVALENCE OF EMPHYSEMA BY COMMODITY AND POPULATION GROUP (2012)

| Age group (years) | Black | | White | | Coloured | | Unknown | | Total | |
|-------------------|------------|------------|------------|------------|----------|------|----------|------|------------|------------|
| | N | Rate | N | Rate | N | Rate | N | Rate | N | Rate |
| Gold | 86 | 226 | 174 | 539 | 0 | - | 0 | - | 260 | 369 |
| Platinum | 24 | 134 | 13 | 500 | 0 | - | 0 | - | 37 | 180 |
| Coal | 12 | 414 | 15 | 517 | 0 | - | 0 | - | 27 | 466 |
| Asbestos | 31 | 443 | 5 | 556 | 4 | - | 0 | - | 40 | 465 |
| Iscor | 0 | - | 9 | 563 | 0 | - | 0 | - | 9 | 529 |
| Diamond | 0 | - | 3 | - | 0 | - | 0 | - | 3 | - |
| Copper | 1 | - | 4 | - | 0 | - | 0 | - | 5 | 556 |
| Manganese | 5 | 278 | 2 | - | 0 | - | 0 | - | 7 | 350 |
| Other | 3 | - | 6 | 300 | 0 | - | 0 | - | 9 | 250 |
| Unknown | 2 | - | 1 | 167 | 0 | - | 3 | - | 6 | 316 |
| Total | 164 | 232 | 232 | 521 | 4 | | 3 | | 403 | 346 |

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 (2012)

| Years of service | Black | | White | | Coloured | | Unknown | | Total | |
|------------------|------------|------------|------------|------------|----------|------|----------|------|------------|------------|
| | N | Rate | N | Rate | N | Rate | N | Rate | N | Rate |
| <1 | 8 | 471 | 0 | - | 1 | - | 0 | - | 9 | 450 |
| 1 - 5 | 23 | 159 | 11 | 440 | 0 | - | 0 | - | 34 | 200 |
| 6-10 | 16 | 137 | 14 | 368 | 1 | - | 0 | - | 31 | 197 |
| 11-15 | 19 | 253 | 30 | 577 | 0 | - | 0 | - | 49 | 386 |
| 16-20 | 29 | 309 | 27 | 529 | 1 | - | 0 | - | 57 | 388 |
| 21-25 | 29 | 230 | 34 | 540 | 0 | - | 0 | - | 63 | 333 |
| 26-30 | 18 | 277 | 44 | 543 | 1 | - | 0 | - | 63 | 429 |
| 31-35 | 10 | 400 | 37 | 544 | 0 | - | 0 | - | 47 | 505 |
| 36-40 | 1 | - | 17 | 708 | 0 | - | 0 | - | 18 | 621 |
| 41+ | 1 | - | 11 | 579 | 0 | - | 0 | - | 12 | 600 |
| Unknown | 10 | 278 | 7 | 304 | 0 | - | 3 | - | 20 | 308 |
| Total | 164 | 232 | 232 | 521 | 4 | | 3 | | 403 | 346 |

Note: rates have not been calculated where numbers are small

SECTION 7 – MESOTHELIOMA

There were 45 of cases of mesothelioma in 2012.

TABLE 7-1 NUMBER AND PROPORTION OF MESOTHELIOMA CASES BY AGE AND POPULATION GROUP (2012)

| Age group (years) | Black | | White | | Coloured | | Unknown | | Total | |
|-------------------|-------|------|-------|------|----------|---|---------|---|-------|------|
| | N | % | N | % | N | % | N | % | N | % |
| 40-49 | 1 | 3.2 | 0 | - | 0 | - | 0 | - | 1 | 2.2 |
| 50-59 | 15 | 48.4 | 2 | 14.3 | 0 | - | 0 | - | 17 | 37.8 |
| 60-69 | 7 | 22.6 | 6 | 42.9 | 0 | - | 0 | - | 13 | 28.9 |
| 70-79 | 6 | 19.4 | 5 | 35.7 | 0 | - | 0 | - | 11 | 24.4 |
| 80+ | 2 | 6.5 | 1 | 7.1 | 0 | - | 0 | - | 3 | 6.7 |
| Total | 31 | | 14 | | 0 | | 0 | | 45 | |

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

Twenty three (51.1%) of the cases had worked in asbestos mines at some stage in their careers and 6 (13.3%) had been exposed to asbestos in the environment.

TABLE 7-2 NUMBER AND PROPORTION OF MESOTHELIOMA CASES BY COMMODITY AND POPULATION GROUP (2012)

| Commodity | Black | | White | | Coloured | | Unknown | | Total | |
|-----------|-------|------|-------|------|----------|---|---------|---|-------|------|
| | N | % | N | % | N | % | N | % | N | % |
| Asbestos | 16 | 51.6 | 1 | 7.1 | 0 | - | 0 | - | 17 | 37.8 |
| Gold | 0 | - | 4 | 28.6 | 0 | - | 0 | - | 4 | 8.9 |
| Coal | 0 | - | 1 | 7.1 | 0 | - | 0 | - | 1 | 2.2 |
| Platinum | 2 | 6.5 | 0 | - | 0 | - | 0 | - | 2 | 4.4 |
| Iscor | 1 | 3.2 | 4 | 28.6 | 0 | - | 0 | - | 5 | 11.1 |
| Manganese | 4 | 12.9 | 0 | - | 0 | - | 0 | - | 4 | 8.9 |
| Industry | 0 | - | 1 | 7.1 | 0 | - | 0 | - | 1 | 2.2 |
| Other | 6 | 19.4 | 3 | 21.4 | 0 | - | 0 | - | 9 | 20.0 |
| Unknown | 2 | 6.5 | 0 | - | 0 | - | 0 | - | 2 | 4.4 |
| Total | 31 | | 14 | | 0 | | 0 | | 45 | |

SECTION 8 – PRIMARY LUNG CANCER

Forty two cases of primary lung cancer were found at autopsy, 31.0% of which were in black and 69.0% were in white miners. Most of the cases had squamous cell lung carcinoma (n = 22; 52.4%) followed by small cell lung carcinoma (n = 8; 19.0%), adenocarcinoma (n = 7; 16.7%) and large cell lung carcinoma (n = 5; 11.9%).

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 (2012)

| Commodity | Black | | White | | Coloured | | Unknown | | Total | |
|--------------|-----------|-----------|-----------|-----------|----------|----------|----------|----------|-----------|-----------|
| | N | Rate | N | Rate | N | Rate | N | Rate | N | Rate |
| 40-49 | 3 | 13 | 0 | - | 0 | - | 0 | - | 3 | - |
| 50-59 | 2 | - | 3 | 5 | 0 | - | 0 | - | 5 | 17 |
| 60-69 | 7 | 117 | 10 | 79 | 0 | - | 0 | - | 17 | 91 |
| 70-79 | 0 | - | 12 | 86 | 0 | - | 0 | - | 12 | 73 |
| 80+ | 1 | - | 4 | - | 0 | - | 0 | - | 5 | 57 |
| Total | 13 | 18 | 29 | 65 | 0 | - | 0 | - | 42 | 36 |

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 (2011)

| Age group (years) | Black | | White | | Coloured | | Unknown | | Total | |
|-------------------|-----------|-----------|-----------|-----------|----------|----------|----------|----------|-----------|-----------|
| | N | Rate | N | Rate | N | Rate | N | Rate | N | Rate |
| Gold | 3 | 8 | 22 | 68 | 0 | - | 0 | - | 25 | 36 |
| Platinum | 1 | 6 | 1 | - | 0 | - | 0 | - | 2 | - |
| Coal | 3 | - | 1 | - | 0 | - | 0 | - | 4 | - |
| Asbestos | 6 | 86 | 1 | - | 0 | - | 0 | - | 7 | 81 |
| Copper | 0 | - | 1 | - | 0 | - | 0 | - | 1 | - |
| Manganese | 0 | - | 1 | - | 0 | - | 0 | - | 1 | - |
| Industry | 0 | - | 1 | - | 0 | - | 0 | - | 1 | - |
| Unknown | 0 | - | 1 | - | 0 | - | 0 | - | 1 | - |
| Total | 13 | 18 | 29 | 65 | 0 | - | 0 | - | 42 | 36 |

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 (30.8% overall). The proportion of unnatural deaths increased from 6.4% in 2011 to 8.1% in 2012. The clinical cause of death was not stated for 18.8% of the cases.

TABLE 9-1 CLINICAL CAUSE OF DEATH BY POPULATION GROUP (2012)

| System | Black | | White | | Coloured | | Unknown | | Total | |
|------------------------|------------|------|------------|------|----------|------|----------|------|--------------|------|
| | N | % | N | % | N | % | N | % | N | % |
| Respiratory | 242 | 34.3 | 112 | 25.2 | 3 | 42.9 | 2 | 33.3 | 359 | 30.8 |
| Cardio-vascular | 30 | 4.2 | 65 | 14.6 | 0 | - | 0 | - | 95 | 8.2 |
| Central Nervous System | 54 | 7.6 | 17 | 3.8 | 1 | 14.3 | 0 | - | 72 | 6.2 |
| Gastro-intestinal | 29 | 4.1 | 17 | 3.8 | 0 | - | 0 | - | 46 | 4.0 |
| Genito-urinary | 34 | 4.8 | 10 | 2.2 | 0 | - | 0 | - | 44 | 3.8 |
| Haematological | 9 | 1.3 | 5 | 1.1 | 0 | - | 0 | - | 14 | 1.2 |
| Unnatural | 71 | 10.1 | 23 | 5.2 | 0 | - | 0 | - | 94 | 8.1 |
| Miscellaneous | 132 | 18.7 | 87 | 19.6 | 2 | 28.6 | 0 | - | 221 | 19.0 |
| Not stated | 105 | 14.9 | 109 | 24.5 | 1 | 14.3 | 4 | 66.7 | 219 | 18.8 |
| Total | 706 | | 445 | | 7 | | 6 | | 1 164 | |

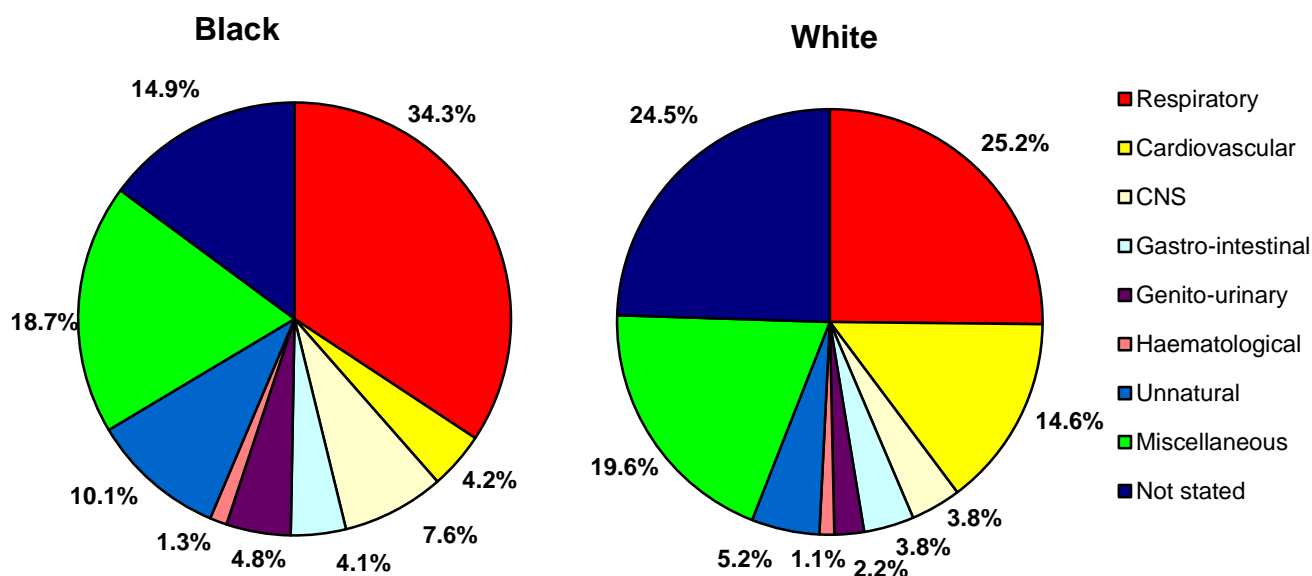


FIGURE 9-1 CLINICAL CAUSE OF DEATH (2012)

SECTION 10 – AUTOPSY FINDINGS IN WOMEN

Of the 1 164 cases examined in 2012, 58 (5.0%) were women, compared to 45 (3.4%) in 2011 and 32 (2.1%) in 2010. Of these, 49 (84.5%) were black, 6 (10.3%) were white and 3 (5.2%) were coloured. The ages of the women and men were similar (54.4 years and 56.2 years respectively).

TABLE 10.1 NUMBER AND PROPORTION OF AUTOPSIES IN WOMEN BY AGE AND POPULATION GROUP (2012)

| Age group (years) | Black | | White | | Coloured | | Total | |
|-------------------|-------|------|-------|------|----------|------|-------|------|
| | N | % | N | % | N | % | N | % |
| 20-29 | 4 | 8.2 | 1 | 16.7 | 0 | - | 5 | 8.6 |
| 30-39 | 12 | 24.5 | 0 | - | 0 | - | 12 | 20.7 |
| 40-49 | 10 | 20.4 | 0 | 0.0 | 0 | - | 10 | 17.2 |
| 50-59 | 4 | 8.2 | 0 | 0.0 | 0 | - | 4 | 6.9 |
| 60-69 | 8 | 16.3 | 3 | 50.0 | 0 | - | 11 | 19.0 |
| 70-79 | 9 | 18.4 | 2 | 33.3 | 1 | 33.3 | 12 | 20.7 |
| 80+ | 2 | 4.1 | 0 | - | 2 | 66.7 | 4 | 6.9 |
| Total | 49 | | 6 | | 3 | | 58 | |

Table 10.2 summarises the distribution of autopsies in women by commodity and population group. Most of the women (28 cases; 48.3%) had been exposed to asbestos, with 19 (67.9%) of these exposed on the mines and 9 (32.1%) having had environmental exposure.

TABLE 10.2 NUMBER AND PROPORTION OF AUTOPSIES IN WOMEN BY COMMODITY AND POPULATION GROUP (2012)

| Commodity | Black | | White | | Coloured | | Total | |
|------------------------|-------|------|-------|------|----------|-------|-------|------|
| | N | % | N | % | N | % | N | % |
| Gold | 14 | 28.6 | 0 | - | 0 | - | 14 | 24.1 |
| Platinum | 8 | 16.3 | 0 | - | 0 | - | 8 | 13.8 |
| Coal | 3 | 6.1 | 1 | 16.7 | 0 | - | 4 | 6.9 |
| Asbestos | 15 | 30.6 | 1 | 16.7 | 3 | 100.0 | 19 | 32.8 |
| Iscor | 0 | - | 1 | 16.7 | 0 | - | 1 | 1.7 |
| Manganese | 1 | 2.0 | 0 | - | 0 | - | 1 | 1.7 |
| Environmental asbestos | 6 | 12.2 | 3 | 50.0 | 0 | - | 9 | 15.5 |
| Unknown | 2 | 4.1 | 0 | - | 0 | - | 2 | 3.4 |
| Total | 49 | | 6 | | 3 | | 58 | |

There were 20 cases of asbestos-related disease: 9 cases of asbestosis and 11 of mesothelioma (Table 10.3).

TABLE 10.3 NUMBER AND PROPORTION OF DISEASES IN WOMEN (2012)

| Disease | N | % |
|-----------------|-----------|----------|
| PTB | 10 | 17.2 |
| Silicosis | 1 | 1.7 |
| Emphysema | 8 | 13.8 |
| Asbestosis | 9 | 15.5 |
| Mesothelioma | 11 | 19.0 |
| Lung cancer | 0 | - |
| No lung disease | 19 | 32.8 |
| Total | 58 | |

APPENDIX 1: DISTRIBUTION OF AUTOPSIES ACCORDING TO THE LAST MINE WHERE THE DECEASED WORKED (2012)

| Commodity | Last mine worked | Black | White | Coloured | Unknown | Total |
|----------------------------------|---------------------------|--------------|--------------|-----------------|----------------|--------------|
| Asbestos | Asbestos Mine | 3 | | | | 3 |
| | Cape Blue | 10 | | 1 | | 11 |
| | Danielskuil Asbestos | 1 | 2 | | | 3 |
| | Gefco | 42 | 3 | 2 | | 47 |
| | Koegas | 2 | | 2 | | 4 |
| | Pomfret Asbestos | 1 | 2 | 1 | | 4 |
| | Wandrag Asbestos | 3 | | | | 3 |
| | White Rock Asbestos | | 1 | | | 1 |
| Total from asbestos mines | | 62 | 8 | 6 | 0 | 76 |
| Cementation | Cementation | 1 | 1 | | | 2 |
| Chrome | Chrome Mine | | 6 | | | 6 |
| | Dilokong Chrome Mine | | 1 | | | 1 |
| | Winterveld Chrome | | 1 | | | 1 |
| Total from chrome mines | | 0 | 8 | 0 | 0 | 8 |
| Coal | Alpha Anthracite Colliery | | 1 | | | 1 |
| | Amcoal Colliery | | 1 | | | 1 |
| | Arnot Colliery | 2 | | | | 2 |
| | Coal Mine | 2 | 3 | | | 5 |
| | Douglas Colliery | | 2 | | | 2 |
| | Duiker Colliery | | 2 | | | 2 |
| | Durnacol Mine | | 1 | | | 1 |
| | Ermelo Coal | | 1 | | | 1 |
| | Gloria Colliery | | 1 | | | 1 |
| | Goedehoop Colliery | 2 | 1 | | | 3 |
| | Greenside Colliery | | 2 | | | 2 |
| | Khutala Colliery | | 3 | | | 3 |
| | Kilbarchen Colliery | | 1 | | | 1 |
| | Kleinkopje Colliery | 1 | 3 | | | 4 |
| | Koornfontein Coal | | 1 | | | 1 |
| | Kriel Colliery | 2 | | | | 2 |
| | Matla Coal | 17 | 1 | | | 18 |
| | Middelburg Colliery | 2 | | | | 2 |

| Commodity | Last mine worked | Black | White | Coloured | Unknown | Total |
|---------------------------------|-------------------------|--------------|--------------|-----------------|----------------|--------------|
| Coal (continued) | Natal Anthracite Coll | | 1 | | | 1 |
| | New Denmark | | 1 | | | 1 |
| | New Vaal Colliery | | 1 | | | 1 |
| | Optimum Colliery | | 1 | | | 1 |
| | Rietspruit Colliery | | 2 | | | 2 |
| | Sasol Coal Mine | 1 | 5 | | | 6 |
| | Sigma Colliery | | 1 | | | 1 |
| | Springbok Colliery | | 1 | | | 1 |
| | Twistdraai | | 1 | | | 1 |
| | Vierfontein Colliery | 1 | | | | 1 |
| | Witbank Collieries | | 1 | | | 1 |
| Total from coal mines | | 30 | 39 | 0 | 0 | 69 |
| Copper | Copper Mine | | 1 | | | 1 |
| | O`Kiep Copper | | 2 | | | 2 |
| | Phalaborwa | | 2 | | | 2 |
| | Prieska | 1 | 1 | | | 2 |
| Total from copper mines | | 1 | 6 | 0 | 0 | 7 |
| Diamond | De Beers Consolidated | 2 | | | | 2 |
| | Diamond Mine | | 1 | | | 1 |
| | Finch Diamond Mine | | 1 | | | 1 |
| Total from diamond mines | | 2 | 2 | 0 | 0 | 4 |
| Ferrochrome | Batlhako Ferrochrome | | 1 | | | 1 |
| Gold | Anglo American GM | | 1 | | | 1 |
| | Anglogold Ashanti GM | 5 | 1 | | | 6 |
| | Beatrix Gold | 34 | 4 | | | 38 |
| | Blyvoorquizicht | | 10 | | | 10 |
| | Bracken Mines | | 1 | | | 1 |
| | Buffelsfontein Gold | | 17 | | | 17 |
| | Consolidated Main Reef | | 1 | | | 1 |
| | Consolidated Murchison | | 1 | | | 1 |
| | Daggasfontein | | 1 | | | 1 |
| | Deelkraal | | 4 | | | 4 |
| | Doornfontein | | 3 | | | 3 |

| Commodity | Last mine worked | Black | White | Coloured | Unknown | Total |
|---------------------|---------------------------|-------|-------|----------|---------|-------|
| Gold (continued) | Driefontein Cons GM | 21 | 3 | | | 24 |
| | Durban Roodepoort Deep | | 10 | | | 10 |
| | East Driefontein | 1 | 11 | | | 12 |
| | East Rand Prop | 1 | 8 | | | 9 |
| | Elandsrand | | 3 | | | 3 |
| | Elsburg GM | | 1 | | | 1 |
| | Evander GM | 2 | 2 | | | 4 |
| | Ezulwini Gold Mine | 1 | 1 | | | 2 |
| | Free State Geduld | | 12 | | | 12 |
| | Free State Saaiplaas | | 1 | | | 1 |
| | Gencor | 5 | | | | 5 |
| | Goldfields | | 1 | | | 1 |
| | Grootvlei Prop | | 5 | | | 5 |
| | Harmony | 198 | 21 | | | 219 |
| | Hartebeesfontein | 3 | 11 | | | 14 |
| | J.I.C. Gold Mine | 2 | 1 | | | 3 |
| | Kinross | 4 | 2 | | | 6 |
| | Kloof | 14 | 10 | | | 24 |
| | Kopanang Gold Mine | 1 | | | | 1 |
| | Leeudoorn | | 3 | | | 3 |
| | Leslie | | 2 | | | 2 |
| | Libanon | | 13 | | | 13 |
| | Lorraine | | 3 | | | 3 |
| | Marievale | | 1 | | | 1 |
| | Masimong Gold Mine | | 1 | | | 1 |
| | Modderfontein | | 1 | | | 1 |
| | New Consort | | 1 | | | 1 |
| | Nigel GM | | 1 | | | 1 |
| | Oryx | 4 | 1 | | | 5 |
| | Pamodzi Mine | | 1 | | | 1 |
| | President Brand | 1 | 2 | | | 3 |
| | President Steyn | | 4 | | | 4 |
| | Rand Uranium Gold | 8 | 1 | | | 9 |
| | Randfontein | 2 | 10 | | | 12 |
| | Simmer & Jack GM | 4 | | | | 4 |
| | South Deep GM | | 5 | | | 5 |

| Commodity | Last mine worked | Black | White | Coloured | Unknown | Total |
|-----------------------------------|----------------------------------|------------|------------|----------|----------|------------|
| | South Roodepoort | 2 | | | | 2 |
| | St Helena | | 2 | | | 2 |
| | Stilfontein | | 2 | | | 2 |
| | Sub Nigel | | 1 | | | 1 |
| | Target Gold Mine | | 1 | | | 1 |
| | Tautona GM | 2 | | | | 2 |
| | Unisel GM | | 1 | | | 1 |
| | Vaal Reefs | 36 | 41 | | | 77 |
| | Venterspost | | 4 | | | 4 |
| | Vlakfontein | | 2 | | | 2 |
| | Welkom GM | 1 | 4 | | | 5 |
| | West Driefontein | 2 | 10 | | | 12 |
| | West Rand Consolidated | | 8 | | | 8 |
| | West Witwatersrand | | 1 | | | 1 |
| | Western Areas | | 6 | | | 6 |
| | Western Deep Levels | | 11 | | | 11 |
| | Western Holdings | | 3 | | | 3 |
| | Western Reef GM | | 1 | | | 1 |
| | Winkelhaak | | 4 | | | 4 |
| Total from gold mines | | 354 | 299 | 0 | 0 | 653 |
| Iron | Sishen Iron Mine | 1 | | | | 1 |
| Lime | Lime Acres | 3 | | | | 3 |
| Manganese | Associated Manganese | 6 | 1 | 1 | | 8 |
| | Hotazel Manganese Mine | 8 | | | | 8 |
| | Manganese mine | 1 | 2 | | | 3 |
| | S A Manganese | 3 | | | | 3 |
| Total from manganese mines | | 18 | 3 | 1 | 0 | 22 |
| Platinum | Amadelbult Platinum (Rustenburg) | 1 | 2 | | | 3 |
| | Bafokeng | 1 | | | | 1 |
| | Eastern Platinum Mine | 30 | | | | 30 |
| | Impala Platinum | 70 | 10 | | | 80 |
| | Karee Platinum | 19 | | | | 19 |
| | Lebowa Platinum Mine | 2 | 1 | | | 3 |
| | Lonmin Platinum | 16 | 3 | | | 19 |

| Commodity | Last mine worked | Black | White | Coloured | Unknown | Total |
|----------------------------------|-------------------------|--------------|--------------|-----------------|----------------|--------------|
| Platinum (continued) | Modikwa Plat Mine | 2 | | | | 2 |
| | Northam Platinum | 7 | | | | 7 |
| | Rustenburg Platinum | 21 | 14 | | | 35 |
| | Swartklip Platinum | 1 | 1 | | | 2 |
| | Two Rivers Platinum | 2 | | | | 2 |
| | Unknown Plantinum | 3 | 1 | | | 4 |
| | Western Platinum | 36 | 4 | | | 40 |
| | Wildebeestfontein | | 1 | | | 1 |
| Total from platinum mines | | 211 | 37 | 0 | 0 | 248 |
| Shaft sinkers | Shaft Sinkers | | 2 | | | 2 |
| | Master Drilling | | 1 | | | 1 |
| Silicon | Silicon Smelters | 1 | | | | 1 |
| Steel & Iron | Iscor | 3 | 17 | | | 20 |
| Non-Miner | Chamber of Mines | | 2 | | | 2 |
| | Environmental | 9 | 4 | | | 13 |
| | Industry | | 4 | | | 4 |
| | Transnet | | 2 | | | 2 |
| Total for non-miners | | 9 | 12 | 0 | 0 | 21 |
| Unknown | Unknown | 9 | 8 | | 6 | 23 |
| TOTAL | | 706 | 445 | 7 | 6 | 1 164 |

APPENDIX 2: PUBLICATIONS AND ACTIVITIES EMANATING FROM PATHAUT DATA OR AUTOPSY SERVICE (2012)

Journal articles

Sonnenberg P, Lim MSC, Dowdeswell RJ, Field N, Glynn JR, *Murray J*. Quantifying errors in the estimation of tuberculosis mortality in a population of South African miners. *Int J Tuberc Lung Dis* 2012; 16 (11): 1449-1454.

Ndlovu N, Davies T, *Milne S*, Nelson G, *Murray J*. Occupational disease rates in South African miners at autopsy: surveillance report 2010. *Occup Health Southern Afr* 2012; 18(2):31-33.

Murray J, Davies JCA, *Phillips JI*. Routinely collected laboratory data: a neglected resource, *Med Tech SA* 2012; 26(1), 7-10.

Lim MSC, Dowdsdwell RJ, *Murray J*, Field N, Glynn JR, Sonnenberg P. The impact of HIV, an antiretroviral programme and tuberculosis on mortality in South African platinum miners, 1992-2010, *Plos One* 2012; 7(6):1-8.

Nelson G, Criswell S R, Zhang J, Murray J, Racette B A. Research capacity development in South African manganese mines to bridge exposure and neuropathologic outcomes. *Neurotoxicology* 2012; 33(4): 683-6.

PhD Thesis

Nelson G. Living in the shadow of a dust cloud: Occupational respiratory diseases in the South African mining industry, 1975 to 2009. PhD thesis, University of Witwatersrand, Johannesburg, 2012.

Awarded University of the Witwatersrand Faculty of Health Sciences Prestigious Postgraduate Degree Award for 2012

Reports

Ndlovu N, Davies T, *Milne S*, Nelson G, *Murray J*. Pathology Division Report: Demographic data and disease trends for January to December 2011. NIOH Report 1/2012. ISSN 1812-7681. National Institute for Occupational Health, National Health Laboratory Service, South Africa, 2012. (http://www.nioh.ac.za/publications/publications_pathaut_reports.htm).

Congresses

Vorajee NI. Pleural pathology - slide seminar: Primary effusion lymphoma. 29th International Congress of the International Academy of Pathology, 30 Sept-05 Oct 2012, Cape Town International Convention Centre, SA.

Vorajee NI. Non-neoplastic lung disease - slide seminar: Nocardia. 29th International Congress of the International Academy of Pathology, 30 Sept-05 Oct 2012, Cape Town International Convention Centre, SA.

Murray J, Phillips J. NIOH experience of mesothelioma. 29th International Congress of the International Academy of Pathology, 30 Sept-05 Oct 2012, Cape Town International Convention Centre, SA.

Murray J. Tuberculosis - what the autopsy can teach us, how TB is changing, and future challenges for autopsy pathology. 29th International Congress of the International Academy of Pathology, 30 Sept-05 Oct 2012, Cape Town International Convention Centre, SA.

Murray J, Ndlovu N, teWaterNaude J. Asbestos related-disease: clinic-pathological correlation. European Respiratory Society Annual Congress 2012, 01-05 Sept 2012, Vienna, Austria.

Murray J, Ndlovu N. Infectious Diseases and Health and Safety in the South African Mining Industry. 30th Congress of the International Commission on Occupational Health, 18-23 March 2012, Cancun Mexico.

Murray J, Lim MSC, Dowdeswell RJ, Glynn JR, Sonnenberg P. Unnatural Deaths in South African Miners, 1992-2008. 30th Congress of the International Commission on Occupational Health, 18-23 March 2012, Cancun Mexico.

Ndlovu N, Murray J. Clinico-pathological correlation of asbestos-related disease in ex-miners. 30th Congress of the International Commission on Occupational Health, 18-23 March 2012, Cancun Mexico. **Runner up prize for student poster award**

Nelson G, Murray J. Silicosis at autopsy in South African platinum mine workers. 30th Congress of the International Commission on Occupational Health, 18 – 23 March 2012, Cancun, Mexico. **Runner up prize for student poster award**

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 |
|---|---------------|--|--|
| Presentation on on autopsy compensation to doctors and nurses in the Internal Medicine Department | 19 April 2012 | Tshepong Government Hospital, Klerksdorp | Prof J Murray Mrs N Ndlovu Mr S Milne Mr G Rani |
| Training 2 prosectors on safety and lung removal. | 03 May 2012 | Thabanchu Hospital (OFS) | Mr D Afrika |
| Presentation on compensation, silicosis and TB | 19 June 2012 | Kusasaletu mine, Carltonville | Mr D Africa Mr P Masilo |
| Presentation on compensation, silicosis and TB to Lafarge, PCP and two small cement companies | 18 Oct 2012 | Lafarge, Lichtenburg | Mr D Afrika |