

# COUNTING THE COST OF INJURY AND POOR HEALTH – AN ANALYSIS OF QCOS DATA

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## **Abstract**

The Queensland Coal and Oil Shale (QCOS) Mining Industry Superannuation Fund provides the industry superannuation service. QCOS pay out superannuation benefits to the families of deceased members and makes insurance payments to persons with chronic disabling health conditions. The following analysis examines the QCOS death and total permanent disability data from 1998 to 2003 to provide the coal mining industry with a perspective on a previously unreported aspect of health and safety outcomes.

The proportions of persons who leave the industry with cancers, heart disease and traumatic injuries are discussed in the context of data on the general population for the equivalent age groups and the need to have health and safety management systems to manage health risks in the workplace.

## **Introduction**

The complex interactions between workers and their workplace activities and environment, make it impossible to develop a single measure of health and safety performance. To assess the improvement in health and safety performance health and safety professionals review a number of indicators. Access to information on mine workers who have left the industry (including died) is limited by both organisational and privacy limitations. Two valuable sources of this information are QCOS and the National Deaths Index held by the Australian Institute of Health and Welfare (AIHW). A research report by SIMTARS / JCB Health and Safety Trust on 2001 examined the AIHW data for heart disease (Bofinger and Ham, 2002a, 2002b).

As part of both the superannuation regulatory requirements and a life and total permanent disability insurance business, QCOS make payments to clients (or their families) on claims made due to total permanent disability or death. De-identified data compiled from these claims is the basis for the examination of a performance indicator that counts the cost of death and total permanent disability in the Queensland coal mining industry. The information derived from this analysis is placed in context with other sources of coal mining industry health and safety data.

## **Background on QCOS**

QCOS is legislated under the *Coal and Oil Shale Mine Workers' Superannuation Act 1989* (with amendments to June 2000) as the coal mining industry's superannuation and long service leave entitlement provider. QCOS collects employer superannuation and long service leave contributions from coal producers and contactors servicing the mines on behalf of approximately 10,000 clients most of whom are paid under the Coal Industry Award. In 2002, QCOS reported that the total funds under management had grown to \$ 909 million. Benefits paid by the fund for 2001/02 were \$45.6 million for which 4% was for deaths and 8% for incapacity.

## **Sources of data**

For both the superannuation regulatory requirements and a life and total permanent disability insurance business, payments are made to clients (or their families) on claims made due to total permanent disability or death. As clients reach 60 years of age, they may access their superannuation as either a lump sum or as an annuity. All funds must be withdrawn in this fashion by the age of 65 years. No data is therefore collected on persons over 65 years and limited data is collected on persons older than 60 years.

The data provided by QCOS included the age, experience, mine type and year of last work of the mine workers as well as whether the worker was still working in the coal industry

In order to put the QCOS data into context, it is compared with related data sets published by the Department of Natural Resources and Mines (2002) and data compiled on deaths of mine

workers as part of a 'Heart Disease Risk Factor' research project undertaken by SIMTARS (Bofinger and Ham, 2002).

### **Method of analysis**

The 267 records provided by QCOS were classified into 10 categories and analysed by category type, year and length of experience. For the purpose of analysis, the QCOS data has been divided into groups consistent with the International Classification of Disease (ICD Version 10). For occupational risk assessment purposes, a modification is made to the classification system to capture information of deaths and total permanent disability due to nervous and mental disorders such as depression, suicide and alcoholism. Under the ICD, these may be classified as external injuries which is often the clinical outcome.

The age distribution of the coal mining industry employees was estimated from health assessment age distribution data published by the Department of Natural Resources and Mines (2002). Death rates by cause were estimated from the QCOS data and compared with general community (male) data published by the Australian Institute of Health and Welfare (2002).

A method of estimating the total cost to the community of death and total permanent disability was used to compare the QCOS data with costs estimated from other data sets published by the Department of Natural Resources and Mines (2002).

### **Results**

The number of claims for total permanent disability (TPD) and death is provided in Table 1. The deaths show a highly irregular pattern that indicates that data from individual years is of limited use for statistical analysis. As the insurance started in 1997-98, data for 1998 should be considered as not representative of a normal full year. The delays in lodging and assessing claims cause to data for 2002 and 2003 to be considered incomplete.

**Table 1 QCOS Data - Deaths and TPD by Year**

<b>Year</b>	<b>Deaths</b>	<b>TPD</b>	<b>Total</b>
1998	10	22	32
1999	8	65	73
2000	13	59	72
2001	6	46	52
2002	13	24	37
2003	1	0	1
<b>Total</b>	<b>51</b>	<b>216</b>	<b>267</b>

Table 2 shows deaths and TPD by age group. It should be noted that persons in the 30 to 45 age group dominate the workforce. The table shows most TPD and deaths are in the 45 to 60 age groups. The comparisons with the general population are examined in a later section.

**Table 2 Deaths and TPD by age group**

<b>Age Group</b>	<b>Deaths</b>	<b>TPD</b>	<b>Total</b>
>25	1	3	4
25 - 29	4	6	10
30 - 34	6	7	13
35 - 39	6	21	27
40 -44	4	25	29
45 - 49	12	42	54
50 - 54	10	62	72
55 - 59	8	41	49
60 -62	nil	9	8
<b>Total</b>	<b>51</b>	<b>216</b>	<b>267</b>

The most common disorder is musculo-skeletal disorders as shown in Table 3. Other common causes include external causes (injury), cancer, circulatory disease (heart attack and

stroke) and nerve and mental disorders. The average age of sufferers of external causes is 41, while circulatory disease is more likely to affect the oldest group at an average age of 53 years.

A total of 51 deaths were reported in the QCOS data. The common causes of death were cancer, external causes (injuries), circulatory disease and nervous / mental disorders. It should be noted that 1998 to 2002 has been a relatively good period with only 8 deaths reported by the Mines Inspectorate. This compares to 1994 when 11 deaths were reported largely as a result of the Moura Disaster.

**Table 3 Death and TPD by cause**

Cause	Deaths	TPD	Totals	Av. Age
Cancer	14	20	34	51
Circulatory disease	12	21	33	53
Ear disorders	0	3	3	
Endocrine disorders	0	3	3	
Infectious diseases	0	5	5	
Musculo-skeletal disorders	0	83	83	47
Nervous / mental disorders	9	43	52	48
Respiratory disease	0	4	4	
External causes	13	32	45	41
Other	3	2	5	
Total	51	216	267	48

Table 4 shows that external causes dropped dramatically in 2001. This coincided with the introduction of the new legislation and increased drug and alcohol screening. There appears to be a decline in circulatory disease but a possible increase in nervous / mental disorders which is also reflected in other injury and workers compensation statistics. The 2002 data is incomplete because of time delays in lodging and processing claims.

**Table 4 Causes by year**

Cause	Year					Totals
	1998	1999	2000	2001	2002	
Cancer	5	7	7	7	8	34
Circulatory disease	7	10	7	3	5	32
Musculo-skeletal disorders	8	21	26	21	8	84
Nervous / mental disorders	3	11	12	14	11	51
External causes	7	13	16	5	4	45
All Others	2	11	4	2	1	20
Totals	32	73	72	52	37	266

The Department of Natural Resources and Mines (2002) reports that underground miners represent 25% of the workforce but suffer over a third of QCOS reported disorders shown in Table 5. One measure of the effectiveness of safety training programs is the percentage of serious disorders that afflict workers with less than five years experience. Table 5 shown that 32% of underground disorders have serious conditions compared to only 13% for open disorders. Work by Ham (2000) showed that the open cut workforce is slightly older than the underground workforce.

**Table 5 Distribution by Mine Type and Experience Group**

Mine Type	Experience Group		Total	% < 5 years
	0 to 5 years	5 plus years		
Open cut	22	144	166	13
Underground	28	59	87	32
Other	4	10	14	29
Total	54	213	267	20

Examining Table 6, there is a common trend in most disorders that the open cut mines show a concentration of the disorders in the 10 plus years experience group while disorders are more evenly spread among underground workers.

**Table 6 Disorders by Mine Type and Experience Group**

Disorder	Experience Group	Employer			Total
		O / C	U / G	Other	
Cancer	0 - 5	6	4	1	11
	5 - 10	1	1	0	2
	10 plus	17	4	0	21
Subtotals		24	9	1	34
Circulatory disease	0 - 5	1	2	0	3
	5 - 10	2	3	1	6
	10 plus	17	4	2	23
Subtotals		20	9	3	32
Musculo-skeletal disorder	0 - 5	4	11	0	15
	5 - 10	6	6	1	13
	10 plus	38	16	2	56
Subtotals		48	33	3	84
Nervous disorder	0 - 5	3	3	1	7
	5 - 10	5	3	1	9
	10 plus	25	7	3	35
Subtotals		33	13	5	51
Traumatic Injuries	0 - 5	6	8	1	15
	5 - 10	5	6	0	11
	10 plus	13	5	1	19
Subtotals		24	19	2	45
Other	0 - 5	3	2	0	5
	5 - 10	2	1	0	3
	10 plus	10	3	0	13
Subtotals		15	6	0	21
Totals		164	89	14	267

As a means of putting the cost of death and total permanent disability in to a financial context, an estimate is made of lost earnings based on an estimated average \$70,000 annual income ( estimated from Joint Coal Board (2001) figures). Table 7 shows that while miners with less than 5 years experience made up 20 % of cases, their losses were 30% of the total of \$215 million.

**Table 7 Distribution of Earnings Lost by Mine Type and Experience Group**

Mine Type	Experience Group		Total
	0 to 5 years	5 plus years	
	\$ M	\$ M	\$ M
Open cut	32.8	91.4	124.2
Underground	37.8	53	90.8
Total	70.6	144.4	215

**Comparison with other injury data sets**

A comparison with between NRM injury and lost time data, Workcover data (NRM, 2002) and lost wage estimates ( annualised) based on QCOS death and TPD data is shown in Table 8. The data is reduced to man-years lost and wage costs for comparative purposes

**Table 8 NRM injury and lost time data, Workcover data compared to QCOS data**

<b>Data Source</b>	<b>Days lost</b>	<b>Man-Years lost</b>	<b>Total Cost \$M</b>
Reported Lost Time Injury Data	3627	18	1
Injury Lost Time from Production Returns	5475	27	2
Sickness Lost Time from Production Returns	31158	156	12
Workers Compensation Report			4
Lost Wage Estimate from QCOS data		660	43

In 2001, the Australian Institute of Health and Welfare supplied data on deaths from a register of Queensland and New South Wales coal mine workers for a research project. Some of this data was published in the SIMTARS/JCB Health and Safety Trust Heart Disease Risk Factor Research Report. The published data on 292 former Queensland mine workers is compared to the QCOS data on Table 9. The data sets are similar in percentage terms for circulatory disease and external causes. Cancers appear less in the QCOS data. The SIMTARS/JCB Project data did not report deaths related to nervous / mental disorders separately. The data is probably hidden in with other causes of death. The QCOS data confirmed the findings of the SIMTARS/JCB study that miners had a lower circulatory disease risk than the general population.

**Table 9 QCOS Data compared to SIMTARS/JCB Heart Disease Risk Research Project**

<b>Cause of Death</b>	<b>QCOS Data</b>		<b>SIMTARS/JCB Project Data</b>		<b>AIHW Gen.Pop.</b>
	<b>Number</b>	<b>Percent</b>	<b>Number</b>	<b>Percent</b>	<b>Percent</b>
Cancer	14	27	113	39	27
Circulatory disease	12	24	75	26	40
Nervous / mental disorders	9	18	0	0	na
Respiratory diseases	0	0	12	4	10
External causes	13	25	66	23	6
Other	3	6	26	9	17
<b>Total</b>	<b>51</b>	<b>100</b>	<b>292</b>	<b>100</b>	<b>100</b>

In Australia's Health 2001, the AIHW published information on deaths for various age groups due to various causes. Two of the age groups reported (25 to 44 and 45 to 64) largely fall within the groups of the QCOS data. After estimating the age distribution of the coal mining population from reported health assessment data (NRM 2002), it was possible to compare the QCOS data (1998 to 2002) and the AIHW data (2000) in terms of death rates per 100,00 employees. This is shown in Table 10.

While some caution needs to be exercised in interpreting the relatively low number of QCOS reported deaths, the coal miners generally have statistically significant (95% confidence) lower death rates than the general population. There are two important exceptions to the general trend. Firstly, there is a higher rate of cancers in the younger mining work group but with the small numbers involved the difference is not statistically significant.. This issue warrants further research. The second issues is that the AIHW did not report death due to nervous / mental disorders. The QCOS data demonstrates that focus on long-term nerve disorder and stress risk management is warranted.

**Table 10 Estimation and comparison of death rate between QCOS and AIHW data**

**Population Analysis of Group Aged 25 to 44**

Disease	General population			Mining Population			Mining/Gen Pop Rate %
	Numbers Gen.Pop	Percent	Rate/100,000	Numbers Min.Pop	Percent	Rate/100,000	
Cancer	228	5.3	7.78	4	19.0	13.38	172
Circulatory Disease	565	13.1	19.22	1	4.8	3.34	17
Digestive Disorders	328	7.6	11.15	0	0.0	0.00	0
Injury	2233	51.8	76.01	10	47.6	33.44	44
Nerves/Mental	na	na	Na	5	23.8	16.72	na
Other	957	22.2	32.58	2	9.5	6.69	21
<b>Total</b>	<b>4311</b>	<b>100</b>	<b>146.74</b>	<b>21</b>	<b>100.0</b>	<b>70.23</b>	<b>48</b>

**Population Analysis of Group Aged 45 to 64**

Disease	Numbers	Percent	Rate/100,000	Numbers	Percent	Rate/100,000	Mining/Gen Pop Rate %
Cancer	4626	41.4	206.33	10	33.3	44.25	21
Circulatory Disease	3184	28.5	142.04	10	33.3	44.25	31
Respiratory Disorders	536	4.8	23.92	0	0.0	0.00	0
Injury	1061	9.5	47.35	3	10.0	13.27	28
Nerves/Mental	na	na	Na	4	13.3	17.70	na
other	1765	15.8	78.74	3	10.0	13.27	17
<b>Total</b>	<b>11173</b>	<b>100</b>	<b>498.38</b>	<b>30</b>	<b>100</b>	<b>132.74</b>	<b>27</b>

**Discussion**

McDonald (1995) criticised the coal mining industry for over-emphasis on lost time injury rate as a primary indicator of health and safety performance. His concern was that focus on lost time injury frequency rates deflected focus from the causes of serious injuries that constituted 15% of injuries but represented 85% of injury costs.

At the other end of the health and safety spectrum, Kerr (1966) reported that for each industrial fatality reported there were between 3 to 5 occupational related fatalities that were not reported but surfaced on coroners reports and death certificates as likely to be of an occupational origin.

The Industry Commission report on Work, Health and Safety (1995), accepted evidence being compiled for the Worksafe Report on Best Estimate of the Magnitude of Health Effects of Occupational Exposure to Hazardous Substances (Kerr, 1996) that identified widespread under-reporting of occupational related death through illness. The Commission concluded that systems needed to be put in place to monitor long term exposures and provide a mechanism for collating long term health outcomes for persons working in environments of elevated risk.

The mining industry collects some exposure data while the doctors collect health data and QCOS captures some critical health outcome data. There is a need for a collective effort to compile these data sets for dose-response risk management studies without jeopardising the privacy entitlements of individual mine workers (Bofinger and Ham, 2001)

The QCOS data set has been very useful but it is limited in that death and disability data of persons over 60 years age is not reliably collected. To obtain a more complete picture, data needs to be regularly sourced and analysed from the Deaths Index held by the AIHW.

The delay in reporting the QCOS data needs to be considered in drawing conclusions from the results. The assessment of total permanent disability often takes 6 to 12 months to assess while a few cases may take several years. By late June only one case had been reported for the 2003 year. In first six months of 2003, 9 cases for 2002 were reported and a further six came from 1999 to 2001. The delay in reporting may be incorrectly interpreted as declining rates of death and total permanent disability. The drop from 72 in 2000 to 52 in

2001 should be considered as real, but the drop to 36 in 2002 should not be taken as a reliable indicator as more total permanent disabilities can be expected to be reported for 2002 in the future.

As the insurance program only began in 1997-98, the 1998 data set should be regarded as underestimating the real extent of total permanent disabilities.

From a legislative perspective, section 6 of the *Coal Mining Safety and Health Act 1999* states that the objective of the act is to protect the health and safety of persons at coal mines to be protected and ensure that the risk of injury or illness .... be at an acceptable level'. While current systems that include safety management plans deal effectively with the management of short term risks, the management of long term risks require an entirely different approach.

Before the risks can be effectively managed and demonstrated to be managed, it is necessary to establish an effective data collection system. Division 2, Part 6 of the *Coal Mining Safety and Health Regulations 2001* (Coal Mine Workers Health Scheme) sets out a framework for the collection of long term health and exposure monitoring. Importantly, sections 49 and 53 require a safety management plan for monitoring of workers exposure to hazards with (presumably reliable) data to be maintained for 30 years. The question of why should the data be kept for 30 years needs to be considered. From an evidence based risk management perspective, the data has little meaning if it can not be used to correlate cumulative exposure with the progression of degenerative health outcomes.

One of the limitations of the regulation is that it is difficult to systematically capture final health outcome data – either of death or total permanent disability. This is where the QCOS data on death and total permanent disability is particularly valuable. While it may be possible to extract largely the same data from the Workcover and Australian Institute of Health and Welfare databases the process would be complex, less reliable and would have a time lag.

As a part of employers' obligations to have safety management plans, there is a need to access reliable evidence based risk assessments so that appropriate trigger levels for management of persons at risk can be set. As outlined above, the legislation sets out a framework to collect the necessary data for the evidence based research necessary to assess critical points of increasing risk. While technically it is feasible to obtain the exposure and health outcome data, there is also the issue of confidentiality of private health data. Ethics considerations demand workers to sign consent forms for researchers to gain access to medical records and health outcome data that need to be analysed in conjunction with the exposure data.

### **Conclusions**

A mechanism to use superannuation fund data to identify some adverse long-term health outcomes has been demonstrated. The data has been analysed and placed into the context of related data sources. Musculo-skeletal disorders are the most common cause of total permanent disability (83 of 267), but are not identified as a cause of death. Nervous and mental disorders (52) are the second highest cause of death and total permanent disability and represent the most common (14) cause of death. External causes (45) is the third most common issue reported in the QCOS data. Other common causes of death are cancer (14 deaths) and circulatory disease (12 deaths).

External cause injuries afflict younger persons where the average age is 41 years. By comparison, circulatory diseases are likely in an older group where the average age is 53 years.

Underground coal mines constitute 25% of the workforce but suffer 30% of QCOS reported disorders. With the open cut mines, the disorders are more focussed on the older / more experienced groups.

If the annual cost of injury is only counted in terms of days lost from reported injury data, the estimated cost is only \$1M, but Workcover statistics indicate a cost of \$4M. This compares with data from lost time returns indicating sickness may cost \$12M per year. These statistics

generally exclude QCOS reported death and disability that is costing the individual mine workers and community approximately \$43M per year

Combining QCOS data and reported health assessment data, it has been possible to estimate death rates for various disorders for mine workers in the 25 to 44 and 45 to 65 age groups. Comparing the results to those published for the general Australian population data, death are generally lower in the coal mining industry. While cancer appears more common in the younger age group, small numbers prevent this from being a statistically significant difference.

The reporting structure for the general community does not recognise nervous / mental disorders in the same way as classified in the QCOS data which identifies it as a major issue. This concern is supported by data from the Inspectorate and Workcover that identifies stress as a major growth area in both mining and general population occupational disorders.

The classification of cause of death or total permanent not always clear cut. Some cases have multiple causes in which the key issues is a matter of personal judgement. There is almost a continuum between back disorders, back pain, pain, depression, alcoholism and suicide. Again classification may be subjective. While the classification has largely followed the International Classification of Diseases, a departure has been made for risk management purposes for nervous and mental disorders. This group includes suicide and alcoholism as well as depression and pain.

The most ambiguous issue is back pain. Many people in the industry have a level of back pain. The majority is believed to be associated with a degeneration of the bones and cartilage in the spine that impinges on nerves within the spine. The ambiguity lies in the question is this a nerve or musculo-skeletal disorder. The approach taken in this paper is to classify it as a nerve disorder unless there is some additional reference to the musculo-skeletal system or traumatic injury.

The QCOS data set only commenced in 1998 and is limited in that death and disability data of persons over 60 years age is not reliably collected. To obtain a more complete picture, data needs to be regularly sourced and analysed from the Deaths Index held by the AIHW. This data set overcomes the problem associated with interstate migration.

This analysis has provided an industry wide perspective. As a part of the legislated obligation, mine operators are required to have a Safety Management Plans to manage risks associated with hazardous exposures. There is a need to incorporate exposure data with this style of data collection and analysis at the industry and corporate levels to demonstrate that long term work conditions and environments are being effectively managed and not causing unacceptable risks. This is, however, a new challenge.

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