

## Chapter 13

### Surveillance of work-related fatalities using External Cause codes

#### 13.1 INTRODUCTION

This thesis provides comprehensive data on the number and rate of work-related fatal injuries of workers for the four-year period 1989 to 1992 inclusive. The first work-related fatalities study provided similar information for the three-year period 1982 to 1984 inclusive<sup>4</sup>. No reliable information is available on the Australian work-related fatality experience before 1982, from 1985 to 1988, or since 1992. Compensation information from the National Data Set suggests that the rate of work-related fatal injury has changed little in the 1990s<sup>275</sup>, but incomplete coverage and lack of information prior to 1991 limit the usefulness of these data for revealing long-term trends.

The Ninth Revision of the International Classification of Diseases (ICD-9)<sup>237</sup> was used to classify deaths registered in Australia from 1979 to 1998. The Tenth Revision, ICD-10<sup>309</sup>, has been used since then. The ABS uses information provided by Death Registrars, sometimes enhanced through enquiries, to assign to each death an ICD code representing the Underlying Cause of Death. Under ICD-9 rules, if the morbid condition responsible for death is injury or poisoning, then the External Cause of that condition is recorded as the Underlying Cause. For example, a death due to brain trauma (morbid condition) resulting from a fall from a height (external cause) would be coded to the latter.

Work-related deaths are generally not individually identifiable in the Deaths Data system, because there is no work-related indicator. However, some External Causes are only relevant to work-related deaths of workers, and others can be expected to have a high proportion of deaths that are work-related. If it can be assumed that the proportion of deaths that are work-related in some External Cause categories is more-or-less constant over time, that the proportion of all work-related deaths in each of these categories also remains more-or-less constant, and that the application of the codes does not change over time, then the yearly Deaths Data can be used to approximate the trend in the number and rate of work-related deaths over many years. This section attempts to use External Cause codes to track the work-related deaths of workers in Australia for the period 1979 to 1997 inclusive.

## **13.2 METHODS**

Data were obtained on all deaths whose causes were coded by the ABS according to ICD-9 – that is, all deaths registered from 1979 to 1998 inclusive. Deaths that occurred from 1979 to 1997 inclusive were selected. Deaths that occurred in 1998 were omitted because some of these were registered after 1998 and were coded according to ICD-10, not ICD-9. Information on work-related deaths of workers was obtained from two studies of work-related fatal injuries – the current one (WRFS 2), covering the years 1989 to 1992 inclusive, and WRFS 1, covering the years 1982 to 1984 inclusive. The approach had three stages.

Firstly, using information from the second of the two studies (WRFS 2), and the ABS Deaths Data from 1989 to 1992, the proportion of deaths in each External Cause category that was of workers, due to work-related causes and which arose from a workplace incident (with the other exclusions outlined later) was determined.

(Information from WRFS 2 was used rather than information from the earlier study (WRFS 1) because WRFS 2 contained information on more recent deaths and because it probably provided slightly better coverage of work-related traumatic deaths than WRFS 1.) Those categories that had a high enough number of working deaths (chosen a priori as four or more), and a high enough proportion of deaths that were work-related (with about 50% or more chosen a priori), were identified. A number of categories were used, in an attempt to cover the many types of work-related death and to provide stability in the total estimates of work-related death from year to year. The analysis was performed using combined data for the four years, then checked for stability using the yearly data.

Secondly, to validate these proportions, the category-specific proportions determined using WRFS 2 were applied to Deaths Data from 1982, 1983 and 1984, and the resultant predicted numbers of workplace deaths compared to actual numbers found in WRFS 1.

Finally, the validated category-specific proportions were applied to Deaths Data for each of the 19 years, thereby producing yearly estimated numbers of work-related deaths for the period 1979 to 1997 inclusive. Overall and category-specific results were determined. Estimated yearly rates were produced by dividing the estimated numbers by appropriate workforce denominator data.

### **13.2.1 ADJUSTING THE RATES BY INDUSTRY MIX**

Workers in different industries have different risk of fatal injury. Therefore, changes in industry distribution of the workforce over time could result in changes in overall fatality rates even when there has been no change in fatality risk for individual workers.

Common ways of dealing with this possibility are to look at industry-specific rates, or to adjust the overall rates using the industry distribution and industry-specific rates in the different years. For the years not covered by the fatalities studies, industry-specific rates are not available. However, industry population data, based on the Australian Standard Industrial Classification (ASIC), are available<sup>291, 298</sup>. Using these population data, and industry-specific rates determined from the WRFS 2 data, indirect standardisation of estimated yearly rates was undertaken. This could only be done for the years 1979 to 1993, because ABS data from 1994 onwards were coded using a different industry coding scheme.

### **13.2.2 DENOMINATOR DATA**

The denominators used were of the Employed Civilian Labour Force (ECLF) and were based on the relevant Labour Force Surveys conducted during 1979 to 1997 inclusive by the ABS<sup>242</sup>. The ECLF includes nearly all working persons aged 15 years or older, but specifically excludes members of the armed services. For this analysis, persons older than 64 years were also excluded from the denominator data.

### **13.2.3 STANDARDISATION**

To enable more meaningful comparison, some results shown in figures have been standardised by dividing each value by the average value for that category and expressing the result as a percentage.

### **13.2.4 DATA RESTRICTIONS**

Some restrictions of the data were required, with the following groups excluded:

- persons fatally injured in motor vehicle incidents on public roads;
- persons aged less than 15 years or more than 64 years;
- military personnel; and

- persons whose death was medically certified (Table 13.1).

The reasons for these exclusions are as follows.

The analysis excluded work-road deaths. The working deaths in WRFS 2 had been separated into those that resulted from motor vehicle incidents on public roads (work-road deaths) and those that resulted from other incidents (workplace deaths). Five hundred and forty three (30.4%) of the 1,787 working deaths were work-road deaths. The work-road deaths would be expected to have been coded to the “Motor vehicle traffic accident” External Cause code categories (E810.0 to E819.9). However, none of these three or four digit External Cause code categories is specific to, or theoretically likely to be mainly comprised of, working deaths, and working deaths made up a small proportion of the relevant External Cause code categories. This means that the “Motor vehicle traffic accident” External Cause codes are poor proxies for working deaths, as changes in the categories are likely to overwhelmingly reflect changes in road safety for the general population and to be very insensitive to changes specifically related to work.

Persons aged less than 15 years, who only comprised 0.6% of all workplace deaths, were excluded to match the available denominator data. Persons older than 64 years were excluded because, as for the road deaths described previously, they are very unlikely to be fatally injured due to work-related causes (work-related deaths comprised only 1.4% of deaths of persons aged above 64 years), and they comprised only a small proportion of all workplace deaths in this study (6%).

Military persons were excluded because they were not included in the available denominator data and did not comprise a large proportion of workplace deaths (3.1%).

Persons whose death was medically certified (deaths certified by a medical practitioner rather than a Coroner) were excluded because very few can be expected to be work-related (only three persons in the four years covered by WRFS 2), and the cause of death profile of medically certified deaths is very different to that of non-medically certified deaths.

Males and females were both included in the analysis. Within the 15 to 64 year age group, the differences in External Cause coded cause of death between male and female workers was not large enough to warrant the exclusion from the analysis of the relatively small number (4.2%) of women.

### **13.3 RESULTS**

#### **13.3.1 SELECTION OF APPROPRIATE EXTERNAL CAUSE CODE CATEGORIES**

There were 1,118 workplace deaths in WRFS 2 that met the inclusion criteria. Firstly, using four-digit External Cause code categories, and a rough criterion of categories comprising four or more work-related deaths and a work-related proportion of 50% or more, 31 categories were identified. These deaths comprised 60% of all relevant workplace deaths identified in WRFS 2.

**Table 13.1 Selected characteristics of working deaths and all deaths. Australia, 1989 to 1992**

	Working deaths					All deaths				
	<15 n = 13	15-64 n = 1,681	>64 n = 92	Total n = 1,787	Military n = 48	<15 n = 1,589	15-64 n = 14,204	>64 n = 6,441	Total n = 22,428	MCD n = 2,938
Motor vehicle traffic incident (%) <sup>1</sup>	38.5	31.5	17.4	30.8	27.1	40.3	50.8	23.0	41.8	1.3
Air transport (%) <sup>1</sup>	0	7.0	1.1	6.6	43.8	0.3	2.0	0.2	1.3	-
Falls (%) <sup>1</sup>	0	6.3	12.0	6.6	4.2	2.3	4.5	50.2	17.8	73.7
Drowning (%) <sup>1</sup>	0	1.8	3.3	1.9	2.1	22.6	4.5	2.0	5.1	0.3
Machinery (%) <sup>1</sup>	15.4	13.9	22.8	14.3	2.1	1.4	1.8	0.5	1.4	0
All deaths (%) <sup>2</sup>	0.8	11.8	1.4	8.0	0.2	7.1	63.3	28.7	100.0	13.1
All working deaths (%) <sup>3</sup>	0.7	94.1	5.1	100.0	2.7	na	na	na	na	na
All workplace deaths (%) <sup>4</sup>	0.6	93.2	6.0	100.0	3.1	na	na	na	na	na

1: Percentages are of the relevant number in each column.

2: Percentages are of the total number of deaths in Australia, either in the relevant age group or overall, as appropriate.

3: Percentages are of all working deaths.

4: Percentages are of all workplace deaths, calculated using the number of workplace deaths in the column category as the numerator.

Secondly, four-digit categories that had less than four deaths but a very high proportion of work-related deaths were identified. Where these could be logically grouped with each other or the previously selected four-digit categories, they were retained. Isolated four-digit groups with less than four deaths, but a high proportion of work-related deaths, were not retained unless the category definition was likely to be specific to work-related deaths. This added another 13 categories.

Thirdly, four-digit External Cause code categories that did not have any work-related deaths, but that theoretically were specific to work-related deaths, were included, being combined with related four-digit categories that had been previously retained. Six four-digit categories, all identifying railway workers, were included using this criteria.

Finally, where possible, four-digit External Cause code categories were grouped into logical groups at the three-digit, or two-digit, level. All four-digit categories within a three-digit level were included, except that four-digit categories with a high number of deaths but a low proportion of work-related deaths were excluded. For example, in Air and Space Transport Accidents, four-digit categories describing military and commercial aircraft were included, but those describing other powered aircraft were excluded. The results of this approach are shown in Tables 13.2 and 13.3.

**Table 13.2 Specific External Cause code categories with four or more workplace deaths and a high proportion of workplace deaths Australia, 1989 to 1992**

Category	External Cause code	Number	% WRFS 2 workplace deaths	% All deaths in the category
Rail – Hit by rolling stock - staff	8050	12	1.1	80.0
MV non TA - off road vehicle - driver	8210	10	0.9	45.5
MV non TA - off road vehicle - pedestrian	8217	4	0.4	100.0
MV non TA - collision - pedestrian	8227	19	1.7	54.3
Water - craft - submersion - crew	8302	14	1.3	73.7
Water - other - crew	8322	8	0.7	72.7
Air - other - crew in surface to surface	8412	5	0.4	71.4
Air - other - other in surface to surface	8413	13	1.2	86.7
Air - other - surface to air	8414	11	1.0	84.6
Powered vehicles "at" work	8469	10	0.9	100.0
Accidental poisoning by other gas	8698	6	0.5	54.5
Fall from ladder	8810	16	1.4	51.6
Fall from scaffold	8811	15	1.3	93.8
Animals - other - other	9068	12	1.1	66.7
Cave – in	9133	18	1.6	90.0
Falling objects	9169	120	10.7	75.5
Machines - tractors	9190	59	5.3	80.8
Machines - mining	9191	22	2.0	100.0
Machines - cranes	9192	64	5.7	94.1
Machines - metalwork	9193	8	0.7	100.0
Machines - woodwork	9194	10	0.9	76.9
Machines - transmission	9196	4	0.4	100.0
Machines - dozers	9197	35	3.1	92.1
Machines - other	9198	22	2.0	95.7
Machines - not specified	9199	5	0.4	71.4
Pressure vessel - other	9218	6	0.5	85.7
Explosion - gases	9232	5	0.4	55.6
Electricity - generating/lines	9251	33	3.0	75.0
Electricity - industrial	9252	31	2.8	93.9
Electricity - other	9258	24	2.1	75.0
Electricity - unspecified	9259	7	0.6	58.3
<b>Total</b>		<b>628</b>	<b>56.2</b>	<b>78.6</b>

**Table 13.3 Final selected External Cause code categories with a high proportion of workplace deaths, plus deaths by year. Australia, 1989 to 1992**

Category	External Cause code	Number	% of WRFs 2 workplace deaths	% All deaths in the category
Rail crew	8000, 8010, 8020, 8030, 8040, 8050, 8060, 8070	15	1.3	75.0
Off road transport	8210-8219, 8220-8229	47	4.2	45.2
Water transport crew and wharf workers	8302, 8306, 8312, 8316, 8322, 8326, 8342, 8346, 8352, 8356, 8362, 8366, 8372, 8376, 8382, 8386	32	2.9	76.2
Air transport	8401-8404, 8407, 8408, 8411-8414, 8417, 8418, 8427, 8428, 8431-8434, 8437, 8438	32	2.9	50.8
Powered vehicle at worksite	8469	10	0.9	100.0
Gassing - not CO or CO2	8690-8699	8	0.7	57.1
Fall - ladder or scaffold	8810, 8811	31	2.8	66.0
Animal attack	9068	12	1.1	66.7
Cave-in	9133	18	1.6	90.0
Falling objects	9169	120	10.7	75.5
Machines	9190-9199	229	20.5	89.5
Pressure vessel	9210-9219	7	0.6	87.5
Explosives	9230-9239	10	0.9	55.6
Electricity	9251-9259	95	8.5	78.5
All categories		666	59.6	74.0
1989		175	56.1	73.8
1990		183	62.9	78.2
1991		165	60.4	70.2
1992		143	59.1	73.7
All years		666	59.6	74.0

This process resulted in the creation of fourteen categories - railways, motor vehicle transport not on public roads, water transport, air transport, powered vehicles in work sites, accidental gassing, falls, animal attack, cave-in, falling objects, machinery, explosions involving pressure vessels, explosions involving explosives, and electricity. The categories covered a wide range of circumstances and represented 60% of all the eligible workplace deaths. Of all deaths in the selected categories, 74% were workplace deaths, ranging from 45% for off road transport to 100% for powered vehicles at a work site. These overall percentages were stable for the four years of WRFS 2.

For each category, the proportion of all deaths that were workplace deaths, and the proportion of all workplace deaths in each category, were also reasonably stable, except for air transport and some categories with low numbers of deaths, such as accidental gassing and cave-in (Table 13.4).

### **13.3.2 VALIDATION WITH DATA FROM 1982 TO 1984**

Using the categories and proportions selected using WRFS 2 data, predicted deaths were determined for the WRFS 1 period. These were compared to the actual number of deaths identified in WRFS 1. The number of predicted deaths was about 12% greater than the observed number of deaths, with this difference being very consistent for each of the three years. Also, there was a lot of variability in the predicted:observed percentages (ie the predicted deaths as a percentage of the observed deaths) for individual categories, particularly those with small numbers of deaths. However, the ratio for the machinery category was consistently very close to 100% (101% to 104%) and the ratios for the falling object (90% to 111%), rail crew (83% to 120%), falls (79% to 88%) and cave-in (105-113%) categories were also reasonably consistent and within 21% of 100 (Table 13.5).

**Table 13.4 Workplace deaths: number and percentage of workplace deaths and percentage of category. By year and External Cause code category for selected External Cause code categories. Australia, 1989 to 1992**

Category	1989	1990	1991	1992	Total
<b>Number of workplace deaths</b>					
Rail crew	2	4	4	5	15
Off road transport	11	12	11	13	47
Water transport	3	10	9	10	32
Air transport	7	24	0	1	32
Powered vehicle at worksite	2	5	2	1	10
Gassing - not CO or CO2	0	4	4	0	8
Fall - ladder or scaffold	10	8	7	6	31
Animal attack	3	1	3	5	12
Cave-in	7	2	8	1	18
Falling objects	37	25	31	27	120
Machines	64	59	61	45	229
Pressure vessel	2	2	3	0	7
Explosives	1	3	4	2	10
Electricity	26	24	18	27	95
<b>Total cases</b>	<b>175</b>	<b>183</b>	<b>165</b>	<b>143</b>	<b>666</b>
<b>% WRFS 2 workplace deaths</b>					
Rail crew	0.6	1.4	1.5	2.1	1.3
Off road transport	3.5	4.1	4.0	5.4	4.2
Water transport	1.0	3.4	3.3	4.1	2.9
Air transport	2.2	8.2	0.0	0.4	2.9
Powered vehicle at worksite	0.6	1.7	0.7	0.4	0.9
Gassing - not CO or CO2	0.0	1.4	1.5	0.0	0.7
Fall - ladder or scaffold	3.2	2.7	2.6	2.5	2.8
Animal attack	1.0	0.3	1.1	2.1	1.1
Cave-in	2.2	0.7	2.9	0.4	1.6
Falling objects	11.9	8.6	11.4	11.2	10.7
Machines	20.5	20.3	22.3	18.6	20.5
Pressure vessel	0.6	0.7	1.1	0.0	0.6
Explosives	0.3	1.0	1.5	0.8	0.9
Electricity	8.3	8.2	6.6	11.2	8.5
<b>Total cases</b>	<b>56.1</b>	<b>62.9</b>	<b>60.4</b>	<b>59.1</b>	<b>59.6</b>
<b>% All deaths in the category</b>					
Rail crew	50.0	100.0	80.0	71.4	75.0
Off road transport	42.3	44.4	40.7	54.2	45.2
Water transport	75.0	62.5	90.0	83.3	76.2
Air transport	87.5	88.9	0.0	14.3	50.8
Powered vehicle at worksite	100.0	100.0	100.0	100.0	100.0
Gassing - not CO/CO2	0.0	100.0	80.0	0.0	57.1
Fall - ladder/scaffold	76.9	66.7	63.6	54.5	66.0
Animal attack	60.0	33.3	75.0	83.3	66.7
Cave-in	100.0	100.0	88.9	50.0	90.0
Falling objects	77.1	75.8	73.8	75.0	75.5
Machines	88.9	92.2	89.7	86.5	89.5
Pressure vessel	100.0	100.0	75.0	0.0	87.5
Explosives	25.0	60.0	80.0	50.0	55.6
Electricity	68.4	80.0	81.8	87.1	78.5
<b>Total cases</b>	<b>73.8</b>	<b>78.2</b>	<b>70.2</b>	<b>73.7</b>	<b>74.0</b>

**Table 13.5 Predicted versus actual workplace deaths: number and percentage of actual. By year and External Cause code category for selected External Cause code categories and overall. Australia, 1982 to 1984**

Category	1982			1983			1984			Total		
	Predict <sup>1</sup>	Actual <sup>2</sup>	% <sup>3</sup>	Predict <sup>1</sup>	Actual <sup>2</sup>	% <sup>3</sup>	Predict <sup>1</sup>	Actual <sup>2</sup>	% <sup>3</sup>	Predict <sup>1</sup>	Actual <sup>2</sup>	% <sup>3</sup>
Rail crew	7.5	9	83	6.0	5	120	9.8	10	98	23.3	24	97
Off road transport	10.8	10	108	10.8	4	271	13.1	10	131	34.8	24	145
Water transport	13.0	9	144	9.1	7	131	9.1	6	152	31.2	22	142
Air transport	3.0	2	152	11.2	5	223	7.1	5	142	21.3	12	178
Powered vehicle at worksite	1.0	1	100	5.0	3	167	2.0	2	100	8.0	6	133
Gassing - not CO/CO2	2.9	1	286	4.0	2	200	1.7	0	-	8.6	3	286
Fall - ladder/scaffold	7.9	10	79	10.6	12	88	7.3	9	81	25.7	31	83
Animal attack	2.7	2	133	2.7	2	133	0.0	0		5.3	4	133
Cave-in	6.3	6	105	4.5	4	113	4.5	4	113	15.3	14	109
Falling objects	42.3	47	90	30.9	28	111	38.5	37	104	111.7	112	100
Machines	70.7	69	102	50.1	48	104	52.8	52	101	173.5	169	103
Pressure vessel	1.8	1	175	0.0	0	-	4.4	4	109	6.1	5	123
Explosives	2.8	4	69	2.8	2	139	2.8	4	69	8.3	10	83
Electricity	38.5	25	154	37.7	32	118	22.8	20	114	98.9	77	128
Sub total	211.0	196	108	185.4	154	120	175.8	163	108	572.2	513	112
Unknown		1			1			3	0		5	
Other		118			116			98	0		332	
Total	354.1	315	112	311.0	271	115	294.9	264	112	960.5	850	113

1: Predicted number of deaths, based on proportions determined from WRFS 2 and Deaths Data information for the relevant time period.

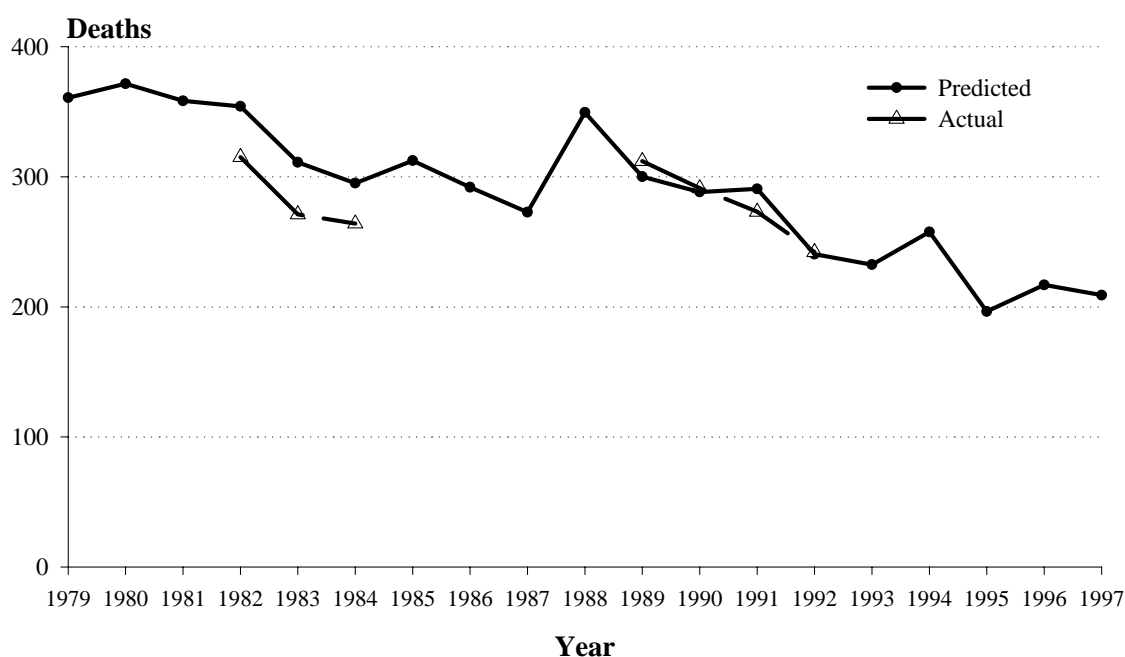
2: Actual number of deaths identified in WRFS 1 for the relevant time period.

3: Predicted deaths as a percentage of actual deaths.

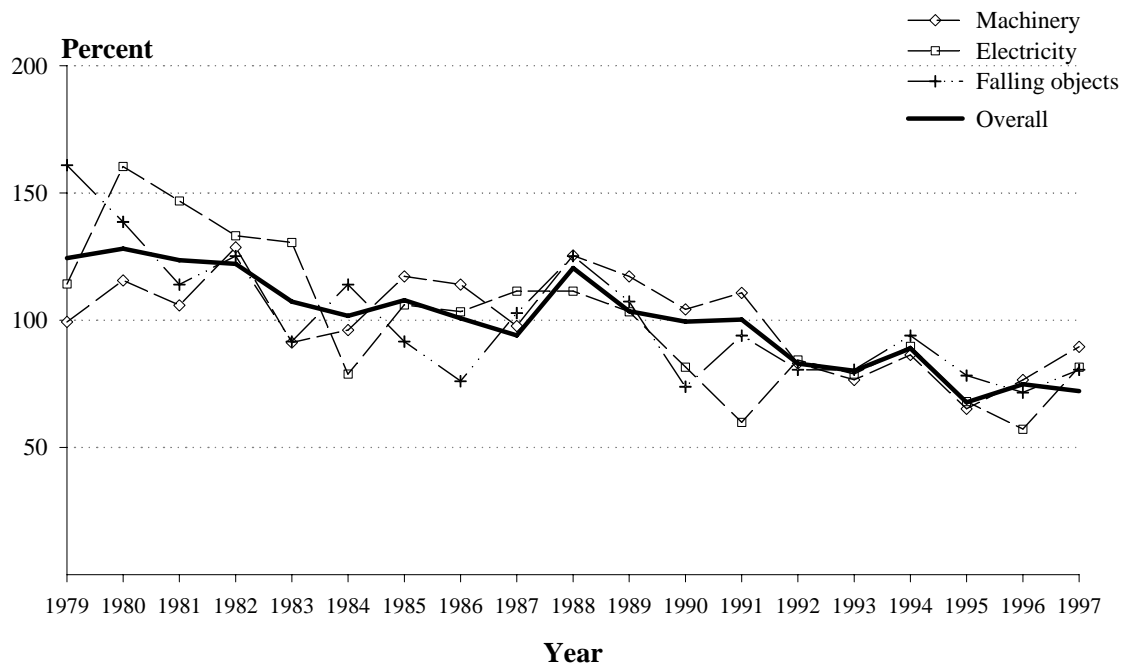
### 13.3.3 PREDICTING DEATHS

Having validated the selected predictor categories and percentages, these were applied to the deaths data from the years 1979 to 1997 inclusive, resulting in predicted number of overall, and category-specific, work-related deaths for each of the years. The overall deaths showed a gradual decline over the period, with the exception of a considerable increase in 1988 (Figure 13.1). Compared to the average value in the first three years (1979 to 1981) of 364, the average value in the final three years (1995 to 1997) of 207 was 43% lower. A similar appearance, but with more variation, was seen for the numbers in the main specific categories: machinery, falling objects, electricity and off-road transport (Figures 13.2 and 13.3).

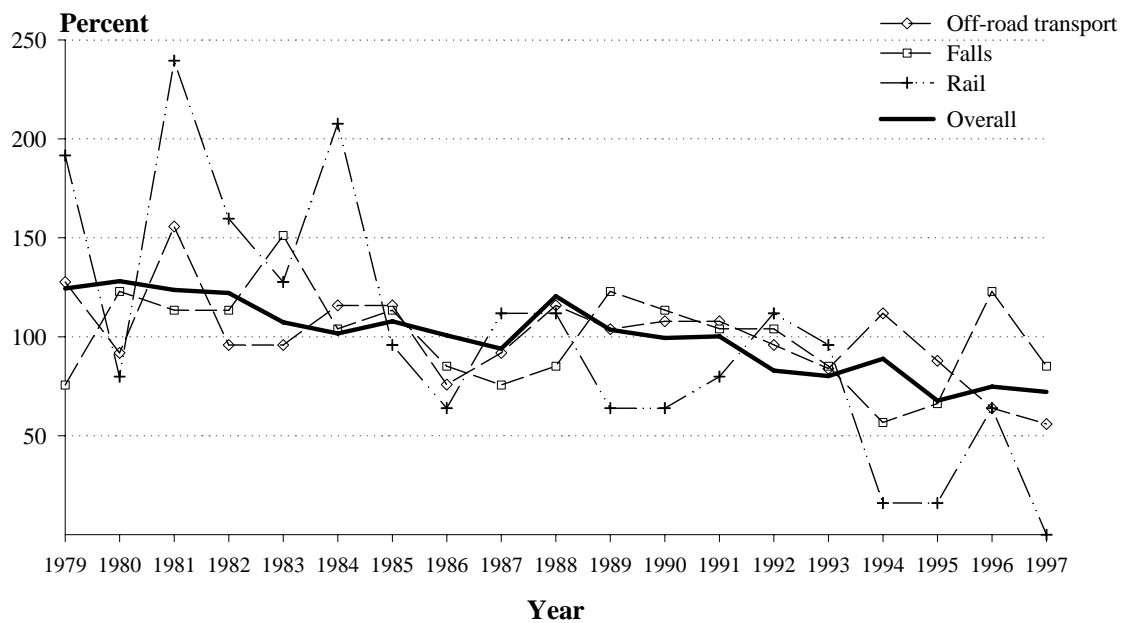
**Figure 13.1 Predicted workplace deaths, 15 to 64 years only  
Number. Australia, 1979 to 1997**



**Figure 13.2 Predicted workplace deaths - selected categories  
15 to 64 years only. Standardised to average numbers  
Number. Australia, 1979 to 1997**

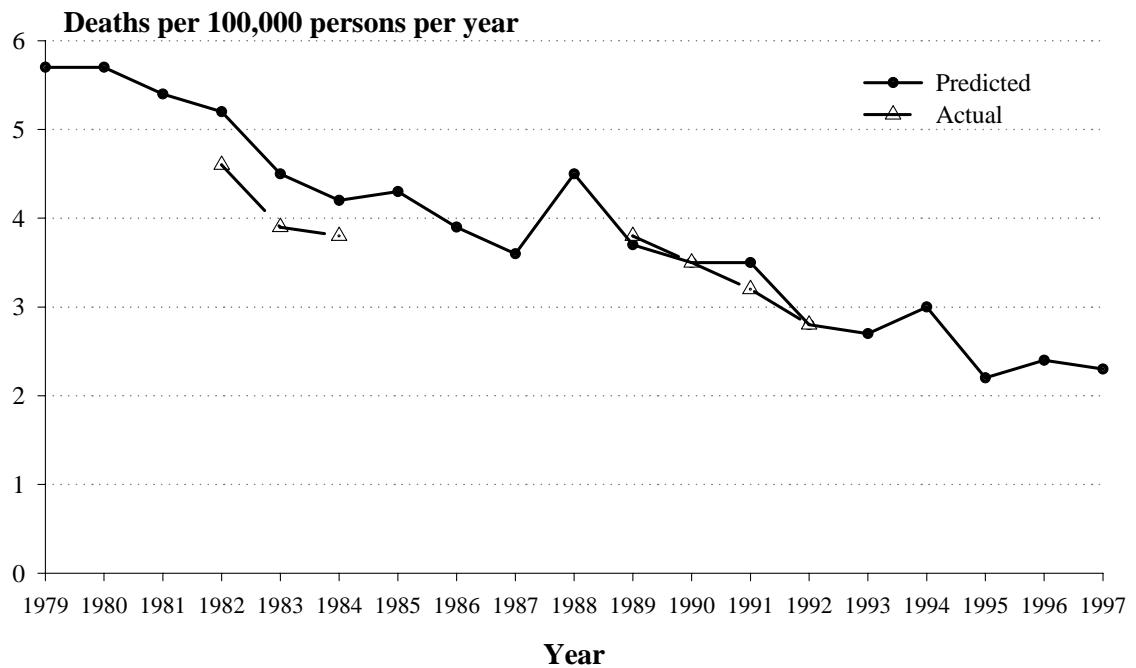


**Figure 13.3 Predicted workplace deaths - other selected categories  
15 to 64 years only. Standardised to average numbers  
Number. Australia, 1979 to 1997**

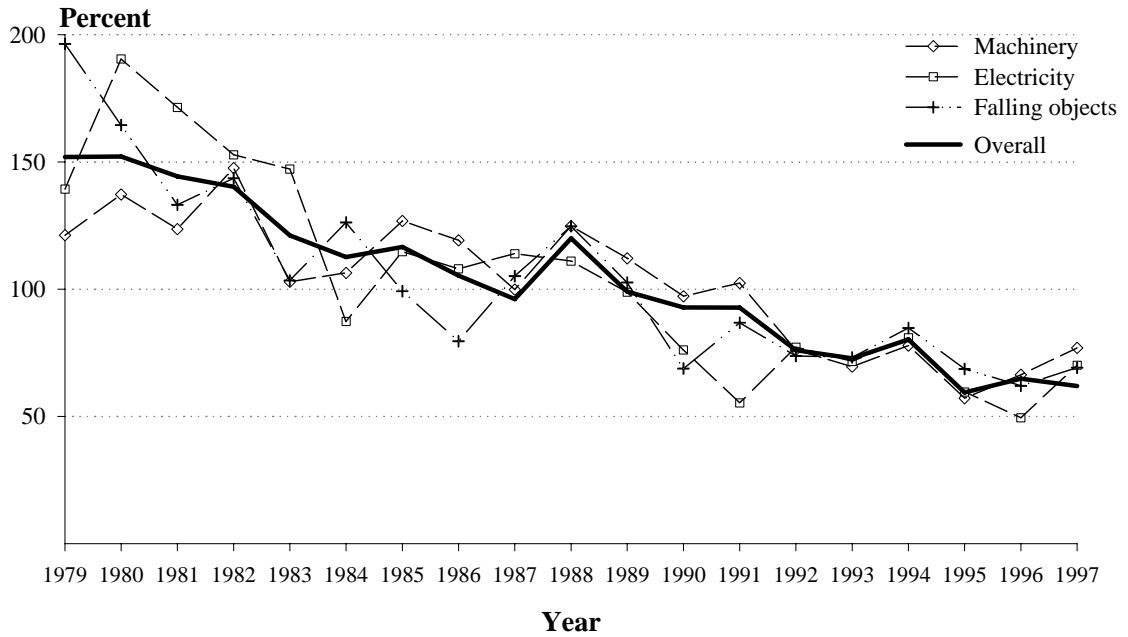


The results are more meaningful if expressed as rates, thereby taking into account changes in the size of the working population. Rates showed a similar, but steeper, gradual decline, with the average annual rate for the final three-year period of 2.31 being 58.5% lower than the average initial three-year value of 5.57. This represents an average fall of 3.1% per year (Figure 13.4). The main specific categories again reflected the trend for the overall work-related deaths. As might be expected, the smaller specific categories generally fluctuated considerably. Notwithstanding the interpretation problems caused by this fluctuation, rail transport deaths appeared to decline considerably, especially from the early 1990s (Figures 13.5 and 13.6).

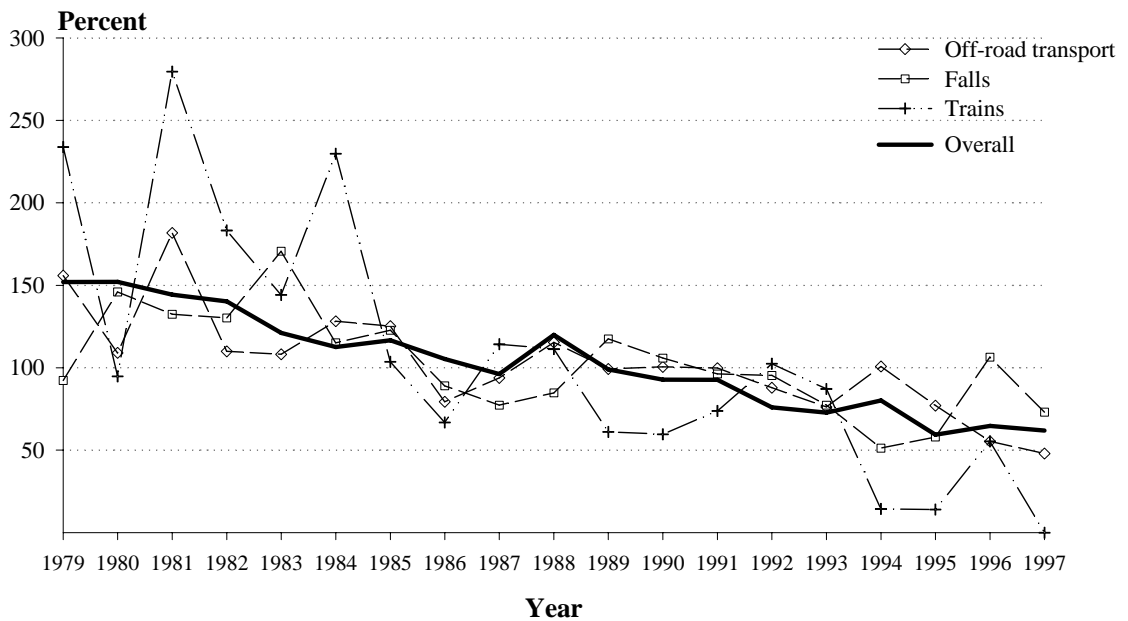
**Figure 13.4 Predicted workplace death rate  
15 to 64 years only. Australia 1979 to 1997**



**Figure 13.5 Predicted workplace death rates - selected categories  
15 to 64 years only. Standardised to average rate  
Australia, 1979 to 1997**



**Figure 13.6 Predicted workplace death rates - other selected categories  
15 to 64 years only. Standardised to average rate  
Australia, 1979 to 1997**

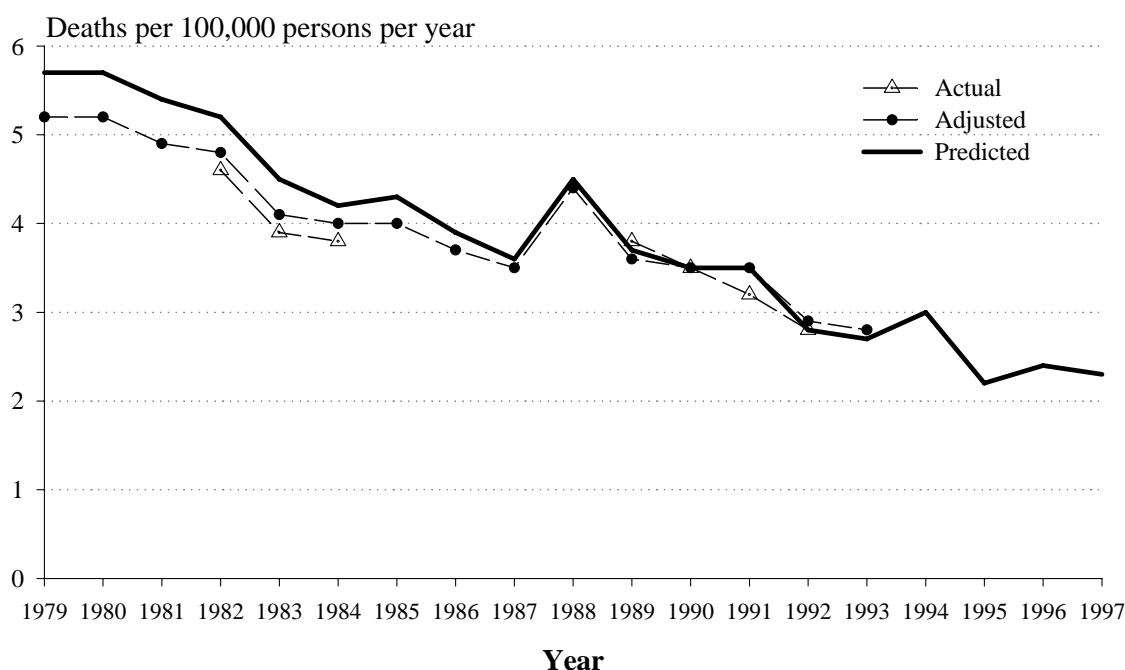


### 13.3.4 ADJUSTING THE RATES BY INDUSTRY MIX

The industry-adjusted rates in the first few years of the study period were about eight percent below the unadjusted rates. By 1988 the adjusted rates were within two percent of the unadjusted rates, and in the last two years for which adjusted data were available, 1992 and 1993, the adjusted rates were three or four percent higher (Figure 13.7).

Using the adjusted data, and the average rate for 1979 to 1981 compared to the average of 1991 to 1993, the rate of workplace death fell approximately 2.6% per year for the 15 years between 1979 and 1993.

**Figure 13.7 Predicted workplace death rates - crude and industry adjusted 15 to 64 years only. Australia 1979 to 1997**



## 13.4 DISCUSSION

This analysis aimed to use data from two specific studies of work-related deaths to estimate work-related deaths for periods between and adjacent to the study periods.

This provided estimates of the number of workplace deaths in Australia over two decades, information that is not available from any other source. The results suggest

that there was a fairly steady decline in the number and rate of workplace deaths from 1979 to 1997. Only a small proportion of this decrease appeared to be due to changes in the industry mix of the workforce.

The analysis does not provide information on the cause of this decline, but the specific category results suggest that it was seen in most major circumstances. The mid to late 1980s was a time of major change in approach to OHS in Australia, with Robens-style legislation<sup>272</sup> introduced in most States and Territories. The effects of this approach could be expected to be seen gradually from the late 1980s onwards. Since the decline in fatality rate was fairly steady from 1979 to 1997, the results do not indicate any major effect of this change in approach. Instead, they suggest a gradual improvement in OHS over the last two decades. This is not to say the changed approach has not been worthwhile, but the data do not provide any evidence of its specific effectiveness in preventing fatalities over and above whatever changes were already happening that were reducing the fatality rate. Data on non-fatal work-related injury in Australia suggest a similar gradual decline in the 1990s, but information prior to 1991 is not available<sup>275</sup>. Information on fatality rates in the 1980s and 1990s in the United States<sup>53, 224, 228-230</sup>, New Zealand<sup>67</sup> and Italy<sup>199</sup> suggest a similar decline to that seen in Australia.

Unfortunately, industry-specific information on the rate of work-related traumatic death was not available except for the period of the fatalities studies. Such information might provide a better insight into the causes of the apparent decline in rates, since it may well be that, as found in WRFS 2, not all industries changed in the same way and at the same times. Changes in industry-specific rates, related to specific prevention activities, are often useful measures with which to evaluate the effectiveness of the prevention approaches. There was also no information provided on work-road deaths, as these

were seen to be too small a component of the total road deaths to be able to be usefully predicted by the approach used here.

The difference between the predicted and adjusted lines indicates the extent to which major changes in industry distribution of the workforce, rather than changes in OHS, contributed to a decline in fatality rates. Approximately 20% of the apparent decline appears to have been due to industry changes. However, indirect standardisation was used (because the data to allow direct standardisation were not available), and this does not completely control for the effects of confounding due to industry mix changes<sup>264</sup>, so the industry contribution may have been higher. Comparison between WRFS 1 and WRFS 2 rates, which could be directly standardised, found that about 40% of the apparent decline was due to industry changes (see Chapter 6). Also, the approach assumes that the relative mix of hazards and associated risks between industries remained constant, which seems a reasonable assumption, but one for which there is little information to support or refute.

#### **13.4.1 ASSUMPTIONS UNDERLYING THE METHOD**

The analysis was based on several assumptions that should be tested where possible, and the results raise a number of questions. The first assumption is that there are particular External Cause code categories for which a high proportion of the deaths were workplace deaths (as defined earlier). This seems logical, based on External Cause code definitions, and was clearly shown to be true for this analysis (see Tables 13.2 and 13.3). Categories with high proportions of workplace deaths were chosen because changes in the number of deaths in these categories are more likely to sensitively reflect changes in workplace safety than are categories with very few workplace deaths.

The second assumption is that the proportion in these categories stays roughly the same over time. The year-specific analysis of WRFS 2 data showed that this was the case for the years of the study, although more so for some categories than others (see Table 13.4). Of the chosen categories, those with larger numbers tended to have the most stable proportions. Those with smaller numbers, or covering deaths likely to occur in clusters (such as air transport deaths), tended to show much more yearly fluctuation in their proportions. However, the indicator was deliberately developed to include many different categories. This had the disadvantage that some categories with small numbers or clustered events were included, but it also allowed most types of fatal workplace event to be covered to some extent, so the indicator was more representative, and increased the likelihood that random fluctuations in categories would balance each other out. The results suggest this approach was successful, with the total proportion of deaths in the selected categories only varying from 70% to 78% in the four years of WRFS 2. The validation using these proportions to predict the number of deaths during the WRFS 1 period (1982 to 1984) suggests that the assumptions held for years other than those covered by WRFS 2 (1989 to 1992). The predicted numbers were about 12% higher than the “actual” numbers (ie those identified in WRFS 1) for each of the three years (see Table 13.5). Allowing for the uncertainties inherent in the analytical approach, this degree of disagreement is certainly acceptable. Although there are many possible explanations for the 12% difference, the most likely one is that the observed numbers of WRFS 1 deaths were actually an underestimate of the true number of workplace deaths, either because of problems identifying the deaths from the coronial files, and/or incomplete application of External Cause codes by the ABS to external cause deaths. The possibility of underestimation due to study factors was mentioned by the WRFS 1 study team in their main paper<sup>4</sup>, but this cause is not likely to account for

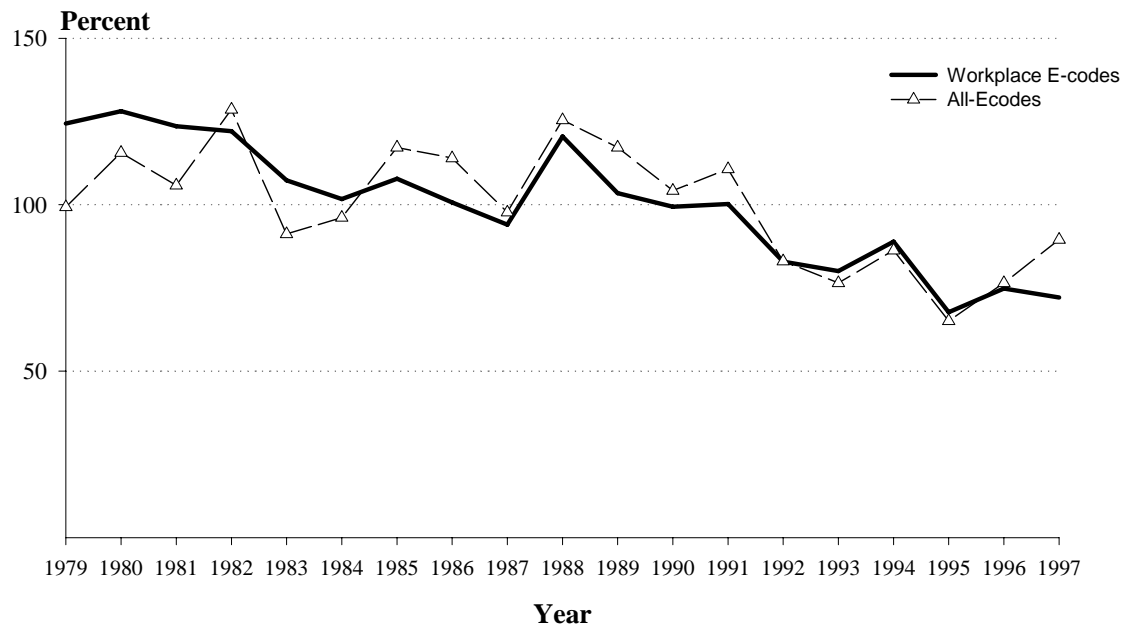
the full 12% difference. The extent of possible problems with application of the External Cause codes is not known.

A third assumption is that the proportion of workplace deaths covered by the chosen categories remained constant over time for the nineteen years covered by the analysis. This was certainly true for the four years covered by WRFS 2, during which time the percentage varied only from 56% to 63%. A change in the relative mix of hazards and associated risks could cause a departure from this assumption. This could happen if one sector of the workforce had a major change in technology or approach to OHS whilst most other sectors did not. However, it is more likely that changes would occur very slowly over time and would occur across most of the workforce. Therefore, it is likely that this third assumption is satisfied.

The approach used in this analysis was not specifically designed to provide information on trends in workplace deaths for single External Cause code categories. The number of deaths in single categories is more prone to be affected by significant variation due to random factors or isolated changes in coding practice. However, data for categories with a larger number of deaths are likely to be more stable. Validation with WRFS 1 data suggests that the data for the machinery category was most reliable, and falling object, falls, rail crew and cave-in categories reasonably so. This finding is consistent with deaths in these categories, especially machinery deaths, being likely to be allocated an appropriate External Cause code and to be adequately documented in coronial files, and so likely to be correctly identified as being work-related or not. Therefore, results for these specific categories can be considered to be reasonably reliable. The overall rates showed a largely consistent decline over the 19 years. However, both the numbers and the rates showed a prominent peak in 1988. The rate in 1987 was 20% lower than

that in 1988 and that in 1989 was 18% lower than that in 1988, much bigger changes than in any other year (although there was a considerable drop in 1995). The predicted numbers could be considered consistent with two parallel lines, one from 1979 to 1987, and another from 1988 to 1997. This raises the possibility of a change introduced in 1988. The most obvious cause for this would be a change in coding practice, with external cause deaths preferentially coded to the categories of interest in the study. If that was the case, the overall External Cause code rates would not show an increase. However, as seen in Figure 13.8, the rates for all non-suicide External Cause code deaths (suicides have been excluded in the presented results) show a similar increase in 1988. That is, whatever happened in 1988 resulted in an increase in many types of external cause deaths. Such a result might be caused by change in coding practice leading to deaths being assigned an External Cause code, whereas previously they would not have been given one. It seems unlikely that this would happen to a major degree. If it happened in a single State or Territory the change would be obvious in the deaths data from that jurisdiction, but there was no such change seen when examining the data on a State and Territory-specific basis. Nor were there obvious differences when the data were examined on the basis of age, gender or when looking at specific categories. Therefore, the apparent peak in 1988 remains unexplained, and may just represent an extreme example of the expected random variability from year to year. Interestingly, this rise in 1988 was seen for three of the major specific categories (see Figures 13.5 and 13.6).

**Figure 13.8 Predicted workplace deaths compared with all non-suicide external cause deaths, 15 to 64 years only. Standardised to average numbers. Number. Australia, 1979 to 1997**



The approach used here would not be necessary if there was a method for easily identifying work-related traumatic deaths in a consistent and on-going basis. This could be at least partially achieved if death certificates included a facility to identify deaths that were related to work exposures (such as is in existence in the United States), and the routine deaths data recorded this information. Although there are definite limitations to such an approach, there are also many strengths<sup>34</sup>, and the inclusion of such information would be a major improvement on the current situation in Australia. A related approach could be to use the developing National Coroners Information System, which has the potential to provide more robust assessment of work-relatedness. A work-related identifier based on this assessment could be provided to the ABS and linked to the other information in the Deaths Data system. Also, ICD-10, which is now in use for coding deaths, includes an "Activity" data element that has a category for "working for income". This has the potential to allow the work-related traumatic deaths of workers to be easily identified from routine deaths data.

### 13.5 CONCLUSION

In conclusion, on the basis of the results from this analysis, there was a steady decline in the rate of work-related fatal injury in workplaces in Australia from 1979 to 1997 inclusive, with the only exception being an increase around 1988. The decrease was about 2.6% per year. Industry changes in the workforce account for part of the difference, but probably less than half. The increase in 1988 does not appear to have been due to industry changes or major changes in coding approach, and is probably due to random variation. The first work-related fatalities study (WRFS 1) slightly undercounted workplace deaths, but not to a large extent. The approach used here has shown that routine deaths data can provide useful information on trends in work-related fatalities over time. However, the usefulness of this information would be vastly improved if the routine deaths data directly identified work-related deaths reliably.