

Chapter 12

External Cause codes

12.1 INTRODUCTION

All deaths in Australia are supposed to be assigned an ICD cause of death code. During the period covered by the study, ICD-9 was the ICD version being used. Under ICD-9, all external cause deaths should be assigned an ICD-9 external cause code, otherwise known as an External Cause code. The ICD system is used for routine monitoring of deaths in most countries, and most countries do not have a system for easily identifying work-related deaths. Monitoring External Cause codes is a potential mechanism for monitoring work-related fatal injury. Therefore, it is important to understand which External Codes are allocated to the main work-related categories of interest. The External Codes allocated to the deaths identified in this study are considered in this Chapter. The usefulness of External Cause codes for long-term surveillance of work-related injury deaths is considered in Chapter 13.

12.2 WORKING CASES

Overall, the single biggest External Cause code category was “Motor vehicle traffic accidents” (MVTAs), which accounted for 31% of the working deaths and, as expected, virtually all the work-road deaths. External Cause code categories covering machinery, falling objects, aircraft crashes, falls and electricity each accounted for more than six percent of working deaths and ten percent of workplace deaths, with machinery accounting for 20% of the workplace deaths (Table 12.1).

Compared to men, considerably higher proportions of women were assigned External Cause codes indicating deaths due to MVTAs or assault, with much lower proportions assigned External Cause codes indicating deaths due to falling objects, machinery or electricity (Table 12.2).

The main age-related differences were higher proportions of death of persons 65 years or older coded to falls or machinery External Cause code categories (Table 12.3).

Table 12.1 External Cause code categories - workplace, work-road and working deaths. Number and percent. Australia, 1989 to 1992

External Cause code category	Workplace		Work-road		Working	
	Number	%	Number	%	Number	%
Railways	18	1.4	1	0.2	19	1.1
Motor vehicle traffic accident	31	2.5	520	95.8	551	30.8
Motor vehicle non-traffic accident	75	6.0	5	0.9	80	4.5
Other road vehicle accident	26	2.1			26	1.5
Water transport	56	4.5			56	3.1
Air transport	118	9.5			118	6.6
Vehicle accident nec	11	0.9			11	0.6
Accidental poisoning	19	1.5			19	1.1
Falls	117	9.4			117	6.6
Fire and flames	10	0.8	1	0.2	11	0.6
Environmental factors	34	2.7			34	1.9
Submersion, suffocation, etc	56	4.5	1	0.2	57	3.2
Falling objects	128	10.3	2	0.4	130	7.3
Strike against/struck by	13	1.1			13	0.7
Caught in/between	3	0.2			3	0.2
Machinery	253	20.3	3	0.6	256	14.3
Cutting/piercing	4	0.3			4	0.2
Pressure vessels	7	0.6			7	0.4
Firearm missile	20	1.6			20	1.1
Explosives	10	0.8			10	0.6
Hot/corrosive material	2	0.2			2	0.1
Electricity	116	9.3			116	6.5
Other/unspecified	14	1.1	5	0.9	19	1.1
Late effects of accidents	6	0.5			6	0.3
Adverse effects of therapeutics, etc	1	0.1			1	0.1
Assault	48	3.9	1	0.2	49	2.7
Uncertain intent	6	0.5			6	0.3
Unknown	42	3.4	4	0.7	46	2.6
Total	1,244	100.0	543	100.0	1,787	100.0

**Table 12.2 External Cause code categories by sex - working deaths
Percent. Australia, 1989 to 1992**

External Cause code category	Male	Female	Total	
	(%) n = 1,696	(%) n = 91	Number	%
Railways	1.1	-	19	1.1
Motor vehicle traffic accident	30.2	42.9	551	30.8
Motor vehicle non traffic accident	4.4	5.5	80	4.5
Other road vehicle accident	1.4	3.3	26	1.5
Water transport	3.2	2.2	56	3.1
Air transport	6.8	3.3	118	6.6
Vehicle accident nec	0.6	-	11	0.6
Accidental poisoning	1.1	-	19	1.1
Falls	6.6	5.5	117	6.6
Fire and flames	0.6	1.1	11	0.6
Environmental factors	1.8	4.4	34	1.9
Submersion, suffocation, etc	3.1	3.3	57	3.2
Falling objects	7.7	-	130	7.3
Strike against/struck by	0.7	1.1	13	0.7
Caught in/between	0.1	1.1	3	0.2
Machinery	14.8	5.5	256	14.3
Cutting/piercing	0.2	-	4	0.2
Pressure vessels	0.4	-	7	0.4
Firearm missile	1.2	-	20	1.1
Explosives	0.6	-	10	0.6
Hot/corrosive material	0.1	-	2	0.1
Electricity	6.7	2.2	116	6.5
Other/unspecified	1.1	-	19	1.1
Late effects of accidents	0.4	-	6	0.3
Adverse effects of therapeutics, etc	-	1.1	1	0.1
Assault	2.1	15.4	49	2.7
Uncertain intent	0.4	-	6	0.3
Unknown	2.6	2.2	46	2.6
Total	100.0	100.0	1,787	100.0

**Table 12.3 External Cause code categories by age - working deaths
Percent. Australia, 1989 to 1992**

External Cause code category	<15	15-64	>64	Total	
	% n=13	% n = 1681	% n = 92	Number	%
Railways	-	1.1	1.1	19	1.1
Motor vehicle traffic accident	38.5	31.5	17.2	551	30.8
Motor vehicle non traffic accident	23.1	4.1	8.6	80	4.5
Other road vehicle accident	7.7	1.5	-	26	1.5
Water transport	-	3.3	1.1	56	3.1
Air transport	-	7.0	1.1	118	6.6
Vehicle accident nec	-	0.6	1.1	11	0.6
Accidental poisoning	-	1.1	1.1	19	1.1
Falls	-	6.3	11.8	117	6.6
Fire and flames	-	0.5	2.2	11	0.6
Environmental factors	-	1.8	4.3	34	1.9
Submersion, suffocation, etc	-	3.1	3.2	57	3.2
Falling objects	15.4	7.3	5.4	130	7.3
Strike against/struck by	-	0.7	1.1	13	0.7
Caught in/between	-	0.2	-	3	0.2
Machinery	15.4	13.9	22.6	256	14.3
Cutting/piercing	-	0.2	0.0	4	0.2
Pressure vessels	-	0.4	0.0	7	0.4
Firearm missile	-	1.1	1.1	20	1.1
Explosives	-	0.6	-	10	0.6
Hot/corrosive material	-	0.1	-	2	0.1
Electricity	-	6.7	3.2	116	6.5
Other/unspecified	-	1.1	1.1	19	1.1
Late effects of accidents	-	0.3	1.1	6	0.3
Adverse effects of therapeutics, etc	-	0.1	-	1	0.1
Assault	-	2.7	4.3	49	2.7
Uncertain intent	-	0.2	2.2	6	0.3
Unknown	-	2.4	5.4	46	2.6
Total	100.0	100.0	100.0	1,787	100.0

The allocated External Cause codes had the same definition as the mechanisms allocated by WRFS 2 coders for a majority of the main mechanisms, but for many mechanisms there was a considerable number of deaths allocated a very different External Cause code. The relationships between the allocated External Cause codes and mechanisms are summarised in the following paragraphs.

12.2.1 FALLS

Of the 170 falls, 112 (65.8%) were allocated a fall External Cause code (E8810 – E8889), with buildings (E8829: 23.5%), ladders (E8810: 11.1%) and scaffolds (E8811: 8.8%) the largest single External Cause code categories related to falls. Another 15 (8.8%) deaths were coded to animal riding (E8282) and 18 (10.6%) deaths to machinery (E919), with 14 of these involving lifting equipment (E9192) such as cranes or forklifts.

12.2.2 FALLING OBJECTS

Of the 180 deaths due to being hit by falling objects, 112 (62.2%) were allocated a falling object External Cause code (E916). Another 43 (23.9%) were allocated a machinery External Cause code, with 24 of these involving lifting equipment.

12.2.3 ANIMALS

Of the 20 deaths coded to being hit by an animal, 12 (60.0%) were coded to the injury caused by animals External Cause code (E906), and another five (25%) were coded to animal riding (E8282).

12.2.4 TRAPPED BY MACHINERY

Forty-one (95.4%) of the forty-three deaths due to being trapped by machinery were allocated a machinery External Cause code. In contrast, only 24 (61.5%) of the 39 deaths due to being trapped between machinery were allocated a machinery External Cause code, with another twelve (30.8%) allocated vehicle accident External Cause codes (E810 – E848).

12.2.5 HIT BY MOVING OBJECTS

Two hundred and sixteen working deaths involved the residual hit by moving object category, which included pedestrians hit by vehicles, whether or not this occurred on a public road. Of these 216, 69 (31.9%) were assigned a machinery External Cause code,

63 (29.2%) a motor vehicle traffic accident External Cause code (E810 - E819) and 31 (14.4%) a motor vehicle non-traffic accident External Cause code (E820 – E825).

12.2.6 ELECTROCUTION

One hundred and thirteen (96.6%) of the 117 electrical deaths were coded to electric current External Cause codes (E925), with industrial wiring (E9252: 27.4%), power generating plants (E9251: 25.6%), other electric current (E9258: 21.4%) and domestic wiring (E9250: 16.2%) the most common single categories.

12.2.7 DROWNING

Of the 105 drowning deaths, 44 (41.9%) were allocated a water transport accident External Cause code (E830 - E838) and 29 (27.6%) an accidental drowning External Cause code (E910). Another 14 (13.3%) deaths had unknown External Cause codes because they did not appear on the ABS Deaths Data List, only being picked up by checking all individual coronial files.

12.2.8 ACCIDENTAL SHOOTING

Twenty two people who were accidentally shot (and another accidentally stabbed). Of these 22 accidental shootings, 20 (90.9%) were assigned accidental shooting External Cause codes (E922), with one of the remaining two having an unknown cause of death (E7999) and the External Cause code for the other not known.

12.2.9 HOMICIDE

Fifty persons were deliberately injured – 28 shot, 10 stabbed, seven hit with something, three involved in motor vehicle incidents, one drowned and one assaulted without a weapon. Forty eight (96%) of the 50 deaths were assigned homicide External Cause codes. The 28 people who were shot were all allocated firearm External Cause codes (E965), and the 10 people who were stabbed were allocated stabbing External Cause

codes (E966). Five of the seven persons who were hit with something were coded to assault by blunt object (E9682), with the other two allocated stabbing (E966) and unspecified homicide (E9689) External Cause codes. The three persons murdered in motor vehicle incidents were all allocated different External Cause codes - MVTA (E8120), other specified homicide (E9688) and unspecified accident (E9289). The person who was drowned was coded to assault by submersion (E9649), and the remaining person correctly coded to unarmed fight (E960).

12.2.10 VEHICLE CRASHES

There were 653 deaths due to vehicle crashes, with 471 (72.1%) assigned MVTA External Cause codes and 115 (17.6%) assigned air transport accident External Cause codes (E840 – E845). Of the 121 deaths due to aircraft crashes, 114 (94.2%) were assigned air transport accident External Cause codes.

12.3 WORK-ROAD DEATHS

One of the main categories of interest in the study was work-road deaths: persons who fatally injured in motor vehicle incidents on public roads. There were 543 work-road deaths identified as occurring during the study period. No single WRFS 2 mechanism code identified these deaths, although 98% were in two mechanism categories: 470 (86.6%) were coded as vehicle incidents and another 61 (11.2%), nearly all of whom were pedestrians, as being hit by moving objects.

The External Cause code system also has a group of categories that are supposed to cover deaths due to motor vehicle incidents on public roads: motor vehicle traffic accidents (E810 – E819). However, in practice, External Cause codes cannot be used to identify all work-road deaths. Any incident that involves one or more motorised

vehicles or other motorised mobile plant or equipment is classified as a “Motor vehicle traffic accident” (MVTA) if it occurs on a public road. If it does not occur on a public road, it is classified as a “Motor vehicle non-traffic accident” (MVNTA) if a motor vehicle is involved, or as an equipment incident if mobile plant or equipment is involved. Codes E810 - E819 cover the traffic accidents and E820 – E825 cover the non-traffic accidents.

Road vehicle incidents involving only “vehicles” other than motor vehicles or motorised plant or equipment are coded under another set of codes: E826 – E829. Bicycles, animals and animal-drawn vehicles are included here. This External Cause code group does not separately identify incidents that occur on public roads and those that do not occur on public roads. Therefore, if only incidents that occur on public roads are of interest, incidents in the E826-E829 range can’t be included, even though some of them would have occurred on a public road.

A corollary of this is that incidents involving the same type of vehicle or equipment can be classified differently depending on where the incident occurs. For example, a tractor overturning while travelling on a highway between farms is classified in ICD9 as a traffic accident, whereas a tractor overturning on a farm road, or while ploughing a field, is classified as a “machinery accident”. Very similar incidents can be classified as traffic or non-traffic depending on whether the road on which they occur happens to be public or private. Examples are incidents in which a car or truck is travelling on a road and rolls over or collides with something. Conversely, very different incidents can be classified as “non-traffic” just because they both involved motor vehicles and did not occur on a public road. Examples are coal trucks running out of control on a mine site,

land-rovers colliding with wildlife on a forest road, and semi-trailers colliding with each other while travelling on a farm road.

Bearing in mind these issues, the External Cause codes for work-road and not work-road deaths were compared, and the available information for cases for which the WRFS 2 mechanism code and the assigned ABS External Cause code were apparently inconsistent was examined. For this comparison, the following definitions were used:

- MVTA: Motor vehicle traffic accident (E810 – E819)
- MVNNTA: Motor vehicle non-traffic accident (E820 – E825)
- Other RVA: Other road vehicle accident (E825 – E829)
- Work-road: transport-related incident that occurred on a public road and which resulted in the death of a worker (Table 12.4).

Table 12.4 Comparison of case status and ABS External Cause code classification - working deaths. Australia, 1989 to 1992

External Cause	Work-road	Non work-road	Total
MVTA	520	31	551
MV nonTA	5	75	80
Other RVA	0	26	26
Other	14	1,070	1,028
Unknown	4	42	46
Total	543	1,244	1,787

12.3.1 APPARENT WORK-ROAD DEATHS NOT CODED AS MOTOR VEHICLE TRAFFIC

ACCIDENT DEATHS

Twenty-three deaths that were coded in WRFS 2 as having been transport-related incidents on public roads were given External Cause codes that were inconsistent with this. Five of the deaths has been coded as MVNTA: one definitely occurred on a public road (ie ABS code wrong), one definitely occurred on a private road (ie ABS code correct), one occurred on a public road but it was not clear if it should be considered a transport-related incident, and for two it was not clear if the site was a public or private road (assume ABS wrong in these three). None of the deaths had been coded as other road vehicle accidents.

The remaining eighteen deaths had been assigned other or unknown codes: fourteen clearly fitted the ICD-9 definition of a motor-vehicle traffic accident (ie ABS wrong in all fourteen). Two more involved road construction and it wasn't clear if the site should be considered a construction site (and so not a public road) or a public road. They were probably best considered to be construction sites (ie ABS probably correct). Two remaining incidents occurred on public roads but probably were best considered not to be transport-related (ie ABS correct).

12.3.2 APPARENT WORKPLACE DEATHS CODED AS MOTOR VEHICLE TRAFFIC ACCIDENT DEATHS

Thirty-one deaths that were coded in WRFS 2 as NOT being due to transport-related incidents on public roads had been assigned External Cause codes identifying the incidents as motor vehicle traffic accident deaths. Of these, the ABS was clearly wrong in 30 cases. Most of the incidents involved motor vehicles, but did not occur on a public road. A few cases were clearly code entry errors by the ABS coder (eg 8102 instead of 9102). The one case that was probably coded incorrectly in WRFS 2

involved an empty van running down a public road, crashing through a fence and striking a tradesman in the front yard of a house. Since the incident started on a public road, it probably should have been coded as a work-road death in WRFS 2. These results are summarised in Tables 12.5 to 12.7.

Using the WRFS 2 codes, 543 deaths were identified as work-road deaths. Five of these were clearly NOT work-road deaths, and one clear work-road death was not included (sensitivity: $538/539 = 99.8\%$; specificity: $1,243/1,248 = 99.6\%$; accuracy = $1,781/1,787 = 99.7\%$) (Table 12.5). Using the ABS External Cause codes (for deaths classified in WRFS 2 as working deaths), 551 deaths would have been identified as being work-road deaths. Thirty of these were clearly NOT work-road deaths, and 18 clearly work-road deaths would not have been included (sensitivity: $521/539 = 96.7\%$; specificity: $1,218/1,248 = 97.6\%$; accuracy = $1,739/1,787 = 97.3\%$) (Table 12.6). Comparing ABS External Cause codes to WRFS 2 codes, 54/1,787 (3.0%) were coded differently (ie there was 97.0% agreement) (Table 12.7). This information suggests that there were probably 539 true work-road deaths that occurred in Australia during the period covered by WRFS 2.

**Table 12.5 Validity of WRFS 2 case status classification
Working deaths. Australia, 1989 to 1992**

		WRFS2 code		Total
		Work-road	Not work-road	
Truth	Work-road	538	1	539
	Not work-road	5	1,243	1,248
	Total	543	1,244	1,787

**Table 12.6 Validity of ABS External Cause code classification
Working deaths. Australia, 1989 to 1992**

		ABS External Cause code		Total
		Work-road	Not work-road	
Truth	Work-road	521	18	539
	Not work-road	30	1,218	1,248
	Total	551	1,236	1,787

**Table 12.7 Agreement between WRFS 2 cases status classification
and ABS External Cause code classification - working deaths
Australia, 1989 to 1992**

		ABS External Cause code		Total
		Work-road	Not work-road	
WRFS 2	Work-road	520	23	543
	Not work-road	31	1,213	1,244
	Total	551	1,236	1,787

12.4 DISCUSSION

The External Cause codes allocated to work-related deaths of workers illustrate the strengths and weaknesses of the ICD system. At a broad level, the External Cause codes allocated by the ABS had a high sensitivity and specificity for separating workplace deaths from work-road deaths. This is expected, since the ICD system is designed to be able to separately identify motor vehicle-related deaths that occur on a public road and motor vehicle-related deaths that do not occur on a public road.

The External Cause codes are less useful in terms of identifying the key mechanisms involved in certain work-related fatal incidents. The key mechanism in deaths resulting from falls (66% allocated a fall External Cause code), falling objects (62%) and being

trapped between machinery (62%) were not well identified by the allocated External Cause codes. Drowning deaths were particularly under-recognized using External Cause codes, with only 28% allocated a drowning code, and another 42% allocated a water transport accident code. In contrast, fatal incidents involving animals (85%), being trapped by machinery (95%), contact with electricity (97%) and homicide (96%) were very well identified by the allocated External Cause codes.

These findings do not necessarily indicate that the External Cause codes were wrongly assigned by the ABS coders. There were clearly some errors, most of which are likely to have arisen because the coder had incomplete information at the time of coding. However, most of the “problem” with using External Cause codes to identify specific types of incidents arises from the nature of the ICD system, which incorporates multiple axes into a single code, thereby making it difficult to identify all the occurrences of a particular type of incident characterised by only one the axes. The adoption of multiple cause of death coding in routine deaths data in Australia since 1997 has improved the situation somewhat, but some problems related to ICD structure (now ICD-10) remain.

This information indicates the usefulness of External Cause codes allocated by the ABS to deaths that have already been identified as work-related. However, it does not indicate whether or not External Cause codes are useful for identifying work-related deaths in routine data. They are potentially useful, because a significant proportion of deaths in certain External Cause code categories can be expected to be due to work. In fact, some External Cause codes at the four-digit level are specific to working persons, and a larger number of categories are likely to primarily include working persons. This issue is examined in Chapter 13.

12.5 CONCLUSIONS

External Cause codes allocated in routine data to work-related deaths are useful for some of the main injury circumstances in terms of identifying deaths that occurred due to those circumstances. However, for some other main injury circumstances, the External Cause codes were not very useful.