Suicide in the construction industry: an in-depth investigation of deaths occurring among Cbus Superannuation (Cbus) members, 2008.

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Executive summary

Problem statement

- Accuracy of data recording for causes of death among Cbus Superannuation (Cbus) members has previously been identified as a problem.

- This research assessed the accuracy of causes of death recorded among Cbus members for the year 2008 against accounts held in the National Coroners Information System (NCIS).

- The cases chosen for this investigation were those that were deemed as having the potential to be suicide.

- The report also provides information on the overall burden of suicide in the construction period in Australia over time.

Suicide in the construction industry over time in Australia

- An overview of general trends of suicide in the construction industry suggests that while there has been a decrease in the overall suicide rates in the industry, those in the lowest skilled groups are consistently at increased risk compared to higher skilled groups. Further, there was a slight increase in suicide among the lowest skilled jobs during the most recent 2007 recession.

Check of Cbus records against NCIS

- It was revealed that suicide accounted for approximately 12% of all deaths investigated in the Cbus records in 2008 (96 definite and probable suicides out of 802 of all death).

- Suicides were by young to middle-aged males. The main suicide method was hanging, followed by carbon monoxide poisoning and then firearms.

- About 64% of all suicides in the Cbus data set were employed at the time of death and the majority of cases were working in the construction industry. About 23% of cases were unemployed at the time of death.

Recommendations

From a prevention perspective, this study suggests that low skilled workers in construction should be prioritised in prevention and intervention initiatives. In terms of Cbus data recommendations, we would suggest that staff receive further training on how better to code death claims, which would make future data investigations easier. We would recommend that Cbus periodically checks data records against those held in NCIS as a form of quality control. This would help as part of the ongoing monitoring of suicide prevention activities.

Background on suicide in the construction industry

Elevated rates of suicide among construction workers have been identified in several areas of the world including Denmark (Agerbo, Gunnell, Bonde, Mortensen, & Nordentoft, 2007), Canada (Mustard et al., 2010), the USA (Kposowa, 1999; van Wijngaarden, 2003), the UK (Meltzer, Griffiths, Brock, Rooney, & Jenkins, 2008; Roberts, Jaremin, & Lloyd, 2012), Korea (Kim et al., 2006) and Queensland (Andersen, Hawgood, Klieve, Kolves, & De Leo, 2010; Heller, Hawgood, & Leo, 2007). To some extent, this may be connected to the demographic characteristics of the workforce, which is largely comprised of males (ABS, 2012). In Australia and in many other countries, the rate of suicide among males is between three and four times that of women (ABS, 2013). Past research also suggests that suicide among construction workers is connected to excessive alcohol consumption, lack of help seeking, and relationship problems (Gullestrup, Lequertier, & Martin, 2011; Heller et al., 2007). The health of workers in the industry is particularly impacted by poor psychosocial working conditions, including high demand, low job control or autonomy, job insecurity, and poor workplace support (A. D. LaMontagne, Keegel, Vallance, Ostry, & Wolfe, 2008; Vanroelen, Levecque, & Louckx, 2010).

Overview of this report

This research on suicide in the construction industry was commissioned by Cbus Superannuation (Cbus). Cbus is one of Australia's largest industry funds with more than 655,000 members, 75,000 participating employers and assets over $18 billion (AUD). It is a national fund covering the entire construction, building and allied industry workforce. Cbus promotes the health and wellbeing of its members, and invests considerably in a number of industry-specific mental health and suicide prevention activities in construction.

A broad objective of the report is to provide a description of suicide within the construction industry. More specifically, this report provides information on the number of suicides among Cbus members in the year 2008. In addressing these two objectives, the report begins by providing an overview of suicide in the construction industry over time in Australia, with a particular focus on differences by occupational skill level. Following this, an in-depth analysis of Cbus death claims are examined against the data recorded in the National Coroners Information System. The analysis will focus on the year 2008 from all states and territories of Australia and describe the final causes of death and other details for a range of death cases. The motivation for this investigation is described below.

The need to compare death claims held in the Cbus dataset against those held in NCIS

In the event of a death, the family member or another proxy such as a close friend or partner (claimant) contacts the call centre at Cbus. Once this occurs, the Cbus case manager sends out a claim form and requests specific information such as the death certificate, the will, the completed claim form and other information, as deemed necessary on a case-to-case basis.

Cbus has no suicide exclusion clause and, in the occurrence of the death of one of its members, pays out claims to the next-of-kin or other person close to the deceased regardless of the cause of death. In the case of external causes of death, such as suicide, the final cause of death may not be immediately available as these cases need to undergo a coronial review process. This creates problems in understanding how many actual deaths are due to suicides as many cases are unresolved at the time the claim is made to Cbus. Further, it is likely that suicide is not accurately recorded in all cases. Thus, a number of suicides maybe miscoded in other categories of deaths, particularly in those recorded as "subject to a coronial review process" and deaths of unknown intent.

How the research conducted by the University of Melbourne can help resolve the cause of death in Cbus records

This research reconciled causes of death among Cbus members for the year 2008 with those held in the National Coroners Information System (NCIS). The cases chosen for this investigation were those that were deemed as having the potential to be suicide, as well as cases in which the cause of death was ambiguous. Examples of these include: cases where the method of death had a high probability of being suicide based on Cbus records (e.g., hanging, or suicide), external causes of death (e.g., a cause of death listed as "multiple injuries"), or where the cause of death was ambiguous (e.g., "unknown", "undetermined" or "subject to coronial review").

The year 2008 was chosen for examination because it was thought likely that the majority Cbus death cases would be finalised and closed by the coroner's office at the time this project was being conducted. One year only was chosen in order to assess the feasibility of matching the Cbus data to the NCIS data set. Aside from reconciling cause of death, a further step undertaken in this project was to provide information from the NCIS database on method of death, demographic factors, employment status and occupation at the time of death.

A description of the study design and NCIS

This retrospective case-series study utilised data from the National Coroners Information System (NCIS). NCIS is a national internet based data storage and retrieval system for Australian coronial cases, established in 2001 (Bugeja, Clapperton, Killian, Stephan, & Ozanne-Smith, 2010; Daking & Dodds, 2007). NCIS is utilised by coroners, government agencies, and researchers for identifying cases for death investigation, research and to monitor external causes of death in Australia (Bugeja et al., 2010).

Previous to the advent of this database, researchers relied on mortality data provided by the Australian Institute of Health and Welfare, which provides relatively limited information on demographic factors such as occupation. NCIS provides users with basic demographic information on death cases, including employment status and occupation at the time of death. Suicide methods are classified according to the International Classification of Disease – 10th revision (ICD-10) within method specific codes X60-X84 (Chapter 10) (WHO, 1992). Each case on NCIS also routinely includes a police "text" description of the circumstances and background of each extracted case, as well as coronial findings, and toxicology reports.

Overview of national trends in suicide in the construction industry

This section will provide an overall perspective of the number of suicides in the construction industry within Australia. This information will complement a deeper investigation of suicide in Cbus records for the year 2008.

This overview on national trends will focus on males due to the small number of females employed in the industry. This section will also provide a general understanding of suicide in the industry comparative to suicide in the general male population, a description of changes in suicide over time and differences in the lowest versus the highest skill level groups of the industry. We start by explaining the procedure for data extraction of information on suicide, the coding of occupation, and the calculation of suicide rates.

Eligibility and data extraction

All cases officially recorded as intentional self-harm in NCIS were extracted in May 2013. The raw data file included 26,471 individual cases. Only the years 2001 to 2010 were included in this study as a number of suicide cases that occurred after 2010 are still likely to be under coronial review, and will be missing (3,794 suicide cases after 2010 were excluded). Text descriptions of occupation and employment status at the time of death were extracted for each case. Data was also extracted on sex, method of death, age and marital status. Cases were excluded if they were not employed at the time of death. The process of extraction can be seen in Figure 1.

Figure 1. Process for the extraction of occupational data

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┌─────────────────────────┐
│ Cases extracted= 26,471 │
└─────────────────────────┘
            │          ┌──────────────────────────┐
            │────────→ │ Excluded =4,058 from     │
            │          │ years    other    than   │
            ▼          │ 2001 to 2010             │
┌─────────────────────────┐ └──────────────────────────┘
│ Cases remaining= 22,677 │
└─────────────────────────┘
            │          ┌──────────────────────────────┐
            │          │ Excluded      =      4,822   │
            │────────→ │ unemployed, 4,872 retired,   │
            │          │ 2,190 unknown employment     │
            │          │ status, 127 prisoners, 923   │
            │          │ students, 506 home duties,   │
            ▼          │ 33 unspecified other         │
┌─────────────────────────┐ └──────────────────────────────┘
│ Cases remaining= 9,204  │
└─────────────────────────┘
            │          ┌──────────────────────────────┐
            │          │ Excluded (not in construction)│
            │────────→ │ =  7,206  ANZSCO   Major     │
            │          │ grouping 1, 2, 4, 5, 6       │
            ▼          └──────────────────────────────┘
┌─────────────────────────┐
│ Cases    remaining=1,998│
└─────────────────────────┘
            │          ┌──────────────────────────────┐
            │          │ Excluded = 11 females, 39    │
            │          │ uncodable        occupation  │
            │────────→ │ information to lack of        │
            │          │ detail, 1 person under 15    │
            │          │ years                        │
            ▼          └──────────────────────────────┘
┌───────────────────────────┐
│ Cases remaining = 1,947   │
│ Residential building, non-│
│ residential               │
│ building and engineering, │
│ Building maintenance, and │
│ repair                    │
└───────────────────────────┘
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Coding of occupation for national trends

Occupational information was coded by two researchers according to the Australian and New Zealand Standard Classification of Occupations (ANZSCO) (up to the 6-digit level). If more than one occupation was reported, the researchers took the first listed as the primary occupation, unless the second listed occupation provided additional information that the first could not offer (e.g., construction/carpenter). Ambiguous occupational information was coded at the broadest level or was marked as uncodable. Consensus was reached via discussion between two researchers (AM and HN).

Those in the construction industry were identified as being involved in the building of homes, dwellings, buildings, or other structures and roads, as per the Australian and New Zealand Standard Industrial Classification (ABS, 2006). Construction was also defined as building work related to additions, alterations, reconstruction, maintenance, and repairs (ABS, 2006). After applying this definition, occupations coded as being in construction fell into two main groups and three major ANZSCO groups: Skilled trades (ANZSCO level 3) and machine operators and labourers (ANZSCO 7 and 8). ANZSCO 7 (n=58) was aggregated with ANZSCO 8 (n=731) to maximise the total number of cases available for analysis. Unless clearly designated as being in construction, cases in higher skilled occupations such as ANZSCO 1 (Managers) and ANZSCO 2 (Professionals) were excluded as they described a generic set of non-construction related skills (e.g., management and human resources related job tasks) and also because there were only a small number of relevant cases. Only males were included in this study due to small number of women being employed in the construction industry who suicided (n=11, as per Figure 1).

Demographic characteristics and method of death

Overall in Australia, there were 1,947 male suicides identified within the construction industry over the period 2001 to 2010. Approximately 51% of these

cases were in ANZSCO group 3 (skilled trades) and 49% were labourers and machine operators (ANZSCO group 7 and 8). As can be seen in Table 1, a greater proportion of labourers and machine operators were 24 years or younger (19.9%), while a larger proportion of skilled trades workers were aged between 45 and 54 years (18.5%). Most suicide cases in both occupational groups were aged between 25 and 45 years. These age related differences were significant in a chi-square test ($x^2(5)$ = 10.6, p<0.05).

Table 1. Age-profile of suicide among those employed in the construction industry over the period 2001 to 2010.

	Technicians and Trades Workers (%)	Machine operators and labourers (%)
15-24 years	19.9	15.7
25-34 years	28.3	27.0
35-44 years	28.8	29.3
45-54 years	16.7	18.5
55 years and over	5.6	8.5
All Ages total (n)	993	954

Comparative changes in the burden of suicide over time

Over the period 2001 to 2010 in Australia, those employed as labourers or machine operators had an adjusted rate of suicide of 18 per 100,000 persons (95% CI 14 to 22) and those employed in skilled trades had an adjusted rate of suicide of 13 per 100,000 (95% CI 11 to 15). Adjusted suicide rates for skilled trades and labourers and machine operators by year can be seen in Figure 2. This shows a consistent difference in suicide among the lowest and the highest skill level groups. As a comparison, suicide among the general male population for the years 2001 to 2010

was also been plotted in Figure 2 (ABS, 2013). This shows that rates among skilled trades workers were below the general male population over the period 2001 to 2010, while those among lower skilled workers were generally above male suicide in the general population. Data in 2001 indicated the rate of suicide was lower than the general male population, which may reflect problems in NCIS establishing reliable data recording procedures during this time (NCIS began in 2000, and was noted to under-report suicide in its early years of operation) (De Leo et al., 2010).

Figure 2. Suicide rates among males employed in the construction industry, adjusted against the general Australian population.
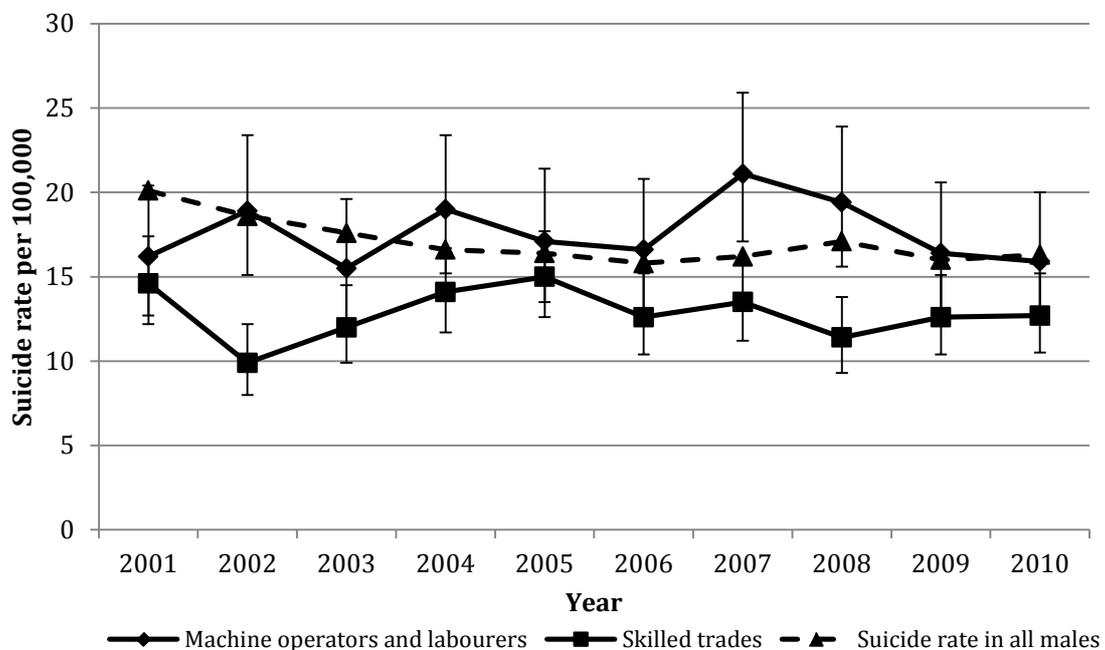
This overview of general trends of suicide in the construction industry suggests that while there has been a decrease in the overall suicide rates in the industry, those in the lowest skilled groups are consistently at increased risk compared to higher skilled groups. Further, there was a slight increase in suicide among the lowest skilled jobs during the most recent 2007 recession.

Check of Cbus records against NCIS

Process for cross-checking of Cbus records against the data records in NCIS

383 death cases deemed as possible suicides were obtained from the 802 cases on file with Cbus for the year 2008. As explained previously, these deaths were those in which the cause of death either indicated suicide (e.g., hanging, or suicide), other external causes of death (e.g., a cause of death listed as "multiple injuries"), or where the cause of death was ambiguous (e.g., "unknown", "undetermined" or "subject to coronial review"). Table 2 provides a broad description of the death cases provided to the University of Melbourne.

Table 2. Death cases by broad category as provided to the University of Melbourne from Cbus records.

	n
Suicide	56
Subject to coronial review	79
Unknown, undetermined, ambiguous	248
Total	383

The data extracted from Cbus files included name (first and last name), date of birth, date of death, occupation, and method of death. This information was used to identify cases contained in the NCIS. The process for retrieving information was to search NCIS for the following details:

- First name and/or last name
- Altering spelling of the first and last name in the case of inconsistencies of spelling if the case was not initially found
- Searching across all states other than the state of residence in Cbus records
- Searching using date of birth and date of death.

Once cases were found in NCIS, the following data was extracted:

- Demographic details (age, sex, marital status, country of birth, employment status and occupation).
- Coronial determination of cause of death
- Method of death
- Relevant case notes
- Inconsistency in the Cbus data fields against the NCIS, such as differences in the cause of death, spelling of first and last name, date of birth and date of death.

## Procedure when coronial determination of intent was missing

For a number of reasons, it is relatively common for the coroner not to provide a determination of the intent of a death, even when the case may be indicative of suicide (De Leo, 2007, 2010). In this case, the lead researcher (AM) made an independent judgement of whether the cases were likely to be suicide. Cases that indicated suicide (or that had evidence/indicators of suicide) were described as "probable" suicides. Probable suicides were those in which there was evidence of a written or verbal statement of intent and a method of high likelihood of being self-inflicted.

Search results for Cbus causes of death in NCIS

Overall results of searches

In 2008, there were 383 possible suicides provided from Cbus to the University of Melbourne to be examined. The process of matching cases can be seen in Figure 2. From the original 383 cases, 273 were matched on the basis of name and state. A further 110 cases required a more intensive effort to be found. This included searching across all states (including the state of residence recorded in Cbus), alteration of the spelling of the first and last name, and alteration of the date of death. Using this method, a further 23 cases were able to be identified. A total of 86 deaths were not able to be found in the NCIS database, and 1 case was a repeat (same last and first name). Further details about the characteristics of those cases that were able to be matched and explanations for the reasons for cases not being able to be matched is provided in the section below (Figure 2).

Figure 2. Cases provided from Cbus
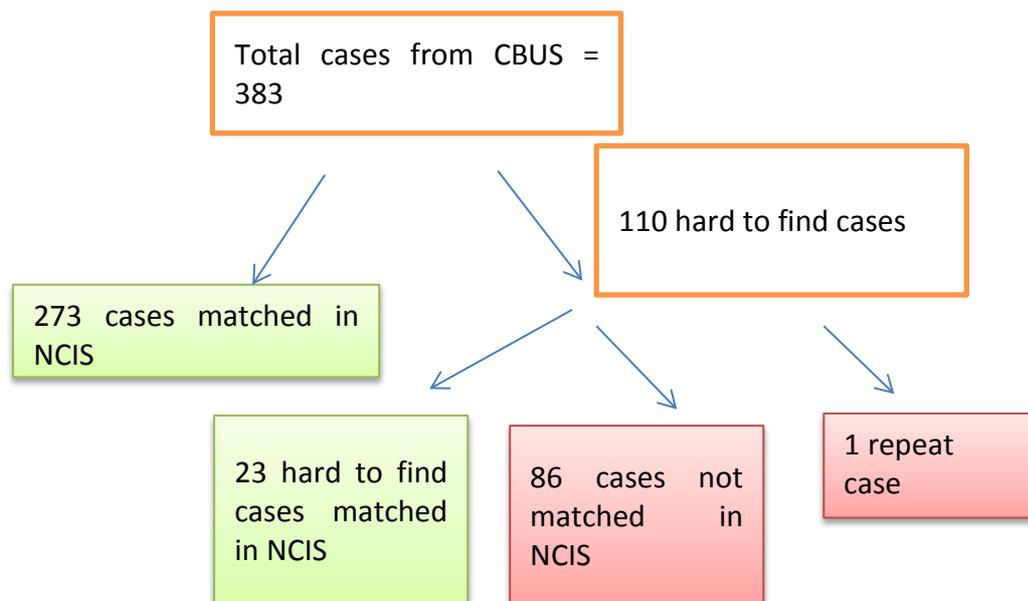
Data inconsistencies and unmatched cases

There were inconsistencies between the Cbus and NCIS records for 119 (40%) of the total number of 296 matched cases. In particular, the largest differences were in date of death and intent. However, there were a number of cases in which Cbus had recorded an exact date of death whereas NCIS only provided a range of two dates in which the death had occurred, since the exact date was not able to be ascertained. For 53 cases with discrepant dates of death, the Cbus date did fall within the date range provided by NCIS. In the case of discrepant data between Cbus and NCIS, the coronial information in NCIS was relied upon rather than the Cbus records. As mentioned, there were 87 deaths from Cbus not able to be matched in NCIS. These are discussed under a separate heading below and are not included in the results presented below.

Cause of death cross-comparison between Cbus and NCIS records

In the original data set from Cbus provided to the University of Melbourne of 383 cases, **Cbus records indicated 56 of these were confirmed suicides**, and another 79 were subject to coronial review. After data matching against NCIS, there were **85 coroner determined suicides, and 11 probable suicides (96 in total).**

Table 3 shows the overall causes of death for the 296 cases matched to the NCIS records. As can be seen, about 29% of these cases were confirmed suicide (deemed to be intentional self-harm by coroner/NCIS), 21% of these were motor vehicle crashes (deemed to be accidental by NCIS), and 18.2% were due to drug overdose (18.2%) (deemed to be accidental by NCIS). There were 16.2% natural deaths. These deaths were not generally straightforward cases, and often involved drugs or alcohol, hence were reviewed by the coroner[1]. There were 11 cases (3.8%) in which

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[1] Generally, deaths that are able to be easily established as due to natural causes are sent straight to births, deaths and marriages without coronial review.

the researchers had to make an independent decision of intent due to this not being present in the coronial records. About 4% of cases had an undetermined finding following a coronial review and after examination by the researchers. These cases did not provide enough information for independent review by the research team and so were left as per the coronial determination of undetermined. These were cases in which the body may not have been found for some time after death, and hence it was difficult to establish cause.

Table 3. Reconciled accounts matching Cbus cases to the NCIS.

	Number	%
Accidental drug overdose (confirmed in NCIS)	54	18.24
Motor vehicle accident (confirmed in NCIS)	62	20.95
Natural (confirmed in NCIS)	48	16.22
Accidental – other methods (confirmed in NCIS)	20	6.76
Assault (confirmed in NCIS)	4	1.35
Probable suicide (researcher determined)	11	3.72
Suicide (confirmed in NCIS)	85	28.72
Undetermined (confirmed in NCIS)	12	4.05
Total	296	

Cbus cases with cause of death recorded as "subject to coronial review", "unknown" and "undetermined" deaths

Causes of death in which the method was ambiguous or undetermined in the Cbus records were of particular interest as these deaths were considered likely suicides. Table 4 below compares the Cbus cause of death (subject to coronial inquiry; unknown; and undetermined death) against the NCIS determination of cause of

death. As can be seen, drug overdose and natural deaths comprise the largest categories of causes of death across all three determinations. As described above, the natural deaths were not straightforward and involved circumstances in which there was ambiguity about the cause and circumstances. A coronial determination of suicide only accounted 21.4% of Cbus cases recorded as subject to coronial review, 13.3% of cases recorded as unknown, and only 2 of cases recorded as undetermined cause of death, 1 of which was a possible suicide as determined by the researcher.

Table 4. NCIS cause of death for Cbus cases "subject to coronial review", "unknown" and "undetermined" deaths.

	Cbus		
	Subject to Coronial review	Unknown	Undetermined
NCIS	Accidental drug overdose (n=16, 22.9%)	Accidental drug overdose (n=10, 16.7%)	Accidental drug overdose (n=4, 66.7%)
	Accidental MVA (n=10, 13%)	Accidental MVA (n=8, 13.3%)	
	Natural (n=19, 27.1%)	Natural (n=20, 33.3%)	
	Accidental- other methods (n=5, 7.1%)	Accidental – other methods (n=4, 6.7%)	
	Possible suicide (n= 3, 4.3%)	Possible suicide (n= 2, 3.3%)	Possible suicide (n= 1, 16.7%)
	Suicide (n=15, 21.4%)	Suicide (n=8, 13.3%)	Suicide (n=1, 16.7%)
	Undetermined (n=2, 2.9%)	Undetermined (n=8, 13.3%)	
TOTAL	70	60	6

The hard to match cases

As mentioned above, 87 Cbus cases were not able to be found in the NCIS database. The causes of death (according to Cbus) for these cases are listed below in Table 5. Only 8% of the cases not in the NCIS system were deemed to be suicides by Cbus. A large number of cases are likely to be natural deaths in NCIS (e.g., Sepsis, Respiratory arrest).

Table 5. Causes of death for those Cbus cases not able to be found in NCIS

Cbus	Number	%
Accident	6	6.9
Haemorrhage	1	1.15
Intracranial haemorrhage	1	1.15
Intracranial pressure	1	1.15
MVA	7	8.05
Multiorgan Failure	1	1.15
Respiratory arrest	12	13.79
Sepsis	5	5.75
Subject to Coronial inquiry	9	10.34
Suicide	7	8.05
Unknown	14	16.09
Drugs/alcohol	7	8.05
External causes of death	8	9.2
Natural	1	1.15
Severe hem pneumothorax	1	1.15
Undetermined	5	5.75
Withdrawn	1	1.15

Three main reasons for why these cases were not able to be found are:

1. The cases are still under coronial review

2. Cases are closed but have not been uploaded onto NCIS

3. Cases were deemed as not needing/requiring coronial investigation.

An explanation or of each of these scenarios is discussed below.

1. The cases are still under coronial review

Information obtained from the NCIS (9th of September 2013) indicates that there may be as many as 1,000 cases that remain open on the system for the year 2008. The largest bulk of these cases are in Victoria and New South Wales. The cases that are most likely to remain open are those in which there is a continuing, criminal investigation, which may account for Cbus records such as:

- Subject to Coronial inquiry (10.34%)

- Suicide (8.5%)

- External (9.2%)

- Undetermined (5.8%)

Further, cases where the cause of death was undetermined in NCIS are usually those in which the deceased body is found sometime after the death occurred, and it is impossible through forensic investigation to establish cause of death.

2. Cases are closed but have not been uploaded onto NCIS

Another problem is that there are likely delays in the time it takes to upload cases onto NCIS (De Leo, 2007, 2010). This is due to staffing shortages in coronial offices. In this case, the coroner may have decided on cause of death but it is not available on NCIS.

3. Cases were deemed as not needing/requiring coronial investigation.

Natural causes of deaths are usually sent to Births, Death and Marriages without coronial review and are therefore not available on the coronial system.

Characteristics of Cbus suicides following review of NCIS (n=96)

Suicide among Cbus members in 2008 were mostly aged between 25 to 34 years (31.25%) and 35 to 44 years (31.25%) (see Table 6) This is roughly equivalent to suicide age distribution in the general male population of Australia. Apart from one case, all the reported suicides in Cbus members were by males.

Table 6. Age demographic of suicides in Cbus members

	N	%
18-24	14	14.58
25-34	30	31.25
35-44	30	31.25
45-54	18	18.75
55-64	4	4.17
Total	96	100

The main method of death for Cbus suicides was hanging, followed by carbon monoxide poisoning, which commonly occurs in a motor vehicle (see Table 7). Firearms and jumping from a height each comprised about 7% of all suicides.

Table 7. Method of death for suicide cases in Cbus members.

	N	%
Motor vehicle accident	1	1.18
Hanging	56	65.88
Firearms	6	7.06
Jumping	6	7.06
Decapitation	1	1.18
Plastic bag asphyxia	1	1.18
Carbon monoxide poisoning	13	15.29
Drug overdose	1	1.18
	85	

30% of suicide cases in Cbus members were married at the time of death, while 29% indicated that they had never been married (see Table 8). This could mean that these people were in a defacto relationship (which the police may not classified as married), or were single at the time of death. About 23% of cases were separated at the time of death.

Table 8. Relationship status at the time of death for Cbus suicide cases.

	N	%
Divorced	7	7.29
Married	29	30.21
Never married	28	29.17
Separated	22	22.92
Unknown	10	10.42
Total	96	100

As can be seen in Table 9, about 64% of those who died due to suicide were in fact employed at the time of death, with about a further 23% being unemployed.

Employment status was not reported in 8.3% of all cases. Only one of the suicides in this Cbus data set for 2008 occurred at the workplace. This person was a miner who had been off on sick leave for a period of 6 weeks and had mental health problems, and the suicide occurred on the first day of returning to work. The method was jumping from a height.

Table 9. Employment status at the time of death for Cbus suicide cases

	N	%
Employed	61	63.54
Unemployed	22	22.92
Pensioner/retired	1	1.04
Student	1	1.04
Unknown	8	8.33
Retired/pensioner	3	3.12
Total	96	

At the time of death, most suicide cases were employed in construction as builders, labourers or skilled trades persons. There was one death of a surveyor, one self-employed painter, one miner, and two truck drivers. A number of cases appeared to have left the construction industry and were working in crowd control (n=1), in a nursery (n=1), and as a zinc lead concentrator (n=1).

Interpretations and discussion of study findings

Overview of the deaths in Cbus dataset in 2008

The purpose of this report was to provide an overview of suicide cases among Cbus members. The study compared information on death cases in the Cbus dataset against those held in the NCIS. As a result of this investigation, it was revealed that suicide accounted for approximately 12% of all deaths in the Cbus records (96 out of the total 802 deaths in 2008). The characteristics of these deaths are generally similar to suicides among the general male population. That is, they are by young to middle-aged males (ABS, 2013). The overall methods of suicide are also similar to that in the general population, being primarily by hanging, followed by carbon monoxide poisoning and then firearms. About 64% of all suicides in the Cbus data set were employed at the time of death and the majority of cases were working in the construction industry. About 23% of cases were unemployed at the time of death. The proportion of suicides that were employed and unemployed at the time of death was similar to what has been reported in the overall NCIS dataset across all industries.

Perspectives on suicide at the national level

While the demographic characteristics of suicides in construction are similar to national rates in Australia as a whole, comparison at the national level suggests several important differences. First, the suicide rate among labourers was significantly greater than the general male population during the period 2001 to 2010. Second, the suicide rate of skilled trades workers within the construction industry was below the national male suicide rate. Third, there was an increasing divergence among those employed in lower versus higher skilled jobs during the most recent economic recession (2007-2009) that was largely driven by increasing rates among the lower skilled occupations. As suggested by past research (Milner,

Spittal, Pirkis, & LaMontagne, 2013; Roberts et al., 2012) this suggests that those in lower skilled jobs within construction are at notably greater risk than those employed in the higher skilled jobs in the industry.

Possible reasons for suicide in the construction industry

There are a number of explanations for suicide among those employed in construction. First, it is possible that the increased rate reflects characteristics of younger male workers employed in labouring professions, who also tend to have higher suicide rates than other age groups (ABS, 2013). Elevated rates among young males may be connected to age-related stressors such as the formation of family and careers, as well as higher levels of impulsivity and greater use of alcohol and drugs (Pitman, Krysinska, Osborn, & King, 2012). This aligns with past research on suicides in the construction industry, which found that alcohol and drugs, untreated mental health conditions and relationship issues precipitated a large proportion of suicide deaths (Heller et al., 2007). Failure to seek or accept help for mental health issues has also been identified as a key risk factor for young males in the construction industry (Heller et al., 2007). At a population level, the higher burden of suicide in labourers and machine operators may reflect risk associated with lower socio-economic status and wider social disadvantage (Pitman et al., 2012).

Workplace and industry related factors may also influence suicide within construction, particularly as individuals working in blue-collar industries are often exposed to poor psychosocial working conditions (Abbe, Harvey, Ikuma, & Aghazadeh, 2011; Basnet P, 2010; Blonk, Broersen, de Croon, Frings-Dresen, & de Zwart, 2002; Boschman, Molen, Sluiter, H.W, & Frings-Dresen, 2010; A D LaMontagne, D'Souza, & Shann, 2012). Adverse psychosocial working conditions are consistently found to have adverse effects on mental health (Bonde, 2008; Stansfeld & Candy, 2006). There is also some preliminary evidence from Germany and Japan that adverse psychosocial working conditions are associated with suicide (Schneider et al., 2011; Takada et al., 2009; Tsutsumi et al., 2007). In Australia, there has been past reports on work-stress related suicide (Bottomley & Neith, 2010), but little

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empirical work. This emphasises the need for more research on this topic in Australia, particularly so as to inform intervention efforts in the construction sector.

Explanations for the higher risk of suicide during the recent GFC

Our investigation suggests that the suicide rate among those in the lowest skilled jobs increased during the most recent recession in Australia. There have been several other reports of increased suicide in response to the 2008 recession in England (Barr, Taylor-Robinson, Scott-Samuel, McKee, & Stuckler, 2012), Greece (Economou et al., 2013), the United States (Reeves et al., 2012), and several other European countries (Stuckler, Basu, Suhrcke, Coutts, & McKee, 2011). Job loss and declining income are thought to be among the main drivers of rising suicide rates in these countries. There have been no reports on Australia, where rates of suicide at a population level have been declining in recent years. Potentially, the general population rate in Australia may be/could be disguising an elevated risk among low-skilled workers most affected by fluctuations in the global economic market (such as construction workers), who are also more exposed to a range of other possible work-related risk factors (Boschman et al., 2010; Goldenhar, Williams, & Swanson, 2003; Heller et al., 2007; A D LaMontagne et al., 2012; McGann, Moss, & White, 2012). Although we note that there were also relatively high suicide rates in 2004, which was before the economic recession.

Limitations of this study

The limitations of this study include the fact that suicide is likely to be under-reported. It is particularly likely that data in later years will be under-reported due to the three-year time frame taken to close coronial files. There is also a possibility of miscoding of occupation, despite independent coding by two researchers. However, we would highlight the fact that this study was based on the best available data to date, and implemented a structured approach to the coding of occupation. The

national coverage of occupationally coded suicide data analysed for this study contributes substantially to current research in Australia, which has previously been confined to specific sample areas and states (Andersen et al., 2010; Bottomley & Neith, 2010; Heller et al., 2007).

Recommendations for prevention

From a prevention perspective, this study suggests that low skilled workers in construction should be prioritised in prevention and intervention initiatives. In 2012, the Australian government invested a considerable amount in a suicide prevention program within the construction industry. This program, called "Mates in Construction", seeks to raise general awareness of suicide and train "gatekeepers" to recognise and refer those at risk. Preliminary evidence suggests that this training has received positive feedback within the industry (Gullestrup et al., 2011). However, long term efforts are needed to assess the efficacy of this intervention in reducing suicidality. Intervention efforts also need to address possible work-related risk factors for suicide.

Recommendations for Cbus

In terms of Cbus data recommendations, we would suggest that staff receive further training on how better to code death claims, which would make future data investigations easier. Further, we would recommend that Cbus periodically checks data records against those held in NCIS as a form of quality control. This would help as part of the ongoing monitoring of suicide prevention activities. This is important because suicide prevention relies on accurate data to determine the size of the problem and to identify those at risk. This information can be used to lobby key stakeholders to establish suicide prevention initiatives and to provide a baseline from which intervention efforts can be measured.

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