



SUICIDE IN THE CONSTRUCTION INDUSTRY: 2001-2018

Report submitted to
MATES in Construction by
The University of Melbourne

Volume IV: July, 2020

Prepared by:

Humaira Maheen¹, Anthony D. LaMontagne^{1,2} and Tania King¹

¹ Centre for Health Equity, School of Population and Global Health,
University of Melbourne

² Institute for Health Transformation, Deakin University

CONTENTS

Introduction	2
Methodology	3
Study design	3
NCIS dataset	3
Ascertainment of occupation	3
Population estimates	3
Analytical approach	4
<i>Descriptive analysis and age-standardised suicide rates</i>	4
<i>Analytical notes and caveats</i>	4
Results	5
a. Age-standardised suicide rates for period 2001-2018	5
b. State specific time trends in age-standardised suicide rates	7
c. Incidence Rate Ratios for each Australian state in 3-year blocks	12
d. Graphical comparisons of state RR of suicide among construction workers (compared to non-construction workers), with RR of construction workers (compared to non-construction workers) in Australia in 3-year blocks	15
e. Age distribution of suicide among construction workers compared to non-construction workers in Australia	20
Conclusion	21
Study limitations	21
In summary	22
References	23
Appendix 1: Occupational Coding	24
Appendix 2: Age-adjusted suicide rates (Construction workers)	26
Appendix 3: Age-adjusted suicide rates (Non-construction workers)	29
Appendix 4: Age distribution of suicides among construction workers for each state relative to Australia	32



Humaira Maheen is a Research Fellow at the Centre for Health Equity, Melbourne School of Population and Global Health. She has specialist expertise in research examining suicide among different occupation groups in Australia and has published extensively in this area. Her current areas of research include women's health, suicide and social determinants of health and wellbeing.



Professor Tony LaMontagne leads the Determinants of Health research domain in the Institute for Health Transformation at Deakin University. His broad research interest is in developing the scientific and public understanding of work as a social determinant of health, and translating this research into policy and practice to improve workplace and worker health. Specific areas of interest include workplace mental health, improving job quality and psychosocial working conditions, and evaluating government policy interventions. His research and publications have influenced policy & practice in workplace health from the local to the international level.



Tania King is an ARC DECRA Senior Research Fellow at the Centre for Health Equity, Melbourne School of Population and Global Health. She is currently working on a range of projects including the MATES Mobile project, a Suicide Prevention Australian project among employed males, and an ARC Linkage Project on gender equality. She is recognized for her work in research on suicide, particularly among males. Her work has been instrumental in understanding the gendered norms, inequalities and processes that lead to poorer health and greater suicide risk.

MATES in Construction refers to one or more of the independent national or state-based organisations of the MATES in Construction group, all of which are Australian companies limited by guarantee. Each state-based organisation is a member of the national organisation, MATES in Construction (Aust) Limited. Each MATES in Construction organisation is a separate legal entity and has no liability for another entity's acts and omissions. MATES in Construction is the brand name for the MATES in Construction group and is used by each separate MATES in Construction organisation MATES in Construction (Aust) Ltd – 99 166 347 539

INTRODUCTION

Construction workers have been identified as being at elevated risk of suicide compared to other workers (Heller et al., 2007). This increased risk has also been consistently documented among Australian construction workers in previous reports for MATES in Construction (King, T., Riccardi, L., Milner, 2018; Maheen and Milner, 2017; Milner, 2016). Excess mortality from suicide among construction workers has also been observed internationally (Meltzer *et al.*, 2008; Peterson et al., 2018; Windsor-Shellard and Gunnell, 2019).

The construction sector accounts for a substantial proportion of Australia's workers, and employs just under 10% of the Australian working population. Only the health care and retail sectors employ more workers (Australian Bureau of Statistics, 2020a). Over the period between 2001 and 2018, the number of people employed in the construction sector rose from 680,000 (7.7% of the Australian working population) to over 1.1 million (9.1% of the Australian working population) (Australian Bureau of Statistics, 2020a). The fact that workers in the construction industry comprise such a substantial proportion of the Australian working population underscores the importance of rigorously monitoring suicide mortality among this group.

A number of factors place construction workers at increased risk of suicide. Firstly, construction workers are predominantly male. Men are at much greater risk of suicide than women (World Health Organization, 2014), and in Australia, 87.6% of construction workers were men in recent labour force statistics (Australian Bureau of Statistics, 2020b). Certain job specific characteristics are also thought to increase the suicide risk among construction workers, including limited job control, job insecurity, periods of unemployment or underemployment, travel and periods of time working away from family and support (Martin *et al.*, 2016).

This report is the fourth in five years that seeks to document suicide mortality, and examine trends in suicide mortality. Here we use the latest suicide mortality statistics to examine trends across the years between 2001 and 2018. This work is critical to MATES in Construction's effort to provide an evidence base for targeted workplace mental health literacy.

The analyses are disaggregated by age group and state, for the benefit of stakeholders and funders of the Mates in Construction program. For the purpose of this report, construction workers are defined as any persons working in the following occupational groups (as listed in Appendix 1: Occupational Coding): construction managers; construction trades workers; building and engineering technicians; electrotechnology and telecommunications trades workers; stationary plant and machine operators; and construction and mining labourers.

METHODOLOGY

Study design

Drawing on coronial data from the National Coronial Information System (NCIS), this report adopts a retrospective mortality design to examine specific suicide rates among construction workers compared to other workers in Australia over time.

NCIS dataset

The National Coronial Information System (NCIS) is a national repository containing data on deaths reported to Coroners in Australia and New Zealand. It contains data sourced from coronial briefs that are created as part of the coronial investigation into the cause of death of an individual. Contained within the NCIS are coded and non-coded data, as well as searchable legal, medical and scientific reports such as the Coroner's finding, post-mortem and toxicology report and police summary of death report. It is important to note that cases are coded by court appointed staff in each state and territorial jurisdiction. While the data is nationally standardised, there are slight differences in data collection approaches across states, as each coronial jurisdiction is governed by its own Coronial Act.

Ascertainment of occupation

Information regarding the age, sex, residency, employment status and occupation of the deceased is contained within the NCIS dataset. The occupation of all suicide cases listed in the NCIS data for the years 2001 and 2018 was ascertained using the Australian and New Zealand Standard Classification of Occupations (ANZSCO), coded to four digits (Australian Bureau of Statistics, 2013). Cases ascribed to the construction industry are listed in Appendix 1: Occupational Coding. All other suicide cases in which the deceased was employed were described as being a non-construction worker.

Population estimates

Population estimates were obtained from the Australian Bureau of Statistics (ABS) using the 2006, 2011 and 2016 census data by occupation, state, year, age and sex. The construction industry

has changed substantially over time, and to account for this, population numbers were adjusted using the quarterly released Labour Force data (Australian Bureau of Statistics, 2020a). The adjustment accounts for the average change in population (each year) with reference to the corresponding Census year. For year 2001-2006, we used 2006 as a reference year; for 2007-2012, the reference year is 2011, and for 2013-2018, we used 2016 as a reference year.

ANALYTICAL APPROACH

Descriptive analysis and age-standardised suicide rates

Male and female suicide rates per 100,000 person-years were calculated for construction workers and workers in all other occupations using population census data (to estimate denominators) and adjusted using quarterly labour force data on the construction industry (described above). Age-standardisation was conducted in reference to the Australian standard population (2001) from the ABS (ABS, 2015).

Rates of suicide were presented graphically to allow an assessment of trends over time. We also calculated incident-rate ratios (IRRs) of suicide among construction workers compared to non-construction workers by state and the time periods 2001–2003, 2004–2006, 2007–2009, 2010–2012, 2013–15, and 2016–18.

Analytical notes and caveats

We compared suicide rates among construction workers to others in the employed population because mental illness and suicide rates are generally higher among the unemployed and those who are ‘not in the labour force’ (NILF). This is known as the ‘healthy worker’ effect (Agerbo, 2005). Comparison of rates in specific occupational groups to the general population would thus be comparing to an artefactually elevated reference, biasing estimates of relative risk downwards for groups with relatively high rates in the working population (under-estimation).

It is important to note that females remain highly under-represented in the construction industry. Further, male suicide cases outnumber female cases. The net effect of this is that analysis of a small number of suicide cases, in a small group (female construction workers) is difficult, and in most cases, is not robust. For this reason, it was not possible to present detailed data for female construction workers in each state due to small numbers. We do however, present this data across the whole population on page 7.

The age-standardised suicide rates (Figures 1-9 and Appendices 2 and 3) for Australia and the more populous states (Victoria, NSW, Queensland, South Australia and Western Australia) are

presented yearly. For the smaller states, the number of suicides was too low to enable this, and suicide rates are presented in three-year blocks.

In the results, we firstly present the age-standardised suicide rates for the period 2001-2018 (results section a), then the state specific time trends in age-standardised suicide rates (b). We then present the incidence rate ratios for each Australian state in 3-year blocks (c), and then a graphical comparison of each State’s RR of suicide among construction workers (compared to non-construction workers), with RR of construction workers (compared to non-construction workers) in Australia in 3-year blocks (d).

RESULTS

a. Age-standardised suicide rates for period 2001-2018

During 2001 to 2018, there were 3621 suicides among identifiable male construction workers in Australia, and 9918 suicides among employed males in other occupations (see Table 1). The number of female construction workers who died by

suicide was low across all Australian states and territories and is not presented due to risk of identification. Analysis henceforth is restricted to male workers only.

Table 1. Numbers of suicides among male construction workers and male non-construction workers, by state and territory and nation-wide, 2001 to 2018.

State	Construction workers	Non-construction workers	Total
ACT	58	180	238
NSW	980	2,943	3,923
NT	75	199	274
QLD	759	1,951	2,710
SA	209	634	843
TAS	107	317	424
VIC	850	2,376	3,226
WA	583	1,318	1,901
Australia	3,621	9,918	13,539

Over the 2001–2018 period, the overall age-standardised suicide rate for male construction workers was 25.2 per 100,000 in Australia.

Table 2 shows the age-adjusted suicide rates per 100,000 persons for the period from 2001-2018 for each Australian state,

along with 95% confidence intervals. Suicide rates are shown for construction versus other workers. The highest suicide rates for male construction workers occurred in the NT, while lowest rates were observed in SA, NSW and QLD. Annual age-adjusted suicide rates for males by state can be seen in Appendix 2 (for smaller states these are shown in 3-year blocks).

Table 2: Numbers of suicides and age-adjusted suicide rates (per 100,000) among male construction workers, by state and territory and nationwide, 2001 to 2018.

State		Number of Suicides	Population*	Adjusted Suicide Rate**	Lower Confidence Level	Upper Confidence Level
ACT	Construction	58	10,641	31.8	22.3	41.4
	Non-construction	180	83,844	11.4	9.6	13.2
NSW	Construction	980	248,992	21.1	19.7	22.6
	Non-construction	2,943	1,328,269	12.1	11.6	12.5
NT	Construction	75	8,771	43.6	33.5	53.7
	Non-construction	199	40,278	26.4	22.6	30.2
QLD	Construction	759	187,341	22.1	20.3	23.8
	Non-construction	1,951	829,007	12.9	12.3	13.5
SA	Construction	209	55,793	21.4	18	24.7
	Non-construction	634	313,918	10.8	9.9	11.6
TAS	Construction	107	18,180	31.0	24.6	37.4
	Non-construction	317	88,708	19.2	17	21.4
VIC	Construction	850	197,912	24.3	22.4	26.2
	Non-construction	2,376	1,088,599	11.8	11.3	12.3
WA	Construction	583	110,153	27.5	25.2	29.9
	Non-construction	1,318	445,745	15.9	15	16.8
Aust	Construction	3,621	837,783	25.2	24.3	26.1
	Non-construction	9,918	4,218,278	12.8	12.5	13

*population is the average yearly population of Census 2006, 2011 and 2016 for male construction and non-construction workers

** the adjusted age-suicide rates are calculated based on 2006, 2011 and 2016 census data by occupation, state, year, age and sex

b. State specific time trends in age-standardised suicide rates

State specific suicide rates over time are shown in Figures 1 to 9. Suicide rates vary considerably over time, and as noted above, for the least populous states we present rates in blocks of three years to smooth this variation (2001–2003, 2004–2007, 2008–2010, 2011–2013, 2014–15, 2016–18). Across all states, the overall rate of suicide among construction workers is consistently higher

than among other workers. We were unable to calculate rates for females due to small numbers of suicide.

In general, suicide rates for both male construction workers and non-construction workers have declined in Australia over the duration of 2001-2018, as Figure 1 shows. There is clearly fluctuation across the years for both groups, and there appears to be a greater decline among construction workers than among other workers.

Figure 1. Age standardised suicide rates for male construction and non-construction workers in Australia (per 100,000)

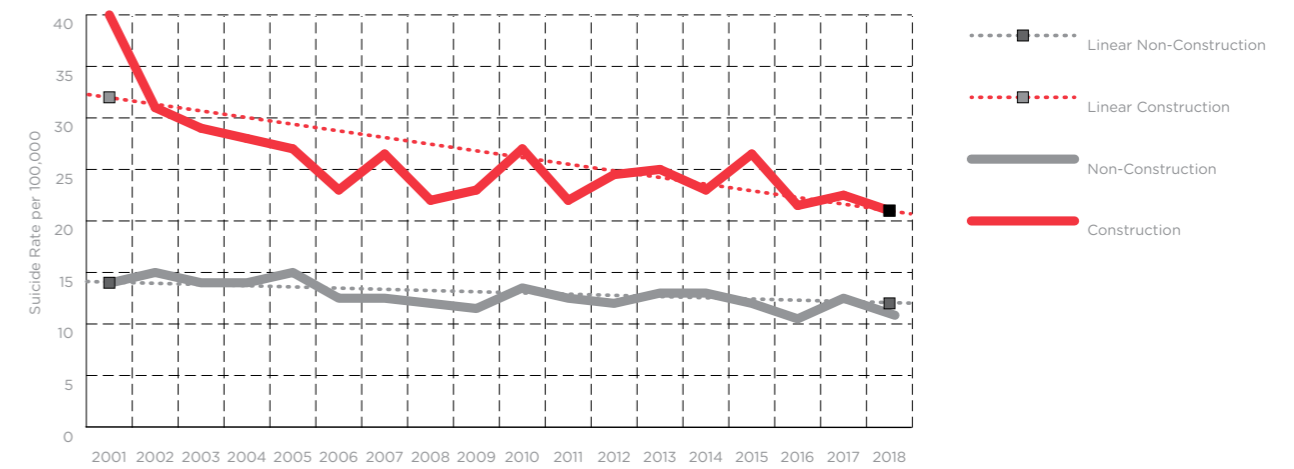
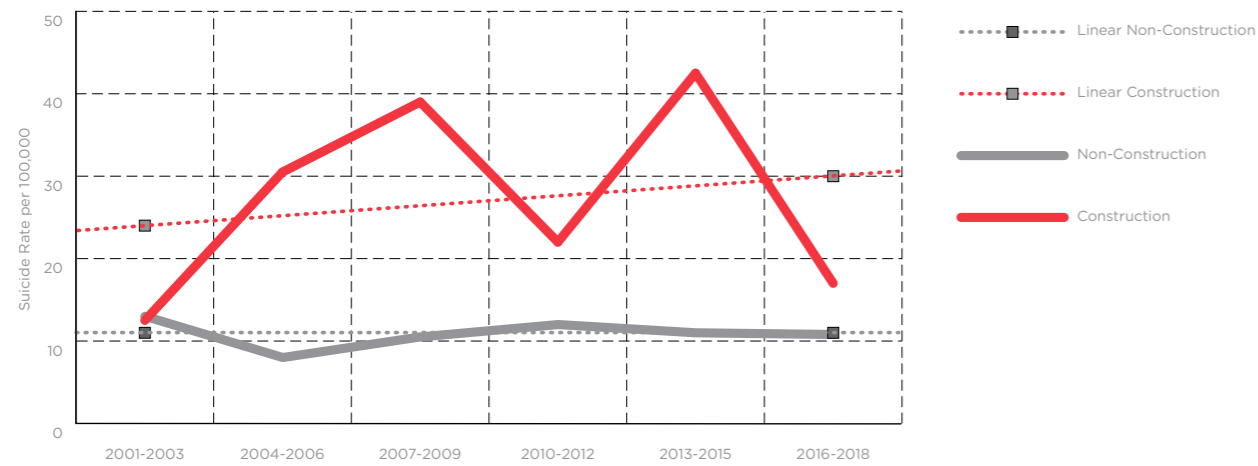


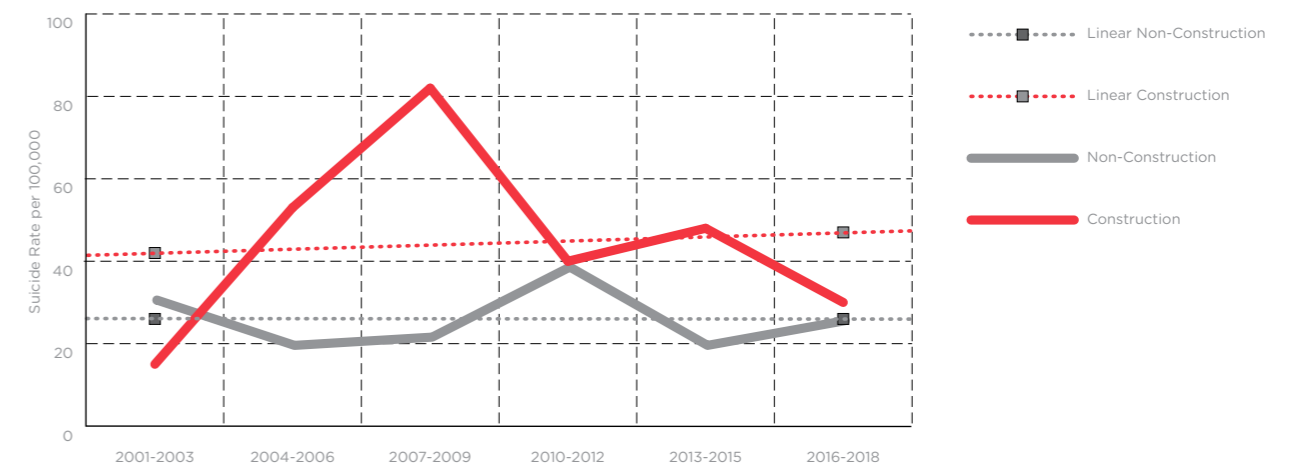
Figure 2 shows suicide rates for male construction workers in the ACT. There is relative stability in suicide rates for non-construction workers, however rates for construction workers showed substantial variation. The overall number of suicides in the ACT is low, and this, together with the small population contributes to the fluctuation in the figure for construction workers in the ACT.

Figure 2. Age standardised suicide rates for male construction and non-construction workers in ACT (per 100,000)



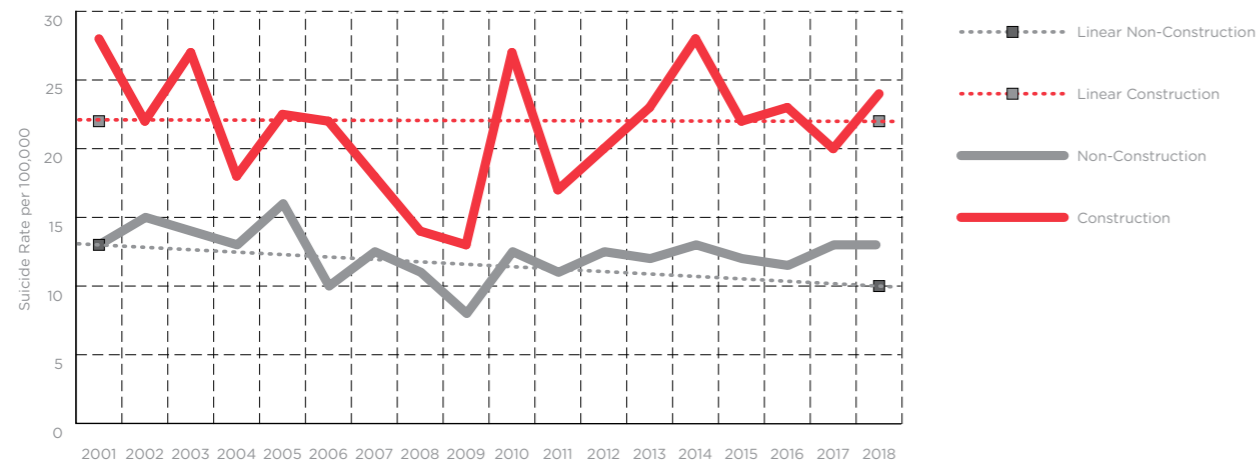
In the Northern Territory (Figure 4), suicide rates for construction workers and non-construction workers have varied across the years. As for ACT, we suggest caution in interpreting these results as overall number of suicides are low.

Figure 4. Age standardised suicide rates for male construction and non-construction workers in NT (per 100,000)



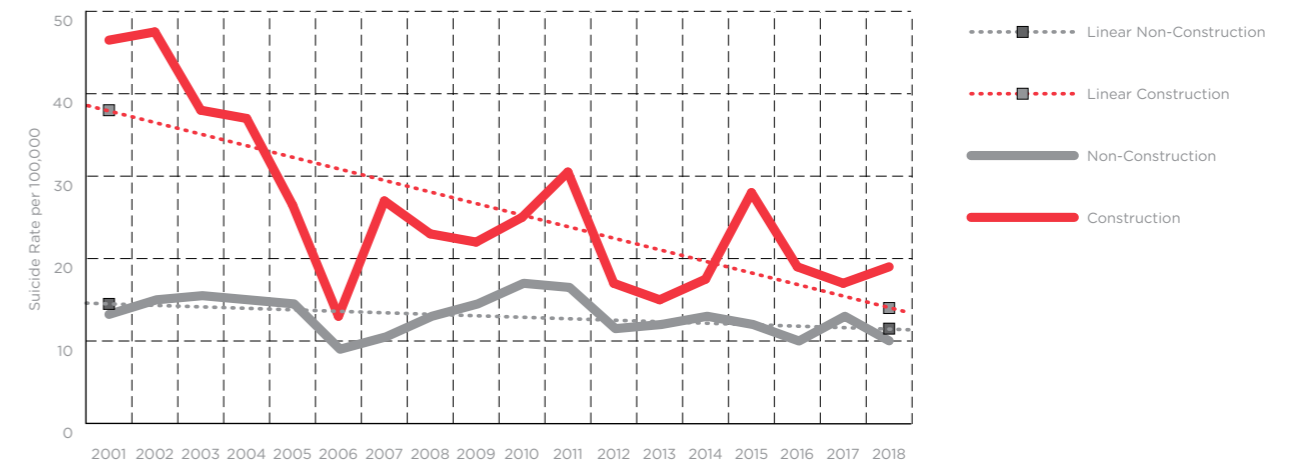
Suicide rates among male non-construction workers in NSW have remained relatively stable across the years of analysis. Rates for male construction workers have fluctuated, but there appears to be little overall shift in rates between the years of 2001-2018.

Figure 3. Age standardised suicide rates for male construction and non-construction workers in NSW (per 100,000)



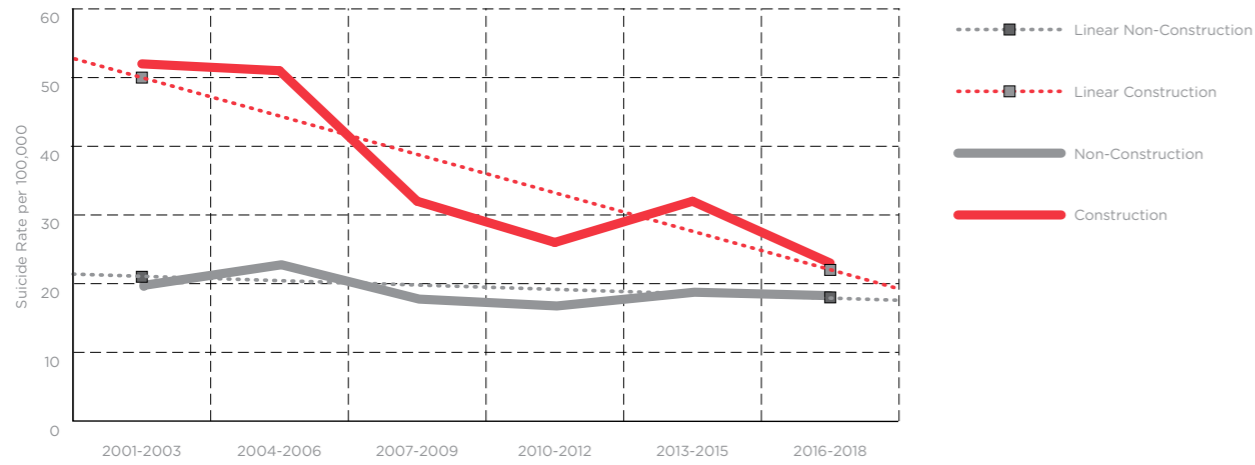
While rates for male non-construction workers in Queensland have changed little (Figure 5), the suicide mortality for construction workers between 2001-2018 has declined and is approaching a point of convergence with suicide mortality rates among non-construction workers. It is important to note that suicide rates among male construction workers in Queensland appear to be one of the lowest among all states and territories.

Figure 5. Age standardised suicide rates for male construction and non-construction workers in QLD (per 100,000)



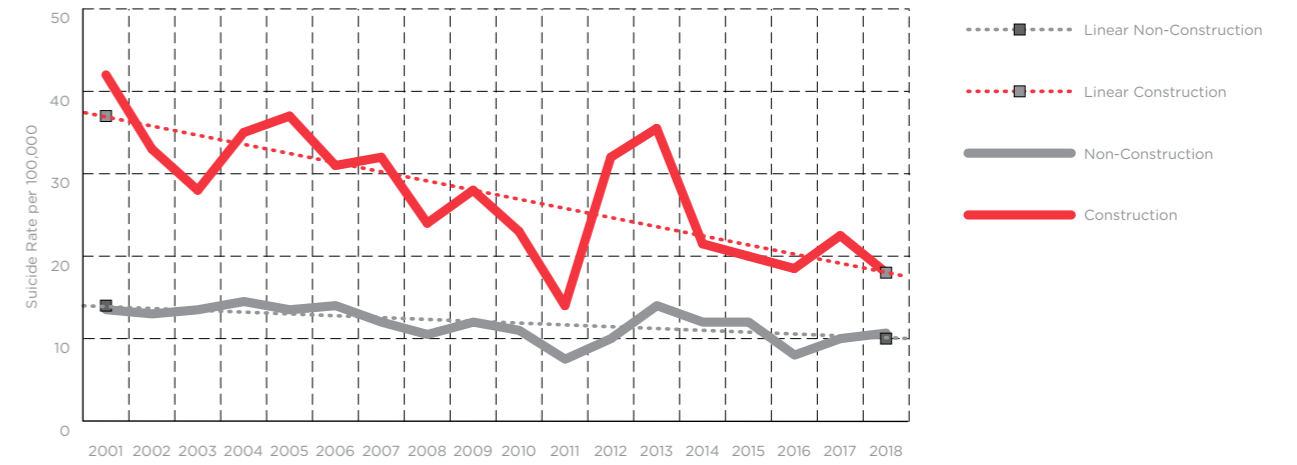
Rates of suicide among male non-construction workers in Tasmania remained relatively steady across the 18 years of data collection, however rates among male construction workers declined to an apparent point of convergence with non-construction workers in 2016-18 (Figure 6).

Figure 6. Age standardised suicide rates for male construction and non-construction workers in TAS (per 100,000)



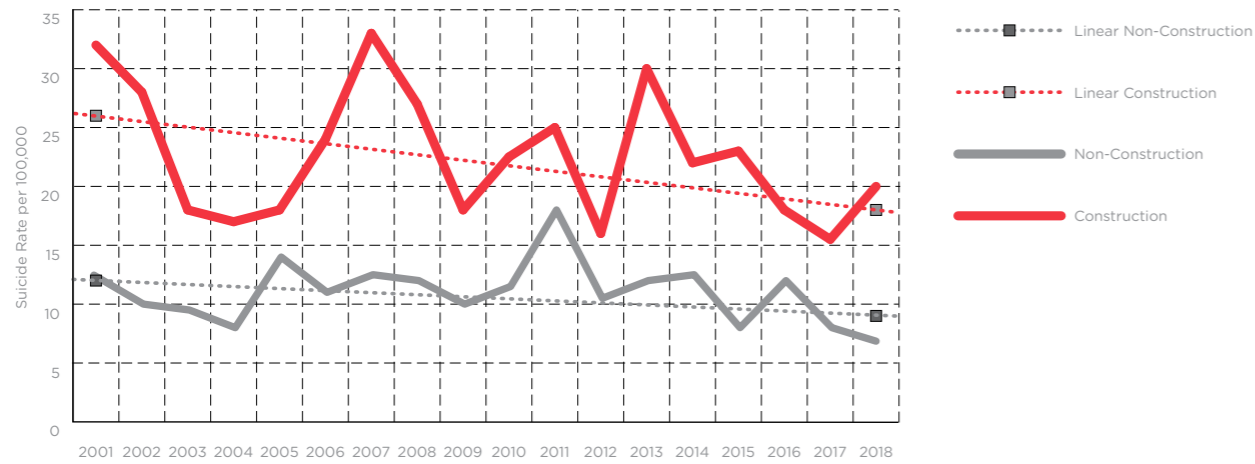
Suicide rates among male construction workers in Victoria are among the lowest across the nation. Moreover, rates of suicide among construction workers in Victoria observably and consistently declined over the period of analysis, while rates among non-construction workers only showed a slight reduction (Figure 8).

Figure 8. Age standardised suicide rates for male construction and non-construction workers in VIC (per 100,000)



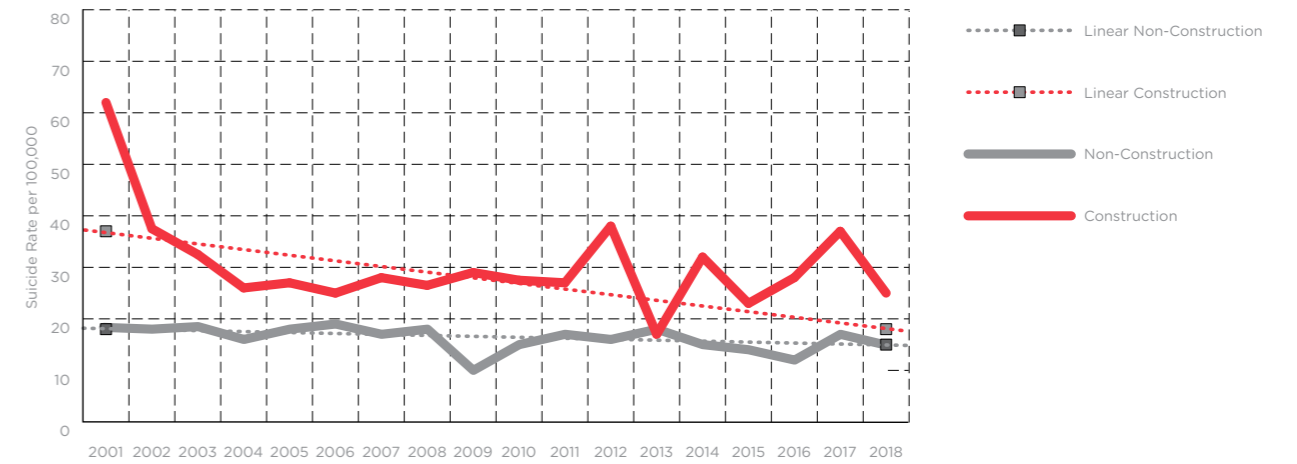
While there was some variability in suicide rates among male construction workers in South Australia, there appeared to be a decline in mortality. More stability was observed for non-construction workers (Figure 7). As for all other states, suicide rates among male construction workers were substantially higher than the rates in non-construction workers.

Figure 7. Age standardised suicide rates for male construction and non-construction workers in SA (per 100,000)



In Western Australia, rates of suicide among male non-construction workers remained stable, and the highest of all states (rates for NT were recently high, however there is substantial fluctuation across the years in this state likely due to its small size). Rates of suicide among construction workers showed substantial fluctuation above and below 28 per 100,000 between 2004 and 2018 (Figure 9).

Figure 9. Age standardised suicide rates for male construction and non-construction workers in WA (per 100,000)



c. Incidence Rate Ratios for each Australian state in 3-year blocks

Table 3 presents the incidence-rate ratios (IRR) for suicide among males in the construction industry compared to males in other occupations by state, for each 3-year block. IRRs by state were not produced for females due to low numbers.

Across Australia, and across all Australian states and all time periods, construction workers have substantially higher suicide rates than non-construction workers. While IRRs varied between 0.81 and 3.74, rates centred around 2.00 (mean 2.11, median

1.93 and IQR 1.81-2.43), broadly indicating construction workers have about double the risk suicide compared to non-construction workers. We note that IRRs less than 1.0 occurred in smaller states, where there was substantial variation in IRRs.

IRRs for Australia, and for Victoria, Queensland, and South Australia showed a moderate decline across the years, suggesting a reduction in suicide rates among construction workers relative to non-construction workers across the years of analysis.

Table 3. Incident rate-ratios (IRRs) of those employed as in construction and non-construction work, males, 2001 to 2018, weighted for age using the Mantel Haenszel method.

State	Year		IRRs	Lower CI	Upper CI
ACT	2001-2003	Construction	1.36	0.35	3.78
		Non-construction	1.00		
	2004-2006	Construction	3.36	1.29	7.90
		Non-construction	1.00		
	2007-2009	Construction	3.42	1.54	7.09
		Non-construction	1.00		
	2010-2012	Construction	2.80	1.23	5.83
		Non-construction	1.00		
	2013-2015	Construction	3.74	1.93	6.97
		Non-construction	1.00		
	2016-2018	Construction	2.52	1.04	5.48
		Non-construction	1.00		
NSW	2001-2003	Construction	1.92	1.60	2.30
		Non-construction	1.00		
	2004-2006	Construction	1.66	1.38	2.00
		Non-construction	1.00		
	2007-2009	Construction	1.42	1.15	1.73
		Non-construction	1.00		
	2010-2012	Construction	1.87	1.55	2.24
		Non-construction	1.00		
	2013-2015	Construction	2.19	1.84	2.60
		Non-construction	1.00		
	2016-2018	Construction	1.93	1.63	2.29
		Non-construction	1.00		

State	Year		IRRs	Lower CI	Upper CI
NT	2001-2003	Construction	0.81	0.21	2.27
		Non-construction	1.00		
	2004-2006	Construction	3.12	1.53	6.16
		Non-construction	1.00		
	2007-2009	Construction	3.30	1.64	6.39
		Non-construction	1.00		
	2010-2012	Construction	1.34	0.68	2.47
		Non-construction	1.00		
	2013-2015	Construction	2.94	1.54	5.53
		Non-construction	1.00		
	2016-2018	Construction	0.84	0.34	1.83
		Non-construction	1.00		
QLD	2001-2003	Construction	3.07	2.48	3.79
		Non-construction	1.00		
	2004-2006	Construction	2.05	1.65	2.54
		Non-construction	1.00		
	2007-2009	Construction	1.90	1.54	2.32
		Non-construction	1.00		
	2010-2012	Construction	1.66	1.37	2.02
		Non-construction	1.00		
	2013-2015	Construction	1.48	1.17	1.84
		Non-construction	1.00		
	2016-2018	Construction	1.72	1.38	2.14
		Non-construction	1.00		
SA	2001-2003	Construction	2.33	1.55	3.45
		Non-construction	1.00		
	2004-2006	Construction	1.89	1.23	2.82
		Non-construction	1.00		
	2007-2009	Construction	2.08	1.39	3.03
		Non-construction	1.00		
	2010-2012	Construction	2.08	1.39	3.03
		Non-construction	1.00		
	2013-2015	Construction	1.87	1.25	2.74
		Non-construction	1.00		
	2016-2018	Construction	1.89	1.19	2.94
		Non-construction	1.00		
TAS	2001-2003	Construction	3.42	1.93	5.86
		Non-construction	1.00		
	2004-2006	Construction	2.00	1.18	3.28
		Non-construction	1.00		
	2007-2009	Construction	1.90	1.08	3.22
		Non-construction	1.00		

State	Year		IRRs	Lower CI	Upper CI
	2010-2012	Construction	1.81	0.95	3.28
		Non-construction	1.00		
	2013-2015	Construction	1.85	1.02	3.21
		Non-construction	1.00		
	2016-2018	Construction	0.84	0.38	1.65
		Non-construction	1.00		
VIC	2001-2003	Construction	2.73	2.24	3.31
		Non-construction	1.00		
	2004-2006	Construction	2.43	2.03	2.91
		Non-construction	1.00		
	2007-2009	Construction	2.36	1.94	2.87
		Non-construction	1.00		
	2010-2012	Construction	2.29	1.86	2.81
		Non-construction	1.00		
	2013-2015	Construction	1.74	1.41	2.13
		Non-construction	1.00		
	2016-2018	Construction	1.82	1.48	2.23
		Non-construction	1.00		
WA	2001-2003	Construction	2.68	2.05	3.47
		Non-construction	1.00		
	2004-2006	Construction	1.62	1.21	2.13
		Non-construction	1.00		
	2007-2009	Construction	1.87	1.45	2.39
		Non-construction	1.00		
	2010-2012	Construction	2.11	1.68	2.65
		Non-construction	1.00		
	2013-2015	Construction	1.65	1.30	2.09
		Non-construction	1.00		
	2016-2018	Construction	2.10	1.66	2.64
		Non-construction	1.00		
Australia	2001-2003	Construction	2.43	2.21	2.67
		Non-construction	1.00		
	2004-2006	Construction	1.99	1.81	2.18
		Non-construction	1.00		
	2007-2009	Construction	1.92	1.74	2.11
		Non-construction	1.00		
	2010-2012	Construction	1.97	1.79	2.16
		Non-construction	1.00		
	2013-2015	Construction	1.87	1.70	2.05
		Non-construction	1.00		
	2016-2018	Construction	1.86	1.69	2.04
		Non-construction	1.00		

d. Graphical comparisons of state RR of suicide among construction workers (compared to non-construction workers), with RR of construction workers (compared to non-construction workers) in Australia in 3-year blocks

Figures 10-17 graphically represent the IRRs shown in Table 3.

Figure 10. Relative risk of suicide among construction workers (vs non-construction workers) in the Australian Capital Territory compared to relative risk of suicide among construction workers (vs non-construction workers) Australia-wide

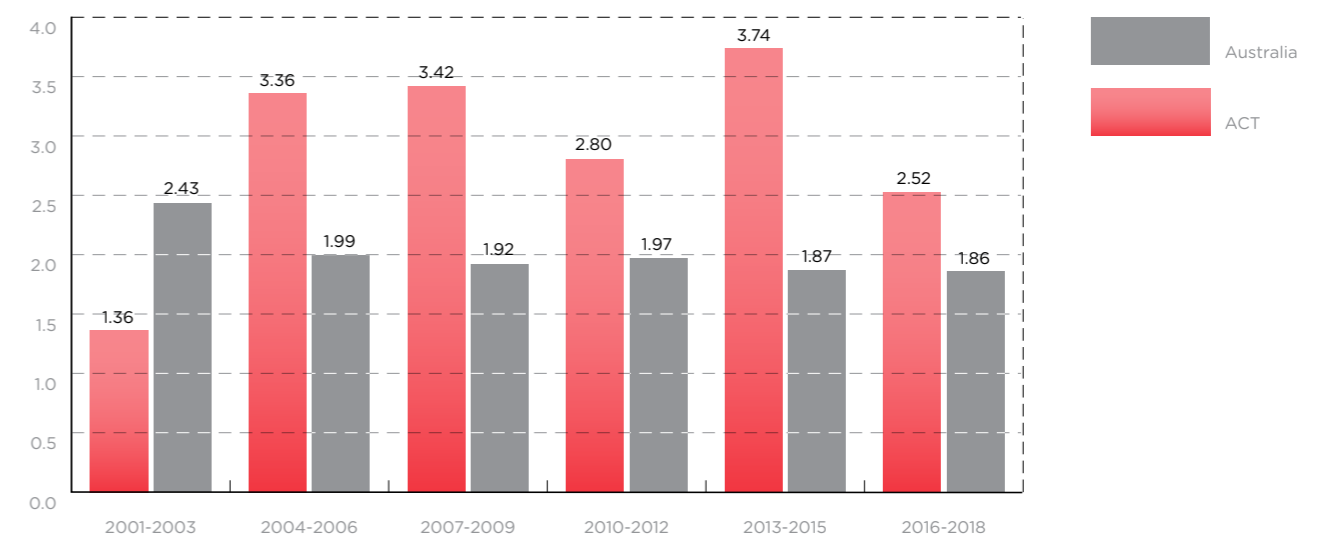


Figure 11. Relative risk of suicide among construction workers (vs non construction workers) in New South Wales compared to relative risk of suicide among construction workers (vs non construction workers) Australia-wide

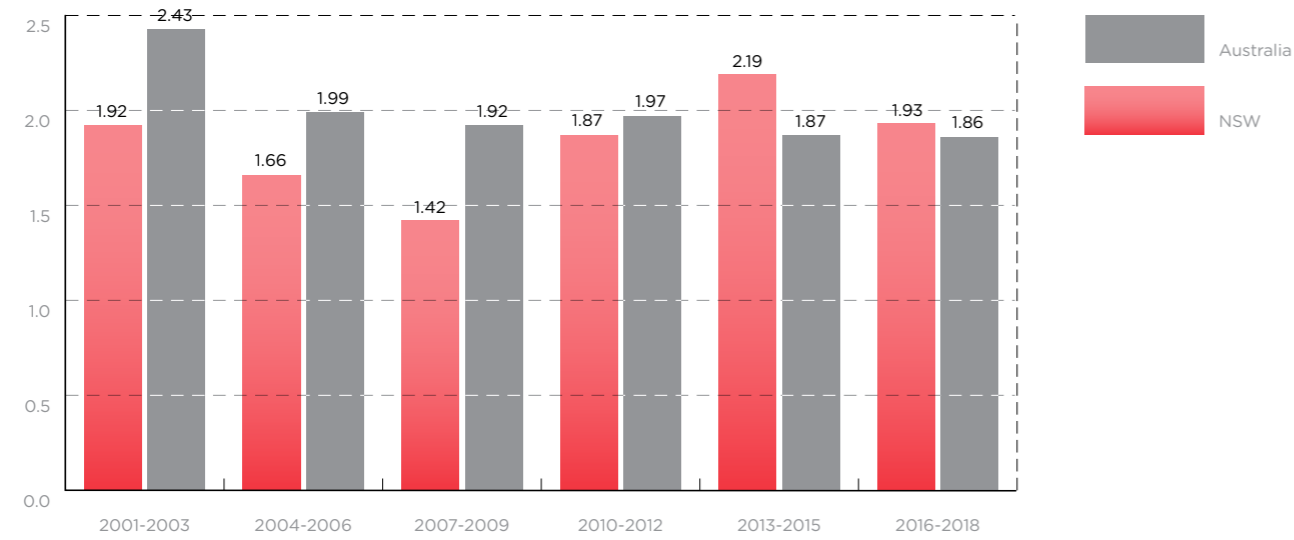


Figure 13. Relative risk of suicide among construction workers (vs non construction workers) in Queensland compared to relative risk of suicide among construction workers (vs non construction workers) Australia-wide

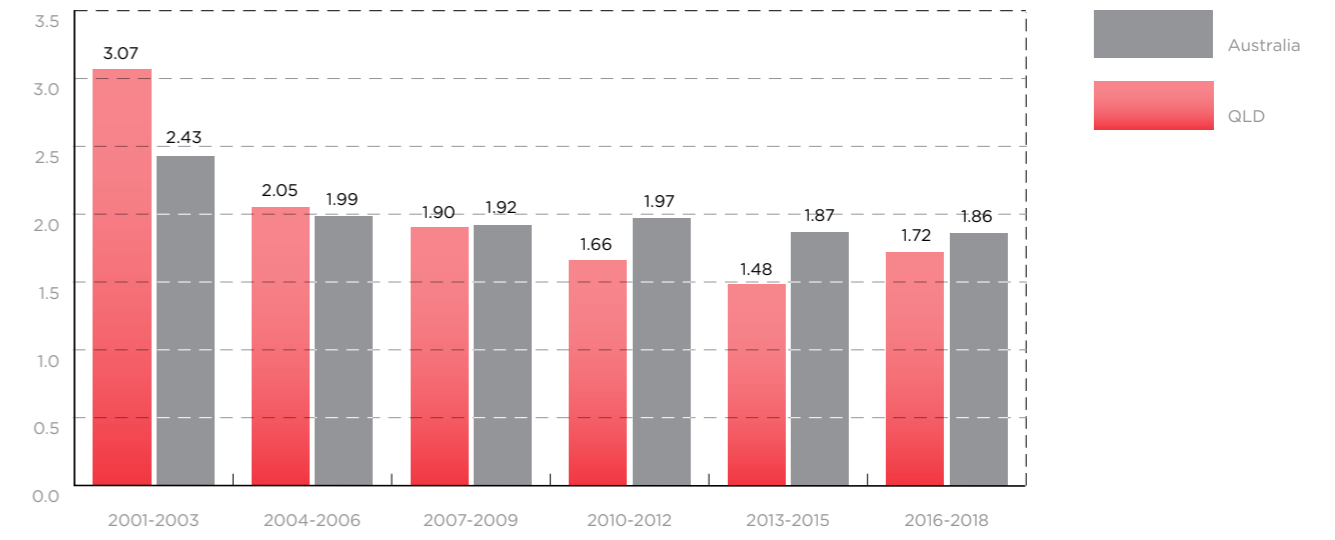


Figure 12. Relative risk of suicide among construction workers (vs non construction workers) in Northern Territory compared to relative risk of suicide among construction workers (vs non construction workers) Australia-wide



Figure 14. Relative risk of suicide among construction workers (vs non construction workers) in South Australia compared to relative risk of suicide among construction workers (vs non construction workers) Australia-wide

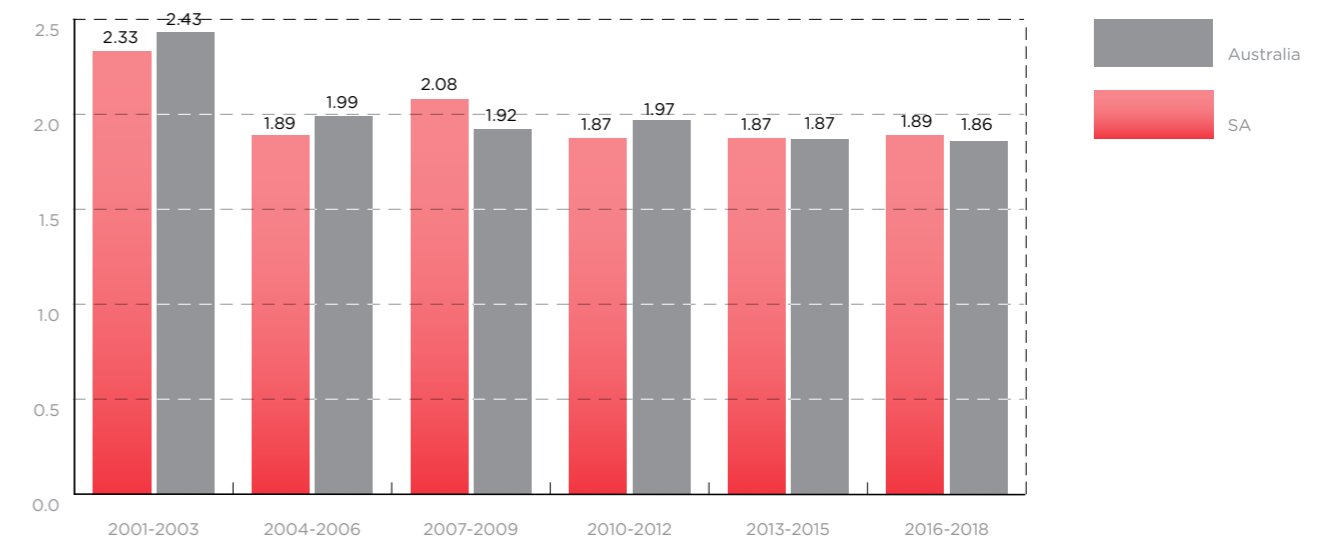


Figure 15. Relative risk of suicide among construction workers (vs non construction workers) in TAS compared to relative risk of suicide among construction workers (vs non construction workers) Australia-wide

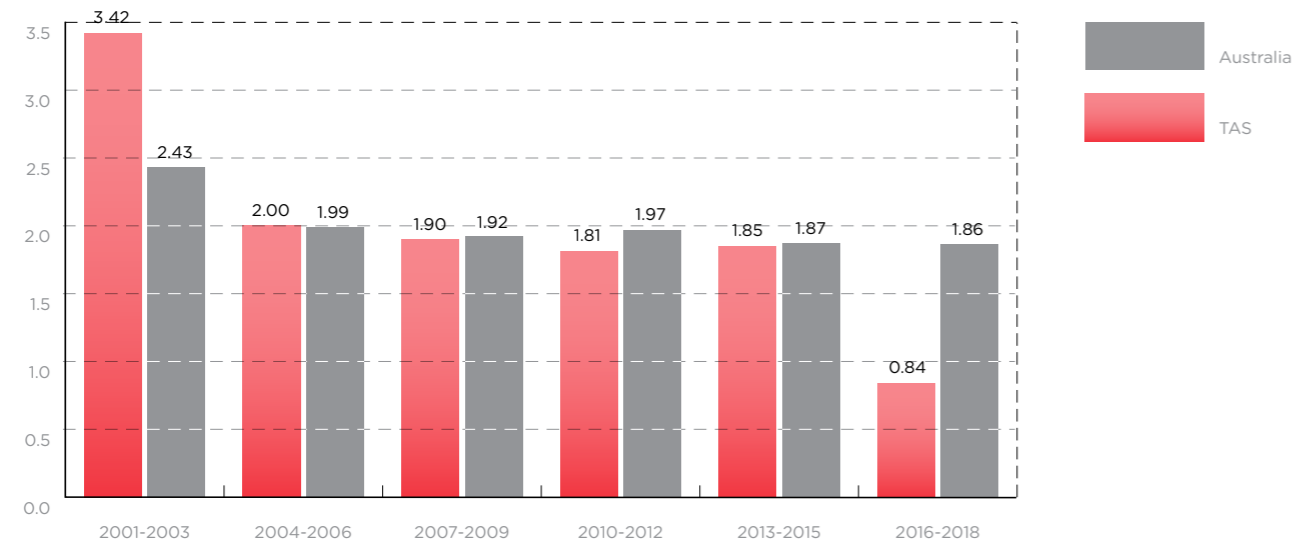


Figure 17. Relative risk of suicide among construction workers (vs non construction workers) in Western Australia compared to relative risk of suicide among construction workers (vs non construction workers) Australia-wide

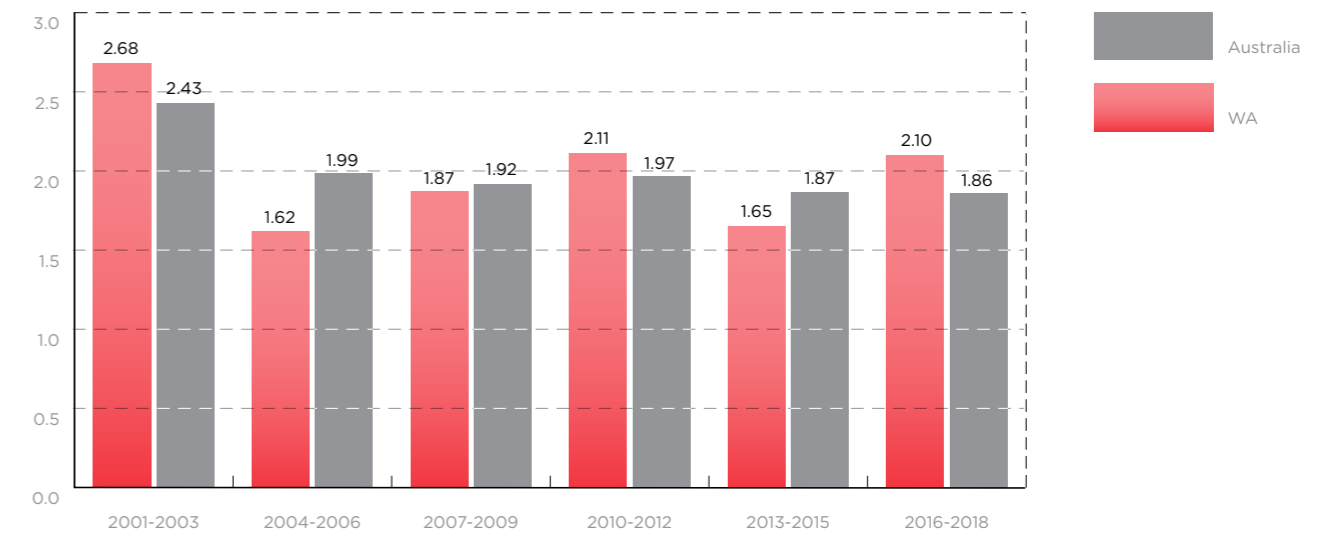
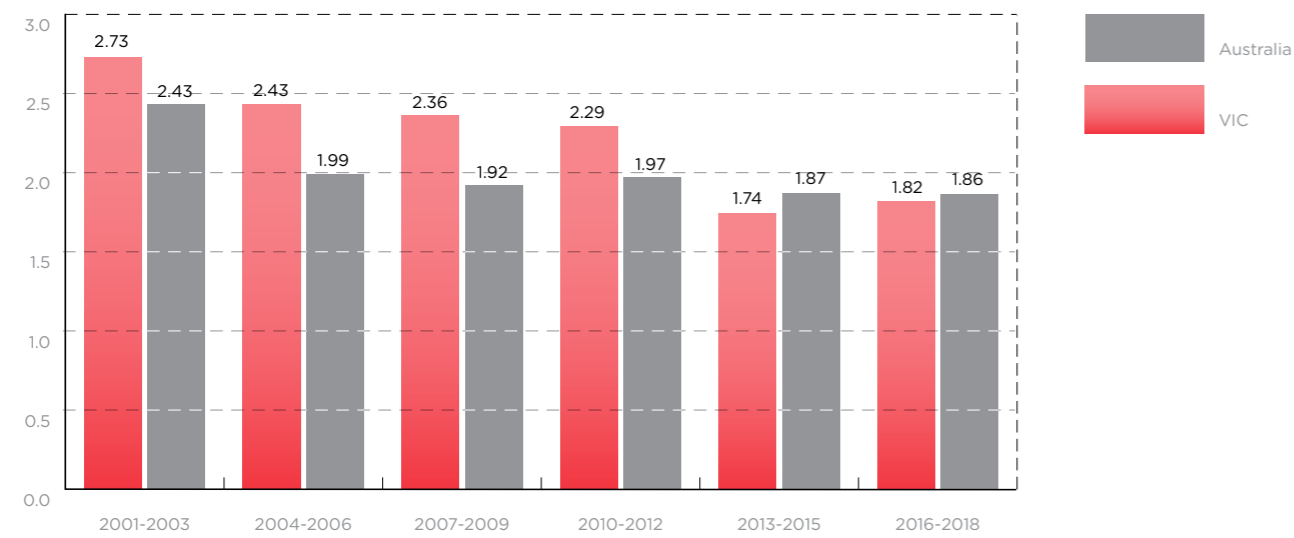


Figure 16. Relative risk of suicide among construction workers (vs non construction workers) in Victoria compared to relative risk of suicide among construction workers (vs non construction workers) Australia-wide

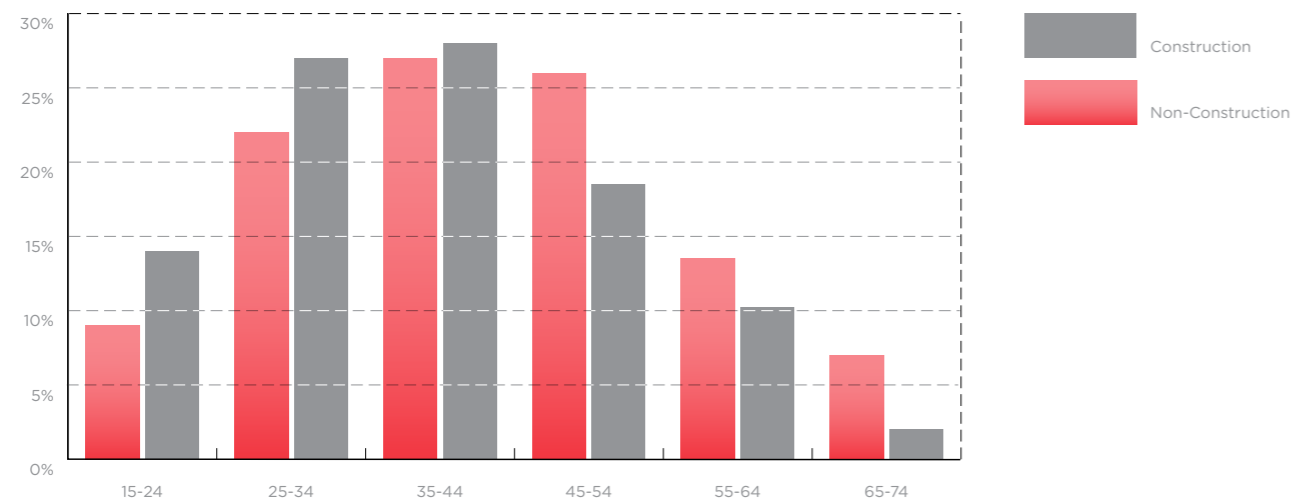


e. **Age distribution of suicide among construction workers compared to non-construction workers in Australia**

Figure 18 shows the age distribution of suicide among construction workers compared to non-construction workers within employed males in Australia. Compared to Australian employed male suicides, a greater proportion of suicides among construction workers occur in younger age-groups. Within Australian males employed in non-construction occupations, almost 10% of suicides occur within those aged 15-24 years, whereas almost 15% of suicides among construction workers occur in this age group. A similar pattern is apparent for males aged 25-34 years: among construction workers, 27.1% of suicides

occur in this age range compared to 21.6% among Australians employed in non-construction jobs. There was little difference in the proportion of suicides among construction and non-construction occupations for those aged 35-44 years, however among those aged 45-54 years, there was a higher proportion of suicides among non-construction workers occurring in this age group. This pattern was repeated, albeit to a lesser extent, for those aged 55-64 years, and those aged over 65 years. Please see Appendix 4, Figures A1-A7 for comparisons of the age distribution of suicide among construction workers for each state, compared to the Australian age distribution of suicide among construction workers.

Figure 18: Age distribution of male construction workers in Australia compared to employed males in non-construction occupations



CONCLUSION

This report provides an updated analysis of suicide mortality among construction workers in Australia. Drawing on 18 years of data (2001-2018), it updates the previous reports conducted in 2016, 2017 and 2018. This report documents some key findings. Firstly, the results highlight increased suicide mortality in construction workers relative to other workers in the Australian population. This has been consistently observed in Australia (Heller *et al.*, 2007) and internationally (Meltzer *et al.*, 2008; Windsor-Shellard and Gunnell, 2019) for decades, and this report documents a continuation of this trend.

The second important finding is that in several states, and across Australia as a whole, descriptive time trends suggest a steady decline in suicide rates among construction workers over time, and a narrowing of the disparity in rates between construction and non-construction workers. Suicide mortality among construction workers appears to be decreasing particularly in Victoria, Tasmania and Queensland. Within these states, we cautiously observe a trend toward convergence between suicide rates for construction and non-construction workers, especially in Tasmania and Queensland.

The final observation is that suicide rates among construction workers varied substantially across State and Territory jurisdictions. We note however that as differences were not formally statistically tested, comparison is difficult because small overall numbers in some states make it difficult to properly assess trends.

Study limitations

We note some limitations of this analysis. While the NCIS data provides the most accurate, comprehensive information regarding suicide deaths that is available, there are some limitations that must be considered. In some suicide cases, the employment status and occupation of the deceased is unknown, or unreported, limiting the accuracy and scope of the analysis. Furthermore, some of the occupations listed by the Coroner are ambiguous or insufficient for coding purposes, thereby resulting in missing data. As a further point, the NCIS data is coded based on the occupation title from police reports, whereas the population data is from the ABS industry/sector estimates.

It is also important to note that coronial processes can be lengthy, and there is frequently a delay in the classification of cases. Some cases, sometimes remain 'open' for years. As a consequence of this, suicide cases may be under-reported in more recent years. It is also the case that variations in coronial processes exist across state and territory jurisdictions, which may result in differences in case identification and classification between jurisdictions (Leo *et al.*, 2010). It is estimated that suicide deaths are underestimated by 11-16% due to an inability to judge intent (such in single occupant car crashes) (Leo *et al.*, 2010).

We also highlight the fact that we have categorised construction workers according to the ANZSCO occupations denoted in Appendix 1. Not all of these occupational codes distinguish between sector, and the "construction worker" category is likely to include some workers employed in the

CONCLUSION

mining and energy sectors. While both denominators and numerators were coded according to this ANZSCO (Australian and New Zealand Standard Classification of Occupations) coding, the quarterly labour force statistics that were used to adjust figures were specific to the construction sector (Australian New Zealand Standard Industry Classification, ANZSIC). This may have introduced some measurement error in estimates.

In summary

In summary, national suicide mortality continues to be higher among construction workers compared to other workers. There is some evidence of a decline in suicide rates among construction workers, and in some states there may be a narrowing of the suicide disparity between construction and non-construction workers. Despite this, suicide remains unacceptably high among this group, and reducing suicide among construction workers should continue to be a key priority for government, organisation and workplace suicide prevention initiatives.

ACKNOWLEDGEMENTS

The authors acknowledge the National Coronial Information System in the Victorian Department of Justice and Community Safety for providing NCIS data, the coroners and their staff in each state and territory who contribute data to the NCIS, and officers of state and territory death registries.

REFERENCES

- ABS**, 2015. 3101.0 - Standard Population for Use in Age-standardisation. Canberra.
- Agerbo**, E., 2005. Effect of psychiatric illness and labour market status on suicide: A healthy worker effect? *J. Epidemiol. Community Health* 59, 598–602. <https://doi.org/10.1136/jech.2004.025288>
- Australian Bureau of Statistics**, 2020a. 6291.0.55.003 - Labour Force, Australia, Detailed, Quarterly, May 2020. Canberra, ACT.
- Australian Bureau of Statistics**, 2020b. 6291.0.55.003 - Labour Force, Australia, Detailed, Quarterly, Feb 2020. Canberra, ACT.
- Australian Bureau of Statistics**, 2013. 1220.0 - ANZSCO - Australian and New Zealand Standard Classification of Occupations, Version 1.3 [WWW Document]. URL <https://www.abs.gov.au/AUSSTATS/abs@.nsf/Latestproducts/1220.0Contents02013,Version1.3?opendocument&tabname=Summary&prodno=1220.0&issue=2013,Version1.3&num=&view=> (accessed 3.14.20).
- Heller**, T., Hawgood, J., Leo, D., 2007. Correlates of suicide in building industry workers. *Arch. Suicide Res.* 11, 105–117.
- King**, T., Riccardi, L., Milner, A., 2018. Suicide in the construction industry: Report submitted to MATES in Construction.
- Leo**, D. De, Dudley, M.J., Aebersold, C.J., Mendoza, J. a, Barnes, M. a, Harrison, J.E., Ranson, D.L., 2010. Achieving standardised reporting of suicide in Australia: rationale and program for change. *Med. J. Aust.* 192, 452–456.
- Maheen**, H., Milner, A., 2017. Suicide in the Construction Industry: Report submitted to MATES in Construction by Deakin University. Volume 2. Melbourne, Australia.
- Martin**, G., Swannell, S., Milner, A., Gullestrup, J., 2016. Mates in Construction Suicide Prevention Program: A Five Year Review. *J. Community Med. Health Educ.* 6, 1–8. <https://doi.org/10.4172/2161-0711.1000465>
- Meltzer**, H., Griffiths, C., Brock, A., Rooney, C., Jenkins, R., 2008. Patterns of suicide by occupation in England and Wales: 2001–2005. *Br. J. Psychiatry* 193, 73–76. <https://doi.org/10.1192/bjp.bp.107.040550>
- Milner**, A., 2016. Suicide in the Construction Industry: Report by Deakin University for MATES in Construction. Volume 1. Melbourne, Australia.
- Peterson**, C., Stone, D.M., Marsh, S.M., Schumacher, P.K., Tiesman, H.M., Wendy, , Mcintosh, L., Colby, , Lokey, N., Aimée-Rika, , Trudeau, T., Bartholow, B., Luo, F., 2018. Suicide Rates by Major Occupational Group- 17 States, 2012 and 2015. *Centers Dis. Control Prev. Morb. Mortal. Wkly. Rep.* 67, 1253–1260.
- Windsor-Shellard**, B., Gunnell, D., 2019. Occupation-specific suicide risk in England: 2011–2015. *Br. J. Psychiatry* 215, 594–599. <https://doi.org/10.1192/bjp.2019.69>
- World Health Organization**, 2014. Preventing suicide, Preventing suicide: A global imperative. Geneva, Switzerland.

APPENDIX 1: OCCUPATIONAL CODING

Occupational information for suicide cases was derived from the Australian and New Zealand Standard Classification of Occupations (ANZSCO) to the four-digit level. Those cases described as belonging to the construction industry are those occupations shown in red font below:

13 Specialist Manager

133 Construction, Distribution and Production Managers

1331 Construction Managers

31 Engineering, ICT and Science Technicians

312 Building and Engineering Technicians

- 3121 Architectural, Building and Surveying Technicians
- 3122 Civil Engineering Draftspersons and Technicians
- 3123 Electrical Engineering Draftspersons and Technicians
- 3124 Electronic Engineering Draftspersons and Technicians
- 3125 Mechanical Engineering Draftspersons and Technicians
- 3126 Safety Inspectors
- 3129 Other Building and Engineering Technicians

33 Construction Trades Workers

331 Bricklayers, and Carpenters and Joiners

- 3311 Bricklayers and Stonemasons
- 3312 Carpenters and Joiners

332 Floor Finishers and Painting Trades Workers

- 3321 Floor Finishers
- 3322 Painting Trades Workers

333 Glaziers, Plasterers and Tilers

- 3331 Glaziers
- 3332 Plasterers
- 3333 Roof Tilers
- 3334 Wall and Floor Tilers

334 Plumbers

- 3341 Plumbers

34 Electrotechnology and Telecommunications Trades Workers

341 Electricians

- 3411 Electricians

342 Electronics and Telecommunications Trades Workers

- 3421 Airconditioning and Refrigeration Mechanics
- 3422 Electrical Distribution Trades Workers
- 3423 Electronics Trades Workers
- 3424 Telecommunications Trades Workers

71 Machine and Stationary Plant Operators

711 Machine Operators

- 7111 Clay, Concrete, Glass and Stone Processing
- 7112 Industrial Spray painters
- 7113 Paper and Wood Processing Machine Operators
- 7114 Photographic Developers and Printers
- 7115 Plastics and Rubber Production Machine Operators
- 7116 Sewing Machinists
- 7117 Textile and Footwear Production Machine Operators
- 7119 Other Machine Operators

712 Stationary Plant Operators

- 7121 Crane, Hoist and Lift Operators
- 7122 Drillers, Miners and Shot Firers
- 7123 Engineering Production Systems Workers
- 7129 Other Stationary Plant Operators

82 Construction and Mining Labourers

821 Construction and Mining Labourers

- 8211 Building and Plumbing Labourers
 - 8212 Concreters
 - 8213 Fencers
 - 8214 Insulation and Home Improvement Installers
 - 8215 Paving and Surfacing Labourers
 - 8216 Railway Track Workers
 - 8217 Structural Steel Construction Workers
 - 8219 Other Construction and Mining Labourer
-

APPENDIX 2: AGE ADJUSTED SUICIDE RATES (CONSTRUCTION WORKERS)

Age-adjusted suicide rates among males employed in the construction industry, by state and year.

Years	State	Age-standardised suicide rates per 100,000	Lower confidence interval	Upper confidence interval
2001-2003	ACT	12.7	0	37.5
2004-2006	ACT	30.2	0	64.4
2007-2009	ACT	39.4	0.4	78.4
2010-2012	ACT	21.4	0	51
2013-2015	ACT	42.0	4.4	79.5
2016-2018	ACT	16.9	0	41.2
2001	NSW	28.7	21.1	36.2
2002	NSW	21.5	15.4	27.7
2003	NSW	26.7	18.1	35.3
2004	NSW	18.8	13.4	24.2
2005	NSW	22.6	14.8	30.4
2006	NSW	21.4	15.7	27
2007	NSW	18.8	12.6	25
2008	NSW	13.9	9.5	18.3
2009	NSW	13.4	9.1	17.7
2010	NSW	26.2	18.5	33.9
2011	NSW	16.5	11.6	21.4
2012	NSW	20.3	14.9	25.6
2013	NSW	23.2	15.5	30.9
2014	NSW	23.9	17.7	30.1
2015	NSW	27.9	21.1	34.7
2016	NSW	22.9	16.9	28.9
2017	NSW	19.9	14.5	25.2
2018	NSW	23.1	17.5	28.7
2001-2003	NT	14.9	0	44.2
2004-2006	NT	52.7	0	105.8
2007-2009	NT	82.2	15.8	148.7
2010-2012	NT	40.4	0.4	80.4
2013-2015	NT	48.3	8.9	87.8
2016-2018	NT	30.2	0	64.9

Years	State	Age-standardised suicide rates per 100,000	Lower confidence interval	Upper confidence interval
2001	QLD	46.4	31.8	61
2002	QLD	47.5	33.6	61.4
2003	QLD	37.8	21	54.7
2004	QLD	36.2	26.5	45.9
2005	QLD	26.3	18.8	33.9
2006	QLD	12.9	7.7	18.1
2007	QLD	26.5	16.7	36.3
2008	QLD	23	15.2	30.7
2009	QLD	21.5	15.3	27.7
2010	QLD	25	16.7	33.3
2011	QLD	30.3	22.7	37.8
2012	QLD	17	11.2	22.7
2013	QLD	15	8.2	21.9
2014	QLD	17.2	9.7	24.8
2015	QLD	27.5	18.3	36.7
2016	QLD	18.9	13	24.9
2017	QLD	16.5	11.2	21.7
2018	QLD	18.6	12.7	24.5
2001	SA	31.5	14.3	48.8
2002	SA	28.7	13	44.4
2003	SA	18.1	6.2	29.9
2004	SA	17	5.8	28.1
2005	SA	18.1	6.8	29.5
2006	SA	23.8	10.8	36.8
2007	SA	32.8	10	55.7
2008	SA	26.6	12.1	41.1
2009	SA	18.8	7.7	30
2010	SA	22.2	10.5	33.8
2011	SA	24.8	12.6	37
2012	SA	15.6	5.9	25.3
2013	SA	30.1	7.9	52.3
2014	SA	21.4	10.2	32.7
2015	SA	22.8	8.4	37.1
2016	SA	13	3.9	22.2
2017	SA	15.4	5.8	24.9
2018	SA	20.1	5.5	34.8

Years	State	Age-standardised suicide rates per 100,000	Lower confidence interval	Upper confidence interval
2001-2003	TAS	51.4	10	92.9
2004-2006	TAS	50.4	17.1	83.7
2007-2009	TAS	32.2	6.4	58
2010-2012	TAS	25.5	3.1	48
2013-2015	TAS	31.6	6.3	57
2016-2018	TAS	22.7	0	45.5
<hr/>				
2001	VIC	42	30.4	53.6
2002	VIC	33.1	23.9	42.4
2003	VIC	29	20.4	37.7
2004	VIC	34.9	25.6	44.2
2005	VIC	36.6	25.3	48
2006	VIC	30.5	22.7	38.3
2007	VIC	31.5	23.2	39.8
2008	VIC	24.6	16.3	32.9
2009	VIC	28.3	18.5	38.1
2010	VIC	23.5	14.9	32.1
2011	VIC	14.6	9.5	19.7
2012	VIC	32	23.2	40.9
2013	VIC	35.5	22.3	48.7
2014	VIC	21.3	14	28.6
2015	VIC	19.9	13.2	26.7
2016	VIC	18.6	11.4	25.8
2017	VIC	22.5	15.6	29.3
2018	VIC	18.2	12.3	24.1
<hr/>				
2001	WA	61	41.3	80.7
2002	WA	37.6	21.8	53.3
2003	WA	33.1	19.3	47
2004	WA	26.3	14.4	38.1
2005	WA	27.7	16.8	38.5
2006	WA	25.4	15.4	35.4
2007	WA	29.2	18.7	39.7
2008	WA	27.1	17.8	36.4
2009	WA	29.4	16.7	42.1
2010	WA	28.2	19	37.5
2011	WA	27.2	18.3	36.2
2012	WA	37.6	26.8	48.5
2013	WA	17.6	10.7	24.4
2014	WA	32.4	22.7	42
2015	WA	23.6	15.4	31.9
2016	WA	28.9	18	39.9
2017	WA	36.1	24.3	47.9
2018	WA	24.8	16.3	33.3

APPENDIX 3: AGE ADJUSTED SUICIDE RATES (NON-CONSTRUCTION WORKERS)

Age-adjusted suicide rates among males employed in non-construction occupations, by state and year.

Years	State	Age-standardised suicide rates per 100,000	Lower confidence interval	Upper confidence interval
2001-2003	ACT	13.1	5.3	20.8
2004-2006	ACT	8.3	2.1	14.5
2007-2009	ACT	10.6	4	17.2
2010-2012	ACT	12	4.9	19.2
2013-2015	ACT	11	4.4	17.6
2016-2018	ACT	11.2	2.8	19.5
<hr/>				
2001	NSW	13.1	11.1	15.2
2002	NSW	14.6	12.4	16.8
2003	NSW	13.5	11.4	15.5
2004	NSW	13.1	11	15.1
2005	NSW	15.7	13.3	18.2
2006	NSW	10.6	8.7	12.4
2007	NSW	12.7	10.7	14.6
2008	NSW	10.9	9.2	12.7
2009	NSW	8.9	7.3	10.6
2010	NSW	11.5	9.7	13.3
2011	NSW	10.6	8.8	12.4
2012	NSW	11.7	9.8	13.6
2013	NSW	11.5	9.3	13.7
2014	NSW	12.4	10.5	14.4
2015	NSW	11.2	9.4	13.1
2016	NSW	9.8	8	11.5
2017	NSW	12.7	10.7	14.7
2018	NSW	12.6	10.5	14.6
<hr/>				
2001-2003	NT	30	12.9	47.1
2004-2006	NT	19.8	6	33.6
2007-2009	NT	20.9	7.1	34.7
2010-2012	NT	38.9	19.6	58.1
2013-2015	NT	19.3	6.5	32.1
2016-2018	NT	26.2	11.1	41.3

Years	State	Age-standardised suicide rates per 100,000	Lower confidence interval	Upper confidence interval
2001	QLD	13.3	10.7	15.9
2002	QLD	14.9	11.8	17.9
2003	QLD	15.2	12.2	18.2
2004	QLD	14.8	11.9	17.8
2005	QLD	14.7	11.6	17.9
2006	QLD	9.4	7.3	11.5
2007	QLD	10.4	8.1	12.7
2008	QLD	12.5	10	15
2009	QLD	14.5	11.7	17.3
2010	QLD	16.9	14.1	19.6
2011	QLD	16.6	13.6	19.5
2012	QLD	11.1	8.7	13.5
2013	QLD	11.4	9	13.7
2014	QLD	12.6	10.1	15
2015	QLD	11.9	9.6	14.2
2016	QLD	9.9	7.8	12.1
2017	QLD	13.1	10.7	15.5
2018	QLD	9.7	7.7	11.8
2001	SA	13.7	9.2	18.2
2002	SA	10.1	6.7	13.6
2003	SA	9.9	5.9	13.9
2004	SA	8.2	5.1	11.3
2005	SA	14	9.9	18
2006	SA	10.8	6.3	15.4
2007	SA	12.4	8.6	16.3
2008	SA	12.2	8.5	15.9
2009	SA	9.8	6.4	13.3
2010	SA	11.2	7.6	14.7
2011	SA	12.9	9	16.9
2012	SA	10.4	6.8	14
2013	SA	12.2	8.1	16.3
2014	SA	12.3	8.4	16.2
2015	SA	8.4	5.2	11.7
2016	SA	10.9	7.2	14.5
2017	SA	8.2	5.1	11.3
2018	SA	6	3.3	8.6
2001-2003	TAS	20.2	8.8	31.7
2004-2006	TAS	22.7	12.9	32.6
2007-2009	TAS	18.7	9.9	27.5
2010-2012	TAS	16.8	7.6	26
2013-2015	TAS	19.1	9.7	28.5
2016-2018	TAS	18.8	9.9	27.7

Years	State	Age-standardised suicide rates per 100,000	Lower confidence interval	Upper confidence interval
2001	VIC	13.5	11.1	15.9
2002	VIC	13.1	10.7	15.5
2003	VIC	13.5	11.1	15.9
2004	VIC	14.6	12.1	17
2005	VIC	13.4	11	15.7
2006	VIC	14	11.6	16.5
2007	VIC	12.2	10.1	14.4
2008	VIC	10.2	8.3	12.1
2009	VIC	11.9	9.8	14.1
2010	VIC	11	9	13
2011	VIC	7.5	5.9	9.2
2012	VIC	9.9	8.1	11.8
2013	VIC	13.7	11.3	16.1
2014	VIC	12	10	14
2015	VIC	11.7	9.8	13.7
2016	VIC	8.9	7.1	10.7
2017	VIC	10.4	8.5	12.3
2018	VIC	10.7	8.8	12.6
2001	WA	18.3	13.9	22.7
2002	WA	18	13.4	22.7
2003	WA	18.4	13.8	23
2004	WA	16.6	12.7	20.5
2005	WA	18	13.5	22.6
2006	WA	19	13.9	24.1
2007	WA	17.3	13.4	21.3
2008	WA	17.9	13.9	21.8
2009	WA	10.1	7.1	13
2010	WA	14.5	11	18.1
2011	WA	16.6	12.7	20.5
2012	WA	15.6	12	19.2
2013	WA	17	13.2	20.8
2014	WA	15.1	11.7	18.6
2015	WA	13.5	10.3	16.8
2016	WA	12.2	9	15.4
2017	WA	16	12.5	19.5
2018	WA	14.7	11.2	18.1

APPENDIX 4: AGE DISTRIBUTION OF SUICIDES AMONG CONSTRUCTION WORKERS

Age distribution of suicides among construction workers for each state relative to Australia.

Figure A1: Age distribution of suicide among ACT male construction workers compared to Australian male construction workers

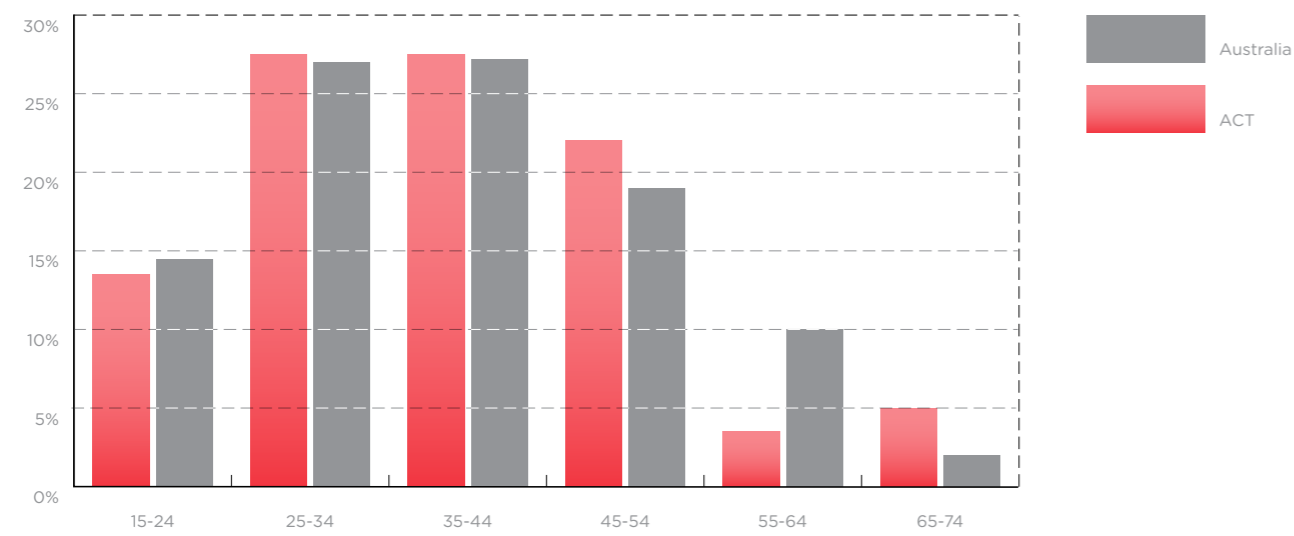


Figure A2: Age distribution of suicide among NSW male construction workers compared to Australian construction workers

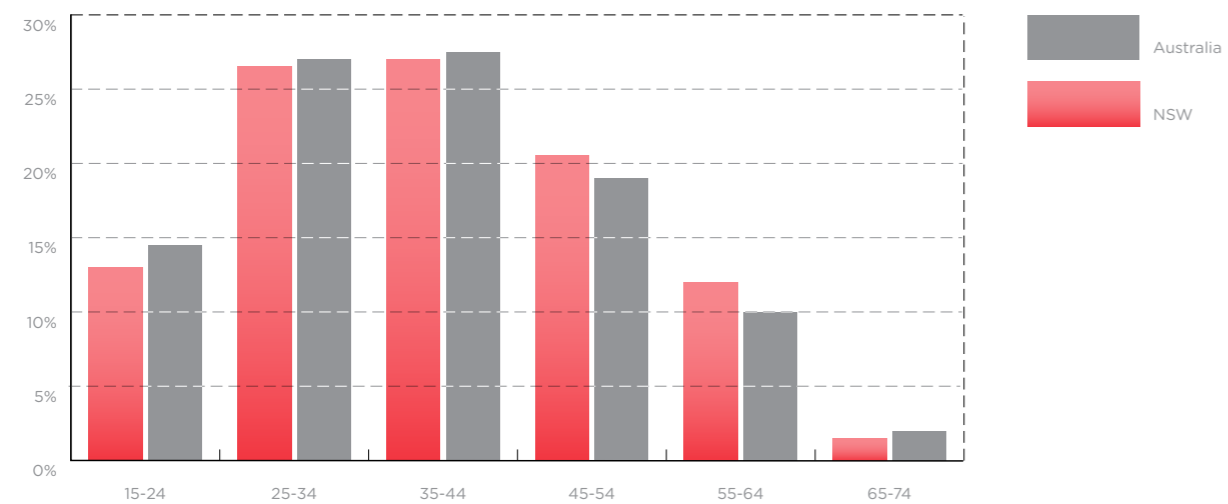


Figure A3: Age distribution of suicide among Queensland male construction workers compared to Australian male construction workers

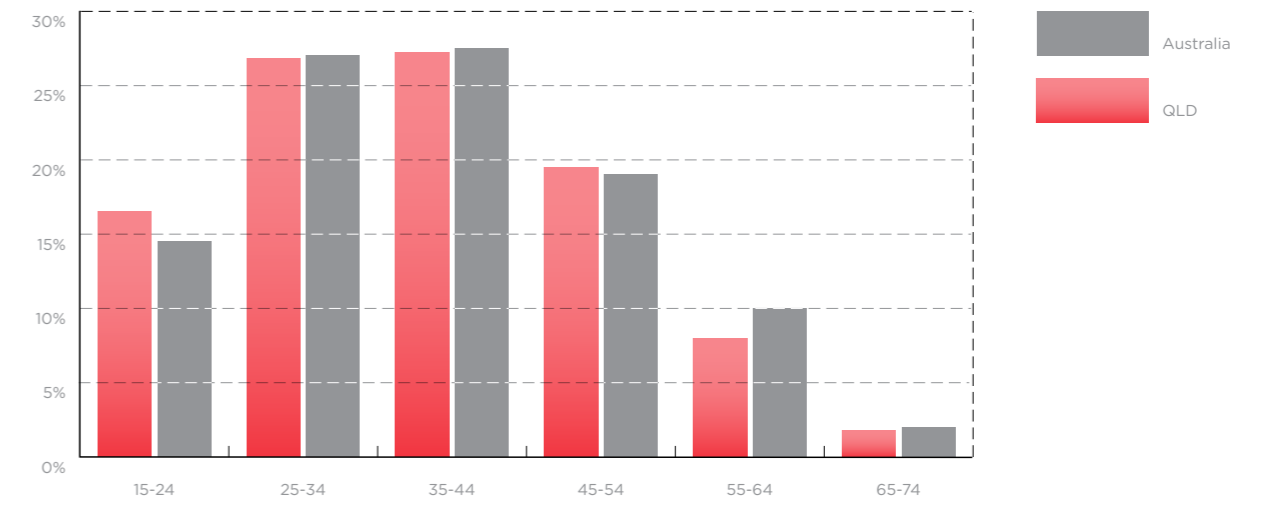


Figure A4: Age distribution of suicide among South Australian male construction workers compared to Australian male construction workers

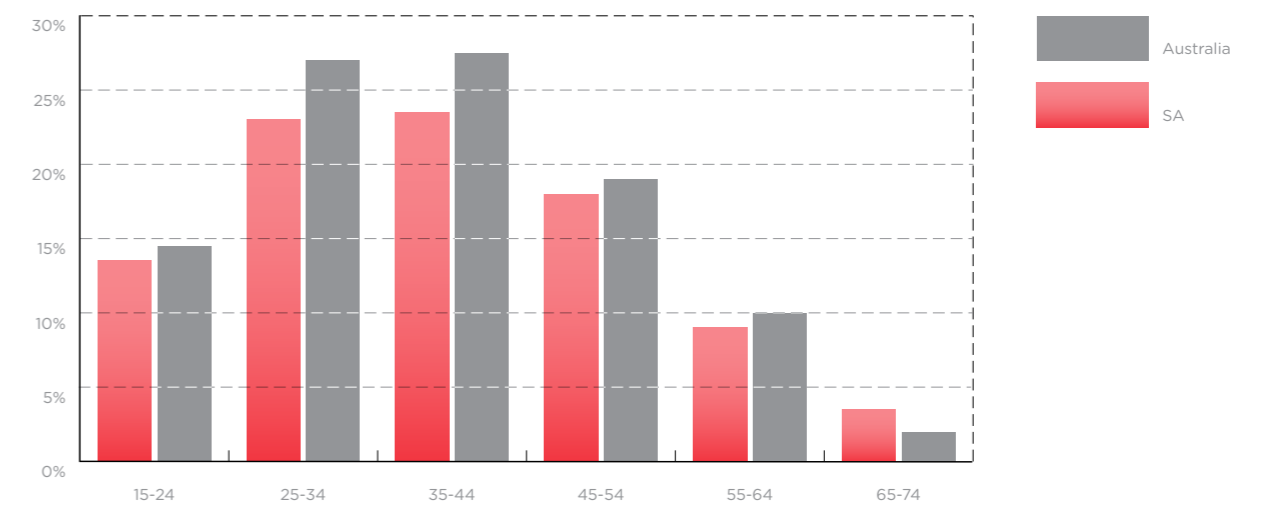


Figure A5: Age distribution of suicide among Tasmanian male construction workers compared to Australian male construction workers

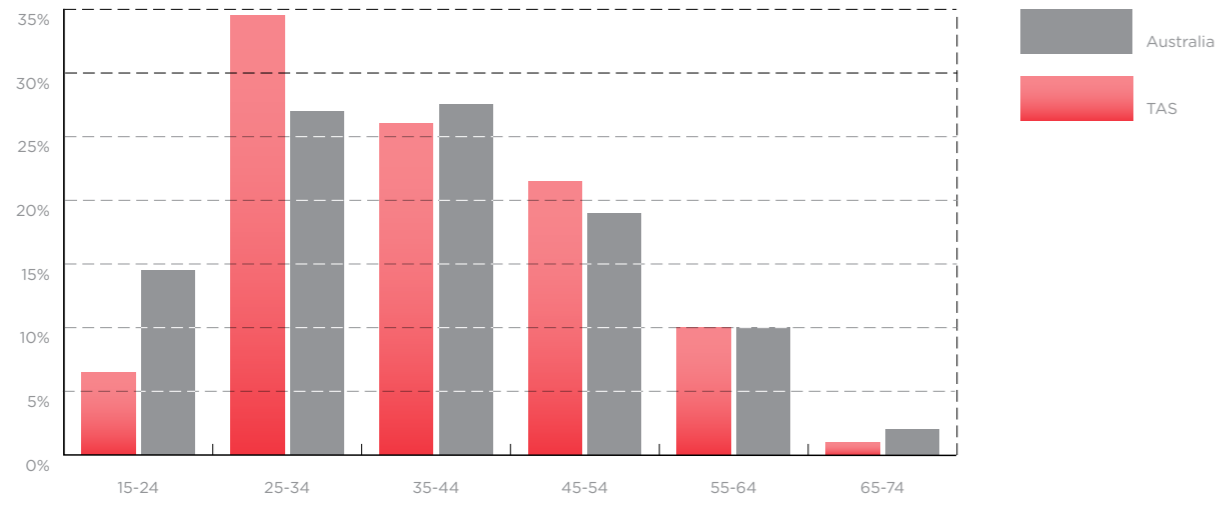


Figure A7: Age distribution of suicide among Western Australian male construction workers compared to Australian male construction workers

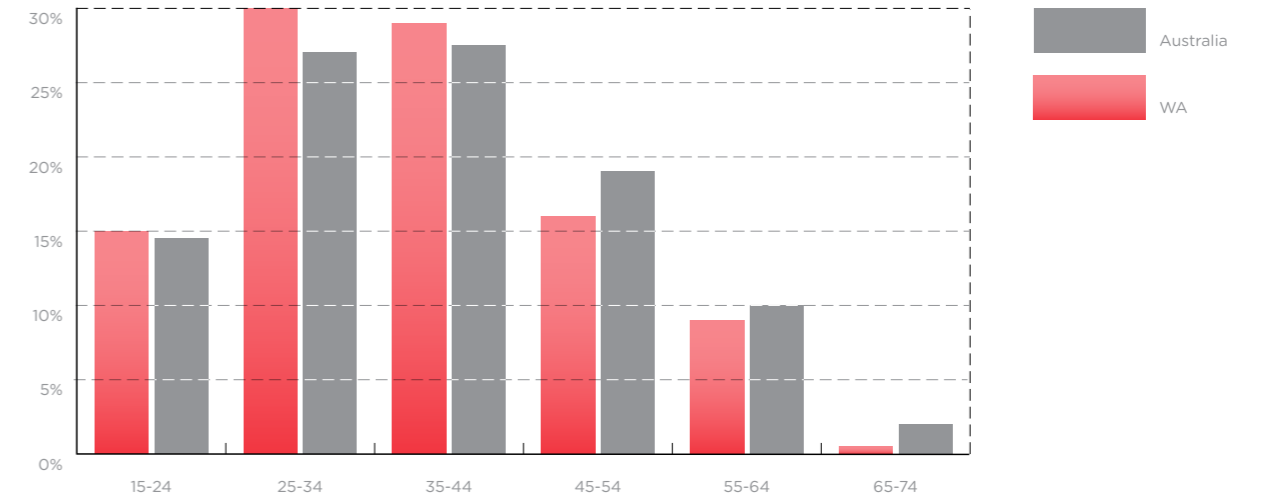
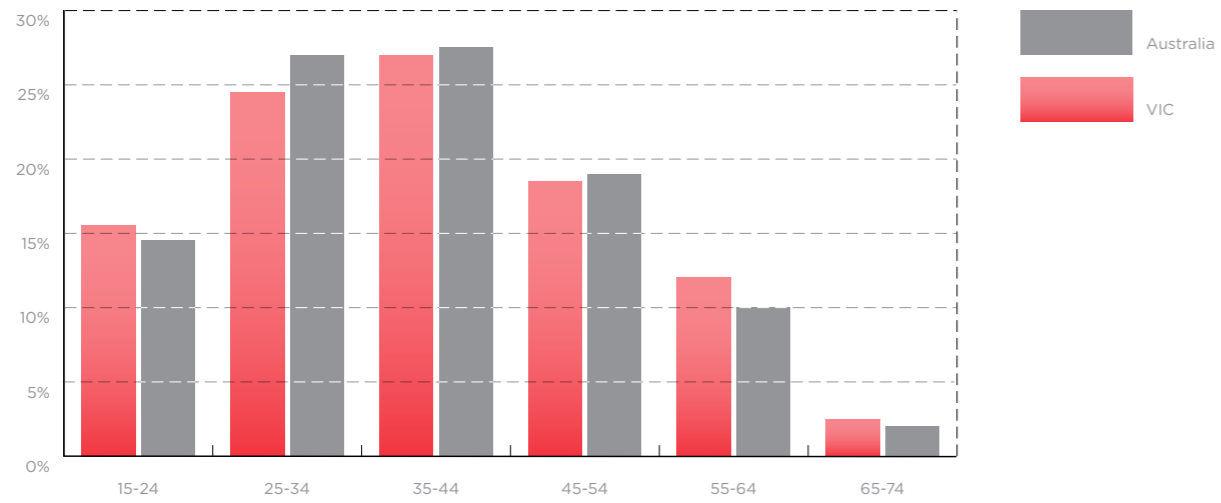


Figure A6: Age distribution of suicide among Victorian male construction workers compared to Australian male construction workers





CORRESPONDENCE

Anthony LaMontagne
Centre for Health Equity
School of Population and Global Health
University of Melbourne
Phone: +61 3 9035 9875



Chris Lockwood
Chief Executive Officer – National
MATES in Construction (Aust) Ltd
Level 1, 35 Astor Tce, Spring Hill QLD 4004
PO Box 1001, Spring Hill QLD 4004
Ph: (07) 3063 7055
24/7 Helpline 1300 642 111
mates.org.au