



SUICIDE IN THE CONSTRUCTION INDUSTRY: 2001-2019

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INTRODUCTION

Suicide is one of the leading causes of death in Australia. In 2020, 3139 Australians are known to have died by suicide and of these, more than three-quarters were male. Among Australian males in 2020, suicide was the 10th leading cause of death (Australian Bureau of Statistics, 2020a).

A substantial proportion of males who die by suicide are of working age (Australian Bureau of Statistics, 2020a). It has also been observed that suicide varies by workplace and occupational factors, and some occupational groups and sectors are at higher risk of suicide than others. Within suicide research, therefore, there is considerable interest in understanding the extent to which workplace factors may increase or ameliorate suicide risk. There is also interest in assessing the utility of workplaces as settings in which suicide prevention initiatives can be implemented.

One occupational group that is at elevated risk of suicide is that of construction workers. In many industrialised countries, construction workers are known to be at greater risk of suicide relative to non-construction workers (Heller et al., 2007; Meltzer et al., 2008; Peterson et al., 2018; Windsor-Shellard and Gunnell, 2019). In Australia, male construction workers have consistently been found to die by suicide at about twice the rate of other male workers (King, T., Riccardi, L., Milner, 2018; Maheen and Milner, 2017; Milner, 2016).

The construction sector accounts for a sizeable proportion of the Australian workforce, employing 1.2 million employees, equating to approximately 9% of the Australian working population. Only the health and retail sectors employ more workers (Australian Bureau of Statistics, 2022). 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 in this group.

There is no single factor that is thought to increase the risk of suicide among construction workers, rather a constellation of factors is implicated. First, construction workers are predominantly male. As noted above, men are at much greater risk of suicide than women (World Health Organization, 2014), and in Australia, 87.1% of construction workers were men in recent labour force statistics (Australian Bureau of Statistics, 2022). Certain job specific characteristics are also thought to increase 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).

In recognition of the greater risk of suicide among construction workers, significant industry-focussed suicide prevention programs have been implemented across Australia. At the forefront of this, MATES in Construction have designed and implemented a comprehensive, multi-modal suicide prevention program across several Australian states (Martin and Gullestrup, 2014). This has led to the training of more than 225,000 construction workers in General Awareness Training, 20,025 “Connectors” (workplace volunteer suicide support workers) and 2,732 “ASIST” volunteers across the Construction industry in Australia (MATES in Construction, 2022). This has motivated and led to similar programs

within the construction sector in Australia, as well as internationally, (World Health Organization, 2021) and its utility as a workplace program has inspired its extension to other sectors.

To inform its ongoing suicide prevention efforts, and to provide an evidence base for targeted workplace mental health literacy, MATES seeks to understand suicide trends among Australian construction workers. This report documents the updated examination of suicide mortality among Australian male construction workers relative to non-construction workers. We use the latest suicide mortality statistics obtained from the National Coronial Information Service to examine trends across the years between 2001 and 2019.

The analyses are disaggregated by 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

Using a retrospective case-series design and coronial data from the National Coronial Information System (NCIS), we assessed suicide rates among employed Australians, comparing rates among construction workers relative to non-construction workers over time. Ethics approval was granted by the University of Melbourne Human Research Ethics Committee (#1748773.2), the Coroners Court of Victoria Research Committee (CCOV RC 264) and the Justice Human Research Ethics Committee (JHREC).

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 coronial investigations. Contained within the NCIS are coded and non-coded data, as well as searchable legal, medical and scientific reports such as the coroner's findings, post-mortem and toxicology reports and police summaries of death reports. Details regarding deaths are coded according to pre-specified fields by court-appointed staff in each state and territorial jurisdiction. The NCIS database has a comprehensive search strategy that allows the retrieval of demographic information (such as age, sex, employment status, occupational text), and ICD-10 codes for suicide cases.

Inclusion criteria

To be included in this study, cases were retrieved if:

1. intent type was coded as intentional self-harm
2. the case was reported as closed
3. year of death was between 2001-2019
4. the decedent was employed at the time of death

Ascertainment of occupation

Occupations are entered in the NCIS occupational field as free text. We coded all information in this occupational text field according to the Australian and New Zealand Standard Classification of Occupations (ANZSCO) four digit structure (Australian Bureau of Statistics, 2013), for all deaths due to intentional self-harm, and for the years 2001 to 2019.

Cases ascribed to the construction industry are listed in Appendix 1: Occupational Coding. All other suicide cases in which the deceased was employed were categorised 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. 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. The construction industry population fluctuates over time, and to account for this, population numbers were adjusted using the quarterly released Labour Force data (Australian Bureau of Statistics, 2020b). This adjustment accounts for the average change in population (each year) with reference to the corresponding Census year.

ANALYTICAL APPROACH

Analytical Approach

In descriptive analyses, we first examined suicide numbers pooled across time for males and females. Age-adjusted rates per 100,000 person-years for males, pooled across time were calculated for construction workers and non-construction workers 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 for construction workers and non-construction workers over time were presented graphically for each state and territory, in yearly intervals for the most populous states and in three-year intervals for Tasmania, Australian Capital Territory (ACT), Northern Territory (NT).

To assess rates of suicide across time, we calculated incidence-rate ratios (IRRs) of suicide among construction workers compared to non-construction workers by state and for time periods of three-year intervals (2001–2003, 2004–2006, 2007–2009, 2010–2012, 2013–15, and 2016–19).

To assess the long-term trends in suicide mortality groups, and to evaluate the extent to which these trends differed – that is, whether the suicide trend for construction workers differed to that of non-construction workers – we used joinpoint regression analyses. This method fits a series of joined straight lines on a log scale to the trends in the rates, with each joinpoint representing a change in trend at a $p < 0.05$ level (Clegg et al., 2009). Two measures of trends are produced by the joinpoint analysis. The annual percentage change (APC) measures significant changes in trends corresponding to each time segment. The average annual percentage change (AAPC) provides a summary measure of a trend change for the whole period, as well as a pair-wise comparison of the trend differences of groups over time (Clegg et al., 2009; Kim et al., 2004).

Descriptive analyses and comparison of incidence rates were carried out in STATA SE 16.0, and joinpoint analysis was performed using the joinpoint software (Version 4.9.0.1) from the Surveillance Research Program of the US National Cancer Institute (NIH, 2004).

IMPORTANT CONSIDERATIONS

A note about industry and occupation

The ABS provides a classification structure for occupations Australian and New Zealand Standard Classification of Occupation, ANZSCO) and industry (Australian and New Zealand Standard Industry Classification, ANZSIC). Ideally, for this research, the ANZSIC classification is most relevant to identify construction workers, however information on industrial sector is only collected for cases where the ‘activity’ field is paid or unpaid work at the time of the fatal incident. In all cases within this dataset, ‘activity’ was coded as ‘self-inflicted harm’ and therefore industry information was not collected. This means that to identify construction workers, we were reliant on information contained in the occupation or job description field. One particular limitation of this approach is that common occupational titles can occur in multiple industries (e.g., a machinery operator might be working in the construction or mining sectors). As a consequence, the decedents identified as being in the construction sector in this analysis, may be employed in the construction, mining, manufacturing or other sector. Such misclassification is likely to be minimal for manufacturing and other sectors - that is, there will be minimal cases in which occupations identified as being in construction should, in fact, be classified in the manufacturing or other sectors because construction is such a large sector at the national level. Distinguishing between mining and construction occupations is more difficult, and it is here that greatest misclassification is likely to occur. Importantly however, the construction sector substantially outnumbers the mining sector: while the mining industry in Australia employs approximately 2.2% of the working population, the construction sector employs about 9% (Australian Bureau of Statistics, 2022). This means that while there will be some misclassification in the estimates obtained in this analysis, we are confident that the overall trends observed here will be more representative of what is occurring in the construction industry, than any other sector.

Employed population

To mitigate the healthy worker effect, the comparator used in this analysis was “non-construction workers”. The healthy worker effect is the term applied to the observation that an individual must be in reasonable health in order to be employed – this means that there is selection of healthy people into the workforce,

and selection of unhealthy people out of the workforce. As a consequence of this phenomena, mental illness and suicide rates are generally higher among the unemployed and those who are ‘not in the labour force’ (NILF). Comparison of rates of suicide in occupational groups to rates in the general population that includes the unemployed, would thus lead to biased estimates. To ensure comparability between construction workers and the referent population, we therefore restricted the analysis to the employed population.

Female construction workers

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 not feasible. For this reason, it was not possible to present detailed data for female construction workers in each state due to small numbers. The exception to this is that Tables 1 presents statistics for the total population including males and females, and Table 3 presents rates for females.

Updated cases

Coronial cases can remain open for years. As an example, in August of 2022, 31.3% cases from 2021 and 58.4% of cases from 2020 were closed, and 68.7% and 41.6% remained open respectively. Typically, about 95% of cases are closed after five years, however a small percentage of cases remain open for decades. Each year, a small number of remaining cases from any of the preceding years are closed. As a consequence of this, calculated rates for preceding years may shift slightly across time, as more cases are closed. We also note that it is for this reason that we do not include the two previous years in this analysis, and only present results up to and including 2019, for which 88.2% of cases are closed.



RESULTS

Age-standardised suicide rates for period 2001-2019

For the period between 2001 to 2019, there were 4143 suicides among identifiable construction workers (male and female) in Australia, and 14178 suicides among the rest of the employed population (see Table 1).

Table 1. Numbers of suicides among male and female construction workers and non-construction workers, by state and territory and nation-wide, 2001 to 2019.

State	Construction n (%)	Non-construction n (%)	Total n (%)
ACT	61 (1.5)	245 (1.7)	306 (1.7)
NSW	1195 (28.8)	4266 (30.1)	5461 (29.8)
NT	84 (2.0)	270 (1.9)	354 (1.9)
QLD	819 (19.8)	2639 (18.6)	3458 (18.9)
SA	224 (5.4)	858 (6.1)	1082 (5.9)
TAS	124 (3.0)	477 (3.4)	601 (3.3)
VIC	981 (23.7)	3522 (24.8)	4503 (24.6)
WA	655 (15.8)	1901 (13.4)	2556 (14)
Total (Australia)	4143 (100)	14178 (100)	18321 (100)

Table 2 shows the age-adjusted suicide rates per 100,000 male workers for the period from 2001-2019 for Australia, and each Australian state, along with 95% confidence intervals. Suicide rates are shown for construction versus non-construction workers. Over the 2001–2019 period, the overall age-standardised suicide rate for male construction workers was 26.1

per 100,000 in Australia (95% CI 25.2-26.9), almost twice that of other male workers (13.5 per 100,000, 95% CI 13.2-13.7). It is important to note that these statistics represent pooled rates across the 19-year time period, and do not reflect the current rates (Figures 1-9 convey the overall trends and current rates).

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 2019.

State		Number of Suicides	Population*	Adjusted Suicide Rate**	Lower Confidence Level	Upper Confidence Level
ACT	Construction	60	10,674	32.5	23.3	41.7
	Non-construction	187	84,160	11.0	9.4	12.7
NSW	Construction	1,176	250,178	24.3	22.8	25.8
	Non-construction	3,415	1,329,664	13.1	12.6	13.6
NT	Construction	84	8,842	51.9	40.5	63.3
	Non-construction	228	40,419	28.5	24.7	32.3
QLD	Construction	809	187,823	23.5	21.7	25.3
	Non-construction	2,123	832,030	13.1	12.5	13.7
SA	Construction	220	55,833	21.0	18.0	23.9
	Non-construction	693	314,303	11.1	10.3	12.0
TAS	Construction	124	18,160	37.5	30.5	44.6
	Non-construction	362	88,746	20.8	18.6	23.0
VIC	Construction	969	198,745	27.5	25.6	29.4
	Non-construction	2,749	1,093,888	12.6	12.2	13.1
WA	Construction	637	110,727	30.4	27.9	32.8
	Non-construction	1,447	447,613	16.4	15.6	17.3
Aust	Construction	4,079	840,982	26.1	25.2	26.9
	Non-construction	11,204	4,230,822	13.5	13.2	13.7

*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

Due to low numbers, we only present overall suicides for females. As Table 3 shows, the suicide rate among female construction workers was approximately twice that of female 'other' workers. Given small cell sizes, the report henceforth focuses on males only.

Table 3: Numbers of suicides and age-adjusted suicide rates (per 100,000) among female construction workers, Australia, 2001 to 2019

State		Number of Suicides	Population*	Adjusted Suicide Rate**	Lower Confidence Level	Upper Confidence Level
Aust	Construction	64	46,735	6.5	4.8	8.1
	Non-construction	2,974	4,440,923	3.4	3.2	3.5

* 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

The age distribution of suicides among male workers (Table 4) shows that of suicides among construction workers, a slightly higher proportion occurred in those aged 25-34 years, while among 'other' workers, a higher proportion of suicides occurred in those aged 45-54 years, and 55-64 years.

Table 4: Age distribution of suicide deaths among male workers

Male n (%)	Construction n (%)	Non-construction n (%)
15-24	594 (14.6)	1,121 (10)
25-34	1,126 (27.6)	2,406 (21.5)
35-44	1,111 (27.2)	2,942 (26.3)
45-54	774 (19.0)	2,850 (25.4)
55-64	424 (10.4)	1,581 (14.1)
65-74	50 (1.2)	303 (2.7)
Total	4,079 (100)	11,203 (100)

*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

Time trends in age-standardised suicide rates: Australia

Table 5 presents the average annual percentage change (AAPC) in suicide trends for the period between 2001-2019. There is evidence that suicide mortality declined among construction workers and non-construction workers, with an annual decline among construction workers of 3.0%, and a 1.4% decline among non-construction workers. The AAPC pair-wise comparison measure indicates

that the annual rate of change among construction workers was greater than that observed among non-construction workers, with a statistically significant difference (AAPC 1.1, $p < 0.001$) between the two trends. This indicates that the annual rate of change for construction workers was 1.1% greater than among non-construction workers. The suicide trends for the two groups are depicted in Figure 1 below.

Table 5: Australian male suicide mortality comparison of construction vs non-construction workers (2001-2019; pooled, all years)

	Construction workers	Non-construction workers
AAPC, 95% CI, p-value	-2.5 (-3.4, -1.6 ; $p < 0.001$)	-1.4 (-1.8,-1.0; $p < 0.001$)
AAPC Comparison, 95% CI, p-value	1.1 (0.1, 2.5; $p < 0.001$)	

Figure 1: Comparison of annual percentage change in age-standardised suicide rates of construction vs non-construction workers



*Indicates that the Annual Percentage Rate Change (APC) is significantly different from zero at the alpha = 0.05 level. Final Selected Model: Non-construction - 0 Joinpoints, Construction - 0 Joinpoints. Failed to reject Parallelism.

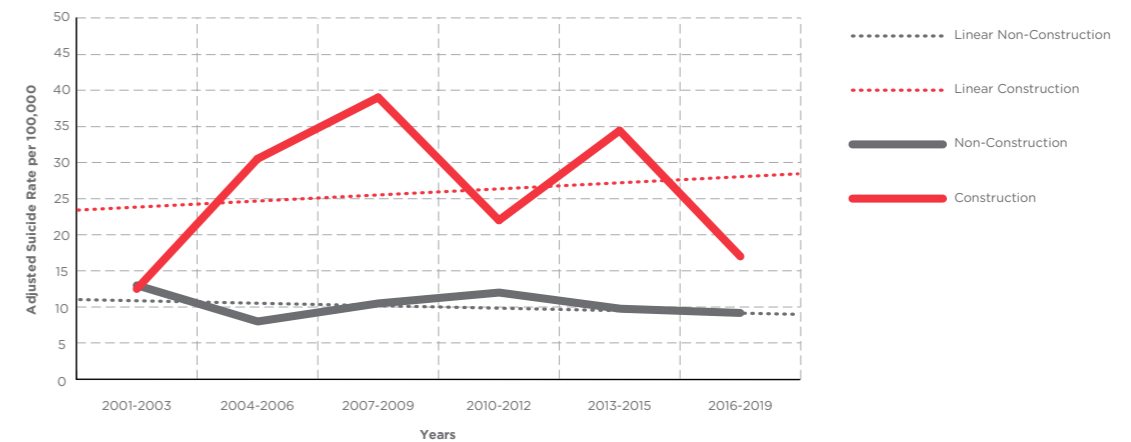
Time trends in age-standardised suicide rates: States

Suicide rates for each state over the years 2001-2019 are presented in Figures 1 to 8 (noting that it was not possible to use AAPC methods to examine state trends in suicide rates due to insufficient numbers). As noted in the methods section, for the least populous states (Tasmania, Northern Territory and Australian Capital Territory)

we present rates in blocks of three years to smooth fluctuation due to small numbers (2001-2003, 2004-2007, 2008-2010, 2011-2013, 2014-15, 2016-19). Across all states, the overall rate of suicide among construction workers is consistently higher than among non-construction workers.

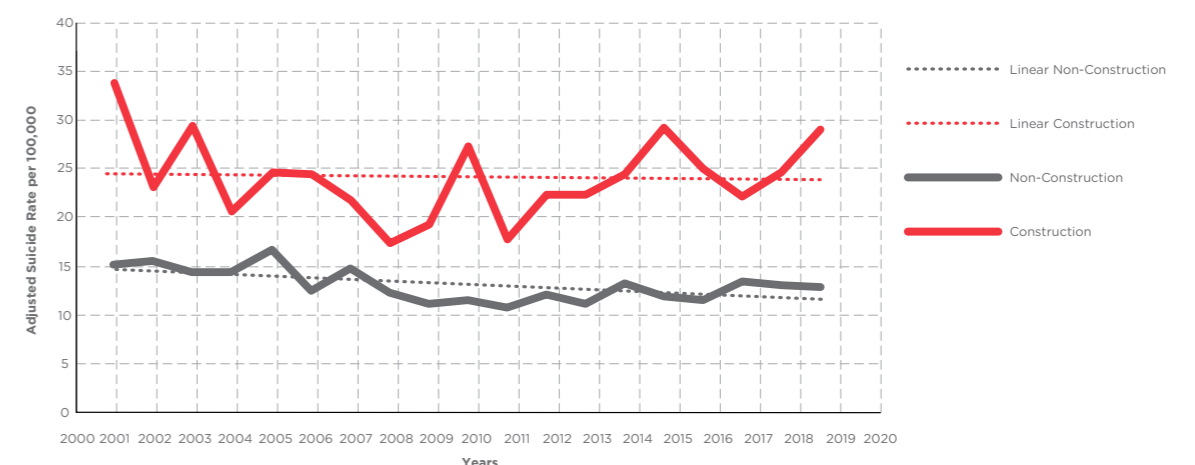
Figure 2 shows suicide rates for male workers in the ACT. The rates of suicide among construction workers remain higher than those among non-construction workers. While the trends for male construction workers and non-construction workers appeared to have been diverging until 2013-2015, rates for construction workers in 2016-2019 dropped to 17.9 per 100,000. Given the relatively small population of the ACT, caution is needed when interpreting these observations.

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



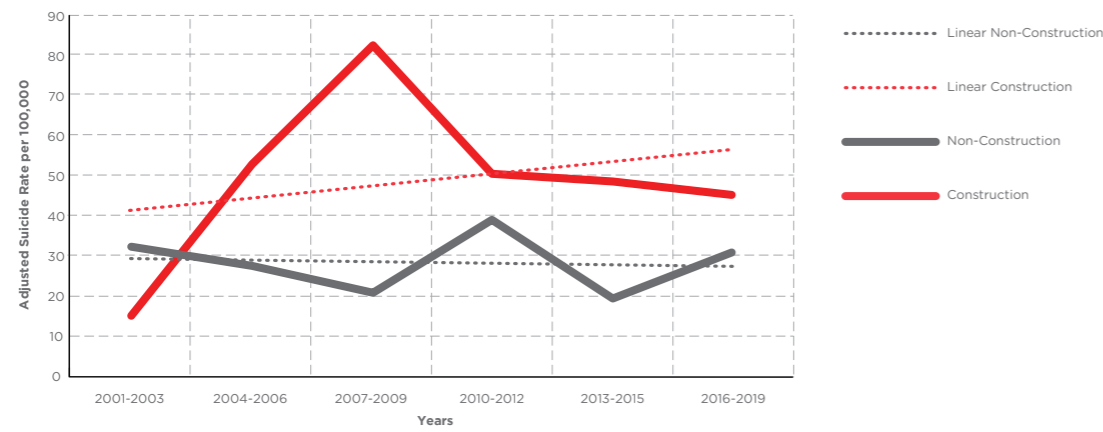
Suicide rates among male non-construction workers in NSW have remained relatively stable across the years of analysis. For male construction workers, the overall trend for the years 2001-2019 shows relative consistency with about 25 suicide deaths per 100,000. However current (2019) rates of suicide among construction workers in NSW are among the highest in the nation, at 29.2 per 100,000 (while for non-construction workers, rates are 12.9 per 100,000).

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



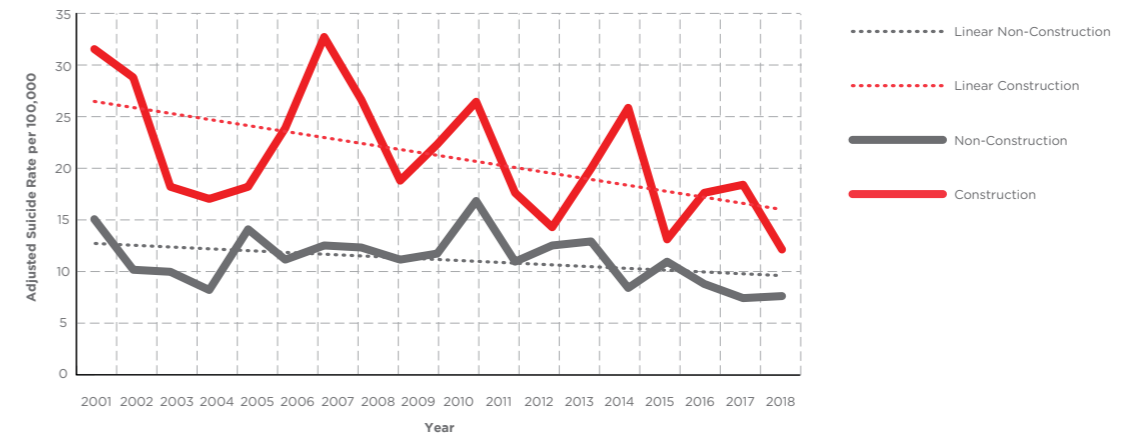
Due to the small population in the Northern Territory, suicide rates show considerable variation, even despite assessment in 3-year blocks (Figure 4). Overall rates among construction workers have remained higher than non-construction workers, however there was convergence in rates between the two groups for the three most recent time points.

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



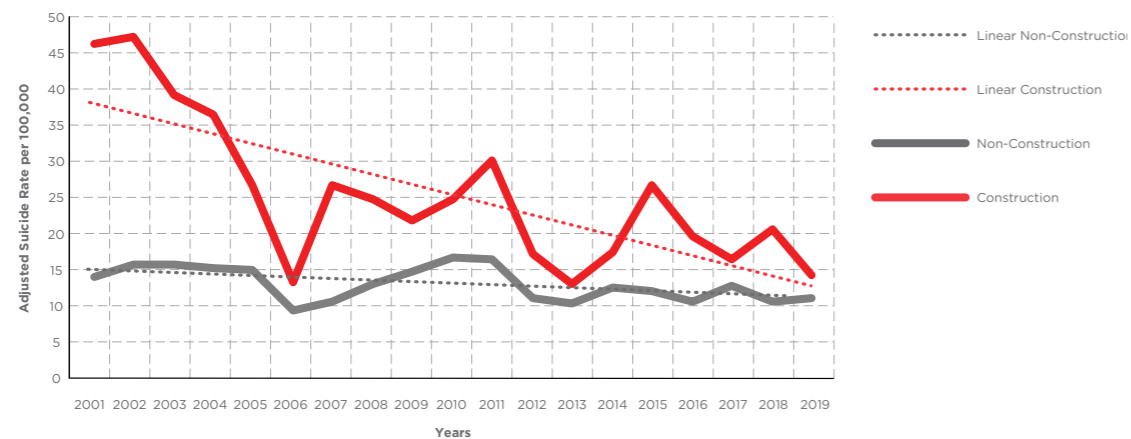
Suicide rates for both construction workers and non-construction workers in South Australia are currently the lowest in the nation; rates for construction workers for 2019 were 12.1 per 100,000 and rates for non-construction workers were 7.5 per 100,000. There was an overall trend toward convergence in suicide rates between construction workers and non-construction workers in South Australia, although this was less pronounced than in other “converging states” such as Queensland and Victoria (Figure 6).

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



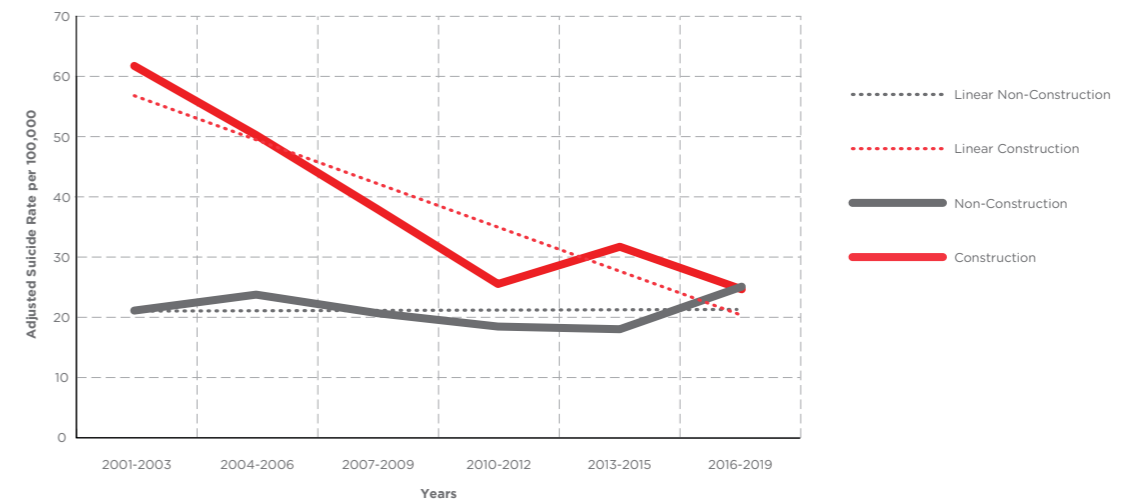
Suicide rates for construction workers in Queensland have continued to decline across the period between 2001-2019, while rates for male non-construction workers in Queensland have remained relatively stable (Figure 5). The combination of these trends has resulted in considerable convergence in suicide rates between construction workers and non-construction workers. Rates for the most recent time point (2019) were 14.3 per 100,000 for construction workers and 11.3 per 100,000 for non-construction workers.

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



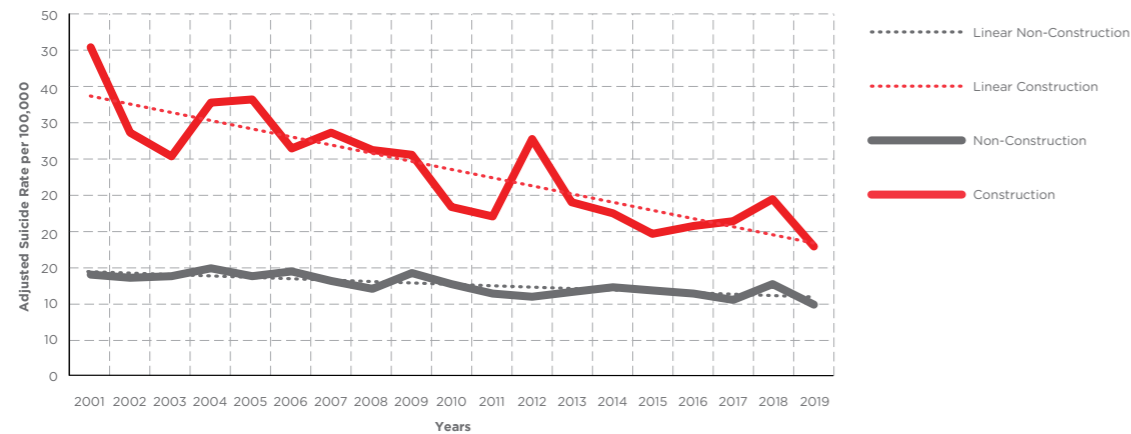
As for some other states, suicide trends in Tasmania show a convergence between male construction workers and non-construction workers – this being largely attributed to a decline in rates among construction workers, and relative stability in rates for non-construction workers (Figure 7). The rates for construction workers and non-construction workers were the same in the last time point (25), but nonetheless relatively high relative to other states, particularly for ‘other’ workers.

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



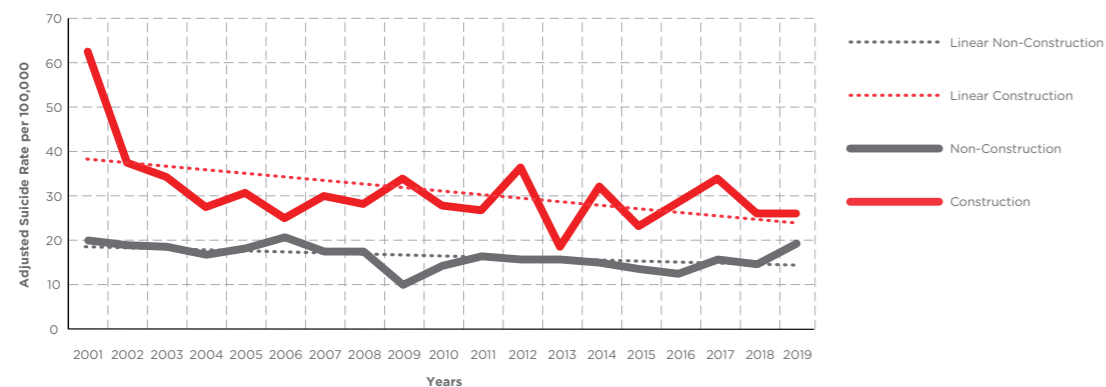
Suicide rates among male construction workers in Victoria have shown a consistent decline between the years 2001-2019, while rates for non-construction workers have remained relatively stable. These two trends have led to a pattern of convergence in rates between construction workers and non-construction workers, although the overall difference between construction and non-construction workers is not as small as in other states. Overall, rates of suicide in Victoria for both construction workers and non-construction workers who are male are some of the lowest in the nation, and for 2019, were 18 and 10 per 100,000 respectively.

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



Aside from an early and rapid reduction in suicide mortality among male construction workers in Western Australia, overall trends have not markedly changed (Figure 9). Suicide rates for other male workers, while lower than construction workers, have remained relatively stable across the 19 years (and the trend has largely run parallel to that of construction workers since 2004). Current suicide rates in Western Australia are among the highest of all states for both construction workers (26.4 per 100,000) and non-construction workers (19.7 per 100,000).

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



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

The incidence-rate ratios (IRR) comparing suicide rates among males in the construction industry to males in other occupations by state, and for each 3-year block are shown in Table 6. These calculations are a relative measure, providing an indication of how suicide rates in construction workers compare to rates in non-construction workers in the same state, they do not provide an indication of the actual suicide rate.

Rate ratios in some of the smaller states such as ACT, NT and Tasmania showed substantial variation, and are less reliable because of smaller absolute numbers than estimates in some of the larger states. The IRRs for Queensland, South Australia and Victoria show a steady decline across the time period, while the IRRs in NSW have remained consistently hovering around 2. For Australia as a whole, the IRR has decreased, and is now below 2.

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	3.21	1.24	7.49
		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	3.71	1.82	7.22	
	Non-construction	1.00			
2016-2019	Construction	2.55	1.24	4.89	
	Non-construction	1.00			
NSW	2001-2003	Construction	2.00	1.68	2.36
		Non-construction	1.00		
	2004-2006	Construction	1.68	1.41	2.00
		Non-construction	1.00		
	2007-2009	Construction	1.53	1.27	1.83
		Non-construction	1.00		
2010-2012	Construction	1.97	1.65	2.34	
	Non-construction	1.00			
2013-2015	Construction	2.15	1.81	2.54	
	Non-construction	1.00			
2016-2019	Construction	1.94	1.69	2.23	
	Non-construction	1.00			

State	Year		IRRs	Lower CI	Upper CI
NT	2001-2003	Construction	0.71	0.19	1.97
		Non-construction	1.00		
	2004-2006	Construction	2.60	1.33	4.88
		Non-construction	1.00		
	2007-2009	Construction	3.49	1.80	6.53
		Non-construction	1.00		
	2010-2012	Construction	1.53	0.81	2.75
		Non-construction	1.00		
	2013-2015	Construction	2.83	1.49	5.29
		Non-construction	1.00		
2016-2019	Construction	1.15	0.56	2.19	
	Non-construction	1.00			
QLD	2001-2003	Construction	2.96	2.39	3.64
		Non-construction	1.00		
	2004-2006	Construction	2.04	1.65	2.51
		Non-construction	1.00		
	2007-2009	Construction	1.90	1.56	2.32
		Non-construction	1.00		
	2010-2012	Construction	1.67	1.37	2.02
		Non-construction	1.00		
	2013-2015	Construction	1.44	1.14	1.80
		Non-construction	1.00		
2016-2019	Construction	1.59	1.31	1.91	
	Non-construction	1.00			
SA	2001-2003	Construction	2.25	1.49	3.32
		Non-construction	1.00		
	2004-2006	Construction	1.87	1.22	2.80
		Non-construction	1.00		
	2007-2009	Construction	2.01	1.35	2.92
		Non-construction	1.00		
	2010-2012	Construction	1.73	1.19	2.46
		Non-construction	1.00		
	2013-2015	Construction	1.81	1.21	2.66
		Non-construction	1.00		
2016-2019	Construction	1.77	1.19	2.58	
	Non-construction	1.00			
TAS	2001-2003	Construction	3.54	2.05	5.94
		Non-construction	1.00		
	2004-2006	Construction	2.11	1.27	3.40
		Non-construction	1.00		
	2007-2009	Construction	1.98	1.16	3.29
		Non-construction	1.00		

State	Year		IRRs	Lower CI	Upper CI
	2010-2012	Construction	1.63	0.86	2.91
		Non-construction	1.00		
	2013-2015	Construction	1.85	1.02	3.21
		Non-construction	1.00		
	2016-2019	Construction	1.08	0.63	1.77
		Non-construction	1.00		
VIC	2001-2003	Construction	2.75	2.27	3.32
		Non-construction	1.00		
	2004-2006	Construction	2.48	2.08	2.95
		Non-construction	1.00		
	2007-2009	Construction	2.33	1.94	2.79
		Non-construction	1.00		
2010-2012	Construction	2.10	1.74	2.54	
	Non-construction	1.00			
	2013-2015	Construction	1.73	1.41	2.11
		Non-construction	1.00		
	2016-2019	Construction	1.74	1.47	2.05
		Non-construction	1.00		
WA	2001-2003	Construction	2.61	2.00	3.37
		Non-construction	1.00		
	2004-2006	Construction	1.62	1.23	2.12
		Non-construction	1.00		
	2007-2009	Construction	2.03	1.59	2.58
		Non-construction	1.00		
2010-2012	Construction	2.06	1.63	2.58	
	Non-construction	1.00			
Australia	2013-2015	Construction	1.68	1.32	2.12
		Non-construction	1.00		
	2016-2019	Construction	1.95	1.60	2.37
		Non-construction	1.00		
	2001-2003	Construction	2.42	2.21	2.66
		Non-construction	1.00		
2004-2006	Construction	1.99	1.82	2.18	
	Non-construction	1.00			
2007-2009	Construction	1.95	1.78	2.13	
	Non-construction	1.00			
2010-2012	Construction	1.94	1.77	2.12	
	Non-construction	1.00			
2013-2015	Construction	1.85	1.68	2.03	
	Non-construction	1.00			
2016-2019	Construction	1.79	1.66	1.94	
	Non-construction	1.00			

Incidence rate ratio charts (States compared to Australia)

Graphical comparisons of each state's IRR for suicide among construction workers (compared to non-construction workers), with the Australian overall IRR for suicide among construction workers (compared to non-construction workers) in 3-year blocks.

Figures 10-17 graphically represent the IRRs shown in Table 6.

Figure 10. IRRs for suicide among construction workers (vs non-construction workers) in the Australian Capital Territory compared to Australia-wide IRRs for suicide among construction workers (vs non-construction workers)

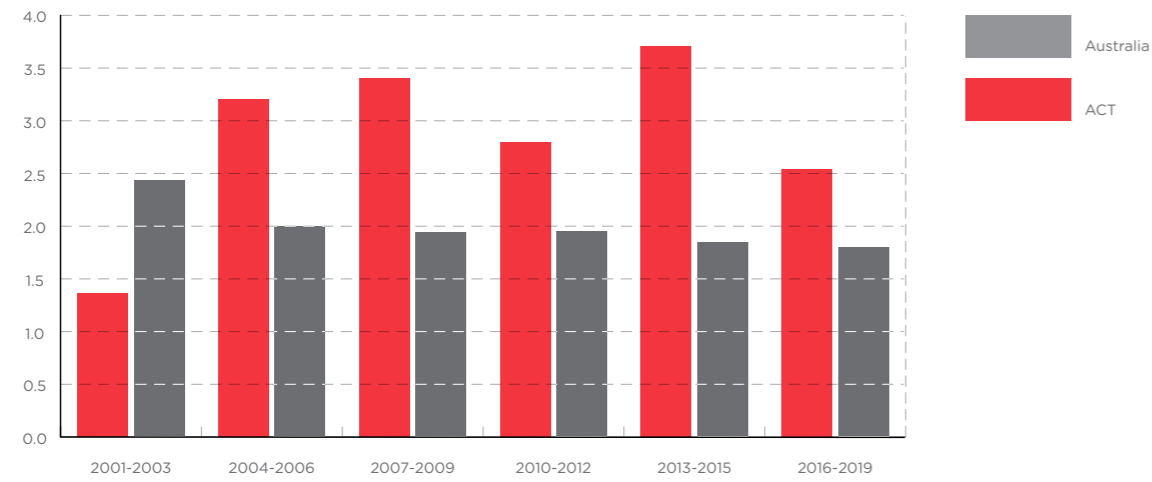


Figure 11. IRRs for suicide among construction workers (vs non construction workers) in New South Wales compared to Australia-wide IRRs for suicide among construction workers (vs non construction workers)

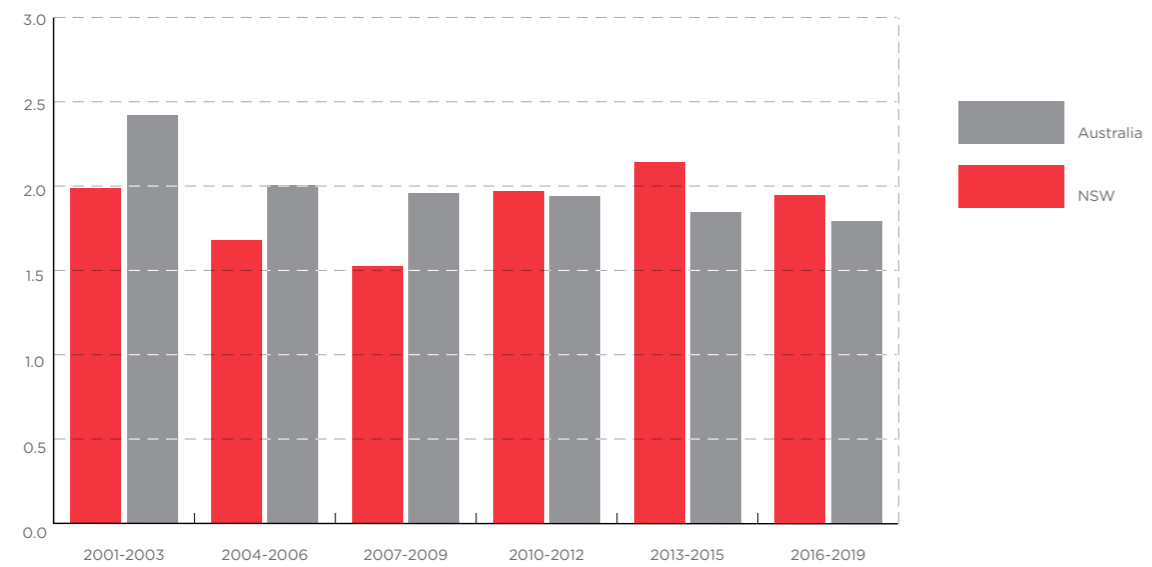


Figure 12. IRRs for suicide among construction workers (vs non construction workers) in Northern Territory compared to Australia-wide IRRs for suicide among construction workers (vs non construction workers)

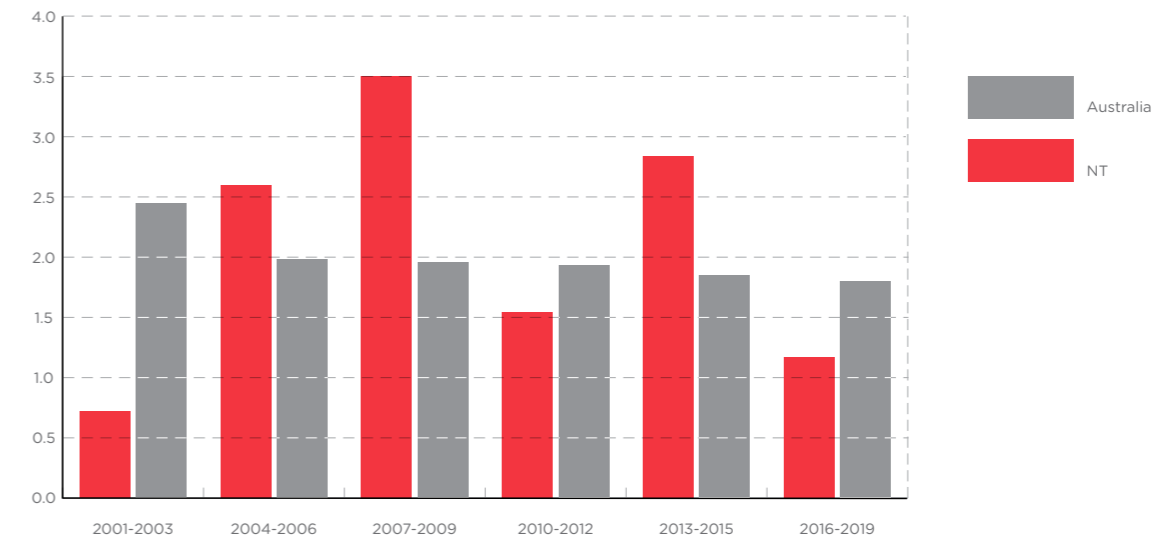


Figure 13. IRRs for suicide among construction workers (vs non construction workers) in Queensland compared to Australia-wide IRRs for suicide among construction workers (vs non construction workers)

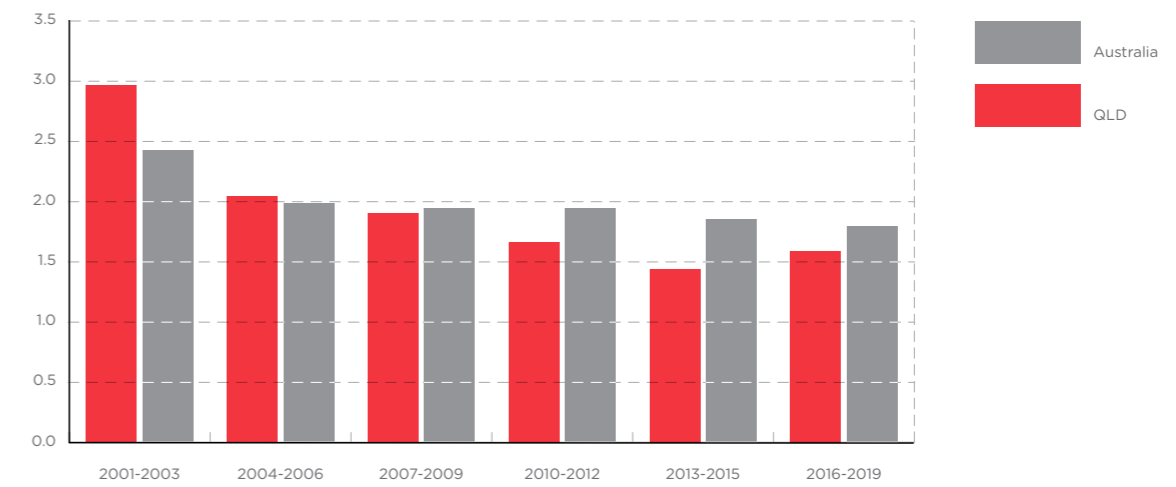


Figure 14. IRRs for suicide among construction workers (vs non construction workers) in South Australia compared to Australia-wide IRRs for suicide among construction workers (vs non construction workers)

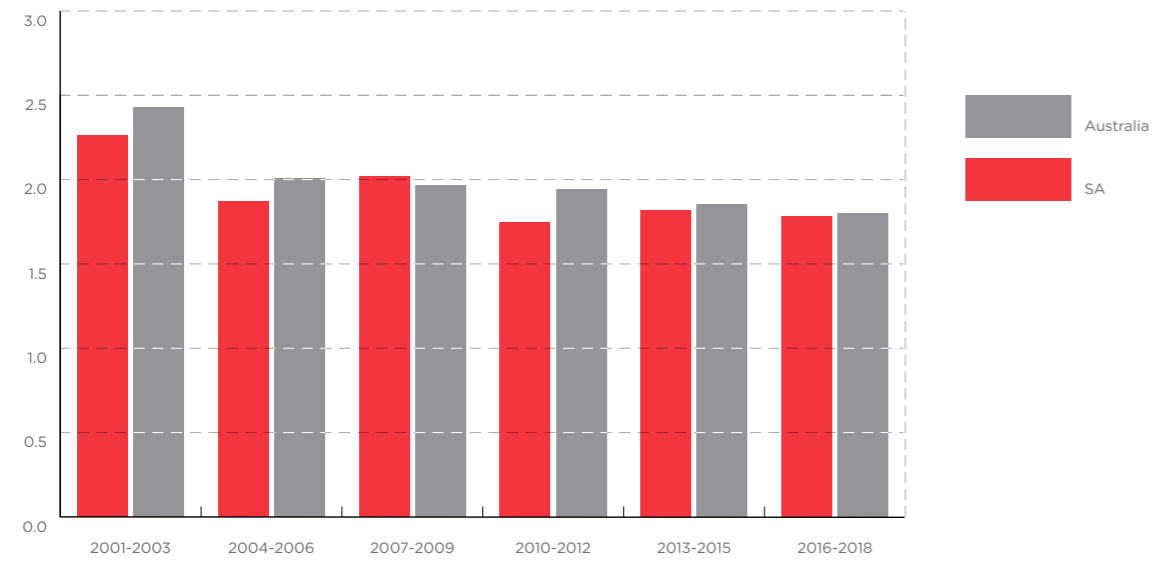


Figure 16. IRRs for suicide among construction workers (vs non construction workers) in Victoria compared to Australia-wide IRRs for suicide among construction workers (vs non construction workers)

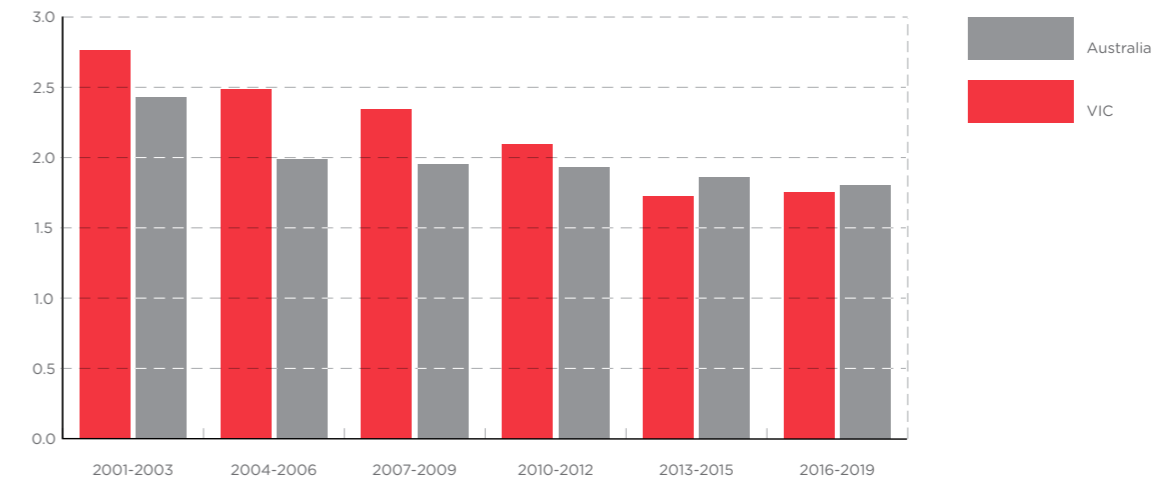


Figure 15. IRRs for suicide among construction workers (vs non construction workers) in TAS compared to Australia-wide IRRs for suicide among construction workers (vs non construction workers)

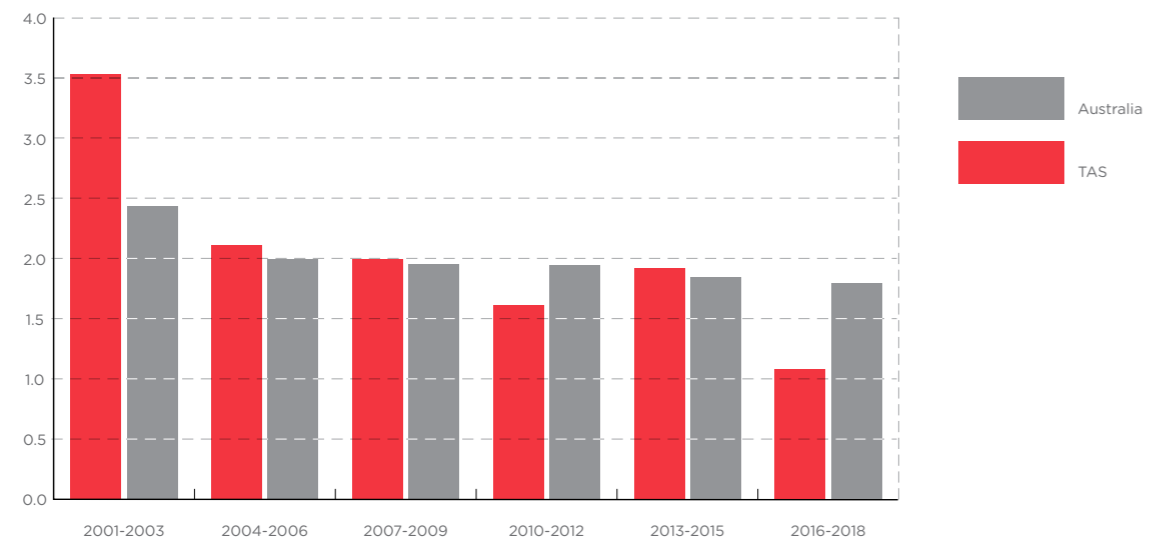
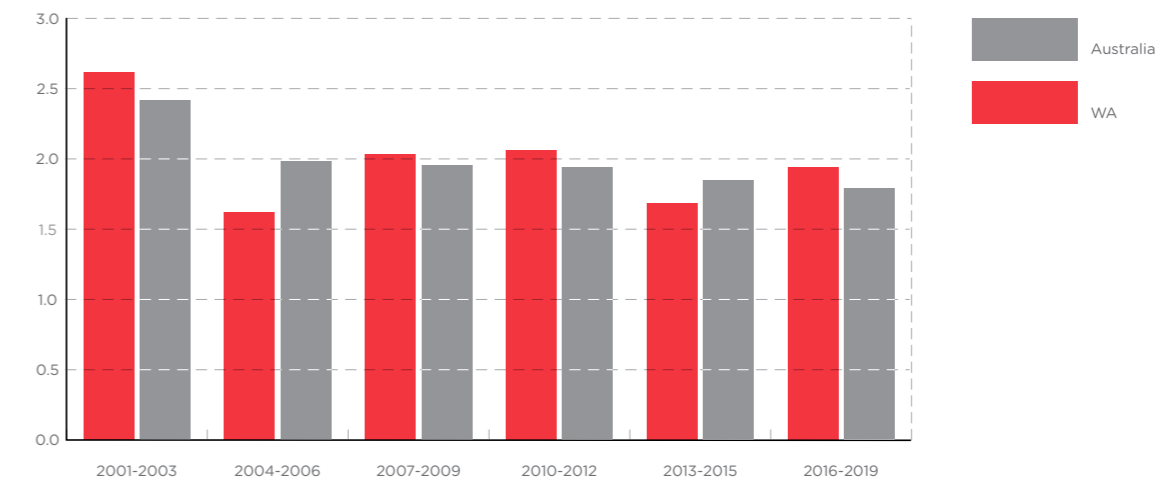


Figure 17. IRRs for suicide among construction workers (vs non construction workers) in Western Australia compared to Australia-wide IRRs for suicide among construction workers (vs non construction workers)





DISCUSSION

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 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

We acknowledge the work of Associate Professor Allison Joy Milner, who died tragically in August 2019. Allison made substantial contributions to workplace and suicide research, and her generosity, drive, vim, and verve will not be forgotten. We also acknowledge the source of this data, the National Coronial Information Service, and the source organisation of the data, the Victorian Department of Justice and Community Safety. We also remember those who have died by suicide, especially those whose deaths are contained in this data.

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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

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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 (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	4.0	17.2
2010-2012	ACT	12.0	4.9	19.2
2013-2015	ACT	9.9	3.7	16.1
2016-2019	ACT	9.1	3.1	15.0
2001	NSW	15.2	13.0	17.5
2002	NSW	15.5	13.2	17.7
2003	NSW	14.4	12.3	16.6
2004	NSW	14.4	12.2	16.5
2005	NSW	16.7	14.2	19.2
2006	NSW	12.5	10.4	14.5
2007	NSW	14.9	12.8	17.0
2008	NSW	12.4	10.6	14.2
2009	NSW	11.2	9.4	13.0
2010	NSW	11.6	9.9	13.4
2011	NSW	10.8	9.0	12.7
2012	NSW	12.1	10.2	14.1
2013	NSW	11.1	9.2	13.0
2014	NSW	13.3	11.3	15.4
2015	NSW	11.9	9.9	13.8
2016	NSW	11.6	9.7	13.5
2017	NSW	13.4	11.5	15.3
2018	NSW	13.1	11.0	15.2
2019	NSW	12.9	10.9	14.8
2001-2003	NT	32.3	14.6	50.0
2004-2006	NT	27.5	11.1	43.8
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
2016-2019	NT	30.5	14.2	46.7

Years	State	Age-standardised suicide rates per 100,000	Lower confidence interval	Upper confidence interval
2001	QLD	14.2	11.5	16.9
2002	QLD	15.8	12.7	19.0
2003	QLD	15.8	12.7	18.8
2004	QLD	15.3	12.3	18.4
2005	QLD	15.1	11.9	18.3
2006	QLD	9.6	7.5	11.8
2007	QLD	10.6	8.3	12.9
2008	QLD	13.1	10.5	15.6
2009	QLD	15.0	12.2	17.8
2010	QLD	16.9	14.1	19.6
2011	QLD	16.6	13.6	19.5
2012	QLD	11.3	8.9	13.7
2013	QLD	10.4	8.4	12.5
2014	QLD	12.7	10.2	15.1
2015	QLD	12.1	9.8	14.5
2016	QLD	10.8	8.6	13.0
2017	QLD	13.0	10.7	15.3
2018	QLD	10.7	8.5	12.9
2019	QLD	11.3	9.1	13.5
2001	SA	15.0	10.3	19.6
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	14.0	9.9	18.0
2006	SA	11.1	6.6	15.6
2007	SA	12.4	8.6	16.3
2008	SA	12.2	8.5	15.9
2009	SA	11.0	7.4	14.6
2010	SA	11.7	8.1	15.3
2011	SA	16.8	12.3	21.4
2012	SA	10.8	7.1	14.5
2013	SA	12.5	8.5	16.5
2014	SA	12.9	8.9	16.9
2015	SA	8.4	5.2	11.7
2016	SA	10.9	7.2	14.5
2017	SA	8.7	5.6	11.9
2018	SA	7.3	4.3	10.2
2019	SA	7.5	4.3	10.7
2001-2003	TAS	21.2	9.6	32.8
2004-2006	TAS	23.6	13.6	33.6
2007-2009	TAS	20.6	11.4	29.8
2010-2012	TAS	18.7	9.1	28.3
2013-2015	TAS	17.9	9.2	26.6
2016-2019	TAS	25.0	14.4	35.7

Years	State	Age-standardised suicide rates per 100,000	Lower confidence interval	Upper confidence interval
2001	VIC	14.1	11.7	16.6
2002	VIC	13.7	11.2	16.2
2003	VIC	14.0	11.6	16.5
2004	VIC	15.0	12.5	17.5
2005	VIC	13.9	11.6	16.3
2006	VIC	14.6	12.1	17.1
2007	VIC	13.2	11.0	15.4
2008	VIC	12.1	10.0	14.2
2009	VIC	14.4	12.0	16.7
2010	VIC	12.8	10.7	15.0
2011	VIC	11.5	9.5	13.5
2012	VIC	11.1	9.1	13.1
2013	VIC	11.7	9.7	13.7
2014	VIC	12.4	10.4	14.5
2015	VIC	12.0	10.0	13.9
2016	VIC	11.5	9.5	13.5
2017	VIC	10.7	8.9	12.5
2018	VIC	12.9	10.8	15.0
2019	VIC	10.0	8.2	11.8
2001	WA	20.2	15.4	25.0
2002	WA	19.1	14.4	23.9
2003	WA	18.8	14.2	23.5
2004	WA	17.0	13.1	20.9
2005	WA	18.6	14.0	23.2
2006	WA	20.9	15.7	26.2
2007	WA	17.6	13.6	21.6
2008	WA	17.9	13.9	21.8
2009	WA	10.2	7.3	13.2
2010	WA	14.7	11.2	18.3
2011	WA	16.8	12.9	20.7
2012	WA	16.1	12.4	19.7
2013	WA	16.0	12.5	19.4
2014	WA	15.1	11.7	18.6
2015	WA	13.7	10.5	17.0
2016	WA	12.8	9.5	16.0
2017	WA	16.0	12.5	19.5
2018	WA	14.8	11.4	18.2
2019	WA	19.7	15.6	23.8

APPENDIX 3: 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	0.00	37.5
2004-2006	ACT	30.2	0.00	64.4
2007-2009	ACT	39.4	0.40	78.4
2010-2012	ACT	21.4	0.00	51.0
2013-2015	ACT	34.4	0.00	68.9
2016-2019	ACT	17.9	0.00	43.5
2001	NSW	33.9	25.7	42.1
2002	NSW	23.3	16.9	29.7
2003	NSW	29.6	20.7	38.5
2004	NSW	20.8	15.1	26.5
2005	NSW	24.7	16.7	32.8
2006	NSW	24.6	18.5	30.7
2007	NSW	21.9	15.3	28.4
2008	NSW	17.4	12.5	22.3
2009	NSW	19.4	14.1	24.7
2010	NSW	27.4	19.6	35.1
2011	NSW	17.9	12.8	23.0
2012	NSW	22.4	16.8	28.0
2013	NSW	22.4	15.9	28.9
2014	NSW	24.6	18.4	30.9
2015	NSW	29.4	22.4	36.3
2016	NSW	25.2	18.9	31.4
2017	NSW	22.3	17.0	27.5
2018	NSW	24.7	18.9	30.4
2019	NSW	29.2	21.6	36.8
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	50.5	5.9	95.0
2013-2015	NT	48.3	8.9	87.8
2016-2019	NT	45.2	0.5	90.0

Years	State	Age-standardised suicide rates per 100,000	Lower confidence interval	Upper confidence interval
2001	QLD	46.4	31.8	61.0
2002	QLD	47.5	33.6	61.4
2003	QLD	39.4	22.4	56.4
2004	QLD	36.8	27.1	46.6
2005	QLD	26.9	19.2	34.5
2006	QLD	13.4	8.1	18.7
2007	QLD	27.0	17.1	36.8
2008	QLD	25.0	17.0	33.0
2009	QLD	21.9	15.7	28.1
2010	QLD	25.0	16.7	33.3
2011	QLD	30.3	22.8	37.8
2012	QLD	17.4	11.6	23.2
2013	QLD	13.1	7.4	18.8
2014	QLD	17.5	9.9	25.0
2015	QLD	26.9	17.8	36.1
2016	QLD	19.7	13.7	25.8
2017	QLD	16.5	11.2	21.7
2018	QLD	20.8	14.6	27.0
2019	QLD	14.3	9.2	19.3
2001	SA	31.5	14.3	48.8
2002	SA	28.7	13.0	44.4
2003	SA	18.1	6.2	29.9
2004	SA	17.0	5.8	28.1
2005	SA	18.1	6.8	29.5
2006	SA	23.8	10.8	36.8
2007	SA	32.8	10.0	55.7
2008	SA	26.6	12.1	41.1
2009	SA	18.8	7.7	30.0
2010	SA	22.2	10.5	33.8
2011	SA	26.4	13.8	38.9
2012	SA	17.5	7.2	27.9
2013	SA	14.3	5.4	23.1
2014	SA	20.0	9.1	30.9
2015	SA	25.8	9.5	42.1
2016	SA	13.0	3.9	22.2
2017	SA	17.5	7.6	27.4
2018	SA	18.3	5.0	31.7
2019	SA	12.1	3.6	20.7

Years	State	Age-standardised suicide rates per 100,000	Lower confidence interval	Upper confidence interval
2001-2003	TAS	61.8	15.6	108
2004-2006	TAS	50.4	17.1	83.7
2007-2009	TAS	37.9	9.8	66.0
2010-2012	TAS	25.5	3.1	48.0
2013-2015	TAS	31.6	6.3	57.0
2016-2019	TAS	24.6	2.6	46.7
2001	VIC	45.5	33.4	57.6
2002	VIC	33.7	24.4	43.1
2003	VIC	30.5	21.6	39.4
2004	VIC	37.9	28.3	47.6
2005	VIC	38.4	26.9	50.0
2006	VIC	31.5	23.6	39.3
2007	VIC	33.8	25.2	42.3
2008	VIC	31.4	21.3	41.5
2009	VIC	30.8	20.7	40.9
2010	VIC	23.5	14.9	32.1
2011	VIC	22.2	16.0	28.5
2012	VIC	33.0	24.0	42.0
2013	VIC	24.1	15.9	32.2
2014	VIC	22.6	15.2	30.0
2015	VIC	19.9	13.2	26.7
2016	VIC	20.9	13.4	28.3
2017	VIC	21.6	15.5	27.7
2018	VIC	24.7	17.5	31.8
2019	VIC	18.0	12.1	23.8
2001	WA	62.6	42.6	82.5
2002	WA	37.6	21.8	53.3
2003	WA	34.5	20.4	48.7
2004	WA	27.6	15.5	39.7
2005	WA	30.9	19.4	42.3
2006	WA	25.4	15.4	35.4
2007	WA	30.3	19.5	41.0
2008	WA	28.6	19.0	38.1
2009	WA	34.2	21.0	47.5
2010	WA	28.2	19.0	37.5
2011	WA	27.2	18.3	36.2
2012	WA	36.8	26.1	47.5
2013	WA	18.9	11.8	26.0
2014	WA	32.4	22.7	42.0
2015	WA	23.6	15.4	31.9
2016	WA	28.9	18.0	39.9
2017	WA	34.3	24.2	44.4
2018	WA	26.4	17.6	35.3
2019	WA	26.4	17.5	35.4





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