Suicide in Australia: meta-analysis of rates and methods of suicide between 1988 and 2007

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ABSTRACT

Objective: To examine the changes in rates of methods of suicide in Australian states and territories between 1988 and 2007.

Design and setting: Meta-analysis of suicide mortality rates and suicide methods (hanging, shooting, gassing, poisoning, jumping from a height, drowning, use of a sharp implement) for males and females in Australian states and territories in the decades 1988–1997 and 1998–2007.

Main outcome measures: Changes in use of suicide methods from 1988 to 2007; changes in the overall suicide rates and in rates for each method of suicide in Australian states and territories between 1988–1997 and 1998–2007.

Results: There was a decline in rates of shooting, gassing, poisoning and drowning in males and a decline in shooting, gassing, jumping from a heiight and drowning among females, but an increase in hanging by both males and females in the decade 1998–2007 when the compared to 1988–1997. There was significant variation in the rates of and trends in methods of suicide between the states and territories of Australia between 1988–1997 and 1998–2007.

Conclusions: The decline in rates of suicide in most parts of Australia coincides with a reduction in the availability of lethal methods. Consideration should be given to further measures to limit the availability of lethal methods of suicide.

MJA 2010; 192: 432–437

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In 1997, there was a peak in the number of suicides in Australia, when 2720 deaths were classified as suicide, giving an overall non-age-adjusted rate of 14.7 per 100 000. Over the next 10 years, the total number of suicides fell so that in 2007, 1880 deaths were classified as suicide, an overall non-age-adjusted rate of 8.9 per 100 000.[1] Although the number of deaths from suicide fell, this does not appear to be the result of a decline in suicidal ideation or rates of attempted suicide. The 1997 National Survey of Mental Health and Wellbeing (NSMHW) found a 12-month prevalence of suicidal ideation of 2.9%, and that 0.3% of the population had attempted suicide.[2] In the 2007 survey, those figures were 2.3% and 0.4%, respectively.[3]

A comparison of 2007 NSMHW data and completed suicide rates suggests that as few as one in 40 suicide attempts results in a fatality. However, a recent Australian study estimated that 12% of patients arriving at a hospital after a suicide attempt died,[4] and there is wide variation in the lethality of methods used. For example, the estimated mortality from self-shooting is 90%, from attempted hanging is 83% and from jumping from a height is 60%, whereas fewer than 3% of suicide attempts by self-poisoning or by sharp implement result in death.[4]

In this study, we examine the rates of suicide by method of suicide in the Australian states and territories in each of the two decades between 1988 and 2007. During this period, Australia introduced one of the world's first national suicide prevention strategies,[5] and measures to reduce the availability of some lethal methods of committing suicide, including the firearms "buy back" scheme[6,7] and the introduction of catalytic converters in all new cars.[8] There was also a major change in the pattern of prescription of antidepressant medications, with a decline in the use of tricyclic antidepressants and an increase in the use of the less toxic serotonin re-uptake inhibitors.[9]

The reduction in firearm suicide in Australia in the past two decades is well known,[6,10] but we were unable to locate any studies reporting changes in the rates of suicide by other methods. Our hypothesis in this study was that any reduction in suicide would result mainly from the decreased availability of some lethal methods, including gassing, shooting and non-gas poisoning (referred to here as "poisoning"), and that methods of suicide that are less amenable to regulatory control, such as hanging, drowning, use of a sharp implement and jumping from a height, would not have declined.

METHODS

Suicide deaths coded using the International Classification of Diseases (ICD) 9 (ninth revision) and ICD-10 in each Australian state and territory were obtained from the Australian Bureau of Statistics (ABS) for each of the 20 years between January 1988 and December 2007 (Brooke Black, Information Consultant, ABS, personal communication).[11] Suicide rates were calculated for hanging, strangulation and suffocation (ICD-9, 953; ICD-10, X70); non-gas poisoning (ICD-9, 950; ICD-10, X61, X66, X68 and X69); poisoning with gas (ICD-9, 951 and 952, ICD-10, X67); use of firearm or explosive (ICD-9, 955; ICD-10 X72–X75); jumping from a height (ICD-9, 957; ICD-10, X80); self-stabbing and cutting (ICD-9, 956; ICD-10, X78); and drowning (ICD-9, 954; ICD-10, X71) for each state and territory for each year, and for the two decades 1988–1997 and 1998–2007. ICD-9 and ICD-10 codes for suicide are highly comparable.[12,13]

Statistical analysis

ABS figures for the population of males and females in June of each year in each state and territory were used to calculate annual non-age-adjusted suicide rates.[14] The sum of suicides and populations in each year of each decade was used to calculate male and female suicide rates for each suicide method in each state and territory in the two decades. Poisson regression analysis was used to assess the changes in suicide method over the 20 years from 1988 to 2007 after controlling for the total number of suicides.

A planned meta-analysis was undertaken. First, meta-analyses were used to calculate a pooled national rate of suicide by any method for each decade. The two decade-long periods were chosen to increase the accuracy in the rates of suicide in regions with small numbers and to minimise the effect of delayed coroners' verdicts. Second, meta-analyses were used

to estimate a national suicide rate for each method of suicide in each decade. Thus, a third set of meta-analyses was used to examine changes in the national rates of suicide by method of suicide, as small changes in method in the more populous states could conceal significant but opposing trends in the less populous states in any analysis of national rates. Meta-analysis was used to estimate rates and changes in rates in all three analyses because pooling of results by simple addition might not be valid because of heterogeneity, and might conceal significant variations in state and territory suicide rates.[15] Rate ratio was used as the measure of effect size. The two decades were regarded as independent samples because of the large demographic changes in Australia over that time. The choice of a fixed or random effects meta-analysis was made on the basis of an assessment of statistical heterogeneity in suicide rates (between states and territories in both periods) using an I-square statistic, and on the basis of statistical heterogeneity in the rate ratios after the examination of changes in suicide rates.[16]

Meta-analysis was conducted using Comprehensive Meta-Analysis (CMA) version 2 (Biostat, Englewood, NJ, USA). CMA uses the same computational algorithms to weight studies by inverse variance and to calculate effect sizes and pooled estimates as are used in the Cochrane Collaboration and other systematic reviews.

1 Changes in use of suicide methods over time in Australia 1988–2007*

Method	Sex	B†	95% CI	P
Hanging	Males	0.048	0.045 to 0.052	< 0.001
	Females	0.048	0.042 to 0.055	< 0.001
Shooting	Males	− 0.068	− 0.073 to − 0.064	< 0.001
	Females	− 0.074	− 0.093 to − 0.054	< 0.001
Gassing	Males	− 0.016	− 0.020 to − 0.011	< 0.001
	Females	− 0.008	− 0.018 to 0.002	ns
Poisoning	Males	− 0.026	− 0.032 to − 0.021	< 0.001
	Females	− 0.023	− 0.029 to − 0.016	< 0.001
Jumping from a height	Males	− 0.003	− 0.013 to 0.070	ns
	Females	− 0.020	− 0.035 to − 0.005	0.01
Drowning	Males	− 0.025	− 0.039 to − 0.011	< 0.001
	Females	− 0.026	− 0.042 to − 0.009	0.002
Sharp implement	Males	0.013	0 to 0.064	ns
	Females	− 0.005	− 0.031 to 0.022	ns

ns = not-significant. * Poisson regression, controlled for using the total number of suicides. † Regression coefficient. ◆

RESULTS

Rates and methods of suicide by males, 1988–2007

In 1988, the national male suicide rate per 100 000 males per annum was 21.0. The most common methods were shooting (5.93), hanging (5.14), gassing (4.43) and poisoning (2.56). Less common methods were jumping from a height (0.84), drowning (0.43) and suicide by sharp implement (0.43). Other methods, including electrocution, immolation and jumping in front of moving vehicles, accounted for a total of less than 1.17 per 100 000 per annum.

In the following 10 years, there was a trend towards an increase in suicide by males, to a peak in 1998 when the national suicide rate was 28.3 per 100 000. This peak was associated with a near doubling of the rate of hanging, and occurred despite a 60% fall in firearm suicides between 1988 and 1998. Between 1998 and 2007, there were declines in suicides by hanging (by 29%), gassing (by 69%), shooting (by 34%), jumping (by 29%), use of sharp implements (by 25%) and drowning (by 46%). By 2007, the total male suicide rate had fallen to 13.9 per 100 000 per annum, a decline of 51% in 10 years. Suicides by methods other than hanging, shooting, gassing, poisoning, jumping, drowning or sharp implement declined as a proportion of suicides and, by 2007, accounted for 2.7% of suicides.

Poisson regression analysis showed a rise in the proportion of all male suicides by hanging over the period 1988 to 2007, but a decline in the proportion of suicides by shooting, gassing, poisoning and drowning. The proportion of suicide by jumping and sharp implement remained unchanged. (Box 1).

Rates and methods of suicide by females, 1998–2007

In 1988, the national female suicide rate per 100 000 females per annum was 5.64. The most common method was poisoning (2.25) at a rate that was similar to that of males (2.56). Suicide by other methods was less common in females, and the rates of hanging (1.09) gassing (0.83), shooting (0.38), jumping (0.30), drowning (0.35) and use of sharp implements (0.02) were all lower than for males. Over the next 10 years, there was a decline in suicide among females by all methods except hanging, which rose by 75% to 1.93 per 100 000 per annum, resulting in a small rise in the overall rate of suicide for females.

In the decade from 1998 to 2007 there was a 26% decline in the total female suicide rate, to 3.96 per 100 000 per annum as a result of declines in suicides by hanging (by 10%), gassing (by 63%), shooting (by 74%), jumping (by 38%), drowning (by 20%) and use of sharp implements (by 29%).

Poisson regression analysis showed an increase in the proportion of all female suicides by hanging over the period 1988 to 2007, but a decline in suicide by shooting, poisoning and drowning, and no change in the proportion of female suicides by gassing and use of sharp implements (Box 1).

Meta-analysis of rates and methods of suicide in Australian states and territories

Between 1998 and 2007, New South Wales, Victoria and the Australian Capital Territory had lower rates of male suicide than the other states and less than half the rate in the Northern Territory (Box 2). In the decade 1988 to 1997, there were no significant differences between the states and territories in the suicide rates of females. However, from 1998 to 2007 the rates of female suicide in the Tasmania and NT were significantly higher, and the rates in NSW and the ACT were lower than the other states (Box 2). The ACT, NSW and Vic had lower rates of female suicide for most methods of suicide than South Australia, Queensland, Western Australia and Tas in both decades. During 1998 to 2007, the NT had the highest rate of male suicide and female

2 Meta-analyses of rates (per 100 000 male or female population) of Australian state and territory suicide methods during 1988–1997 and 1998–2007 and of the rate ratio between these periods

	Male				Female			
Method	Suicide rate 1988–1997	Suicide rate 1998–2007	Rate ratio (95% CI)	*P*	Suicide rate 1988–1997	Suicide rate 1998–2007	Rate ratio (95% CI)	*P*
All methods								
New South Wales	20.3	16.5	0.81 (0.78–0.88)	< 0.01	5.31	4.16	0.78 (0.73–0.84)	< 0.01
Victoria	19.3	16.2	0.84 (0.80–0.88)	< 0.01	5.21	4.92	0.94 (0.87–1.02)	0.16
Queensland	23.6	19.6	0.83 (0.80–0.87)	< 0.01	5.65	4.92	0.87 (0.79–0.96)	< 0.01
South Australia	21.7	21.1	0.98 (0.91–1.05)	0.51	5.52	5.15	0.93 (0.81–1.07)	0.33
Western Australia	20.8	19.2	0.92 (0.87–0.99)	0.02	4.79	5.16	1.08 (0.95–1.23)	0.26
Tasmania	24.4	22.7	0.93 (0.82–1.04)	0.21	5.55	6.42	1.16 (0.92–1.46)	0.22
Northern Territory	25.5	35.6	1.39 (1.18–1.64)	< 0.01	4.07	5.94	1.46 (0.95–2.24)	0.08
Australian Capital Territory	17.2	15.8	0.92 (0.77–1.09)	0.36	4.82	4.64	0.96 (0.70–1.33)	0.82
Heterogeneity (I squared)	94.2	98.1	88.3		41.5	86.1	79.0	
Pooled rate	21.4	20.1	0.92 (0.86– 0.99)	0.02	5.31	5.04	0.96 (0.86–1.06)	0.39
Hanging								
New South Wales	6.04	8.02	1.33 (1.25–1.41)	< 0.01	1.21	1.58	1.31 (1.14–1.49)	< 0.01
Victoria	5.65	7.38	1.31 (1.21–1.40)	< 0.01	1.27	1.82	1.43 (1.23–1.65)	< 0.01
Queensland	6.51	9.46	1.45 (1.34–1.57)	< 0.01	1.18	1.91	1.62 (1.35–1.93)	< 0.01
South Australia	7.09	10.09	1.42 (1.27–1.59)	< 0.01	1.07	1.74	1.64 (1.24 –2.16)	< 0.01
Western Australia	7.26	9.94	1.37 (1.24–1.52)	< 0.01	1.39	2.26	1.63 (1.30–2.04)	< 0.01
Tasmania	4.76	8.85	1.86 (1.48–2.34)	< 0.01	1.14	2.10	1.84 (1.15–2.93)	0.01
Northern Territory	8.92	25.07	2.81 (2.19–3.61)	< 0.01	2.84	3.54	1.25 (0.74–2.12)	0.41
Australian Capital Territory	5.06	6.87	1.36 (1.01–1.83)	0.04	2.24	1.53	0.68 (0.41–1.15)	0.15
Heterogeneity (I squared)	88.3	98.3	83.6		77.3	81.8	53.0	
Pooled rate	6.23	9.81	1.49 (1.36–1.64)	< 0.01	1.36	1.94	1.44 (1.27–1.64)	< 0.01
Shooting								
New South Wales	3.90	1.64	0.42 (0.38–0.47)	< 0.01	0.20	0.12	0.61 (0.41–0.90)	0.01
Victoria	3.84	1.70	0.44 (0.39–0.50)	< 0.01	0.19	0.16	0.84 (0.57–1.29)	0.43
Queensland	7.49	2.51	0.33 (0.30–0.37)	< 0.01	0.31	0.20	0.62 (0.41–0.96)	0.03
South Australia	4.94	2.21	0.45 (0.37–0.54)	< 0.01	0.42	0.15	0.37 (0.19–0.71)	< 0.01
Western Australia	3.55	1.97	0.56 (0.46–0.67)	< 0.01	0.28	0.13	0.48 (0.25–0.75)	0.04
Tasmania	10.29	5.08	0.49 (0.40–0.62)	< 0.01	0.76	0.70	0.92 (0.47–1.78)	0.8
Northern Territory	9.37	4.48	0.48 (0.34–0.68)	0.05	0.99	1.04	1.06 (0.42–2.68)	0.91
Australian Capital Territory	2.66	1.62	0.61 (0.37–1.00)	< 0.01	0.14	0	0.18 (0.01–3.75)	0.27
Heterogeneity (I squared)	98.7	96.3	78.5		86.0	90.0	11.3	
Pooled rate	5.19	2.40	0.45 (0.39–0.51)	< 0.01	0.34	0.23	0.65 (0.53–0.79)	< 0.01
Gassing								
New South Wales	4.39	2.67	0.61 (0.56–0.66)	< 0.01	0.70	0.43	0.62 (0.50–0.77)	< 0.01
Victoria	4.76	3.51	0.74 (0.67–0.81)	< 0.01	0.84	0.68	0.81 (0.66–1.00)	0.05
Queensland	4.33	3.78	0.87 (0.79–0.97)	0.01	0.78	0.80	1.02 (0.81–1.30)	0.84
South Australia	4.83	4.74	0.98 (0.85–1.14)	0.8	1.01	0.90	0.89 (0.65–1.24)	0.5
Western Australia	6.30	4.07	0.65 (0.57–0.74)	< 0.01	0.99	1.02	1.03 (0.77–1.38)	0.83
Tasmania	6.23	5.46	0.88 (0.69–1.11)	0.28	1.44	1.15	0.80 (0.49–1.32)	0.38
Northern Territory	3.68	1.81	0.49 (0.28–0.87)	0.01	1.23	1.35	1.10 (0.48–2.50)	0.82
Australian Capital Territory	5.19	4.68	0.90 (0.66–1.24)	0.53	1.49	1.22	0.82 (0.45–1.50)	0.52
Heterogeneity (I squared)	89.9	95.3	86.8		77.3	90.2	46.1	
Pooled rate	4.95	3.78	0.77 (0.66–0.88)	< 0.01	0.96	0.86	0.83 (0.75–0.92)	< 0.01

2 (*continued from previous page*)

Method	Male				Female			
	Suicide rate 1988–1997	Suicide rate 1998–2007	Rate ratio (95% CI)	*P*	Suicide rate 1988–1997	Suicide rate 1998–2007	Rate ratio (95% CI)	*P*
Poisoning								
New South Wales	2.58	1.55	0.60 (0.54–0.67)	< 0.01	1.86	1.28	0.69 (0.61–0.78)	< 0.01
Victoria	2.13	1.33	0.63 (0.55–0.72)	< 0.01	1.81	1.43	0.79 (0.69–0.91)	< 0.01
Queensland	2.74	2.04	0.75 (0.65–0.86)	< 0.01	2.46	1.53	0.62 (0.54–0.73)	< 0.01
South Australia	2.57	2.37	0.92 (0.75–1.13)	0.43	2.08	2.01	0.97 (0.78–1.21)	0.79
Western Australia	1.87	1.59	0.85 (0.68–1.06)	0.16	1.53	1.40	0.92 (0.72–1.17)	0.48
Tasmania	1.34	1.78	1.33 (0.83–2.11)	0.23	2.08	2.18	1.05 (0.71–1.55)	0.8
Northern Territory	3.12	2.19	0.70 (0.40–1.22)	0.21	1.73	1.35	0.78 (0.37–1.67)	0.53
Australian Capital Territory	2.46	2.62	1.07 (0.68–1.67)	0.78	1.22	2.99	2.45 (1.43–4.21)	< 0.01
Heterogeneity (I squared)	83.1	89.3	77.1		80.6	87.5	80.9	
Pooled rate	2.32	1.85	0.78 (0.67–0.91)	< 0.01	1.89	1.68	0.87 (0.73–1.05)	0.15
Jumping from a height								
New South Wales	1.17	0.99	0.85 (0.73–0.98)	0.03	0.54	0.36	0.67 (0.53–0.85)	< 0.01
Victoria	0.69	0.51	0.74 (0.58–0.94)	0.01	0.24	0.17	0.70 (0.47–1.05)	0.09
Queensland	0.84	0.54	0.64 (0.49–0.83)	< 0.01	0.29	0.22	0.76 (0.50–1.15)	0.19
South Australia	0.38	0.44	1.16 (0.70–1.93)	0.56	0.15	0.17	1.12 (0.50–2.49)	0.79
Western Australia	0.40	0.60	1.49 (0.98–2.27)	0.07	0.23	0.12	0.54 (0.26–1.11)	0.1
Tasmania	0.52	0.80	1.55 (0.75–3.19)	0.23	0.30	0.62	2.08 (0.85–5.11)	0.11
Northern Territory	0.56	2.00	3.59 (1.35–9.52)	0.01	0	0.31	5.91 (0.31–114.48)	0.24
Australian Capital Territory	1.37	0.87	0.64 (0.32–1.27)	0.20	0.75	0.73	0.98 (0.43–2.27)	0.97
Heterogeneity (I squared)	91.7	92.0	72.8		87.5	86.7	29.3	
Pooled rate	0.69	0.73	0.97 (0.75–1.24)	0.80	0.31	0.28	0.74 (0.63–0.88)	< 0.01
Drowning								
New South Wales	0.42	0.29	0.69 (0.53–0.90)	0.01	0.30	0.19	0.62 (0.45–0.86)	< 0.01
Victoria	0.36	0.27	0.75 (0.54–1.04)	0.08	0.27	0.19	0.71 (0.48–1.04)	0.08
Queensland	0.36	0.28	0.76 (0.52–1.11)	0.15	0.25	0.13	0.52 (0.31–0.86)	0.01
South Australia	0.50	0.32	0.63 (0.38–1.06)	0.08	0.38	0.35	0.91 (0.54–1.55)	0.73
Western Australia	0.31	0.33	1.06 (0.63–1.77)	0.84	0.20	0.22	1.06 (0.56–2.00)	0.87
Tasmania	0.48	0.76	1.60 (0.76–3.39)	0.22	0.97	0.82	0.85 (0.46–1.54)	0.58
Northern Territory	0	1.24	23.08 (1.37–388.3)	0.03	0.86	0.21	0.24 (0.05–1.16)	0.08
Australian Capital Territory	0.82	0.56	0.69 (0.29–1.63)	0.39	0.61	0.24	0.40 (0.12–1.30)	0.13
Heterogeneity (I squared)	48.9	84.4	41.6		85.2	85.8	5.3	
Pooled rate	0.41	0.40	0.77 (0.66–0.90)	< 0.01	0.39	0.25	0.69 (0.57–0.82)	< 0.01
Use of a sharp implement								
New South Wales	0.39	0.38	0.98 (0.76–1.25)	0.84	0.11	0.07	0.68 (0.41–1.15)	0.15
Victoria	0.41	0.36	0.87 (0.65–1.17)	0.35	0.13	0.07	0.56 (0.31–1.01)	0.05
Queensland	0.38	0.34	0.92 (0.64–1.30)	0.62	0.11	0.08	0.71 (0.36–1.43)	0.34
South Australia	0.38	0.44	1.16 (0.70–1.93)	0.56	0.16	0.14	0.87 (0.38–1.96)	0.73
Western Australia	0.37	0.22	0.61 (0.35–1.05)	0.08	0.07	0.16	2.28 (0.89– 5.83)	0.09
Tasmania	0.30	0.51	1.68 (0.66–4.26)	0.28	0.34	0.62	1.82 (0.77–4.30)	0.17
Northern Territory	1.45	1.91	1.32 (0.65–2.64)	0.44	1.23	1.04	0.85 (0.35–2.03)	0.71
Australian Capital Territory	0.61	0.87	1.42 (0.62– 3.29)	0.41	0.41	0.37	0.90 (0.29–2.79)	0.86
Heterogeneity (I squared)	70.9	89.7	0		89.0	93.0	31.0	
Pooled rate	0.45	0.49	0.96 (0.83–1.11)	0.53	0.20	0.19	0.84 (0.65–1.09)	0.19

suicide by hanging and sharp implement, and the highest rate of female shooting suicide.

In 1998 to 2007, Tas had the highest rate of male gassing and shooting. In NSW, rates of both male and female suicide by jumping were about twice those of other mainland states.

Meta-analysis of the rate ratios of methods of suicide in Australian states and territories between 1988–1997 and 1998–2007

Between 1988–1997 and 1998–2007, there was a small but significant decline in the pooled Australian suicide rate for males and a smaller and statistically non-significant decline in the rate for females (Box 2). In the case of both male and female suicide, this result concealed significant differences between states and territories. NSW and Qld had a significant fall in both male and female suicide, Vic and WA had significant declines in male but not female suicide rates, and the NT had a significant increase in male suicide.

Male hanging increased significantly in every state and territory over the two decades. Rates of hanging by females also increased significantly in every state, but had a non-significant fall in the ACT.

Shooting suicides by males declined significantly in every state and territory. There were significant declines in shooting suicides by females in NSW, Qld, SA and WA. Male suicide by gassing declined significantly in NSW, Vic, Qld, WA and the NT. Female gassing declined significantly in NSW. Male and female suicide by poisoning declined in NSW, Vic and Qld, while female suicide by poisoning increased significantly in the ACT. Male suicide by jumping from a height declined in NSW, Vic and Qld, but increased in the NT. Female suicide by jumping declined significantly in NSW, but not in other regions. Male suicide by drowning fell in NSW but increased significantly in the NT. Female drowning decreased significantly in NSW and Qld.

DISCUSSION

Using meta-analysis, we found evidence of a modest but statistically significant decline of 8% in the pooled estimate of male suicide in Australia over the past 20 years, indicated by a rate ratio of 0.92 between the two decades (Box 2). Despite the fall in national rates of suicide among males, there was a significant increase in suicides among males in the NT. Meta-analysis did not show a significant decline in female suicide in Australia, despite significant falls in female suicide in NSW and Qld.

Considered nationally, the falls in male suicide were due to significant reductions in shooting, gassing and poisoning, and occurred despite an increase in suicide by hanging. There were similar changes in the methods of suicide used by females. These results are consistent with the hypothesis that that measures to control the availability of firearms, the requirement for new cars to be fitted with catalytic converters and the decline in the prescription of tricyclic antidepressants have resulted in a decline in total suicide rates.

In contrast to shooting, gassing and poisoning, hanging suicides by males and females increased, rare suicides by sharp objects were unchanged, and jumping from a height declined only among females. The absence of a demonstrable fall in the rates of suicide by these methods might be because they are difficult to regulate. The exception was drowning, a rare method of suicide that might never be regulated, that declined significantly among males and females.

The higher rate of suicide by jumping in NSW relative to other states might be explained by the ready access to cliffs and the greater number of high bridges and tall buildings in the Sydney region. The increase in male suicides in the NT, due to very high rates of jumping, hanging and, according to these statistics, drowning, has been discussed elsewhere.[17]

A potential limitation of our study is that there has been debate about the quality of ABS suicide data, and whether differences in the way suicide has been defined and identified have influenced the reported rates of suicide.[18,19] The main limitation of ABS data is the reliance on coronial verdicts, which are often delayed and sometimes pass an open verdict as to the cause of death. An investigation of under-reporting of suicides in ABS data, using data from 2000 and 2005, found that about 9% of cases in which there might have been suicidal intent were coded as having an "ill defined and unknown" cause (ICD-10, R95–R99), and a further 13% of cases that might have been suicides had no recorded cause of death.[20] Suicides by hanging and self-strangulation were found to be more likely to result in open verdicts. However, despite some variation from year to year, systematic under-reporting of suicide occurred in all the years of this study, with the delayed findings of coronial inquiries appearing in the figures for subsequent years. The ABS has improved its methods for recording suicide, but some of the reduction in rates of suicide deaths reported in this study might be the result of the use of non-suicide codes in some of the years pending a verdict of a coronial inquiry.

Although the limitations of the ABS data may have resulted in underreporting of suicides, the most common method of suicide leading to uncertain coroner's verdicts was hanging, with potential underreporting in the ABS data.[18,19] However, our results have shown that hanging became the most common method of suicide in the later, second decade of study.

Suicide in Australia might be reduced by three broad types of public health measure. First, the provision of mental health services to a greater proportion of previously untreated mentally ill people might prevent some suicides — there is evidence that the early treatment of psychotic illness can reduce suicide attempts.[21,22] However, in the past decade, there was only a modest increase in the proportion of mentally ill people receiving treatment, from 32.5% in 1997 to 34.9% in 2007.[23] A second approach would be to attempt to identify and treat high-risk individuals. This is also unlikely to be especially successful, because methods of assessing suicide risk have only modest sensitivity and specificity, and because suicide is rare.[24,25] The limited capacity to predict who will commit suicide is evident from the statistic that more than

3 Ways that may further reduce the availability of lethal methods of suicide

- Make benzodiazepines an S8-category drug and reduce the quantity that can be dispensed at one time.
- Ban the storage of firearms in the home in urban areas, so that all recreational weapons are stored in approved repositories.
- Regulate to install motor-exhaust gas sensors linked to engine immobilisers.
- Ban long, pointed kitchen knives to reduce self-stabbing, as well as the stabbing of other people.[26]
- Erect protective barriers at well-known jumping points.[27,28]

2% of the Australian population experience suicidal ideas in any given year, but fewer than one in 10 000 complete suicide. Hence, the intervention that would be most likely to further reduce the rate of suicide would be to further limit the availability of lethal means (Box 3).

ACKNOWLEDGEMENTS

We thank Peter Arnold for his assistance in the preparation of the manuscript.

COMPETING INTERESTS

Matthew Large and Olav Nielssen jointly received a grant in aid of $30 000 in 2007–2008 in order to employ a research assistant for an unrelated study of suicide.

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(Received 28 Jun 2009, accepted 13 Nov 2009) ❑