



cutting through complexity

KPMG HEALTH ECONOMICS

The economic cost of suicide in Australia

Prepared for: Menslink

October 2013

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Need help?

If you or someone you know is contemplating suicide or needs help call:

Lifeline - 13 11 14

Kids Helpline - 1800 55 1800

Mental Health Line - 1800 011 511

MensLine Australia - 1300 78 99 78

Suicide Call Back Service - 1300 659 467

Acronyms

ABS	Australian Bureau of Statistics
ACT	Australian Capital Territory
AISRAP	Australian Institute for Suicide Research and Prevention
BITRE	Bureau of Infrastructure, Transport and Regional Economics
GDP	Gross Domestic Product
NCIS	National Coroners Information Service
NT	Northern Territory
NSW	New South Wales
Qld	Queensland
QSR	Queensland Suicide Register
SA	South Australia
Tas.	Tasmania
Vic.	Victoria
WA	Western Australia

Executive Summary

Menslink is a not for profit organisation developed in 2002 with the aim of providing support to young men across the Canberra region, primarily through mentoring and counselling.

Since its beginning, Menslink has supported over one thousand men, leading to improved lives and wellbeing, and a reduced risk of suicide. Staff and volunteers see firsthand the economic and social cost of suicide, and the great gains that can be achieved by delivering programs that help young men change their life.

Despite programs like those delivered by Menslink, many suicides still occur each year among men and women. According to the Australian Bureau of Statistics (ABS), there were 2,273 suicides in 2011,¹ with 76 per cent of these impacting males. The median age of suicide for males was 43.4 years, and the age specific suicide rate was higher for males across all ages. All of these suicides could be considered preventable.

However, suicide still remains a leading cause of social burden in Australia. There is a large human cost associated with suicide such as emotional impacts on family and friends, and broader economic costs such as the use of services leading up to and immediately following suicide. There are also indirect economic costs to society through premature mortality, such as lost productivity.

KPMG was commissioned by Menslink to estimate the economic cost of suicide among Australian men and women.² This includes estimating the number of suicides in Australia for 2012, the productivity loss associated with premature mortality, other costs associated with suicide, and the loss of healthy life years.

Estimated number of suicides

The number of suicides was calculated using the latest published ABS data, historical trends in suicides and adjustments for recognised under-reporting of suicides.

It was estimated that 2,614 Australians died from suicide in 2012 (see Chart 1). This included:

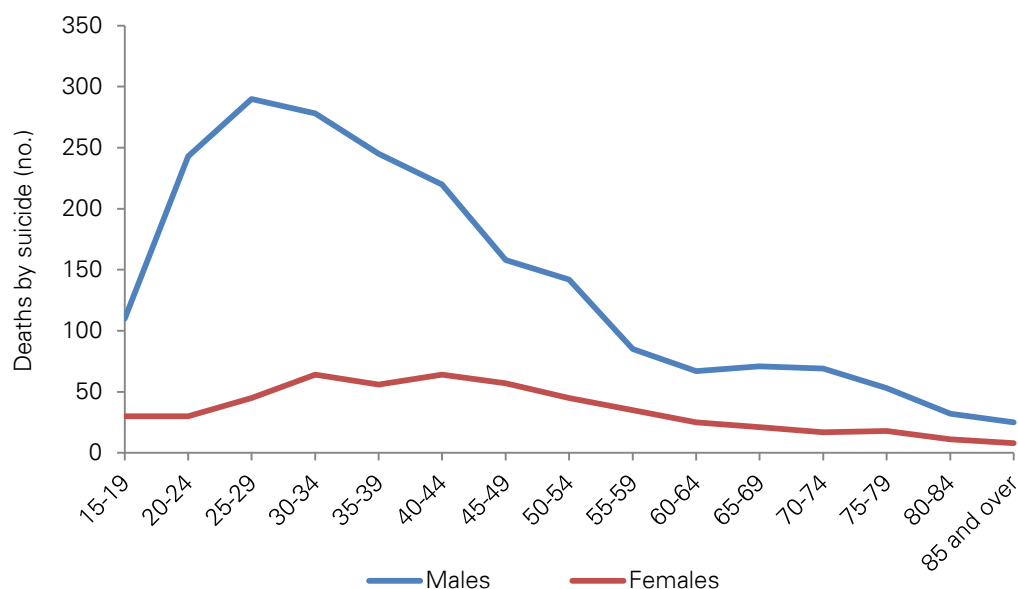
- 2,088 male suicides; and
- 526 female suicides.

Publically released figures for causes of death showed that suicides were greater than deaths attributable to skin cancer or road-related car accidents (ABS 2013, BITRE 2013).

¹ The most recent statistics on suicide across Australia.

² Although there are substantial costs associated with attempted suicide (e.g., through the use of health and human services), estimating these types of costs was beyond the scope of this project.

Chart 1: Estimated suicide by age group for males and females in 2012



Note: Data has been revised for under-reporting. See Appendix A for details of the methodology.
 Source: KPMG calculations; ABS (2013a).

Economic cost of suicide

The economic cost of suicide is comprised of direct and indirect costs. In this study, the direct costs of suicide relate to coronial inquiries, police and ambulance services, and counselling support provided to family and friends of the deceased.

The indirect cost of suicide is the lost economic contribution of an individual due to premature mortality. It was measured as the income a person would have been expected to receive from the age of their death until retirement.

The economic cost per suicide was estimated using published literature and data on income and employment rates sourced from the ABS. Employment rates were adjusted given around 90 per cent of people who die by suicide also have a mental health condition.

Based on the estimated number of suicides, and the estimated cost per suicide, the total economic cost of suicide was calculated as **\$1.7 billion** for 2012 (see Table 1).

Table 1: Economic cost of suicide in 2012

Type of cost	Male (\$ million)	Female (\$ million)	Persons (\$ million)
Indirect costs	1,466	171	1,637
Direct costs	16	4	20
Total	1,482	175	1,657

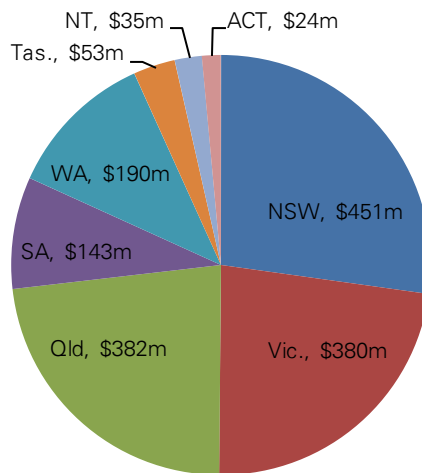
Note: Productivity loss for each suicide death was calculated as the present value of lifetime earnings that would have otherwise been received.

Source: KPMG calculations.

Approximately 90 per cent of the total economic cost of suicide is attributable to male suicide. This is due to several factors, including the increased number of suicides by males, the younger average age for male suicides compared to females (40.5 years compared to 44.3 years respectively), and the higher income and employment rates for males.

Based on the proportion of suicides in each jurisdiction, New South Wales bears the greatest share of the total economic cost of suicide followed by Queensland and Victoria (see Chart 2). Costs by jurisdiction are broadly proportional to their population share, although Queensland and the Northern Territory have a relatively higher share of the economic costs of suicide.

Chart 2: Distribution of economic cost of suicide by jurisdiction 2012



Source: KPMG calculations; ABS (2013c).

Income tax revenue foregone

An individual's lost income due to suicide is also a loss to the federal government through income tax revenue that would otherwise have been received. It is estimated that the present value of income tax revenue lost due to suicide in 2012 is **\$525 million**. While this is not an economic cost, it is important to the distribution of loss from premature death.³

Years of life lost

Years of life lost was calculated as the average number of years that a person would have lived, had they not died prematurely, multiplied by the number of deaths in a given year.

The total years of life lost to suicide in 2012 was estimated to be **108,120 years**, with the greatest burden affecting males aged 25 to 29 and women aged 30 to 34 years.

³ Tax is considered a transfer between individuals and government and therefore is not considered a cost to the economy.

1 Introduction

Menslink engaged KPMG to estimate the economic cost of suicide to Australia. This chapter outlines the objectives and scope of the engagement.

1.1 Objectives

The objective of the engagement was to determine the total economic cost of suicide in Australia and to examine the impact of this on income tax revenue of the government.

The purpose was to highlight the magnitude of the problem, including its distributional impact across genders, age groups and jurisdictions. This is to provide decision-makers with a greater insight into the potential benefits (i.e. avoided economic cost) from investing in programs and treatments that reduce the number of suicides in Australia.

1.2 Scope

This report has been prepared according to the agreed scope of the engagement. This includes:

- analysing recent trends in statistics measuring suicides including limitations with the data;
- estimating the number of suicides in Australia in 2012 using up-to-date statistical information (e.g., Australian Bureau of Statistics) and making adjustments for potential data limitations;
- estimating the productivity loss associated with suicide resulting from premature mortality;
- estimating other economic costs associated with suicide;
- estimating loss in federal government taxation revenue due to premature mortality; and
- estimating the loss of healthy life years associated with suicide.

The project scope does not include measuring the economic cost of attempted suicide or conditions related to suicide, such as depression and other mental health conditions.

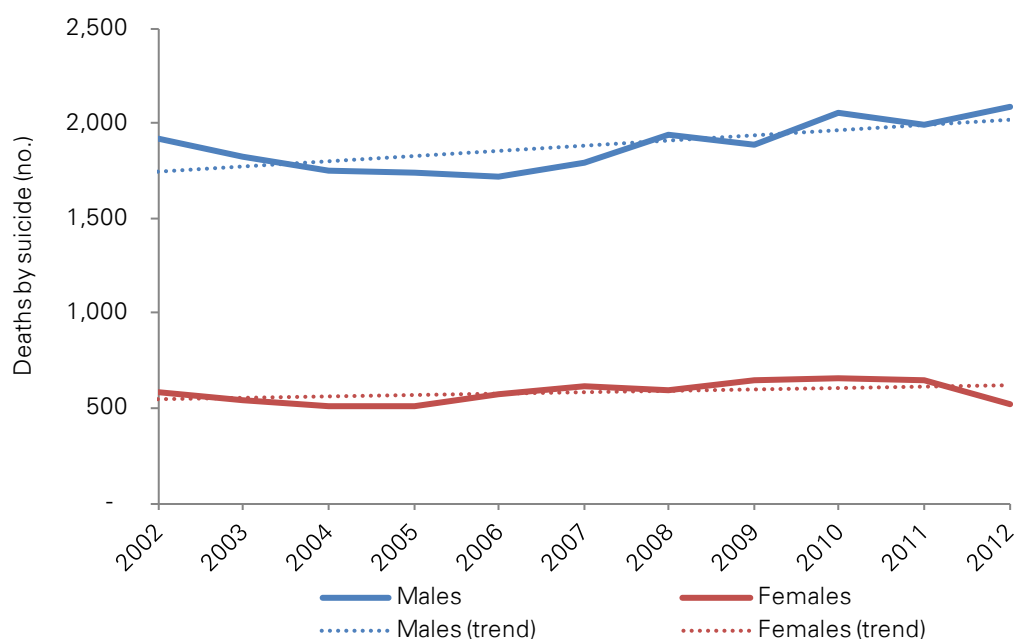
2 Suicide in Australia

This chapter provides an overview of data related to suicide across age groups and jurisdictions for males and females, and provides estimates of the number of suicides in 2012. The primary data source related to suicides in Australia is the Australia Bureau of Statistics (ABS) annual publication of causes of deaths, with the most recent publication providing figures on suicides for 2011 (ABS 2013a). Methods to adjust suicide statistics for revisions to ABS statistics and potential under-reporting are presented in Appendix A.

2.1 Trends by gender

There were an estimated 2,614 suicides in 2012, of which 2,088 were undertaken by males, and 526 were undertaken by females. After a decline to 2006 for males and 2005 for females, both male and female suicides have since increased. While it is estimated that suicide declined for females in 2012, the long term trend is upward for both males and females.

Chart 2.1: Number of suicides for males and females

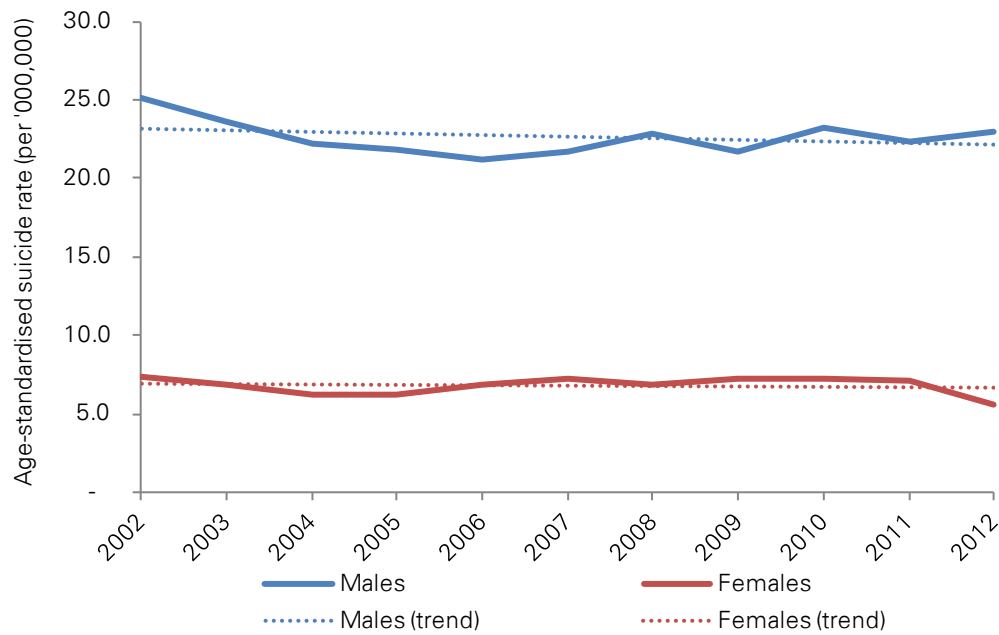


Note: Data has been revised for under-reporting. See Appendix A for details of the methodology.
Source: KPMG calculations, ABS (2013a).

Adjusting the number of suicides for age and sex shows that the rate of suicide has declined slightly for both males and females from 2002 to 2012 (see Chart 2.2).

The age standardised suicide rates for males and females illustrates the magnitude of the issue of suicide for males, which are consistently more than three times the suicide rate of females.

Chart 2.2: Age standardised suicide rates for males and females

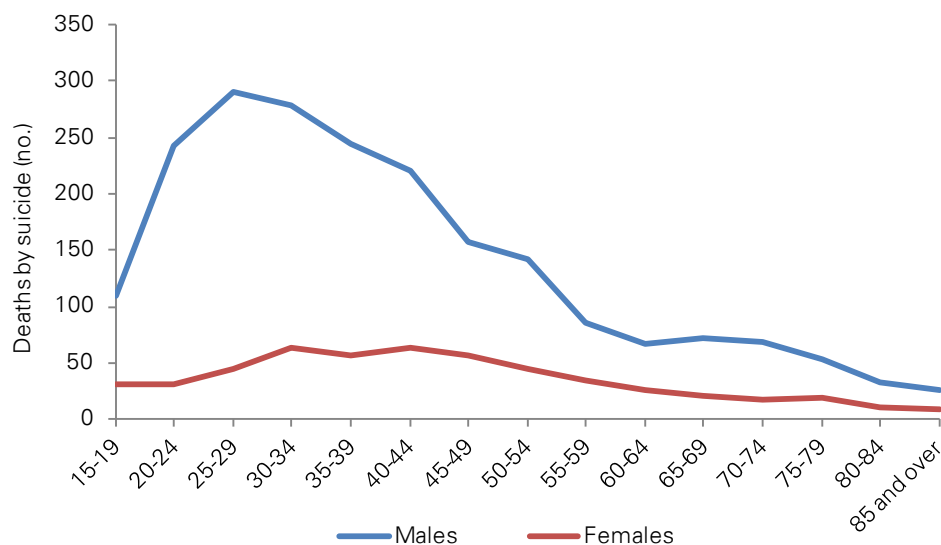


Note: Data has been revised for under-reporting. See Appendix A for details of the methodology.
 Source: KPMG calculations; ABS (2013b).

2.2 Trends by age

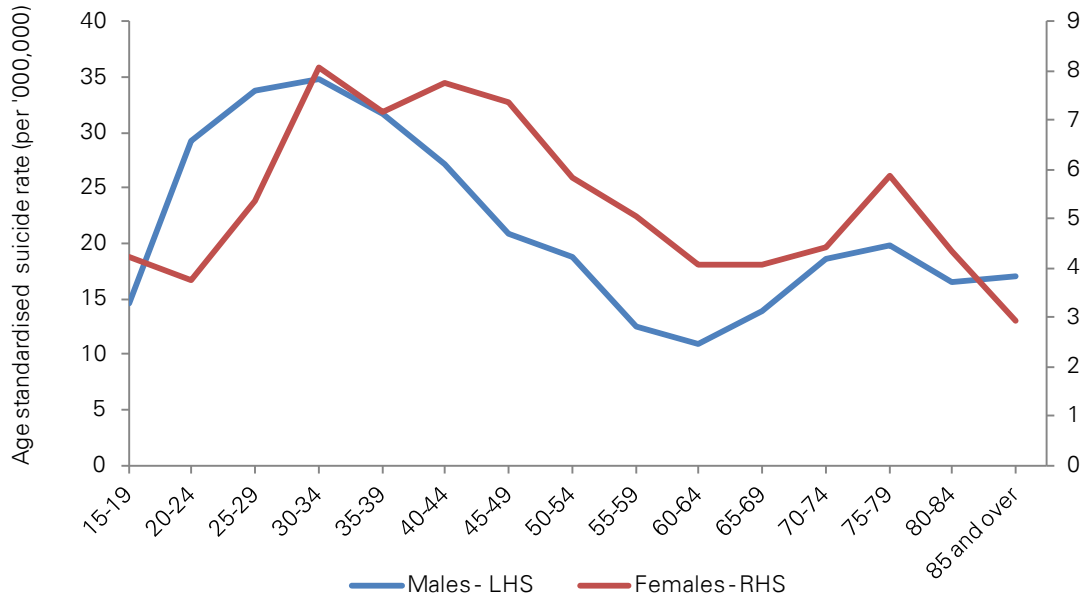
The age composition of suicide shows that the greatest number of suicides was undertaken by males aged 25 to 29, and females aged 40 to 44 (see Chart 2.3). The age standardised rates show a disproportionate number of males that die by suicide are under 40 years of age with another peak around a man's late 70s and early 80s (see Chart 2.4). This is similar to females which exhibits a similar distribution of suicides across age groups, although at a lower suicide rate.

Chart 2.3: Suicide by age group for males and females in 2012



Note: Data has been revised for under-reporting. See Appendix A for details of the methodology.
 Source: KPMG calculations; ABS (2013a).

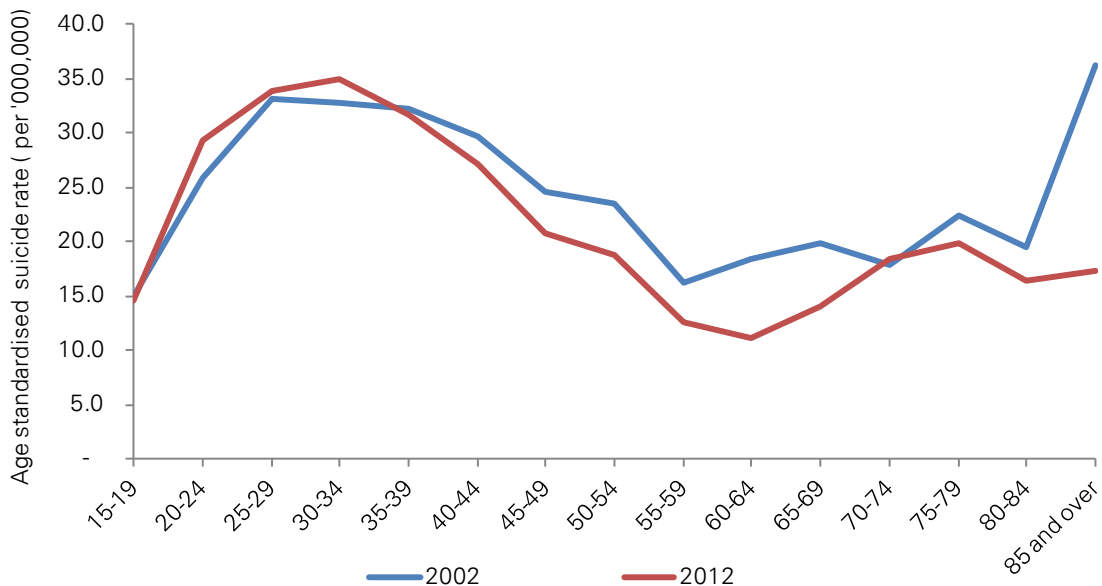
Chart 2.4: Age standardised suicide rate, by age group for males and females in 2012



Note: Data has been revised for under-reporting. See Appendix A for details of the methodology.
 Source: KPMG calculations; ABS (2013b).

Comparing the age standardised rate of suicide for males in 2002 to 2012 shows that there has not been a significant change in the age composition of male suicides over the period (see Chart 2.5).

Chart 2.5: Age standardised male suicide rate by age group



Note: Data has been revised for under-reporting. See Appendix A for details of the methodology.
 Source: KPMG calculations; ABS (2013b).

Similarly, the age standardised rate of suicide for females across age groups does not illustrate a substantial change between 2002 and 2012 (see Chart 2.6), with the exception of the 85 and over age group, when there was much higher rate of suicide for females aged over 85 years in 2002.

Chart 2.6: Age standardised female suicide rate by age group



Note: Data has been revised for under-reporting. See Appendix A for details of the methodology.
 Source: KPMG calculations; ABS (2013b).

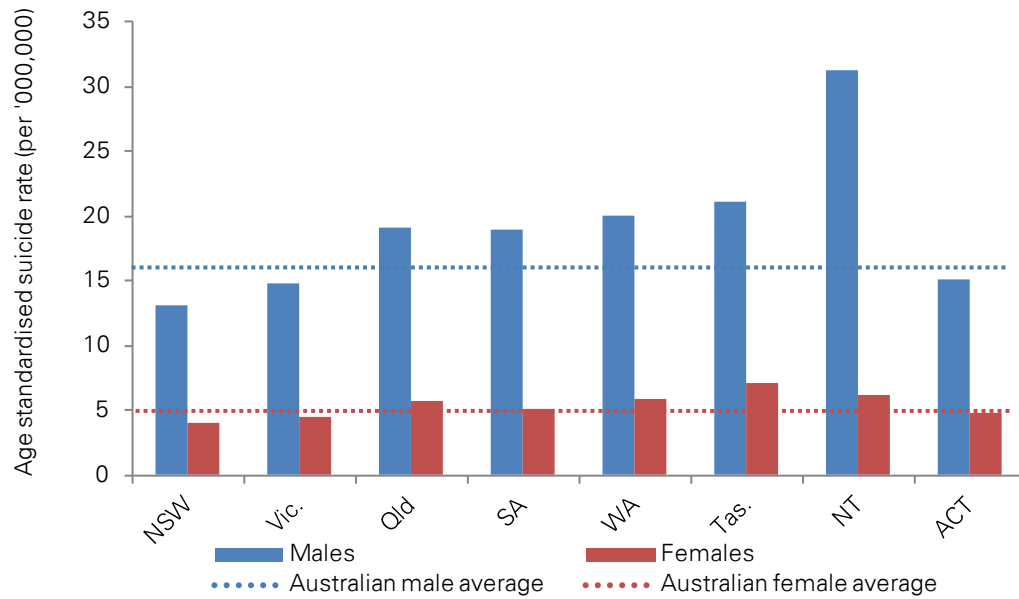
2.3 Trends by jurisdiction

Suicide rates vary by jurisdiction although there is a higher degree of variation across jurisdictions in male suicide rates than female (see Chart 2.7).⁴ The male suicide rate ranges from 13.1 per 100,000 males in NSW to 31.3 per 100,000 in the Northern Territory, with the Northern Territory rate almost double the Australian (male) rate of 16 per 100,000 males.

The female suicide rate across jurisdictions exhibits a much smaller range of 4.1 per 100,000 females in NSW to 7.2 per 100,000 females in Tasmania.

⁴ The standard deviation for the male suicide rate across jurisdictions is 5.6 compared to 0.99 for females.

Chart 2.7: Age standardised suicide rate across jurisdictions, 2007-2011

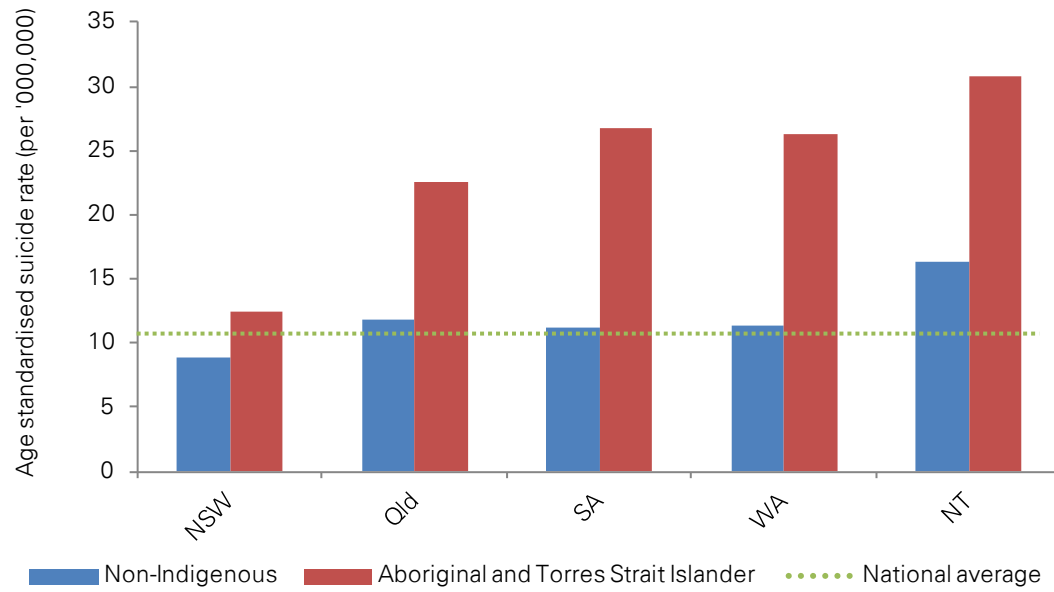


Source: ABS (2013c).

The high male suicide rate in the Northern Territory largely reflects the higher rate of suicide amongst Aboriginal and Torres Strait Islander people.⁵ While the age-standardised suicide rate for Aboriginal and Torres Strait Islander people is higher than the suicide rate for non-Indigenous people across Australia, the suicide rate for Aboriginal and Torres Strait Islander people is highest in the Northern Territory at double the national average (see Chart 2.8).

⁵ The estimated resident population (ERP) of Aboriginal and Torres Strait Islander persons is estimated to be 29.8 per cent of the (ERP) of the Northern Territory in 2011 (ABS 2013e)

Chart 2.8: Age standardised suicide rate by state and Indigenous status, 2001-2010¹



Note: 1. The national average is the age-standardised suicide rate for the period 2007-2011.
Source: ABS (2012); ABS (2013c).

3 Economic cost of suicide

This chapter describes the different components of the economic cost of suicide and summarises the methodology used to estimate the total economic cost of suicide for Australia in 2012. Costs outlined within the chapter include explicit monetary outlays such as the cost of police and emergency services (direct costs), the value of lost output or production arising from suicide (indirect costs), and the loss in life years that would have otherwise been achieved.⁶ A full list of data sources and their use in estimating the economic cost of suicide death is provided in Appendix B.

3.1 Direct costs

There are four direct costs associated with suicide that were used to estimate the economic cost of suicide (see Table 3.1). These include:

- coronial inquiry costs, which are incurred when a sudden or unexplained death has occurred, such as suicide;
- policing costs, which are incurred when police attend the scene, and conduct investigations into the death;
- ambulance service costs, which are incurred when an ambulance attends the scene and transports the victim to hospital; and
- counselling support provided to family and friends of the victim.

Not all costs are incurred in the event of every suicide. In the case of ambulance attendance, it is estimated that an ambulance only attends the scene in two-thirds of suicides (Clayton and Barceló 1999). Conversely, the unit cost of counselling support has been estimated to occur six times for every suicide (Corso 2007).

⁶ Valuing the loss of life for someone who has committed suicide is beyond the scope of this project.

Table 3.1: Direct cost per suicide

Type of cost	Unit cost (\$)	Proportion of suicides (%)	Average direct cost per suicide (\$)	Notes
Coronial costs	2,531	100	2,531	Per road fatality. Includes administrative costs, autopsy costs for 80% of deaths, and coronial inquests in 2% of deaths.
Ambulance costs	1,089	66	718	Based on 1.2 ambulances per attendance, and attendance of at least 1 ambulance at 54 per cent of all deaths by suicide.
Police costs	2,532	100	2,532	Based on NZ police costs,
Grieving costs	318	600	1,910	ConNetica Consulting (2009) estimate that for each suicide, up to six people are affected. It has been assumed that those affected will be provided counselling.

Source: KPMG calculations; O’Dea and Tucker (2005); Clayton and Barceló (1999); BITRE (2000).

3.2 Productivity loss

The human capital approach was used to estimate the indirect economic cost of suicide.⁷ This approach is based on the premise that an individual is irreplaceable (i.e., the economy is at full employment) and the income a person would have earned over their life is a loss in productivity to the economy.

The value of lost productivity was measured as the present value of gross earnings that an individual would have earned had they lived. Consequently, estimates are made about the likelihood of being in paid employment, and the income drawn from this employment. These are estimated separately for males and females, reflecting the different profile of employment and earning capacity of males and females.

3.2.1 Probability of being employed over a lifetime

National figures were used to estimate the probability of a person being employed at a given age. This was measured as the total number of males (females) employed (full time and part-time) in a given age group, divided by the total number of males (females) in that age group.

This is not the same as the inverse of the unemployment rate as the ABS definition of unemployment is a person looking for work. For example, in the quarter ending July 2013, only 43.5 per cent of males aged 15 to 19 years of age were employed (full or part-time), however the unemployment rate was 15.4 per cent.

To account for cyclical effects in the rate of employment, the average employment rate over the last ten years (August 2003 to June 2013) was used for each five year age group (from 15 to 65) for each gender.

⁷ O’Dea and Tucker (2005) provide a summary of selected studies and the valuation of lost productivity used.

It was necessary to make an assumption about each person's employment profile over their life. It is assumed that the current (average) profile of employment will remain consistent. For example, the probability of a 15 year old male being employed when they are 40 years old is the same as the probability of a male being employed that is currently 40 years old.

Adjustments were made to the probability of being employed to reflect that people who die by suicide are more likely to be unemployed throughout their life due to mental health conditions. It was assumed that 90 per cent of persons that die by suicide have a mental illness (The Sainsbury Centre for Mental Health 2003), and that those suffering from a mental illness have a lower probability of being employed (by 8.6 per cent).⁸

3.2.2 Income from employment

Gross earnings that an individual would have earned in their remaining lifetime were estimated using ABS data on the average weekly earnings for males and females (by age group).⁹ This data is drawn from the August 2012 collection and inflated to current prices using the wage price index.

Real income is expected to increase over time in line with labour productivity. Labour productivity was measured as output (i.e., GDP) per hour worked. Over the past 33 years¹⁰ this has varied between -2.1 and 3.6 per cent with an average of 1.5 per cent. The average productivity is used to account for cyclical and structural variations in labour productivity over time.

3.2.3 Lost economic output

The indirect economic cost was estimated for males and females in each age group (see Table 3.2). This illustrates that the younger a person dies by suicide, the greater the lost economic output. It also shows that the lost economic output, on a per person basis is higher for males than for females, reflecting expected higher wages and employment rates over their lifetime.

⁸ Calculation based upon 61 per cent of working-age adults with any type of mental disorder in paid employment in 2007, compare to 67 per cent among those without any disorder (The Sainsbury Centre of Mental Health 2003).

⁹ This includes income that is drawn from full time and/or part-time employment.

¹⁰ This is the full period for which the relevant data (chain-volume GDP and hours worked) are available in a consistent format.

Table 3.2: Productivity loss per suicide by age group

Age group ¹	Present value of expected earnings ² (\$)	
	Male	Female
15-19	812,707	467,174
20-24	939,997	520,908
25-29	973,289	518,641
30-34	958,170	492,393
35-39	895,348	454,207
40-44	853,106	434,754
45-49	638,098	324,457
50-54	457,308	217,933
55-59	258,493	110,331
60-64	74,854	29,109

Note: **1.** It is assumed that each person that dies by suicide would have at least lived to 64 years of age, after which they would have retired; **2.** A discount rate of 7 per cent has been used to estimate the present value.

Source: KPMG calculations

3.3 Total cost of suicide

The total economic cost of suicide was calculated as the sum of the indirect and direct economic costs multiplied by the number of suicides for males and females.

In total, it is estimated that suicide in Australia led to approximately \$20.1 million in direct costs in 2012. The components of the direct costs are the same for both male and female, although the number of suicides to which these apply differ, resulting in an estimated direct cost of \$16.1 million for males and \$4.0 million for females (see Table 3.3).

Table 3.3: The total direct cost of suicide in 2012¹

Type of cost	Average cost per suicide (\$)	Total direct costs (\$)	
		Male	Female
Coronial costs	2,531	5,285,744	1,331,562
Ambulance costs	718	1,499,698	377,798
Police costs	2,532	5,287,077	1,331,898
Grieving costs	1,910	3,988,631	1,004,799
Total		16,061,150	4,046,056

Note: **1.** Based on an estimated 2,088 male suicides and 526 female suicides in 2012.

Source: KPMG calculations

Total productivity loss was estimated for each age group, based on the estimated number of suicides and present value of earnings in each age-sex cohort. It is estimated that suicide in Australia led to approximately \$1.6 billion in productivity loss in 2012 (see Table 3.4).

Table 3.4: Total productivity loss of suicide in 2012

Age group	Total expected earnings lost ² (\$ million)		Persons
	Male	Female	
15-19	89	14	103
20-24	228	16	244
25-29	282	23	306
30-34	266	32	298
35-39	219	25	245
40-44	188	28	216
45-49	101	18	119
50-54	65	10	75
55-59	22	4	26
60-64	5	1	6
Total	1,466	171	1,637

Note: **1.** Number of deaths in each age-sex cohort is outlined in *Table A.3*, p. 35; **2.** A discount rate of 7 per cent has been used to estimate the present value of lost earnings.

Source: KPMG calculations

Together the direct and indirect cost for male and female suicides was estimated to be **\$1,657 million** in 2012. Of this:

- \$1,482 million is attributed to male suicides, and
- \$175 million to female suicides (see *Table 3.5*).

Given the age profile of suicide in 2012, this is an average of approximately \$710,000 per male suicide and \$330,000 per female suicide.¹¹

Table 3.5: Economic cost of suicide in 2012

Type of cost	Male (\$ million)	Female (\$ million)	Persons (\$ million)
Indirect costs	1,466	171	1,637
Direct costs	16	4	20
Total	1,482	175	1,657

Source: KPMG calculations

Net costs were calculated using a real discount rate of seven per cent and sensitivities presented for four per cent and 10 per cent, consistent with NSW Treasury guidelines (NSW Treasury 2007) (see *Table 3.6*).

¹¹ As the cost of suicide is built on the age profile of males and females that die by suicide, any changes in the age profile will change the average cost per suicide.

Table 3.6: Impact of alternate discount rates on results

Discount rate	Male (\$ million)	Female (\$ million)	Persons (\$ million)
4 per cent	2,128	242	2,370
7 per cent	1,482	175	1,657
10 per cent	1,108	134	1,242

Source: KPMG calculations.

3.3.1 Split of economic costs across jurisdictions

Based on the proportion of suicides in each state, the total economic cost of suicide has been broken down by jurisdiction (see Table 3.7). New South Wales bears the greatest share of the total economic cost of suicide followed by Queensland and Victoria.

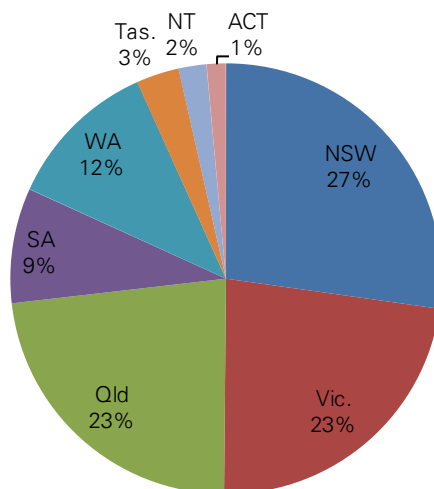
Table 3.7: Economic cost of suicide by jurisdiction in 2012

Jurisdiction	Male (\$ million)	Female (\$ million)	Persons (\$ million)
NSW	404	47	451
Vic.	336	43	380
Qld	343	39	382
SA	129	15	143
WA	170	20	190
Tas.	47	6	53
NT	32	2	35
ACT	21	3	24
Australia	1,482	175	1,657

Source: KPMG calculations; ABS (2013c).

The share of the total cost by each jurisdiction is best illustrated by Chart 3.1, which shows that together Queensland, Victoria and New South Wales bear almost three-quarters of the total economic cost of death by suicide in 2012.

Chart 3.1: Distribution of economic cost of suicide by jurisdiction in 2012



Source: KPMG calculations; ABS (2013c).

3.4 Sensitivity analysis

Sensitivity analysis was undertaken on the total economic cost of suicide to understand the impact of changes in key assumptions on the results. The sensitivity analysis tested changes in:

- under-reporting of male suicides;
- under-reporting of female suicides;
- the lower employment rate of those with a mental illness;
- the proportion of people with a mental illness that die by suicide; and
- labour productivity factor used to inflate real wages over time.

Sensitivity analysis was undertaken on the total economic cost of suicide associated with each variable. Results from the sensitivity analysis show that the true total economic cost of suicide in 2012 is estimated to be between \$1,510 million and \$1,816 million using a 90 per cent confidence interval.¹² Further details of the sensitivity analysis methodology and results are presented in Appendix C.

3.5 Income tax foregone

Premature death by suicide leads to an associated productivity loss if that person was of working age and would have otherwise been part of the workforce. This productivity loss is a loss to the economy and is included in the total cost of suicide presented in Section 3.3.

The income tax that would have been paid on these earnings is a loss of revenue to the federal government. While this is not an economic cost (simply a transfer payment), it is important to note as the loss in revenue reduces the capacity of government to fund expenditure, such as health and education.

¹² With a discount rate of seven per cent.

The estimated loss in taxation revenue was based on the current income tax rates (see Table 3.8). These are assumed to hold constant over the expected life of an individual.

Table 3.8: Tax rates, 2012-13

Taxable income	Tax
0 – \$18,200	Nil
\$18,201 – \$37,000	19c for each \$1 over \$18,200
\$37,001 – \$80,000	\$3,572 plus 32.5c for each \$1 over \$37,000
\$80,001 – \$180,000	\$17,547 plus 37c for each \$1 over \$80,000
\$180,001 and over	\$54,547 plus 45c for each \$1 over \$180,000

Source: ATO (2013).

These tax rates were applied to the real gross income for each age-sex cohort with real income assumed to grow in line with labour productivity (see section 3.2.2).

The total present value of income tax revenue lost due to suicides in 2012 is estimated to be **\$525 million**. Of this, \$473 million is lost due to male suicides, and \$52 million due to female suicides.¹³

3.6 Years of life lost

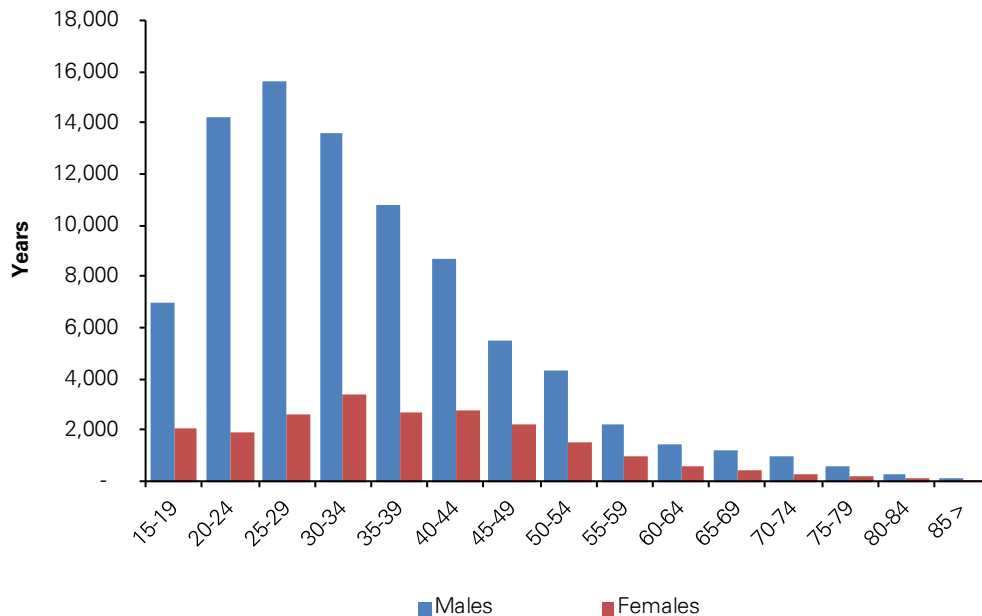
Years of life lost is a measure of the impact of premature mortality on an individual. It was calculated as the average number of years that a person had remaining, had they not died prematurely due to suicide.

The measure is used to quantify social and economic loss due to premature death and is particularly used to emphasise the impact of specific causes of death affecting young people. This is because the measure inherently gives greater weight to deaths at a younger age and a lower weight to deaths at an older age.

The years of life lost due to suicide are greatest for males aged 25 to 29 and women aged 30 to 34 (see Chart 3.2) contributing to a total of **108,120** life years lost. This equates to an average of 41.4 life years lost for each person that dies by suicide.

¹³ With a discount rate of seven per cent.

Chart 3.2: Potential life years lost to suicide in 2012



Note: **1.** Based on an estimated 2,088 male suicides and 526 female suicides in 2012. breakdown of the number of deaths in each age-sex cohort.
 Source: KPMG calculations.

Comparing this to other causes of death shows that suicide has the third highest burden of disease, as measured by years of life lost, after cancer and cardiovascular disease (see Table 3.9).

Table 3.9: Burden of disease in Australia, 2013¹

Cause	Years of Life Lost ²
Cancers	372,817
Cardiovascular disease	271,483
Suicide	108,120
Mental disorders	76,562
Neurological & sense disorders	72,409
Chronic respiratory diseases	52,127
Diabetes mellitus	49,797

Note: **1.** Based upon 2003 YLL data, inflated by 2013 estimates of changes in mortality by Cause Group; **2.** Average of the estimated trend in burden of disease for males and females.
 Source: KPMG calculations; Begg et al (2007).

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Appendices

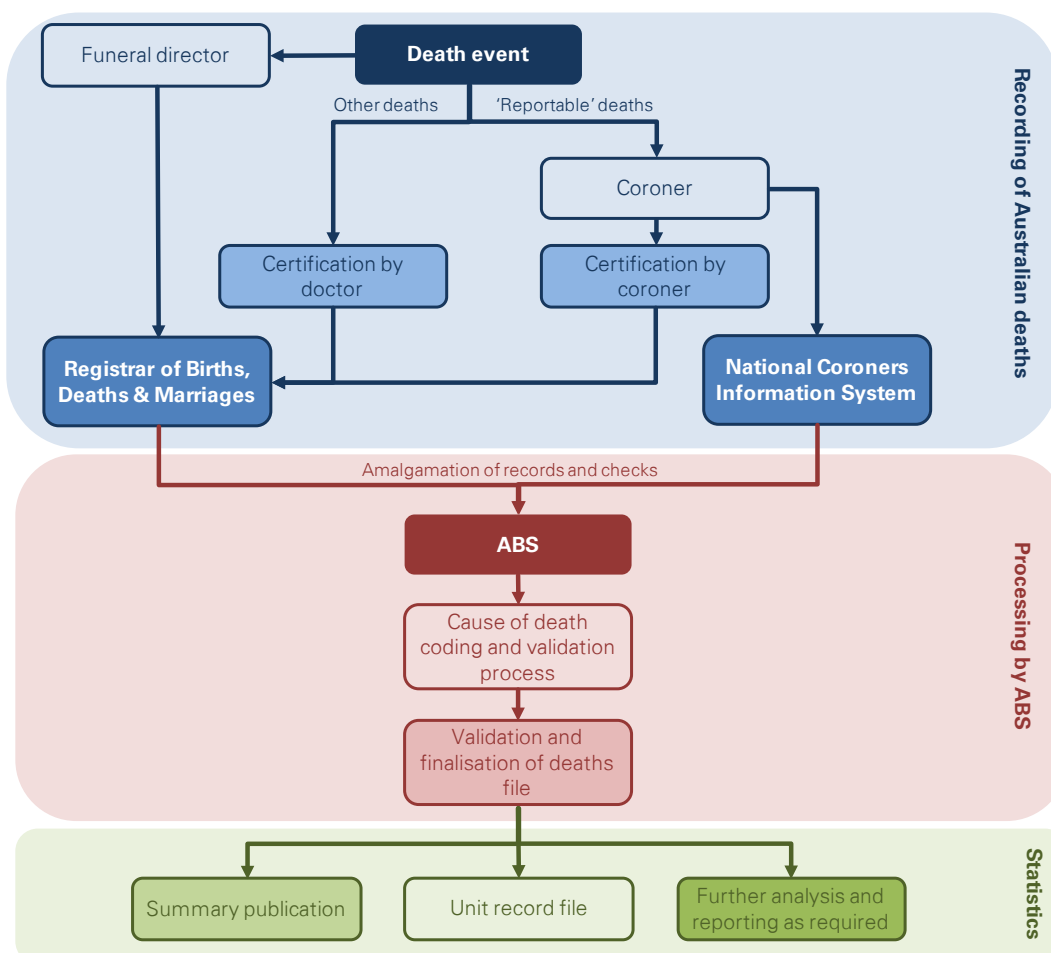
A Methods to adjust suicide death statistics

There are several indications that current statistics on suicide death under-report the extent of the problem in Australia (Sveticic et al 2013). This chapter describes the process of recording and publishing suicide statistics, and presents estimates of the extent of under-reporting. It presents a high level description of the methodology used to estimate the number of deaths by suicide in 2012 for this project, as these statistics are not expected to be released until March 2014, and finalised until 2016.

A.1 Recording suicide statistics

National suicide statistics are processed and published by the Australian Bureau of Statistics (ABS), collating information received from the National Coroners Information Service (NCIS) and the Registrar of Births, deaths and marriages (see Figure A.1).

Figure A.1: Australian mortality statistic system



Source: Adapted from ABS (2013d).

All deaths that are not 'natural causes' are referred to the coroner for investigation. This includes deaths suspected of suicide. The process of determining a cause of death can take several years. Consequently cause of death may not be determined when the publication of death statistics is made, approximately 13 months after the end of the reference period (e.g. deaths in 2012 will be published in 2014) (De Leo et al 2013).

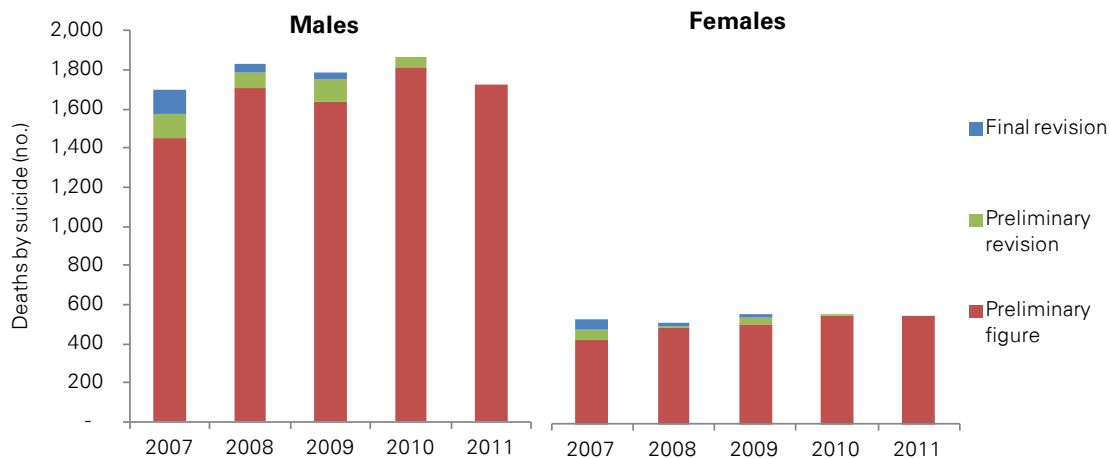
Without subsequent revision of the data, the first publication of cause of death statistics is likely to understate the number of deaths by suicide.

A.1.1 Revisions of ABS statistics

In recognition of the potential for under-reporting, the ABS uses a process for revising causes of death statistics. This involves two further revisions of the data at 12 and 24 months after initial processing of coroner-certified deaths. In order to improve the quality of historical data, ABS has revised all causes of death statistics registered after 1 January 2007.

Preliminary and final revisions have been completed for years 2007, 2008 and 2009. Adjustments to statistics were largest in the first year of revisions with an increase of 13 per cent to male suicides, and 20 per cent to female suicides. While the magnitude of revisions has since decreased, no pattern is discernible due to the limited number of observations (see Chart A.1).

Chart A.1: ABS revisions of death by suicide statistics

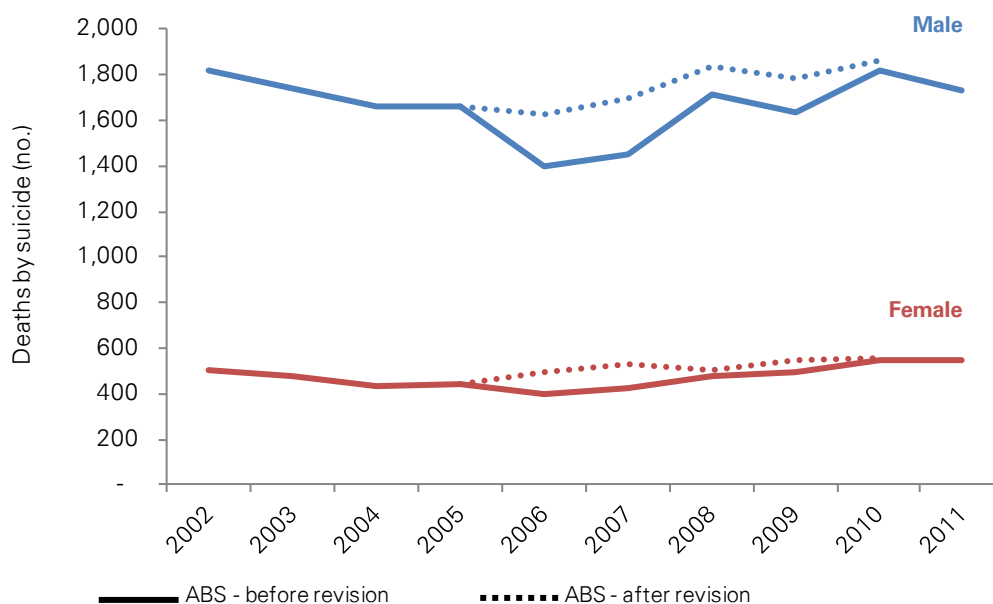


Note: Data for 2010 will undergo a final revision, and data 2011 will undergo a preliminary and final revisions by the ABS.

Source: ABS (2013f).

Comparing revisions for previous years shows that revisions have had a material impact upon the trend established using suicide death data that have not been revised (see Chart A.2).

Chart A.2: Number of suicides for males and females, before and after ABS revisions



Source: ABS (2013f).

A.1.2 Coding of deaths by suicide

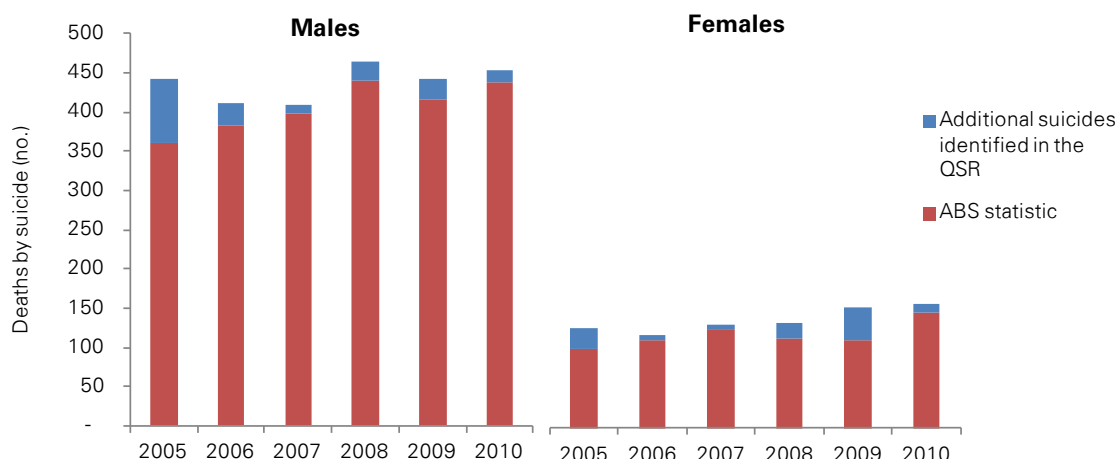
In addition to the revision process, ABS has introduced new coding guidelines. Under the new guidelines, in addition to coroner-determined suicides, the ABS may code deaths to suicide if evidence supports such a determination. Additional information can be gathered from the NCIS such as the presence of a suicide note, or knowledge of previous suicide attempts.

The new coding guidelines go some way to recognising the issue of under-reporting of deaths by suicide, which has been acknowledged by the ABS (2013d). For a coroner to classify a death as suicide, it requires a finding of intent. A coroner may not make a finding of intent for many reasons, including legislative or regulatory barriers, or out of sensitivity to the family of the deceased. Cultural practices and religious beliefs of family members may make it difficult to accept a finding of intentional self-harm.

The magnitude of under-reporting was estimated for this study by comparing the ABS suicide statistics to the Queensland Suicide Register (QSR). The QSR is a suicide mortality database managed by the Australian Institute for Suicide Research and Prevention (AISRAP). It collates information about suicide deaths by Queensland residents and reviews possible suicide cases (and accompanying documents) to determine the level of probability that the death was due to a suicide. Possible suicide cases are classified as either beyond reasonable doubt, probable or possible (De Leo et al 2013).

Comparison of suicides identified in the ABS and QSR data show that the ABS statistics are under-reporting probable cases of suicide (see Chart A.3). Over the six years from 2005 to 2010, ABS statistics under-report Queensland suicides by an average of six per cent for male suicides, and 16 per cent for female suicides.

Chart A.3: Under-reporting suicide in Queensland



Notes: Additional suicides identified in the QSR include suicides classified as ‘beyond reasonable doubt’ and ‘probable’.
 Source: ABS (2013a); De Leo et al (2012); De Leo et al (2013).

Under-reporting of suicide is an issue in other countries. A systematic review of the reliability of suicide statistics reported evidence found evidence of general under-reporting (Tøllefsen et al. 2012). The review includes two studies from Australia. A 2001 study for Queensland showed a 5.5 percent underestimate of suicides over the 1990-95 period using suicide registry data. The other Australian study was conducted in 2009 and showed an 8.0 per cent under estimation for the 2000-05 period (Tøllefsen et al. 2012).

A.2 Adjusting ABS statistics for under-reporting

It is important when estimating the economic cost of suicide that under-reporting of deaths by suicide is taken into account. If under-reporting is not corrected, any measure of the economic cost of suicide will be an underestimate.

As the economic cost of suicide was based on the estimated number of deaths by suicide for the last completed calendar year (2012), under-reporting of deaths by suicide was factored in when developing this estimate.

Adjustments for under-reporting were made to historical statistics of death by suicide by age-sex cohort. Under-reporting was adjusted in two steps:

- ABS revisions; and
- Coding of deaths by suicide.

The purpose of the adjustments was to inflate the existing ABS death by suicide statistics to compensate for the estimated degree of under-reporting. The adjusted historical data was then used to estimate the number of deaths by suicide by age-sex cohort for 2012.

A.2.1 ABS revisions

The extent of ABS revisions was measured for each age-sex cohort, and separately for preliminary and final revisions (see Table A.1).

Table A.1: Average adjustment factors for ABS revisions^{1,2}

Age group	Average preliminary revision (%)		Average final revision (%)	
	Male	Female	Male	Female
15-19	6.39	2.16	1.25	1.68
20-24	4.95	0.39	3.81	0.50
25-29	5.86	1.28	4.50	1.24
30-34	5.49	1.79	2.77	1.50
35-39	5.41	1.47	3.88	2.25
40-44	5.05	2.01	5.30	1.13
45-49	4.75	0.89	4.36	2.88
50-54	5.21	1.15	3.85	1.59
55-59	2.66	2.37	5.07	2.12
60-64	4.09	2.24	4.57	1.79
65-69	7.32	1.10	3.83	0.52
70-74	4.04	1.01	4.88	1.44
75-79	4.96	2.82	3.31	1.67
80-84	5.27	2.77	2.62	(0.83)
85 and over	7.00	2.25	4.04	1.01
Total	5.14	1.55	3.96	1.54

Note: **1.** Revisions are measured as a proportion of the total number of deaths by suicide in each age-sex cohort. **2.** The average is measured for revisions from 2007 to 2009 (inclusive).

Source: KPMG calculations.

The average revision for each age-sex cohort was used to inflate 2010 and 2011 data, as these will be revised by the ABS in subsequent publications.

As 2010 has already had a preliminary revision, only the final revision adjustment factors were applied to the age-sex cohorts. However, 2011 data has not been revised at all, so ABS statistics were inflated to reflect the average adjustment factor for preliminary and final revisions.

A.2.2 Coding of deaths by suicide

The magnitude of under-reporting of death by suicide caused by incorrect coding of cause of death has been measured by comparing the total number of deaths recorded in the QSR and the ABS statistics for Queensland between 2005 and 2010 (see Table A.2).

Table A.2: Average adjustment factor for coding of deaths by suicide

Data source	2005	2006	2007	2008	2009	2010	Average
QSR	442	412	410	464	442	453	
ABS	360	383	397	440	415	437	
Factor of difference	1.23	1.08	1.03	1.05	1.07	1.04	1.06

Source: KPMG calculations.

As all ABS data will be affected by under-reporting of deaths by suicide due to coding, the adjustment factor is applied to all data (2002 to 2011). It is worth noting that the impact of under-reporting of deaths by suicide due to coding may fall over time due to the new guidelines

that ABS has introduced since 2009. At present the time period is too short to see what impact the new coding guidelines are having.

A.2.3 Estimating suicide in 2012

Once the adjustments were made to ABS statistics for under-reporting, the number of deaths by suicide was estimated for each age-sex cohort in 2012. This was based on the trends of the adjusted data for each age-sex cohort (see Table A.3).

Table A.3: Estimated suicides by age group and gender in 2012

Age group	Male (no.)	Female (no.)	Total (no.)
15-19	110	30	140
20-24	243	30	273
25-29	290	45	335
30-34	278	64	342
35-39	245	56	301
40-44	220	64	284
45-49	158	57	215
50-54	142	45	187
55-59	85	35	120
60-64	67	25	92
65-69	71	21	92
70-74	69	17	86
75-79	53	18	71
80-84	32	11	43
85 and over	25	8	33
Total	2,088	526	2,614

Source: KPMG calculations.

B Data sources

Table B.1 outlines the data sources that have been used to construct the estimate of the economic cost of suicide.

Table B.1: Data items used to estimate the economic cost of suicide death

Data item	Used, how?	Source
Gross domestic product, chain volume measure	Calculation of labour productivity	ABS 2013, Table 1: Key national accounts aggregates, Australian National Accounts, cat. no. 5206.0
Life tables	Estimate of life years lost	ABS 2012, Table 1.9, Life tables Australia, Life Tables, States, Territories and Australia, 2009-2011, cat. no. 3302.0.55.001.
Hours worked	Calculation of labour productivity	ABS 2010, Table 19: Aggregate monthly hours worked by employment status and sex – Trend and seasonally adjusted, Labour Force Australia, cat .no. 6202.0.
Wage indexation	Inflate wage (and wage related direct costs) to current prices.	ABS 2013, All WPI Series: Original (financial year index numbers for year ended June quarter), Wage Price Index, Australia, cat. no. 6345.0.
Exchange rates	Convert direct costs taken from foreign studies into Australian dollars: <ul style="list-style-type: none"> • Canadian dollars in 1996; and • NZ dollars in 2004. 	FX Top <ul style="list-style-type: none"> • http://fxtop.com/en/historical-exchange-rates.php?A=1&C1=CAD&C2=AUD&YA=1&DD1=01&MM1=01&YYYY1=1996&B=1&P=&l=1&DD2=31&MM2=12&YYYY2=1996&btnOK=Go%21 • http://fxtop.com/en/historical-exchange-rates.php?A=1&C1=AUD&C2=NZD&YA=1&DD1=01&MM1=01&YYYY1=2004&B=1&P=&l=1&DD2=31&MM2=12&YYYY2=2004&btnOK=Go%21
Tax rates	Calculate expected income tax that would have been paid.	ATO, http://ato.gov.au/Rates/Individual-income-tax-rates/ , accessed 5 September

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Table B.1: Data items used to estimate the economic cost of suicide death

(continued)

Data item	Used, how?	Source
QLD suicide register	Adjust ABS figures for under-reporting	<ul style="list-style-type: none"> De Leo, D and Sveticic, J 2012, Suicide in Queensland 2005-2007: Mortality rates and related data, Brisbane: Australian Institute for Suicide Research and Prevention. De Leo, D, Sveticic, J, and Kumpula, E 2013, Suicide in Queensland, 2008-2010: Mortality rates and related data, Brisbane: Australian Institute for Suicide Research and Prevention.
Death by suicide	Used in the estimation of the number of deaths by suicide in 2012.	ABS 2013, Suicide (Australia), Causes of death, Australia, 2011, cat. no. 3303.0.
ABS suicide revision	Calculate the extent of revision to the data, used in the estimation of deaths by suicide in 2012.	ABS 2013, Deaths by suicide, by sex, age group and revision status, 2006-2011, customised report.
Employment	Estimation of the expected loss of productivity	ABS 2013, Labour Force, Australia, Detailed Quarterly, August 2013, cat. no. 6291.0.55.001.
Weekly earnings	Used as the basis of the measure of income for the expected loss of productivity.	ABS 2013, Employee earnings, benefits and trade union membership Australia, August 2012, cat. no. 6310.0.
Mental health issues	Used to estimate the proportion of people that die by suicide with a mental health issue.	Sainsbury Centre for Mental Health, 2003.
Employment adjustment for mental health	Used to adjust the ABS employment figures to account for the lower employment rate for people with a mental health issue.	Sainsbury Centre for Mental Health, 2003.
Ambulance costs	A component of direct costs	Clayton and Barceló, 1999.
Counselling support	Multiplier used in the estimation of grieving costs associated with death by suicide.	ConNetica Consulting (2009) citing Corso (2007) and Maple (200)

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Table B.1: Data items used to estimate the economic cost of suicide death

(continued)

Data item	Used, how?	Source
Coroner costs	A component of direct costs	BITRE, 2009.
Police costs	A component of direct costs	O’Dea and Tucker, 2005
Grieving costs	A component of direct costs	O’Dea and Tucker, 2005

Source: KPMG

C Sensitivity analysis

A probabilistic sensitivity analysis was undertaken to measure the impact of changes in key inputs on the results of the economic evaluation. It was undertaken using @RISK software which uses Monte Carlo techniques to simulate the impact of changes in one or more assumptions on the model outputs.¹⁴

Sensitivity analysis provides statistical information about models which helps to understand the:

- interactions between key factors which drive model outputs; and
- reliability of central estimates of model outputs.

Although all inputs and assumptions in a model may be subject to variation in practice, sensitivity analysis was only undertaken on a selected number of key inputs to ensure the value of the analysis was not diminished by unnecessary detail.

C.1 Specification for sensitivity results

The sensitivity analysis used assumptions about the probability distributions of each economic evaluation model input along with its maximum and minimum values.¹⁵ Triangular distributions were used with a ten per cent range on either side.

Table C.1 presents the assumptions used to underpin the sensitivity analysis.

Table C.1: Sensitivity analysis assumptions

Variable	Minimum	Mean	Maximum
Revisions to suicide data (male)	0.95	1.06	1.16
Revisions to suicide data (female)	1.05	1.16	1.28
Labour productivity (%)	1.00	1.50	1.99
Employment adjustment factor for mental illness (%)	82.12	91.01	99.89
Proportion of people that die by suicide with a mental illness (%)	80.09	90.00	99.87

Source: KPMG calculations.

¹⁴ @RISK for Excel (v 6) was used by KPMG under license and is Copyright © 2010 by Palisade Corporation.

¹⁵ Probability distributions map each potential event with a numerical probability subject to the constraint that the sum of the probabilities of all events equals one.

C.2 Sensitivity results

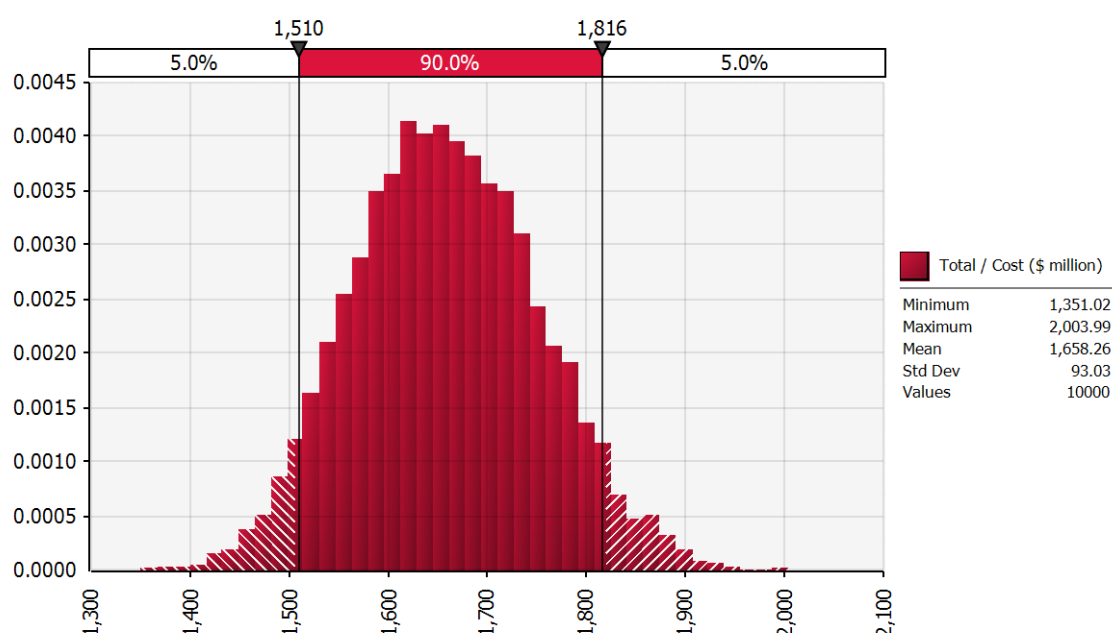
The sensitivity analysis was undertaken with 10,000 simulations. Results are presented in Table C.2 and illustrated in Chart C.1. These results show that the true total economic cost of suicide in 2012 is estimated to be between \$1.5 billion and \$1.8 billion with 90 per cent confidence.

Table C.2: Sensitivity analysis results

Age group	5 th percentile (\$ million)	Mean (\$ million)	95 th percentile (\$ million)	Standard deviation
Total economic cost of suicide	1,510	1,658	1,816	93

Source: KPMG calculations

Chart C.1: Distribution of the total economic cost of suicide



Source: KPMG calculations

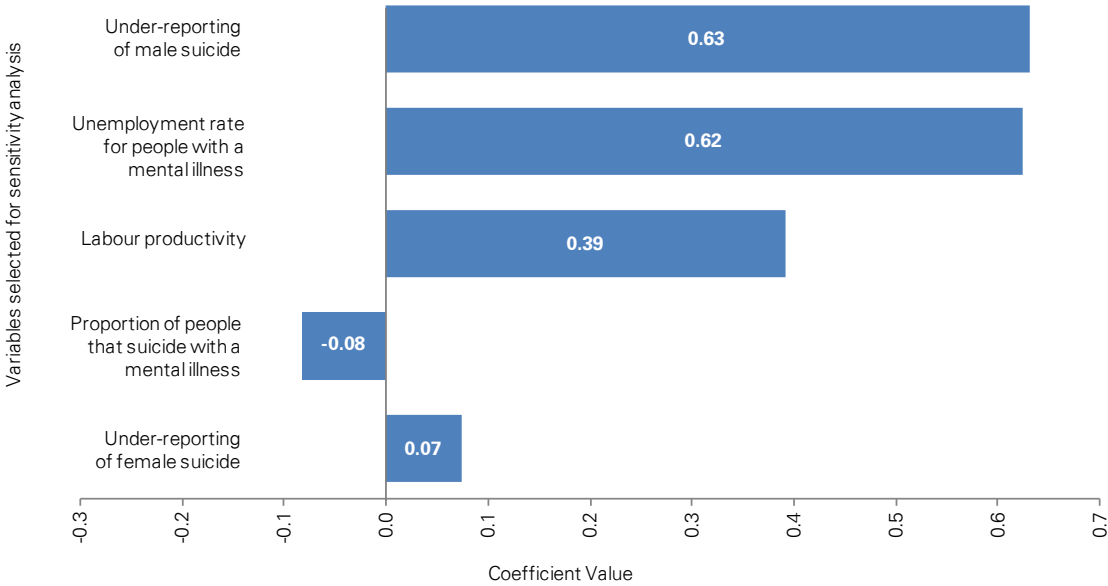
The Spearman's rank correlation coefficients were also estimated to better understand the relative significance of tested model inputs in driving the model outputs. Spearman's rank correlation coefficients range between negative one and one and are a measure of the strength of the positive or negative dependence between two variables.

Estimates of the correlation coefficients between key inputs and the total economic cost of suicide in 2012 are provided in Chart C.2. The two most significant drivers of the total economic cost of suicide are the revisions made to male suicide statistics and the employment adjustment factor for mental illness.

These are expected given that:

- male suicides account for almost 80 per cent of all suicides in 2012, and therefore adjustments to the number of male suicides will impact the economic cost; and
- the employment rate, which is adjusted by the employment adjustment factor, is a key determinant of the income, and therefore the measure of lost productivity and total economic cost.

Chart C.2: Estimated correlation coefficients for the total economic cost of suicide



Source: KPMG calculations.

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