# The Impact of a Suicide Prevention Strategy on Reducing the Economic Cost of Suicide in the New South Wales Construction Industry

Christopher M. Doran[1], Rod Ling[2], Jorgen Gullestrup[3], Sarah Swannell[4], and Allison Milner[5]

[1]School of Human, Health and Social Sciences, Central Queensland University, Brisbane, QLD, Australia
[2]Hunter Medical Research Institute, University of Newcastle, New Lambton, NSW, Australia
[3]Mates in Construction, Spring Hill, QLD, Australia
[4]Mater Hill Psychology Services, Woolloongabba, QLD, Australia
[5]McCaughey VicHealth Centre for Community Wellbeing, Melbourne School of Population and Global Health, The University of Melbourne, VIC, Australia

**Abstract.** *Background:* Little research has been conducted into the cost and prevention of self-harm in the workplace. *Aims:* To quantify the economic cost of self-harm and suicide among New South Wales (NSW) construction industry (CI) workers and to examine the potential economic impact of implementing Mates in Construction (MIC). *Method:* Direct and indirect costs were estimated. Effectiveness was measured using the relative risk ratio (RRR). In Queensland (QLD), relative suicide risks were estimated for 5-year periods before and after the commencement of MIC. For NSW, the difference between the expected (i.e., using NSW pre-MIC [2008–2012] suicide risk) and counterfactual suicide cases (i.e., applying QLD RRR) provided an estimate of potential suicide cases averted in the post-MIC period (2013–2017). Results were adjusted using the average uptake (i.e., 9.4%) of MIC activities in QLD. Economic savings from averted cases were compared with the cost of implementing MIC. *Results:* The cost of self-harm and suicide in the NSW CI was AU $527 million in 2010. MIC could potentially avert 0.4 suicides, 1.01 full incapacity cases, and 4.92 short absences, generating annual savings of AU $3.66 million. For every AU $1 invested, the economic return is approximately AU $4.6. *Conclusion:* MIC represents a positive economic investment in workplace safety.

**Keywords:** self-harm, suicide, prevention, workplace, Mates in Construction, economic, cost

Suicide has been defined as a deliberate act of self-harm performed with the expectation that it will be fatal, while a suicide attempt has been defined as a nonfatal act of self-harm (World Health Organization, 2006). For every death by suicide, there are between 10 and 20 attempted suicides (World Health Organization, 2006).

Suicidal behavior has gained recognition worldwide as a significant public health problem. In Australia, suicide is a leading cause of death with 2,273 deaths (aged over 15 years) in 2011 (1,747 male deaths and 546 female deaths), representing 1.5% of all deaths over the age of 15 (Australian Bureau of Statistics, 2013b). Most deaths by suicide are among people of working age, and suicide is the leading cause of death for men aged 25–44 years and women aged 25–34 years (Australian Bureau of Statistics, 2013b).

An emerging area of interest in suicide research is the impact of employment status and industry on rates of suicide (Milner, Spittal, Pirkis, & La Montagne, 2013; Suicide Prevention Australia, 2014; World Health Organization, 2006). Although being employed is associated with a reduced risk of suicide overall, current evidence suggests suicide rates are differentially distributed across industry and occupational groups. A recent review by Milner et al. (2013) on suicide by occupation found a stepwise gradient in risk, with the lowest-skilled occupations being at greater risk of suicide than the highest-skill-level group (Milner et al., 2013). In a separate analysis using data from the National Coronial Information System (NCIS), Milner et al. confirmed that this gradient also applies within the construction industry (CI; Milner, Niven, & La Montagne, 2014). Further, consistent with previous research, rates of suicide among lower-skilled workers were higher than rates in the general male population (Heller, Hawgood, & De Leo, 2007).

Unfortunately, the prevention of suicide has not been adequately addressed in society or the workforce, perhaps owing to a lack of awareness of suicide as a major problem and the taboo in many societies to discuss it openly (Germain, 2014; World Health Organization, 2006). Mann, Apter, and Bertolote's (2005) systematic review of suicide prevention strategies found that a range of suicide prevention strategies have been proposed despite knowledge deficits about the effectiveness of some common key components. The authors suggest that the most promising interventions aim to improve physician education about suicide, means restriction (i.e., reducing access to lethal methods), and gatekeeper education (i.e., where the roles of gatekeepers are formalized and pathways to treatment are readily available; Mann et al., 2005).

Mates in Construction (MIC) is an example of a multifaceted workplace suicide prevention strategy developed in Australia. MIC was established in 2008 by the Building Employees Redundancy Trust to prevent suicide in the CI (Gullestrup, Lequertier, & Martin, 2011). MIC is a multimodal prevention and early intervention program, consistent with the national "living is for everyone" suicide prevention strategy (Department of Health and Ageing, 2007) and with Mrazek and Haggerty's spectrum of prevention and intervention (1994).

MIC has three main components: general awareness training (GAT); connector training; and applied suicide intervention skills training (ASIST) (Gullestrup et al., 2011). GAT involves a 1-hr training session provided by accredited trainers to construction workers on sites with the aims of increasing awareness of suicide as a workplace health and safety issue, improving knowledge of warning signs, and encouraging workers to seek support. Connector training involves a 4-hr training session provided by MIC. The role of a connector is to keep coworkers safe while connecting them to help, that is, to an ASIST-trained worker, MIC field officer, or case manager. ASIST workers undergo an intensive 2-day training course to enable them to identify cues and respond appropriately to calls for help with the goal of reaching a contract or safe plan involving extra help and safety. MIC accredited sites or employers also receive promotional materials and access to other MIC programs including a 24/7 helpline.

Although MIC originated in Queensland (QLD), it is equally relevant to other Australian states and territories. The aim of the current study was to quantify the economic cost of self-harm and suicide among New South Wales (NSW) CI workers and to examine the potential economic impact of implementing MIC in the NSW CI.

# Method

## Rates of Suicide and Self-Harm in the CI

Suicide data were obtained from the National Coronial Information System (NCIS) for the period 2001–2012. Only male subjects were included in this study because of the small numbers of women in the CI who suicided and consequent confidentiality issues with reporting small sample sizes. Occupational information was coded according to the Australian and New Zealand Standard Classification of Occupations (ANZSCO) and the Australian and New Zealand Standard Industrial Classifications (Australian Bureau of Statistics, 2006; Australian Bureau of Statistics, 2013a). Occupations coded as being in the CI fell into three major groups: technicians and trades worker (ANZSCO major level 3); machine operators (ANZSCO major level 7); and, laborers (ANZSCO major level 8). Suicide in the CI was further classified as higher skill (ANZSCO major level 3) and lower skill (ANZSCO major levels 7 and 8). This approach to the coding and classification of skill level follows the procedure described in a previous journal article (Milner, Niven, et al., 2014).

## Estimating Cost of Self-Harm and Suicide in the NSW CI

The analysis used a costing methodology endorsed by the National Occupational Health and Safety Commission and used in a 2012 report by Safe Work Australia. Both direct and indirect costs were considered for a range of economic agents (including employers, workers, and the government) and by severity of injury. For CI workers, total costs of self-harm and suicide were estimated by multiplying average indirect and direct costs by cases of self-harm and suicides.

A summary of the key parameters, assumptions, and data sources for cost items is provided in Table 1. The classification structure for economic costs is based on six conceptual cost groups: production disturbance costs; human capital costs; medical costs; administrative costs; transfer costs; and other costs. Production disturbance costs reflect short-term impacts until production is returned to pre-incident levels and includes the value of lost production and staff turnover costs. Human capital costs are measured by considering the value of potential future earnings from time of injury to retirement age (i.e., < 65 years) assuming a discount profile and productivity loss. The discount profile considers the likely changes in the value of money over time by including the opportunity cost of saving (4.1%; Reserve Bank of Australia, 2014) and the rate of inflation (2.8%; Australian Bureau of Statistics, 2013c). Medical costs are expenses incurred by workers and the community though medical treatment. Administrative costs include investigation costs, travel costs, and funeral costs. Transfer costs refer to a deadweight loss, measured as the value of taxation receipts foregone, equivalent to 28.75 cents in every foregone tax dollar (Access Economics, 2009). Other costs included in this analysis are cost of carers and aids/modifications for full incapacity cases and the cost of postvention services for fatalities.

Three levels of severity are used in this analysis: short absence involving less than 5 days off work; full incapacity that results in the individual being permanently unable to return to work; and a fatality.

*Table 1.* Summary of key parameters used in costing analysis

| Cost category | Description | Source |
|---|---|---|
| **Production disturbance costs** | | |
| Value of lost production | Average weekly earnings (AWE) × average duration of absence (by severity category); AWE × average duration of absence × 0.4 | Australian Bureau of Statistics, 2014; Safe Work Australia, 2012 |
| Staff turnover costs | The cost of replacing existing staff affected by work-related incidents (26 weeks of AWE) and training of new staff (2.5 weeks of AWE) | Australian Bureau of Statistics, 2014; Safe Work Australia, 2012 |
| **Human capital costs** | | |
| Loss of income | For full incapacity or fatality: loss of earnings from time of injury to retirement age (i.e., < 6 5years), discount rate = 4.1%, inflation rate = 2.8%, productivity rate = 1.6%. For full incapacity, future earnings includes average social welfare payments received (since these contribute to post-injury income) | Australian Bureau of Statistics, 2013c; Australian Bureau of Statistics, 2014; Commonwealth of Australia, 2010; Reserve Bank of Australia, 2014 |
| Loss of government revenue | For full incapacity or fatality, taxation and other revenue foregone when workers are unable to work due to work-related incidents | Australian Bureau of Statistics, 2014; Reserve Bank of Australia, 2014 |
| Social welfare payments | Sickness and social welfare payments borne by the government for people with disabilities (disability support pension payments of AU $700 per fortnight [in 2010 dollars] discounted to present value over the period between the incident and reduced life expectancy | Department of Human Services, 2014 |
| **Medical costs** | | |
| Medical costs | Average medical costs from national dataset for compensation-based statistics | Safe Work Australia, 2012 |
| **Administrative costs** | | |
| Investigation costs | Investigation costs: As a proxy for the costs to firms, investigation and inspection costs reported in jurisdictional annual reports are assumed to match the cost to employers for these functions | Safe Work Australia, 2012 |
| Travel expenses | Payments made for travel expenses to workers' compensation jurisdictions by claimants (as a proxy, assuming that compensation is adequate to cover these expenses) | Safe Work Australia, 2012 |
| Funeral expenses | Average funeral costs are estimated at AU $4,000 | Safe Work Australia, 2012 |
| **Transfer costs** | | |
| Transfer costs | The redistribution of public sector resources to care for incapacitated person incurs deadweight costs on society – for every dollar of tax raised, about 28.75 cents is absorbed in the distortions induced and the administration of the tax system | Access Economics, 2009 |
| **Other** | | |
| Carer costs | For full incapacity, the additional cost of care (estimated applicable disability support pension payments of AU $2,056 per annum, discounted to present value over the period between the incident and reduced life expectancy) | Safe Work Australia, 2012 |
| Cost of aids, equipment, and modifications | For full incapacity cases only, the present value of future costs for aids and modifications (estimated applicable disability support pension payments of AU $646 per annum, discounted to present value over the period between the incident and reduced life expectancy). | Safe Work Australia, 2012 |
| Postvention costs | Cost associated with bereavement for six family/friends – estimated at Au $14,058 per person; employer cost associated with providing counseling and time off work for three colleagues who may have witnessed fatality – estimated at AU $10,000 from time of incident to return to full duties | Comans et al., 2013, Corso, Mercy, Simon, Finkelstein, & Miller, 2007 |

The World Health Organization estimates for every employee who dies by suicide, another 10–20 will make a suicide attempt (17% resulting in a permanent disability and 83% in no disability; World Health Organization, 2006). In this analysis, for every 15 suicide attempts there is one fatality, 2.55 (17%) full incapacity cases, and 12.45 (83%) short absence cases. Corresponding durations of absence (for use in calculation of production disturbance costs) are 0.2 weeks for short absence and 2.6 weeks for full incapacity and fatality. Costs were derived using an incidence-based approach with costs that an injury imposes in future years discounted to 2010 dollars.

## Estimating the Effectiveness of MIC

In an evaluation of the US Air Force suicide prevention program, Knox, Litts, Talcott, Feig, and Caine (2003) calculated the relative risk ratio (RRR, or the ratio of risk) of suicide for air force employees, before and after the in-

*Table 2.* Data underpinning measurement of effectiveness of Mates in Construction

| QLD pre-MIC period | Number of suicide deaths | Construction industry workforce | QLD post-MIC period | Number of suicide deaths | Construction industry workforce |
|---|---|---|---|---|---|
| 2003 | 36 | 115,000 | 2008 | 45 | 174,050 |
| 2004 | 51 | 126,375 | 2009 | 43 | 172,475 |
| 2005 | 41 | 145,250 | 2010 | 45 | 164,950 |
| 2006 | 30 | 154,275 | 2011 | 53 | 168,625 |
| 2007 | 49 | 168,050 | 2012 | 36 | 161,325 |
| Total | 207 | 708,950 | Total | 222 | 841,425 |
| QLD pre-MIC suicide rate | | 29.20 | QLD post-MIC suicide rate | | 26.38 |
| QLD pre-MIC suicide rate lower 95% CI | | 25.22 | QLD post-MIC suicide rate lower 95% CI | | 22.91 |
| QLD pre-MIC suicide rate upper 95% CI | | 33.18 | QLD post-MIC suicide rate upper 95% CI | | 29.85 |

| | QLD RRR | QLD RRR (lower 95% CI) | QLD RRR (upper 95% CI) |
|---|---|---|---|
| QLD post-MIC rate/QLD pre-MIC rate | 0.904 | 0.909 | 0.900 |
| Equivalent percentage change in suicide risk | –9.6% | –9.1% | –10.0% |

| NSW pre-MIC period | Number of suicide deaths | Construction industry workforce |
|---|---|---|
| 2008 | 43 | 224,925 |
| 2009 | 37 | 206,050 |
| 2010 | 57 | 212,700 |
| 2011 | 42 | 209,350 |
| 2012 | 42 | 215,475 |
| Total | 221 | 1,068,500 |
| NSW pre-MIC suicide rate | | 20.68 |
| NSW pre-MIC suicide rate lower 95% CI | | 17.96 |
| NSW pre-MIC suicide rate upper 95% CI | | 23.41 |
| NSW construction industry workforce 2013–2017 | | 1,050,518 |

| | Mean | Lower 95% CI | Upper 95% CI |
|---|---|---|---|
| Est. no. of suicides in NSW 2013–2017 no MIC (i.e., NSW pre-MIC rate) | 217 | 189 | 246 |
| Est. no. of suicides in NSW 2013–2017 with MIC (i.e., QLD RRR) | 196 | 171 | 221 |
| Est. difference in suicide number (over 5-year period) | 21 | | |
| Est. reduction in suicides (per year) | 4.19 | | |
| Est. reduction in suicides attributable to MIC (per year) | 0.40 | | |
| Est. reduction in full incapacity cases attributable to MIC (per year) | 1.01 | | |
| Est. reduction in short absence case attributable to MIC (per year) | 4.92 | | |

*Note*. QLD = Queensland. NSW = New South Wales. MIC = Mates in Construction. RRR = relative risk ratio. Est. = estimated.

tervention. A similar approach was used in this analysis (Table 2). In particular, we used QLD time series data on suicide cases and estimates of the construction industry workforce to generate a suicide risk before and after commencement of MIC activities. The QLD pre-MIC period covered 2003–2007 with the post-MIC period spanned 2008–2012. The QLD RRR was derived with Poisson regression using information on pre- and postsuicide risks.

For NSW, the pre-MIC period was defined as the period 2008–2012 with the post-MIC period spanning 2013–2017. A pre-MIC period suicide risk was calculated using time series data on NSW suicide cases and the NSW CI workforce. The pre-MIC period suicide rate was multiplied by an estimate of the CI workforce (and adjusted by 100,000), to derive an estimate of suicide cases for the period 2013–2017. A key assumption in this calculation is the risk of suicide remains stable in the absence of MIC. To estimate counterfactual suicide numbers for the period 2013–2017, the calculated QLD RRR was used to estimate the reduced risk and change in fatality by suicide among NSW CI workers over the period 2013–2017. The difference between the expected and counterfactual suicide cases provides an estimate of suicide cases averted in NSW in the post-MIC period (2013–2017).

Table 3 provides an overview of MIC construction activities in QLD over the period 2008–2013. All activi-

*Table 3.* Mates in Construction activities in Queensland, 2008–2013

| Year | Queensland construction industry workforce | General awareness training | GAT cumulative | Proportion of workforce exposed to GAT | Connector training | ASIST training |
|---|---|---|---|---|---|---|
| 2008 | 174,050 | 730 | 730 | 0.4% | 55 | 0 |
| 2009 | 172,475 | 3,174 | 3,904 | 2.3% | 227 | 30 |
| 2010 | 164,950 | 5,465 | 9,369 | 5.7% | 333 | 54 |
| 2011 | 168,625 | 7,274 | 16,643 | 9.9% | 478 | 47 |
| 2012 | 161,325 | 9,588 | 26,231 | 16.3% | 507 | 52 |
| 2013 | 161,325 | 9,530 | 35,761 | 22.2% | 793 | 55 |

*Note*. Numbers based on Mates in Construction database (Mates in Construction, personal communication)
ASIST = applied suicide intervention skills training. GAT = general awareness training.

ties have increased steadily since the commencement of MIC with the average uptake (or penetration) of general awareness training (GAT) being 9.4% (i.e., the average proportion of the CI workforce exposed to GAT activities over the period of interest). This rate of 9.4% is applied to the difference in expected and counterfactual NSW suicide cases (derived previously) to derive an estimate of the change in suicide cases attributable to MIC.

### Potential Economic Impact of Implementing MIC in the NSW CI

The potential economic impact of implementing MIC in the NSW CI is derived by comparing the economic savings from fewer suicide and suicide attempts with the cost of implementing the program. Results are expressed as a ratio of benefits to costs with a positive ratio representing a positive economic investment.

### Sensitivity Analysis

Three different sensitivity analyses were undertaken to test the robustness of results to changes in key parameters. First, the proportion of suicide attempts resulting in full incapacity (i.e., 17% of suicide attempts) was varied by ± 5 percentage points. Second, the attribution of MIC to averted suicide and suicide attempts (i.e., 9.4%) was increased by 5 and 10 percentage points of 9.4%. Third, the discount rate (i.e., 4.11%) was adjusted to 0%, 3%, and 5%.

## Results

### Suicide Among QLD and NSW CI Workers

The number of suicide deaths among QLD CI workers over the period 2003–2012 and NSW CI workers over the period 2208–2013 is provided in Table 2. The average age of each suicide fatality among CI workers was 36.8 years and 37.7 years in QLD and NSW, respectively.

### Total Cost of Suicide and Suicide Behavior in the NSW CI

The average cost associated with an incident involving a short-term absence is estimated to cost AU $925; each self-harm incident resulting in full incapacity is estimated to cost AU $2.78 million; and each suicide incident resulting in a fatality is estimated to cost AU $2.14 million. The key cost driver in both full incapacity cases and a fatality is lost income (and taxes), and, for full incapacity only, the additional cost of welfare payments. Given the average age of each suicide is 37.7 years in NSW, this equates to a loss of 27.3 years (65 years − 37.7 years) in potential productive employment.

In 2010, among male CI workers in NSW there were: 145 self-harm incidents resulting in full incapacity; 710 self-harm incidents resulting in a short absence from work; and 57 fatalities by suicide. Multiplying these numbers by average cost per incident suggests that the cost of self-harm and suicide in the NSW CI was AU $527 million in 2010 (Table 4).

### Effectiveness of MIC in the NSW CI

Table 2 provides time series data on suicide cases and estimates of the CI workforce for both QLD and NSW. For QLD, the relative suicide risk rate was 0.9036, suggesting a decreased risk in the post-MIC period of 9.64% (96% CI = 9.1–10.0%). The pre-MIC suicide rate was estimated at 29.20 per 100,000 CI workers (95% CI = 25.22–33.18) and the post-MIC suicide rate was estimated at 26.38 per 100,000 CI workers (95% CI 22.91–29.85).

For NSW, the pre-MIC suicide risk was estimated at 20.68 per 100,000 CI workers (95% CI = 17.96–23.41). Combining this risk with the estimate of the CI workforce for the period 2013–2017 (i.e., 1,050,518) suggests an estimated 217 suicide cases (95% CI = 189–246). Counterfactual suicide numbers were derived by applying the QLD RRR (i.e., 0.9036) to the estimated number of cases (i.e., 217) resulting in 196 suicide cases, a difference of 21 cases over the 5-year period of 2013–2017 or 4.19 fewer suicides per year. The analysis attributed only 9.4% of this difference to MIC to reflect the average uptake of MIC

*Table 4.* Cost of suicide and suicide behavior among New South Wales construction industry workers, 2010 (in Australian dollars)

| | Employer | Worker | Government | Total |
|---|---|---|---|---|
| **Short absence** | | | | |
| Production disturbance costs | $258,834 | $0 | $0 | $258,834 |
| Human capital costs | $0 | $0 | $0 | $0 |
| Medical costs | $354,825 | $0 | $0 | $354,825 |
| Administrative costs | $19,870 | $2,839 | $19,870 | $42,579 |
| Other | $0 | $0 | $0 | $0 |
| Transfer costs | $0 | $0 | $0 | $0 |
| Subtotal | $633,529 | $2,839 | $19,870 | $656,238 |
| **Full incapacity** | | | | |
| Production disturbance costs | $6,085,272 | $0 | $0 | $6,085,272 |
| Human capital costs | $0 | $0 | $364,416,944 | $364,416,944 |
| Medical costs | $72,675 | $280,707 | $1,590,674 | $1,944,056 |
| Administrative costs | $345,061 | $53,053 | $398,114 | $796,227 |
| Other | $0 | $0 | $13,080,842 | $13,080,842 |
| Transfer costs | $0 | $0 | $18,127,194 | $18,127,194 |
| Subtotal | $6,503,008 | $333,760 | $397,613,767 | $404,450,535 |
| **Fatality** | | | | |
| Production disturbance costs | $2,386,381 | $0 | $0 | $2,386,381 |
| Human capital costs | $0 | $0 | $105,281,868 | $105,281,868 |
| Medical costs | $28,500 | $20,777 | $117,734 | $167,010 |
| Administrative costs | $163,590 | $228,000 | $163,590 | $555,180 |
| Other | $1,710,000 | $0 | $4,807,836 | $6,517,836 |
| Transfer costs | $0 | $0 | $7,108,704 | $7,108,704 |
| Sub-total | $4,288,471 | $248,777 | $117,479,732 | $122,016,979 |
| Total | $11,425,008 | $585,375 | $515,113,369 | $527,123,752 |

*Table 5.* Potential economic savings from implementing Mates in Construction in the NSW construction industry (in Australian dollars)

| Type of incident | Number of averted incidents | Average cost per incident | Total cost savings | % Savings to government |
|---|---|---|---|---|
| Short absence | 4.92 | $925 | $4,554 | 3% |
| Full incapacity | 1.01 | $2,782,597 | $2,806,585 | 98% |
| Fatality | 0.40 | $2,140,649 | $846,707 | 96% |
| Total | 6.33 | | $3,657,846 | 97% |

*Note*. NSW = New South Wales.

general awareness training in the QLD CI post-MIC (i.e., 9.4%).

The results suggest that if implemented in the NSW CI, MIC could potentially avert 0.4 suicides, 1.01 suicide attempts resulting in full incapacity, and 4.92 suicide attempts resulting in a short absence from work.

## Potential Economic Impact of Implementing MIC in the NSW CI

The potential economic impact of implementing MIC in the NSW CI is an estimated saving of AU $3.66 million each year (Table 5). The majority of benefits are estimated to flow to the government with a saving of AU $3.56 million each year. If the budget for rolling out the MIC program in NSW is AU $800,000 each year, the benefit–cost ratio is equivalent to 4.6:1, that is, for every AU $1 invested there is a return of AU $4.60, representing a positive economic investment of public funds.

## Sensitivity Analysis

Table 6 provides the results of the sensitivity analysis. All variations in key parameters have little impact on the positive economic benefit of MIC. Reducing the proportion

*Table 6.* Sensitivity analysis of key parameters (in Australian dollars)

| Parameter varied | Number of averted incidents | Economic savings per year | Cost of Mates in Construction | Benefit–cost ratio |
|---|---|---|---|---|
| Proportion of suicide attempts resulting in full incapacity | | | | |
| Sensitivity 1 = 12% | 6.33 | $2,832,654 | $800,000 | 3.54 |
| Baseline = 17% | 6.33 | $3,657,846 | $800,000 | 4.57 |
| Sensitivity 2 = 22% | 6.33 | $4,483,038 | $800,000 | 5.60 |
| Attribution of Mates in Construction to averted suicide and suicide attempts | | | | |
| Baseline = 9.4% | 6.33 | $3,657,846 | $800,000 | 4.57 |
| Sensitivity 3 = 14.4% | 9.65 | $5,577,850 | $800,000 | 6.97 |
| Sensitivity 4 = 19.4% | 13.00 | $7,514,603 | $800,000 | 9.39 |
| Discount rate used to convert future costs to present value | | | | |
| Baseline = 4.11% | 6.33 | $3,657,846 | $800,000 | 4.57 |
| Sensitivity 5 = 0% | 6.33 | $7,083,972 | $800,000 | 8.85 |
| Sensitivity 6 = 3% | 6.33 | $4,289,637 | $800,000 | 5.36 |
| Sensitivity 7 = 5% | 6.33 | $3,249,461 | $800,000 | 4.06 |

of suicide attempts resulting in full incapacity from 17% to 12% changes the benefit–cost ratio from 4.57 to 3.54; attributing a higher proportion of incidents reduced to MIC from 9.4% to 19.4% increases the number of averted incidents, the economic savings, and the benefit–cost ratio. All variations of the discount rate resulted in a positive benefit–cost ratio.

# Discussion

## Main Findings

The CI is the fourth major contributor to Australia's economic output at over AU $100 billion each year, close to 8% of gross domestic product (Australian Bureau of Statistics, 2012). Our analysis has quantified the average cost of a CI male worker dying from suicide at AU $2.14 million, with each worker losing an average of 27.3 years of potential productive employment and 42 years of potential life lost. The total economic cost of suicide and suicide behavior to the NSW CI alone was estimated at AU $527 million in 2010.

Given the fact that suicide is largely preventable (Suicide Prevention Australia, 2014), it is surprising that workplace suicide prevention strategies are not common practice. Our analysis has demonstrated that implementing a multifaceted workplace suicide prevention, that is, MIC, in the NSW CI can prevent fatalities and injuries from self-harm at the same time as saving scarce economic resources. Compared with the cost of implementing MIC, the results suggest that for every AU $1 invested there is a return of AU $4.60 to society.

Only a limited number of similar studies have been conducted. Beyond Blue estimated the return on investment for employers investing in a mentally healthy workplace (Beyond Blue, 2014). The actions selected for the analysis included prevention, early intervention, and rehabilitation/return to work strategies. The authors demonstrated that an investment in mental health in the workplace gives rise to a number of benefits to organizations, people with mental health conditions, coworkers, and clients. The authors found that for every dollar spent on successfully implementing an appropriate action, there is on average $2.30 in benefits to be gained by the organization (Beyond Blue, 2014).

Comans, Visser, and Scuffham (2013) conducted an economic evaluation of the StandBy Response Service, a community-based crisis intervention program for people bereaved by suicide. The authors found StandBy to be a dominant strategy, that is, more effective and less expensive than the alternative. Van Spijker, Majo, Smit, Van Straten, and Kerkhof (2012) conducted a cost-effectiveness analysis of an online, unguided, self-help intervention for reducing suicidal ideation. The authors also found the intervention to be dominant (Van Spijker et al., 2012). Lifeline (2013) published an evaluation report of its Online Crisis Support Chat Service, a crisis intervention service to support suicide prevention in Australia (Lifeline, 2013). The authors reported that for every dollar invested in the online service, there was $8.40 in benefits (Lifeline, 2013).

## Limitations and Strengths

The analysis relied on NCIS data to identify fatalities by suicide in the CI. This data source may, however, have underestimated the number of suicides occurring in Australia owing to coronial and system-related issues (De Leo et al., 2010). Only male suicides were examined in this study because of the small number of female suicides and subsequent confidentiality issues. The potential effectiveness of MIC in the NSW CI relied on a combination of QLD and NSW data. Any underreporting of suicides in the NCIS data are likely to influence the calculated suicide risk, the QLD RRR, and the potential economic impact of MIC.

The results of the sensitivity analyses using lower and upper confidence intervals around the effectiveness rate provided some confidence that the results are relatively robust to such variations.

Although this analysis closely followed the methodology adopted by Safe Work Australia, certain methodological variations were required. For example, unlike the Safe Work Australia approach, this analysis included postvention costs associated with suicide bereavement and counseling. Evidence suggests that postvention costs are significant to both the community and the industry and failure to include these costs would underestimate any cost estimate (Carson J. Spencer Foundation et al., 2013; Comans et al., 2013; Suicide Prevention Australia, 2014).

The analysis did not attempt to estimate the costs saved by the transfer of knowledge gained through MIC training at the workplace to family and friends outside of work. The ripple effects of other suicide gatekeeper programs have shown that for each person trained another five people have conversations with that trainee and learn about best practices in suicide intervention (Carson J. Spencer Foundation et al., 2013; Suicide Prevention Australia, 2014). This transfer of knowledge then increases the potential of saving lives outside of work.

It is also important to note that the analysis period of 2008–2012 includes years of the global financial crisis (GFC), a period when suicides are generally expected to increase. Evidence suggests that the GFC had minimal impact in Australia (Wettenhall, 2011) and therefore was not considered as a potential confounder in this analysis. Further, a recent investigation of suicide during the GFC found a small and relatively transient increase in suicide among the employed population, and a much larger impact on those out of work (Milner, Morrell, & La Montagne, 2014).

World Health Organization evidence on the relationship between suicide and suicide behavior has been used to estimate the relationship between suicide, suicide behavior, and injury resulting from such behavior (World Health Organization, 2006). These relationships have been supported by Australian data (Slade et al., 2009; Suicide Prevention Australia, 2014).

In an examination of suicide in the Australian CI, Milner, Niven, et al. (2014) found that the major method of suicide was consistent with that of the general population (e.g., hanging followed by exposure to carbon monoxide, and firearms). Our analysis tested variations in the proportion of suicide attempts resulting in full capacity with only small changes in the benefit–cost ratio.

Our analysis adopted a conservative approach to outcome measurement by attributing only 9.4% of averted suicide incident to MIC. This rate reflects the average uptake (or penetration) of MIC activities by the CI over the period of interest. It is important to note that once MIC had been established in QLD, the penetration rate was as high as 22.2% (Table 3). It may be expected that penetration rates would be higher than 9.4% in NSW given the lessons learned from the QLD experience. Nevertheless, this conservative approach also allows for the acknowledgment of other implemented population-level suicide programs (Suicide Prevention Australia, 2014).

## Conclusion

This study provides new evidence on the costs associated with self-harm and suicide in the NSW CI for the year 2010 and the potential return on investing in a workplace suicide prevention strategy. These results suggest that MIC can save lives at the same time as saving scarce resources. It represents a positive economic investment into workplace safety in the NSW CI.

## References


Access Economics. (2009). *The economic impact of youth mental illness and the cost effectiveness of early intervention*. Melbourne, Australia: Author.

Australian Bureau of Statistics. (2006). *Australian and New Zealand standard industrial classification (ANZSIC)* (Catalogue No. 1292.0). Canberra, Australia: Author.

Australian Bureau of Statistics. (2012). *1301.0 – Year book Australia*. Canberra, Australia: Author.

Australian Bureau of Statistics. (2013a). *Australian and New Zealand standard classification of occupations* (Catalogue No. 1220.0). Canberra, Australia: Author.

Australian Bureau of Statistics. (2013b). *Causes of death, Australia* (Catalogue No. 3303.0). Canberra, Australia: Author.

Australian Bureau of Statistics. (2013c). *Consumer price index, Australia* (Catalogue No. 6401.0). Canberra, Australia: Author.

Australian Bureau of Statistics. (2014). *Employee earnings, benefits and trade union membership* (Catalogue No. 63100TS0002). Canberra, Australia: Author.

Beyond Blue. (2014). *Creating a mentally healthy workplace: Return on investment analysis*. Canberra, Australia: Australian Government National Health Commission.

Carson J. Spencer Foundation, Crisis Care Network, National Action Alliance for Suicide Prevention, & American Association of Suiciology. (2013). *A manager's guide to suicide postvention in the workplace: 10 action steps for dealing with the aftermath of suicide*. Denver, CO: Author.

Comans, T., Visser, V., & Scuffham, P. (2013). Cost effectiveness of a community-based crisis intervention program for people bereaved by suicide. *Crisis, 34,* 390–397.

Commonwealth of Australia. (2010). *Australia to 2050: Future challenges. Intergenerational report*. Canberra, Australia: Author.

Corso, P. S., Mercy, J. A., Simon, T. R., Finkelstein, E. A., & Miller, T. R. (2007). Medical costs and productivity losses due to interpersonal and self-directed violence in the United States. *American Journal of Preventive Medicine, 32*, 474–482.

De Leo, D., Dudley, M. J., Aebersold, C. J., Mendoza, J. A., Barnes, M. A., Harrison, J. E., … Ranson, D. (2010). Achieving standardised reporting of suicide in Australia: Rationale and program for change. *Medical Journal of Australia, 192*, 452–456.

Department of Health and Ageing. (2007). *Living is for everyone (LIFE) framework*. Canberra, Australia: Commonwealth of Australia.

Department of Human Services. (2014). *Disability support pension*. Canberra, Australia: Author. Retrieved from http://www.humanservices.gov.au/customer/services/centrelink/disability-support-pension

Germain, M. l. (2014). Work-related suicide. An analysis of US government reports and recommendations for human resources. *Employee Relations, 36,* 148–164.

Gullestrup, J., Lequertier, B., & Martin, G. (2011). MATES in construction: Impact of a multimodal, community-based program for suicide prevention in the construction industry. *International Journal of Environmental Research and Public Health, 8*, 4180–4196.

Heller, T. S., Hawgood, J. l., & De Leo, D. (2007). Correlates of suicide in building industry workers. *Archives of Suicide Research, 11*, 105–117.

Knox, K. l., Litts, D. A., Talcott, G. W., Feig, J. C., & Caine, E. D. (2003). Risk of suicide and related adverse outcomes after exposure to a suicide prevention programme in the US Air Force: Cohort study. *British Medical Journal,* 327, 1–5.

Lifeline. (2013). *Social return on investment forecast of the Lifeline Online Crisis Support Chat Service*. Retrieved from https://www.lifeline.org.au/ArticleDocuments/121/Lifeline_Online_Crisis_Support_Chat_SROI_report_final.pdf.aspx

Mann, J. J., Apter, A., & Bertolote, J. (2005). Suicide prevention strategies: A systematic review. *Journal of the American Medical Association, 294*, 2064–2074.

Milner, A., Morrell, S., & La Montagne, A. D. (2014). Economically inactive, unemployed and employed suicides in Australia by age and sex over a 10-year period: What was the impact of the 2007 economic recession? *International Journal of Epidemiology, 43,* 1500–1507.

Milner, A., Niven, H., & La Montagne, A. (2014). Suicide by occupational skill level in the Australian construction industry: Data from 2001 to 2010. *Australian and New Zealand Journal of Public Health, 38*, 281–285.

Milner, A., Spittal, M. J., Pirkis, J., & La Montagne, A. D. (2013). Suicide by occupation: Systematic review and meta-analysis. *The British Journal of Psychiatry, 203*, 409–416.

Mrazek, P. J., & Haggerty, R. J. (1994). *Reducing the risks for mental health disorders: Frontiers for preventive intervention research.* Washington, DC: National Academy Press Institute of Medicine.

Reserve Bank of Australia. (2014). *Cash rate target (2008-2014).* Retrieved from http://www.rba.gov.au/statistics/cash-rate/cash-rate-2008-2014.html

Safe Work Australia. (2012). *The cost of work-related injury and illness for Australian employers, workers and the community: 2008–09*. Canberra, Australia: Author.

Slade, T., Johnston, A., Teesson, M., Whiteford, H., Burgess, P., Pirkis, J., & Saw, S. (2009). *The mental health of Australians 2. Report on the 2007 National Survey of Mental Health and Wellbeing*. Canberra, Australia: Department of Health and Ageing.

Suicide Prevention Australia. (2014). *Work and suicide prevention: Position statement*. Sydney, Australia: Author.

Van Spijker, B. A. J., Majo, C., Smit, F., Van Straten, A., & Kerkhof, A. J. (2012). Reducing suicidal ideation: Cost-effectiveness analysis of a randomized controlled trial of unguided web-based self-help. *Journal of Medical Internet Research, 14*, e141.

Wettenhall, R. (2011). Global financial crisis: The Australian experience in international perspective. *Public Organization Review, 11*, 77-91.

World Health Organization. (2006). *Preventing suicide: A resource at work*. Geneva, Switzerland: Author.

Received December 14, 2014
Revision received August 2, 2015
Accepted August 8, 2015
Published online December 23, 2015

## About the authors

Professor Doran holds a Bachelor of Economics (Honors) degree and a PhD in health economics. He is an international expert in the area of priority setting and is recognized as one of Australia's leading health economists. His research has made an impact at the local, national, and international level.

Dr. Rod Ling holds a Bachelor of Commerce (Economics) degree and a PhD in sociology. He is a health economist employed at the Hunter Medical Research Institute, NSW, Australia. His main research interests are mental health and economic evaluation.

Jorgen Gullestrup is the inaugural manager of MATES in Construction following 13 years as a union official in the Queensland construction industry. He holds a graduate certificate in suicide prevention, a diploma in social welfare, and community development and an associate diploma in labor studies.

Dr. Sarah Swannell is a registered psychologist in private practice and with the Queensland Government. She holds a Bachelor of Social Science (Psychology) (Honors) degree and a PhD in psychiatry. Dr. Swannell's main clinical interests are self-destructive behaviors, trauma, and dissociation. She has published in both national and international peer-reviewed journals.

Dr. Allison Milner is a senior research fellow at the McCaughey VicHealth Centre for Community Wellbeing, Melbourne School of Population and Global Health, Australia. Her research interests include the influence of macro-level employment characteristics, quality of work, job stress, and unemployment as determinants of mental health and suicidality. She has an honors degree in psychology, a Master of Epidemiology, and a PhD in Suicidology.

Christopher M. Doran

School of Human, Health and Social Sciences
Central Queensland University
Level 4, 160 Ann Street
Brisbane 4000
Australia
Tel. +61 412 93-5084
E-mail c.doran@cqu.edu.au