The decline in Australian young male suicide

Stephen Morrella,*, Andrew N. Pageb, Richard J. Taylorb

aSchool of Public Health, University of Sydney, NSW 2006, Australia
bSchool of Population Health, University of Queensland, Herston, Queensland 4006, Australia

Available online 31 October 2006

Abstract

Since the late 1990s there has been a sharp downward trend in Australian young male suicide. It is possible that a major government youth suicide prevention initiative, the National Youth Suicide Prevention Strategy (NYSPS), implemented during 1995–1999 may have influenced the decline. In this article, we examine time trends in age- and means-specific male and female Australian suicide rates in relation to unemployment rates and the NYSPS. Based on Australian suicide data over the period 1966–2003, we assess secular changes in the 20–24 year male suicide to total (crude) male suicide rate ratio in relation to the NYSPS, using interrupted time series analysis (ARIMA), since this was previously found to be significantly associated with the 20–24 year male unemployment to total employment ratio.

Results show that a dramatic reduction in Australian young male (aged 20–34 years) suicide has occurred since 1997–1998, declining from approximately 40 per 100,000 in 1997–1998 to approximately 20 per 100,000 in 2003. Most of the decline is due to a decrease in suicide by hanging and to a lesser extent from motor vehicle carbon monoxide and other gases. Further, the previously established strong secular association (lasting over 3 decades from 1966) between the rate ratio of 20–24 year male suicide to total (crude) male suicide, and the rate ratio of 20–24 year male unemployment to total unemployment, appears to have been disrupted. ARIMA modelling of the suicide ratio against the initiative indicates a highly significant statistical association between the NYSPS and the suicide ratio reduction but not between the NYSPS and the unemployment indicator trend, suggesting a break in the link between young male suicide and unemployment. The recent sudden turnarounds in Australian young male suicide trends and its extent appears to preclude explanations centring on slow-moving social indices traditionally associated with suicide, or on possible cohort effects. This sudden decrease has occurred mainly in non-impulsive means, and at the same time has broken a long-standing secular link between 20 and 24-year-old male suicide and unemployment, lending plausibility to the case for the NYSPS having had an impact on young male suicide in Australia.

Keywords: Suicide; Unemployment; Youth; Australia; Prevention; Men

Introduction

Suicide rates in younger males through the 1970s and 1980s to the 1990s increased in many Western countries including the UK, New Zealand and Australia (Levi et al., 2003), but in some countries have decreased since the mid-1990s, for example 15–19-year-old male rates in the USA (Bridge,
Barbe, & Brent, 2005). In 1993, two of the authors (SM, RT) investigated the aggregate relationship between suicide and unemployment in Australia over 1907–1990 and found a strong serial correlation between the rate ratio of 20–24 year male unemployment to total unemployment, and the rate ratio of 20–24 year male suicide to total (age-standardised) male suicide (Morrell, Taylor, Quine, & Kerr, 1993). These ratios originally covered the period 1966–1990—age- and sex-specific unemployment rates were first collected systematically in Australia only in 1966. The amount of variation in the 20–24 male suicide rate ratio explained by the 20–24 male unemployment rate ratio was found to be 80%, equivalent to a Pearson correlation coefficient of \( \approx 0.9 \). At the time we interpreted this finding \textit{post hoc} in Durkheimian terms, suggesting that relative unemployment levels may have more bearing on young male suicide risk than absolute unemployment levels because they are even more marginalised than older unemployed males (Morrell et al., 1993). The relationship may not hold in times when measured unemployment is quite high or quite low (currently). During the Great Depression for example, the relationship between relative unemployment and suicide rates was weaker (Morrell, Page, & Taylor, 2001). Presently under low unemployment conditions there may be fewer unemployed young people who really want to work and feel bad about not working, i.e., different selection effects may occur depending on extant economic conditions.

Subsequently, we updated the young male unemployment/suicide relationship to cover 1966–1996 (Morrell, Taylor, & Kerr, 1998), this time with the 20–24 year male suicide rate expressed as a ratio of the crude male suicide rate. The strong correlation with the unemployment rate ratio remained when updated again to cover 1997 (Morrell et al., 2001). This secular relationship between unemployment and suicide did not hold nearly as strongly for other male age groups and did not exist at all for females (Morrell et al., 1993). However, as the association was found to be strongest in males aged 20–24 years, a significant change or break in this particular correlation is easier to show than breaks or changes to already weak associations found in other sub-groups.

Overwhelmingly, studies of socio-economic status, including employment status, and suicide have been aggregate in nature. A recent systematic literature review of aggregate studies of suicide and socio-economic status noted that despite some heterogeneity in findings, “(1) the strongest association between aggregate suicide rates and the socio-economic level of area of residence occurs at the community or neighbourhood level, where suicide rates increase as socio-economic levels decrease; and (2) that area suicide rates are most strongly associated with the proportion of residents that are living below the poverty level (or similar measures of economic deprivation)”(Rehkopf & Buka, 2006).

Clearly unemployment rates are a valid measure of economic deprivation, which poses the question of attribution in the case of significant disruptions or modifications in already established aggregate temporal associations between unemployment and suicide rates.

In 1995, the Australian Commonwealth Government began to fund several dozen youth suicide prevention initiatives, under the rubric of the National Youth Suicide Prevention Strategy (NYSPS), in which key health and social service providers for young people (especially those interacting with young people aged 15–29 years) were resourced to implement and integrate youth suicide prevention programs into their service profiles. Individual projects varied widely but received funding over the 1997–1999 period based on merit, with post-funding sustainability a key criterion. A summary of these projects can be found in Australian Institute of Family Studies (2000) and a ‘stocktake’ of most Australian suicide prevention initiatives found in AusEinet (2000). Each NYSPS-funded project had an evaluation component, centring mainly on process or impact evaluation, not outcome evaluation. At the time, the knowledge on which youth suicide public health prevention measures actually worked was rather limited (Gunnell & Frankel, 1994) and consequently a variety of approaches were tried. Some projects were national in scope, others local, and some, in limited ways, were shown to work and others not. However, it was also immediately apparent that the overall effects of the interventions could not easily be assessed, if at all, since suicide is such a rare event. Certainly some individual funded projects had sufficient statistical power to detect an effect on intermediary or prognostic indicators of suicidality (for example, repeat attempted suicide rates or emergency room readmission rates), but the main aim of suicide reduction in young people was viewed to be beyond evaluation, at least in the short and medium terms.
One approach to this question would be to examine if the prevention measures overall may have had some impact on aggregate national secular trends in suicide in the targeted group, especially if there exists an indicator which is sensitive to change. One such indicator is the secular correlation between the 20 and 24-year-male suicide rate ratio and the 20 and 24-year-male unemployment rate ratio. If a sharp decline in young male suicide occurred but its strong correlation with unemployment remained (movements in unemployment rates can also be sudden), then this would be evidence for the intervention not being associated with the downturn; the suicide decline would be more a reflection of improved employment prospects for this group and not the intervention. Of course this approach cannot ‘prove’ causation, but it can at least be used to rule in or out the possibility that the suicide prevention initiative did have some aggregate association with suicide in young people. Conversely, if any changes in suicide rates have also been accompanied by changes to the particular socio-economic relation found already in 20–24-year-old male suicide rates, then this would indicate fulfillment of a necessary but not sufficient condition for the success of the initiative. Accordingly, we examined trends in 15–34 year suicide for Australia overall by sex and by method of suicide, and extend to 2003 an examination of the strong secular association found previously between 20 and 24-year-male suicide and unemployment to see if this particular socio-economic link with suicide has remained.

Methods

Suicide data were obtained from the Australian Bureau of Statistics (ABS) for 1976–2003 and from Commonwealth Year Books for 1966–1975. Age-specific suicide rates for males and females aged 15–34 years by 5-year age-group were calculated for each year 1966–2003, along with total male suicide rates (crude) to calculate the 20–24 year to total male suicide rate ratio.

The 20–24-year-old male suicide ratio was calculated for each year of 1966–2003 as the 20–24 year male suicide rate divided by the total (crude) male suicide rate. The 20–24 year male suicide rate per 100,000 males, and rate ratios of 20–24 year male unemployment and suicide were plotted separately for 1966–2003. Unemployment rates by sex and age group were obtained from the electronic time series collection, AusStats (Australian Bureau of Statistics, 2005). The unemployment rate for each year, by convention taken as that occurring in August, was obtained for males aged 20–24 years and for all persons. A ratio of the male 20–24 year unemployment rate to the total all-persons unemployment rate was calculated for each year 1966–2003.

Method-specific suicide rates were also examined, based on ICD-9 (for 1979–1998) and ICD-10 (for 1999–2003) cause-of-death classification systems (World Health Organisation, 1976, 2006) to determine if the prevention initiative was associated with changes in rates of suicide by particular means. Means examined were hanging and motor vehicle exhaust and other gases. Following the implementation in 1999 of ICD-10 cause-of-death coding in Australian mortality data, it was not possible to calculate separate rates of suicide by motor vehicle exhaust gas since ICD-10 classifies suicide by motor-vehicle exhaust gas under Code X67, “Intentional self-poisoning by and exposure to other gases and vapours” (World Health Organisation, 2006). Accordingly, suicide trends in this broader category were examined for the whole period 1979–2003.

Statistical assessment of the association between the NYSPS and changes in suicide was by interrupted time series analysis of (i) the young male suicide rate ratio against the prevention initiative (as a step function: \( = 0 \) for 1966–1996, \( = 1 \) for 1997–2003); and (ii) the young male unemployment rate ratio against the prevention initiative. The purpose of this was to test for a possible change in the relationship between the suicide and unemployment rate ratios. In other words, if there is a significant association between the prevention initiative and the suicide rate ratio, but not with the unemployment rate ratio, then this would indicate a breaking of the 30-year secular correlation between the unemployment and suicide rate ratios in 20–24-year-old Australian males. Otherwise, the link remains and the NYSPS can with high probability be ruled out as being associated with suicide reductions in young people. Proc ARIMA (AutoRegressive Integrated Moving Average) in SAS v 8.2 was used for the time series modelling, to account for secular trends and underlying autoregressive and moving average processes in time series (SAS Institute, 1999). An autoregressive process is where a value at one point in time is correlated with value(s) for previous time point(s). A moving average process is when the value at a given time point is correlated with random error(s) or shocks, technically known
as ‘white noise error terms’, from previous time point(s).

Results

Suicide rates in 20–24 year old males increased from around 15 per 100,000 in the mid-to-late 1960s (n ≈ 60–70 annually) and exceeded 40 per 100,000 (n = 284) by 1997 (Fig. 1). A steep decline followed, to about 21 per 100,000 in 2003 (n = 152). The trend in 25–29 year old males was similar, especially from the mid-1970s, while the trend in 30–34 year old males was also similar, but with somewhat attenuated fluctuations, with the recent suicide decline occurring post 1998. In contrast, suicide rates in 15–19 year old males declined from a peak in 1988 of 21 per 100,000 (n = 155) to 12 per 100,000 in 2003 (n = 81). The steep suicide declines in the 20–34 year age groups commenced 1–2 years after the suicide prevention initiative was inaugurated in 1995, and contrast with only a moderate decline in the ≥35 year old remainder. Female suicide among 15–34 year old age groups showed no discernible trends, especially from the mid-1970s (Fig. 2), with the wide stochastic variation reflecting small suicide event numbers in females (≈140–190 suicides annually in females aged 15–34 years). In particular, there appears to have been no significant change in 15–34 year old female suicide rates since the suicide prevention initiative of 1995–1999.

Reduced suicide in 20–34-year old males is largely from a decline in suicide by hanging (decreasing from approximately 21 per 100,000 in 1998 to 14 per 100,000 in 2003) and, to a lesser extent, from motor vehicle exhaust and other gases (Fig. 3). Suicide by firearms (not shown) continued to decline over this period (to reach approximately <2 per 100,000 for the 20–34 age group), but showed no similar sharp decrease to hanging, gas or overall for the post-1997 period. There was a similar peak in female hanging suicide as in males after 1998 (3–5 per 100,000), with a subsequent decline from 2000 onwards (not shown).

The strong secular association between the rate ratio of male 20–24 year old suicide to total (crude) male suicide, and the rate ratio of male 20–24 year old unemployment to total unemployment, appears to have been broken by 1998 (Fig. 4). The 20–24 year old-to-total male suicide rate ratio declined from over 1.8 in 1997 to under 1.4 in 2003, while at the same time the 20–24 year old male-to-total employment rate ratio remained at around 1.8.

The extent of the aggregate associations between the suicide prevention initiative and the 20–24 year old male suicide and unemployment rate ratios are shown in the regression model output (Table 1). After differencing by one lag to eliminate secular trend, both time series were best characterised as order 1 moving average (MA(1)) processes, meaning for both the suicide and unemployment rate ratios that any given year in each series was most strongly
correlated to random shocks to the previous year’s suicide rate than to the previous year’s suicide rate itself. After accounting for trend and these moving average effects, the intervention initiative was highly statistically significantly associated with the 20–24 year male suicide rate ratio ($p = 0.001$), but not with the unemployment rate ratio ($p = 0.55$), reflecting the evident graphical departure of the suicide rate and unemployment rate ratios, especially after 1998 (Fig. 4).

**Discussion and implications**

In normal circumstances the marked decline in 20–24 year old male suicide rates would not easily be associated with youth suicide prevention initiatives. After all, suicide rates concern rare events that can vary greatly from year to year, and assessing the NYSPS initiative against these alone would not necessarily indicate its success or otherwise. Certainly there appears to be a temporal statistical association between the NYSPS and the decline in suicide rates that was dominated by the hanging suicide reduction in younger males aged 20–34 years. The suicide decline in the narrower 20–24-year-old male age range might simply have been a continuation of a link with unemployment that was previously shown to exist since the mid-to-late 1960s (Morrell et al., 1993, 1998, 2001). However, this association also now appears to be broken and the break occurred around the same time as the commencement of the 20–24 year old male suicide rate decline. In other words, something has halted, and to some extent reversed, the rising secular trend in 20–24 year old male suicide rates, and something has also broken the decades-long link between these and the 20–24 year old male unemployment rate.
The decline in 25–34 year male suicide rates was similar but less so in males aged 15–19 and ≥35 years. Accordingly, three rather important necessary (but not sufficient) conditions have been fulfilled to suggest the plausibility of youth suicide prevention measures having had some effect on young male suicide.

Implemented over 1995–1999, the NYSPS allocated AUS$31 million to promote a public health approach to reducing suicide and attempted suicide in young people (Australian Institute of Family Studies, 1999, 2000). In particular, the strategy was directed at youth-specific health and social service providers to establish or augment their suicide prevention activities, system-level policies and capacity building. Primary prevention programs included measures to enhance capacity for early intervention and crisis intervention, and secondary and tertiary prevention initiatives including treatment, support and postvention. System-level initiatives centred on policy and planning, research and evaluation, development and dissemination of good practise guidelines, education and training, intersectoral collaboration, restricting access to means, and community development. About 70 such projects were funded by the NYSPS, and a key criterion for funding was sustainability so that measures undertaken would continue after the initial funding had expired. Most funded projects commenced in 1997 or after, and some key funding recipients included Lifeline, Here for Life Suicide Prevention Program, and Cellblock Youth Health Service.

A summative evaluation of the strategy acknowledged that the funding had most likely improved the capacity of services to implement primary prevention and early intervention programs in the community and health sectors, but concluded that there was no evidence that the strategy had led to, or was associated, with reductions in suicidal behaviour or suicide in young people (Australian Institute of Family Studies, 2000). It should be borne in mind that this evaluation report appeared in 2000, somewhat early for an examination of secular trends in youth suicide before and after the NYSPS, especially as death data in Australia do not become available for research purposes for at least 18 months following official vital registration. However, with the added benefit of a few more years of hindsight it is clear that the NYSPS was not associated with any changes in female suicide (see Fig. 2). This is partly due to the infrequency of female suicide in Australia compared to males (about one-fifth as frequent) and partly due to the fact that funding would have been directed more toward higher priority areas including young marginalised or Indigenous males.

Whether further aggregate evidence may be found that the suicide prevention measures have actually caused, or were ‘responsible’ for a reversal in the increasing secular trend in young male suicide is another question. For instance, a number of studies have correlated antidepressant use with suicide (Isacsson, 2000; Olfson, Shaffer, Marcus, & Greenberg, 2003) including a recent Australian cross-sectional study of age-specific antidepressant use and suicide (Hall et al., 2003). However, the beneficial effect of antidepressants in the Australian study mainly was confined to older age groups (Hall et al., 2003). Also, the increasing secular trend in
antidepressant use in Australia has been gradual over the 1990s, and does not correlate strongly with the sharp turnaround in young male suicide in 1997.

Another often mooted possibility is recent gun control legislation, implemented in 1996 shortly following the Port Arthur tragedy in which 35 tourists were murdered in a shooting spree by a lone gunman (Dudley, Cantor, & de Moore, 1996). However, firearm suicide rates had been declining steadily for most of the 1980s and 1990s prior to this legislation, with hanging as a main substitute, and no substantial further firearm suicide decrease followed the implementation of the 1996 gun control legislation which, moreover, outlawed semi-automatic weapons (when a single shot generally suffices for suicide). Furthermore, the large decrease in Australian young male suicide mainly has come from hanging suicide, a less impulsive method not amenable to legislative measures that overwhelmingly aim to restrict access to means. It could be argued at an individual level that suicide prevention measures such as cognitive behavioural therapy would be less effective against impulsive means like firearms, jumping or single motor vehicle fatality, especially when fuelled by alcohol, and more effective against means which require more planning, pre-meditation and thought, such as suicide by hanging or from motor vehicle exhaust or other gases. As Fig. 3 shows, the decline in suicide by motor vehicle exhaust and other gases, while not as dramatic in absolute terms as hanging, has nevertheless also shown a similarly large proportional decline in young males since 1997–1998.

Further possible reasons for the dramatic reduction in young male suicide rates are less easy to pinpoint. For instance, cohort effects would not be associated with such a dramatic short-term change post 1997, since cohort effects act more gradually. In any case, a recent analysis covering the 19th and 20th century found little evidence of cohort effects in NSW suicide (Morrell, Page, & Taylor, 2002). Similar arguments apply to other slow-moving social indicators known to be associated with suicide, including marriage/divorce rates, fertility rates, drug and alcohol consumption rates, levels of religiosity and so on.

While there have been recent reductions in overall unemployment rates in Australia, to levels not seen since at least the early 1980s, the rate ratio of 20–24 year male to overall unemployment has remained high (≈ 1.8), but the corresponding male suicide rate ratio has departed from its close secular association with unemployment for the first time since the mid-1960s. It might be argued that the government’s imposition of a ‘work-for-the-dole’ scheme on the unemployed has produced the desired Durkheimian effect of increased levels of ‘inclusion’ and ‘regulation’, especially in the lives of younger unemployed people. ‘Work for the dole’ was instituted ostensibly to tackle the deleterious effects on the ‘work ethic’ of the long-term unemployed in particular. While this explanation has superficial appeal, given that specific job-search interventions have also been shown to reduce psychological morbidity in the unemployed (Price, Van Ryn, & Vinokur, 1992), such schemes generally have been shown to be of limited efficacy in reducing the characteristically high levels of psychological morbidity associated with being unemployed, especially when the activity involves temporary job placements (Branthwaite & Garcia, 1985). In Australia ‘work-for-the-dole’ initially targeted 18–24 year olds until 1998, with temporary work, usually 6-month placements in community and in private employment settings, as well as other ‘voluntary’ activities which was extended to older unemployed people (aged 25–39 years) only in 2000, (http://www.aph.gov.au/library/intguide/sp/dole.htm) after the turnaround in male suicide rates in these older age groups. Also, after 1999 the NYSPS became the National Suicide Prevention Strategy (NSPS) with a brief to prevent suicide in a broader age range, but using the same overall strategy as the NYSPS. While the NSPS might be expected to have had a somewhat more diluted effect on young male suicide rates, the delayed reduction in suicide rates in the targeted older (25–34 years) male age groups, occurring post 1998, is consistent with the prevention strategy affecting suicide rates, since the NSPS was implemented later than the NYSPS and the reduction in suicide in the older male age groups also occurred later.

To conclude: if the fall in young male suicide rates since 1997 had occurred without a corresponding break in the long-term secular association with youth unemployment, then one would be forced to conclude that the NYSPS was not associated with the youth suicide rate reduction, since the latter would be expected to continue to vary with youth unemployment. However, the evidence is more consistent statistically and circumstantially in favour of the NYSPS plausibly being associated with
the post-1997 fall in young male suicide rates. Still, it is also clear that these findings require more research to better explain the changes in young male suicide that have recently occurred in Australia.

References


