



An investigation of neighborhood-level social, economic and physical factors for railway suicide in Victoria, Australia



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ABSTRACT

Background: This study investigates the associations between railway suicide and neighborhood social, economic, and physical determinants using postcode-level data. It also examines whether the associations are influenced by having high concentration of high-risk individuals in a neighborhood area.

Methods: Railway suicide cases from Victoria, Australia for the period of 2001–2012, their age, sex, year of death, usual residential address and suicide location were obtained from the National Coronial Information System. Univariate negative binomial regression models were used to estimate the association between railway suicide and neighborhood-level social, economic and physical factors. Variables which were significant in these univariate models were then assessed in a multivariate model, controlling for age and sex of the deceased and other known confounders.

Results: Findings from the multivariate analysis indicate that an elevated rate of railway suicide was strongly associated with neighborhood exposure of higher number of railway stations (IRR=1.30 95% CI=1.16–1.46). Other significant neighborhood risk factors included patronage volume (IRR=1.06, 95% CI=1.02–1.11) and train frequency (IRR=1.02, 95% CI=1.01–1.04). An increased number of video surveillance systems at railway stations and carparks was significantly associated with a modest reduction in railway suicide risk (IRR=0.93, 95% CI=0.88–0.98). These associations were independent of concentration of high-risk individuals.

Limitations: Railway suicide may be under-reported in Australia.

Conclusions: Interventions to prevent railway suicide should target vulnerable individuals residing in areas characterized by high station density, patronage volume and train frequency.

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1. Introduction

Railway suicide causes far-reaching and serious implications. It not only has considerable impacts for the victims including death and serious physical disability, but also has traumatizing effects on family and friends as well as witnesses to the suicide incident (e.g., train drivers, railway staff and passengers) (Lukaschek et al., 2011; Odonnell et al., 1994). Other significant consequences include financial loss through service delays and driver absenteeism (Lukaschek et al., 2011; Silla et al., 2012). Railway suicide may also trigger

imitative behavior (i.e. high-risk individuals using the same suicide method following exposure to an incident) (Sonneck et al., 1994).

Railway suicide is highly lethal, with up to 94% of attempts being fatal (Krysinska and De Leo, 2008). In Australia, railway suicide represented 3.3% of all suicides in 2011, with the highest rate reported in Victoria (6.6%) (Australian Bureau of Statistics, 2013). Consistent with studies from other countries (Gershon et al., 2008; Rådbo et al., 2005), a report from Victoria shows that the majority of rail-related fatalities are suicides (Wigglesworth et al., 2005).

Previous research on railway suicide has largely focused on its descriptive epidemiology and the identification of individual risk factors (Krysinska and De Leo, 2008; Mishara, 2007; Ratnayake et al., 2007; van Houwelingen and Kerkhof, 2008) and relatively few studies have explored socio-environmental factors (Too et al., 2014). There is strong evidence for the ecological relationship

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between socio-environments and suicide. For example, area-level socioeconomic deprivation including high unemployment and divorce are associated with an increased population risk of suicide (Barth et al., 2011; Rehkopf and Buka, 2006; Taylor et al., 2005). Social fragmentation (i.e. poor community connection) has also been reported as a strong indicator for suicide (Congdon, 2013; Mok et al., 2013). Other socio-environmental predictors include neighborhood violence, alcohol outlet density and the availability of mental health services (Branas et al., 2011; Giotakos et al., 2012; Kennedy et al., 1999). Understanding the impact of the socio-environment on railway suicide is essential as such knowledge is useful to characterize and identify high-risk areas for targeted interventions to prevent railway suicide.

The current study aimed to investigate the ecological associations between railway suicide and a range of neighborhood social, economic and physical determinants. The determinants included social fragmentation, socioeconomic deprivation, train-related factors, and some other socio-environmental factors that have been shown to be linked with suicide. It is possible that individuals at risk of suicide are attracted to reside in an area with particular characteristics (e.g., closer to mental health services or the anonymity of the location). For this reason, this study also sought to determine whether the associations were a product of contextual effects (i.e. the impacts of area characteristics on individuals) or compositional effects (i.e. the concentration of high-risk individuals).

2. Methods

2.1. Study design

This retrospective study used an ecological design, based on postcode-level data from Victoria, Australia. Postcodes are the smallest geographical units for which reliable data were available for all the variables used in this study. The use of this small geographic unit was advantageous as a previous meta-analysis has shown that smaller geographical units (i.e. environment closer to peoples' homes) have stronger impacts on individuals compared with larger geographical units (Meijer et al., 2012).

2.2. Suicide counts

Railway suicide data were obtained from the National Coronial Information System (NCIS). The NCIS is a national internet-based data storage and retrieval system for all deaths investigated by Australian coroners. Data is available for Victoria from 1 July 2000 onwards. It contains coded and free text demographic information such as age, sex, and usual residential address (i.e. the location where the individual usually resided at around the time of suicide and this is also referred as home address), as well as four full text reports generated for each investigation: the summary of circumstances from the Police Report of Death to the Coroner form, autopsy report, toxicology report, and report of coroner's finding. The NCIS offers the best available information on suicide mortality and is regarded as an unbiased source of suicide figures in Australia (Driscoll et al., 2003). Because the suicide data for the most recent years are usually not available in NCIS due to the time required for coronial investigations (De Leo et al., 2010), this study included the period of 2001–2012 for which reliable data are available.

Cases classified as an intentional self-harm by rail vehicle from Victoria, Australia between 1 January 2001 and 31 December 2012 were extracted and reviewed to ensure they were railway suicide cases. These cases were then cross-referenced with railway suicide deaths identified by the Coroners Court of Victoria. Cases were

excluded if they: (1) were still under investigation at 31 October 2014 (when the data were extracted for analysis); (2) had an unknown place of usual residence; (3) had a postcode of usual residence located outside Victoria; or (4) died after being hit by a tram. For cases included, data on age, sex, year of death, usual residential address and suicide location were extracted for each case and used in the analysis.

2.3. Population data

Population estimates for Victorian postcodes were retrieved from the ABS Census, which is conducted every five years (i.e. 2001, 2006 and 2011). Population data based on the 2001 Census were used for railway suicide cases from 2001 to 2003, population data based on the 2006 Census were used for cases from 2004 to 2008, and population data based on the 2011 Census were used for cases from 2009 to 2012.

2.4. Neighborhood-level data

Residential postcodes of railway suicide cases were merged with a range of neighborhood-level variables, which comprise social, economic and physical data. These data were matched with the year of the suicidal event as closely as possible. In particular, access to data related to the railway network was coordinated by the Department of Transport, Planning & Local Infrastructure (State Government Victoria). This data was provided by several key Victorian railway regulators and operators, including Public Transport Victoria, Victrack, Metro trains, and V/Line. Table 1 shows the details of all neighborhood-level variables included in the analysis.

2.5. Statistical analysis

Descriptive analysis was performed to report details of suicide location and its distance from the deceased's home. The distances were estimated using Google Maps application. Because our data displayed evidence of over-dispersion, negative binomial regression models were used to estimate the ecological associations between railway suicide and neighborhood-level social, economic and physical factors, with an offset term for the population size in each postcode. We used robust standard errors (based on postcode) to account for a possible within-postcode correlation in the outcome. All coefficients were exponentiated to interpret these results as incidence rate ratios (IRRs).

Univariate models were first used to assess all variables individually. Variables which were significant in the univariate models were then carried forward and tested in a multivariate model after controlling for the effects of age and sex of the deceased (and their interaction) and other known confounder(s). Compositional effects were also measured in the multivariate model by adding factors related to concentration of individuals at increased risk for suicide (e.g., males and persons aged 15–44 years) (Australian Bureau of Statistics, 2014). All analyses were conducted using Stata SE 13.1 (Stata Corp., College Station, Texas).

2.6. Ethical approval

The study was approved by the Monash University Human Research Ethics Committee and the Justice Human Research Ethics Committee (State Government Victoria).

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