Predictors of using trains as a suicide method: Findings from Victoria, Australia

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ABSTRACT

This study aimed to investigate the factors associated with the choice of trains over other means of suicide. We performed a case-control study using data on all suicides in Victoria, Australia between 2009 and 2012. Cases were those who died by rail suicide and controls were those who died by suicide by any other means. A logistic regression model was used to estimate the association between the choice of trains and a range of individual-level and neighbourhood-level factors. Individuals who were never married had double odds of using trains compared to individuals who were married. Those from areas with a higher proportion of people who travel to work by train also had greater odds of dying by railway suicide compared to those from areas with a relatively lower proportion of people who travel to work by train. Prevention efforts should consider limiting access to the railways and other evidence-based suicide prevention activities.

1. Introduction

In Australia, hanging, poisoning by carbon monoxide, and poisoning by other substances are the most frequently used methods of suicide (Australian Bureau of Statistics, 2014). However, there is variation in the choice of suicide method used across Australia's eight states and territories. For instance, Victoria has the largest proportion of suicides by jumping in front of a train, in the Northern Territory hanging is more common, and in Western Australia poisoning by carbon monoxide is particular prevalent. The current study focused on suicide by train in Victoria, which accounted for approximately 7% of all suicides in the state (Australian Bureau of Statistics, 2014). This proportion was relatively moderate compared to the global proportion of suicide by train which range from 1% to 12% of all suicides (Krysinska and De Leo, 2008; Taylor et al., 2016).

Suicides by train are highly distressing for train drivers and witnesses (Bardon and Mishara, 2015). They can also cause economic losses through the disruption of train services, driver absenteeism, and counseling required for affected individuals (Lukaschek et al., 2011; Mehnert et al., 2012, Silla et al., 2012). Although suicides by train are a prominent problem within the railway sector, there is limited understanding of the factors associated with an individual's decision to use a train as a method of suicide (as opposed to other methods). One study

interviewed railway suicide survivors and found that nearly half chose trains because they knew of someone else who used this method (O'Donnell et al., 1996). The same study found that some survivors also perceived this method as quick, highly lethal, easily accessible and/or widely available. Another study interviewed nine railway suicide survivors and found that the view that jumping in front of a train has a high chance of dying and easy access to trains were their main reasons for choosing trains (Chowdhury et al., 2000). This second point is consistent with a large body of work showing that suicide by particular means is closely linked with the availability of that means (Ajdacic-Gross et al., 2008; Thomas et al., 2011; Yip et al., 2012).

Previous studies comparing suicides by train with suicides by other means have shown, in general, that suicides by train do not differ from suicides by other means in terms of gender, mental health, adverse life events, and socioeconomic status (Emmerson and Cantor, 1993; Abbot et al., 2003; Silla and Luoma, 2012). However, in one study, nearly 40% of those who died by rail suicide were found to have some kind of connection with rail (e.g. living close to a railway line, past experience trespassing on rail tracks); whereas, only 7% suicides by other means had that same relationship (Abbot et al., 2003). There is also evidence that people who died by rail suicide were younger than those who used other suicide means (Emmerson and Cantor, 1993; Silla and Luoma, 2012). Mental health inpatients were more likely to use trains while

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outpatients were more likely to poison themselves to end their own lives (Huisman et al., 2010). Existing literature on suicides by train showed that the majority of the victims were male, young, never married or single, unemployed or not in the labour force, and have been diagnosed with a mental illness and admitted for mental health care (Mishara, 2007; Ratnayake et al., 2007; Krysinska and De Leo, 2008; van Houwelingen and Kerkhof, 2008).

Beyond this much remains largely unknown about why some people choose trains over other methods of suicide. Based on the findings from previous research, we hypothesized that people who died of suicide by train would be different from those who died of suicide by other means on several factors. Those who died of suicide by train would be younger, never married or single, unemployed or not in the labour force, and have a history of mental illness and mental health hospitalisation. We also hypothesized that these people would have easier access to trains. It is less clear what the association would be for other factors.

2. Methods

2.1. Study setting and design

Victoria is the second largest state in Australia. It has a population of approximately 5.7 million people. Most Victorians live in Melbourne, the state's capital with a population of 4.1 million. Melbourne is serviced by a metropolitan railway network consisting of 16 railway lines with 230 railway stations. Seventy percent of people from Melbourne who travel to work by public transport use train services (Bureau of Infrastructure Transport and Regional Economic, 2012). The railway tracks are generally constructed at ground level and contain a large number of level crossings (where the track and road intersect). About 90% of the tracks are unfenced.

We performed a case-control study using four years of coronial data from Victoria. We compared individuals who died by suicide using a train (cases) to those who died from suicide using all other methods (controls) in order to identify factors associated with using a train as a means of suicide.

2.2. Suicide data

We obtained data on deaths classified as intentional self-harm (ICD-10 code X60-X84, World Health Organization, 2010) from the National Coronial Information System (NCIS). The NCIS is a national internet-based data storage and retrieval system of Australian coronial records. For each record, there are four full text reports: (1) the police summary of circumstances; (2) the autopsy report; (3) the toxicology report; and (4) the coroner's findings. Each record also contains coded information such as age, sex, marital status, employment status, date of death, and usual residential address. NCIS is regarded as the primary data source for research in injury and death (Victorian State Government, 2015). It offers much more detailed information than the Australian Bureau of Statistics (ABS) and is regarded as a reliable source of suicide figures in Australia (Driscoll et al., 2003).

To overcome the possibility that cases could be missed because the coroners' investigation was complete but not yet uploaded into NCIS, the Coroners Court of Victoria (CCOV) cross-referenced the records we identified in NCIS with their own records. As a result, an additional 30 cases over the four years (study period) were identified from CCOV and included. These cases tended to be from more recent years.

We categorised suicides coded as X81 or where "rail vehicle" was identified as the object involved in the death as suicides by train and all other suicides as being due to other means, such as suicides by hanging, poisoning, jumping from height, firearm shooting, cutting and so forth.

2.3. Inclusion and exclusion criteria

We included all suicides that occurred from 1 January 2009 to 31 December 2012. We excluded any suicides that were still under investigation by the coroner on the date of data extraction (8 September 2015) (n =21), had no certain year of death (n =14), where the residential address was outside Victoria (n =22), or had missing information on usual residential postcode (e.g. because of no fixed home address) (n =11).

2.4. Exposure variables

We assessed a number of individual variables in relation to using a train as a suicide means. These were age, sex, marital status, employment status, diagnosed mental illness, history of mental health hospitalisation, history of suicide attempt and blood alcohol concentration. We also included a range of neighbourhood variables in the analyses. They were social fragmentation, socioeconomic status, train-related variables, number of assaults, concentration of alcohol outlets, number of mental health services, and area remoteness. Train-related variables were categorised into three domains (e.g., availability of trains, accessibility to trains and familiarity with trains) based on how they are usually classified in the past literature (Too et al., 2014). All variables used to measure familiarity with trains were a proxy because we were not able to directly measure the deceased's familiarity with trains. These variables were selected because they showed some relationships with suicide by train or overall suicide in the existing literature (e.g., most rail suicide victims were male, young, never married, and/or unemployed; social fragmentation has been found as a strong predictor of suicide; neighbourhood socioeconomic deprivation has been associated with an increased risk of suicide in the population) (Kennedy et al., 1999; Taylor et al., 2005; Rehkopf and Buka, 2006; Mishara, 2007; Ratnayake et al., 2007; Krysinska and De Leo, 2008; van Houwelingen and Kerkhof, 2008; Barth et al., 2011; Branas et al., 2011; Giotakos et al., 2012; Congdon, 2013; Mok et al., 2013).

We included neighbourhood variables that were measured at the postcode level. We merged these with the residential postcodes of all suicide cases. Based on the postcode-level data from the 2011 Census, the median population size covered by a postcode was 2660 individuals, ranging from 0 to 77,756 individuals. The median geographical size of a postcode is 81.2 square kilometres (km^2), ranging from 0.2 to 11420 km^2. Table 1 shows the descriptions of all included variables, such as year(s) of availability, operational definition and source. The data of these variables were obtained from the best possible sources. For examples, individual information about deceased from the NCIS and CCOV, social information from the ABS Census, and train-related information from the railway organisations who own and manage the relevant datasets.

2.5. Statistical analysis

Prior to undertaking our analysis we coded several train-related variables using a procedure recommended by Robertson and colleagues (Robertson et al., 1994). These variables typically had values of either zero (representing no exposure) or a positive number (representing, for example, number of trains per day). We therefore entered these variables into the model using two parameters – a parameter to capture the effect when the exposure had a value of zero, and a parameter to capture the same exposure when it has a value greater than zero. This enabled simultaneous estimation of the relationship between the exposure and the outcome when there was no exposure, and estimation of a dose-response relationship between the exposure and the outcome among those who were exposed.

We used logistic regression to examine the effects of individual and neighbourhood variables on individual choice of a train as a suicide method. Our strategy was to fit a series of models to the data. In the first