

# **Vehicular Fatalities: Accident or Suicide?**

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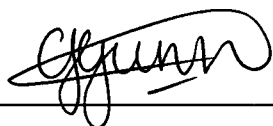
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**STATEMENT OF AUTHENTICITY**

**I declare that this thesis is my own work and that, to the best of my knowledge and belief, it does not contain material from published sources without proper acknowledgment, nor does it contain material which has been accepted for the award of any other higher degree or graduate diploma.**

A handwritten signature in black ink, appearing to read 'C. Gunar', is written over a horizontal line.

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## **Literature Review**

**Vehicular Suicide: Overview and Directions for Future Research**

## **Abstract**

Suicide remains a significant public health problem, and a manner of death which is often misclassified by coroners. There are no standardised criteria for coroners to assist with manner of death determination, and the decisions as to which deaths are attributed to be suicides are often complex, and vary both between individual coroners, and coronial jurisdictions. Despite the variety of available means of suicide completion, only a few methods are commonly used (e.g., overdose, hanging). Often overlooked as a means of suicide is the fatal single-vehicle crash. A motor vehicle presents an ideal means of suicide, due to ease of access, frequency of use, inherent risks involved, and the ability to conceal one's suicidal intent from others. Previous research has suggested that suicide by motor vehicle crash may be attributed to between 1.5% and 5.0% of all vehicular fatalities, but some motor vehicle fatalities are misclassified as accidents, with the true rate of suicide by motor vehicle crash unknown. Suicide prevention strategies have had limited success in reducing the rates of suicide by restricting the availability of access to means of suicide completion. Suicide by motor vehicle crash does not allow for this method of suicide prevention to be implemented, therefore further research is required to not only determine a more accurate account of the number of suicides by motor vehicle crash, but also to establish strategies to prevent suicide by motor vehicle crash and to clarify the parameters by which coroners determine an individual's manner of death.



## **Vehicular Suicide: Overview and Directions for Future Research**

*For in that sleep of death, what dreams may come*

- William Shakespeare, *Hamlet, Act III, Sc 1*

### **Suicide: Historical representations**

For many centuries suicide was condemned as an act of moral turpitude, one which could result in punishment even after death (Massello, 1986). In the middle ages, individuals who committed suicide were denied burial in consecrated ground, and often their bodies were desecrated after death; dragged to the gallows to be hung, burned, hung by chains and left to rot. It was thought that such treatment would prevent the spirit of the deceased from haunting the living (Stauffer, 2004; Richardson & Breyfogle, 1946).

During the Renaissance, philosophers began to question the rationality behinds acts of suicide, and the notion that *melancholia* may be a cause of suicide became prominent. A term reportedly first used by Hippocrates, melancholia was used to describe an affective state which would now be termed depression (Stauffer, 2004). Throughout the Enlightenment, philosophical debate questioned whether suicide was a natural phenomenon. The philosopher Hume suggested that it was the individual's right to choose death when life was unbearable, whether it be due to illness, poverty, or the result of social ills (Stauffer, 2004).

The advent, and pursuit, of scientific investigation, during the 17<sup>th</sup> century, placed an emphasis on discovering the truth in nature through logic, empirical

methods and deductions based on observable phenomena (Stauffer, 2004). Such measures led to suicide being studied as a single entity. The first major contribution to the study of the social and cultural influences on suicide was made towards the end of the 19<sup>th</sup> century by Émile Durkheim in his work *Le Suicide* (Sadock & Sadock, 2003). Durkheim maintained that suicide resulted from a conflict between the individual and society; either from being disconnected from society and essentially isolated, being over-connected with society, or from a disturbed connection with society which would prevent one from following the customary norms of behaviour (Sadock & Sadock, 2003; Stauffer, 2004; Pope, 1976).

Contemporary views of suicide suggest that suicide represents the sequelae or complications of various other conditions, with the majority of suicides being secondary to these conditions (Miles, 1977). Suicidologist, Edwin Shneidman proposed that suicide was a conscious act of self-annihilation, best understood as a multidimensional problem in an individual for whom suicide was perceived to be the most appropriate solution (Pompili, Girardi, Tatarelli & Tatarelli, 2006). Shneidman also suggested that suicide was not always a movement towards death, but rather a movement away from intolerable emotion, unendurable pain, or unacceptable anguish. Such a suggestion mirrors the philosophy of Hume, and lends itself to the suggestion that if one was to reduce the individual's suffering that they would then choose to live (Pompili et al., 2006). Current public health policies have therefore been introduced with the aim of lessening the suffering of individuals, by providing assistance with substance addictions, mental illness and straitened social circumstances, with the aim of reducing the suicide rate of individuals within these groups (Stauffer, 2004).

Despite many years of research into the rationale and causes of suicide, the act continues to carry a stigma in society, and many people still hold the view that suicide is morally wrong (Cholbi, 2007). Suicide remains a critical public health priority, and a manner of death particularly subject to inaccurate determination by coroners (Shen, Hackworth, McCabe, Lovett, Aumage, O'Neil & Bull, 2006; Rosenberg, Davidson, Smith, Berman, Buzbee, Gantner, Gay, Moore-Lewis, Mills, Murray O'Carroll, & Jobes, 1988).

### **Determination of manner of death**

In Australia any equivocal, or unexplained, death is typically investigated by a coroner. The coroner must form an impartial opinion as to the manner of death. Manner of death is typically categorised by the coroner as a natural death, an accidental death, suicide, or homicide. In some cases the coroner will choose to return an open finding when manner of death cannot be clearly determined. The coroners' determinations are based solely upon the evidence presented to them concerning the individual's death, such that it may be stated upon the death certificate (Massello, 1986). Such information typically provides the coroner with an insight into the individual's manner of death. Whilst the physical cause of death (e.g., drug overdose) explains how the individual actually died, the manner of death, or the circumstances that lead to the cause of death, often remain unclear (Scott, Swartz & Warburton, 2006). In 5% to 20% of cases reviewed by coroners, the manner of death is often ambiguous (Scott et al., 2006). Unfortunately, there is not a standardised set of criteria used by coroners to determine the manner of death, and there are likely more 'missed' suicide deaths than deaths of other causes miscounted as suicides, as the decisions as to which deaths are attributed to be suicides is a

difficult and complex one (Rosenberg et al., 1988; Pokorny, Smith & Finch, 1972; Pearson, Caine, Lindesay, Conwell & Clark, 1999).

### ***NASH principle***

Death is often classified by coroners according to the acronym *NASH*, which stands for natural, accident, suicide or homicide (Scott et al., 2006; Richardson & Breyfogle, 1946; Rosenberg et al., 1988).

Determinations of a 'natural' cause of death typically relate to a disease process which is known to have a fatal outcome (Farmer, 1979). Accidental injuries which result in death may or may not be self-inflicted. It is therefore important that the coroner or medical examiner ascertain whether the injuries which resulted in death were indeed self-inflicted, and whether the deceased intended for the action to end his or her life (Richardson & Breyfogle, 1946). Pathological information gathered at an autopsy is utilised to indicate the probability of a particular fatal injury being self-inflicted (Rosenberg et al., 1988). In rare cases, death may have resulted from a homicide, but might, at first glance, appear as an accident or suicide (MacDonald, 1964). A coronial examination into the circumstances surrounding the death is therefore essential, and the evidence upon which the opinion of manner of death is based must meet the standard of proof required by a court of law (Massello, 1986).

Perhaps the most contentious manner of death for coroners to determine is that of suicide. Historically, coronial courts have determined that self-destruction runs counter to an individual's natural instincts, leading to an underlying presumption that suicide goes against one's own nature, thus leading one to question

whether the actions carried out by the deceased were undertaken with the explicit understanding and comprehension that there was a high probability of death (Massello, 1986). The two main criteria which must be satisfied for a determination of suicide to be made are: whether the action was self-inflicted and whether or not the deceased intended to die as a result of that act (Allen, 2000; Cholbi, 2007; Jobes, Casey, Berman & Wright, 1991; Litman, Curphey, Shneidman, Farberow & Tabachnick, 1963). While this may be the case, other criteria used to determine suicide may vary both between jurisdictions as well as between coroners (Jobes et al., 1991). Some coroners may require a suicide note or statement to family or friends, for a determination of suicide to be made (Rosenberg et al., 1988). For others, a collection of implicit or circumstantial evidence may indicate that the decedent not only undertook the action which lead to their death, but did so intending for that to be the outcome (Rosenberg et al., 1988).

Certain methods of death are, however, more likely to receive a determination of suicide over others. Causes of death where suicidal intent can be more readily inferred, such as hanging, asphyxia by plastic bag, lacerations or firearms, are more likely to be classed as suicides than causes in which accidental death may be just as probable, such as drowning, poisoning, burning or vehicular fatalities (Marzuk, Leon, Tardiff, Morgan, Stajic & Mann, 1992). Such deaths are termed 'equivocal suicides', where suicide is a possible manner of death, but there may also be other interpretations of the circumstances which lead to the individual's demise (Litman et al., 1963).

A number of investigative strategies are utilised by coroners to determine the manner of death in equivocal cases. A helpful criterion for determining the manner of death in an equivocal suicide is examining whether the deceased was following

his or her usual lifestyle during the period preceding his or her death. If death followed or resulted from a significant alteration in the deceased's lifestyle, then the chance that the death was a suicide increases (Imajo, 1983). Uncertainty about the most appropriate determination of manner of death also arises when the victim's intention behind their actions is ambiguous, with co-existing wishes to both live and die, or when the self-destructive action is in itself inconclusive, or when death follows after a considerable delay (Litman et al., 1963). Unfortunately, due to variability and error in manner of death determination, there are more likely to be 'missed' suicide deaths, than deaths of other modes misconstrued as suicides (Pearson et al., 1999).

### **Suicide nomenclature**

There has been great debate about the nomenclature and classification of suicidal acts. Suicidal behaviour has often been conceptualised as existing along a continuum of self-harm on which completed suicide is deemed to be the final, and most severe, end point (Muehlenkamp & Gutierrez, 2007). Research has noted a range of behaviours found between thinking about suicide and acting upon those thoughts (Sadock & Sadock, 2003). To this day, however, there is no generally accepted classification for the range of suicide related behaviours (O'Carroll, Berman, Maris, Moscicki, Tanney & Silverman, 1996). There are, however, some commonly utilised definitions found within the suicide literature.

### ***Completed suicide***

Completed suicide refers to death resulting from a self-inflicted, intentional action designed to end one's life (Stauffer, 2004; O'Carroll et al., 1996). For a fatal action to be deemed a suicide it must have been self-inflicted, and also must have been conducted with the individual's intention being to end his or her own life (Jobes et al., 1991; Litman et al., 1963). The advantage of this definition for suicide is that it enables the distinction between suicide, as an intended lethal action, and a fatality where the death is genuinely accidental, in that the individual acted in a manner in which the prospect of his or her own death played no part (Cholbi, 2007).

### ***Suicide attempt/para-suicide***

Suicide attempt typically refers to a non-fatal action, where there is evidence, either implicit or explicit, that the injury was self-inflicted and that the individual intended, at some level, to kill themselves (Stauffer, 2004; O'Carroll et al., 1996). Females are more prone to attempt suicide than males, usually in the context of a recent stressful life event, such as a relationship breakdown (Klerman, 1987). Such attempts are usually the result of impulsive behaviour, and are typically of low-lethality (Klerman, 1987). Research has suggested, however, that some individuals who attempt suicide have mis-judged the lethality of their chosen action, suggesting that a suicide attempt is merely a failure of completion (Peck & Warner, 1995; Stauffer, 2004). While this may be the case, it has been suggested that suicide attempts and suicide completion are related, but not identical, behaviours, with some notable differences in the populations of attempters and completers (Dervic, Grunebaum, Burke, Mann & Oquendo, 2007; Miles, 1977). Research has indicated

that age is one of the most significant factors differentiating suicide attempters from completers. The incidence of attempted suicide is highest amongst young people, and completed suicide is highest amongst the elderly (Merrill & Owens, 1990).

Ambivalent life-threatening gestures, where the individual appears to have little regard for the outcome of their actions, have been termed in the research as “para-suicides” (Stauffer, 2004). Such actions are undertaken not with the purpose of causing one’s death, but rather as a means of expressing anguish and pain, in the hope of receiving aid, comfort or rescue (Cholbi, 2007). Research has indicated that para-suicides have been noted to be more common amongst people who have a greater degree of social integration, namely the young, females and the lower classes (Peck & Warner, 1995). While this may be the case, both those who attempt suicide, and those who engage in para-suicide behaviours, pose a particular concern for health-care professionals, due to their increased rate of future suicidal behaviour (Petrie & Brook, 1992; Diesenhammer, Huber, Kemmler, Weiss & Hinterhuber, 2007; Beautrais, 2003).

### ***Suicidal behaviours and gestures***

Suicidal behaviours refer to all behaviours that represent a person’s intent to commit suicide, or his or her desire to appear as if suicide was intended (O’Carroll et al., 1996; Stauffer, 2004). Such actions, or gestures, are designed to give the appearance of intended self-harm, but lack any real intention to do so (Stauffer, 2004). Often the appearance of the action is utilised by the individual in order to attain some other end, such as to seek help, to punish others, or to receive attention



(O'Carroll et al., 1996). Unfortunately, often a suicidal gesture is made, but the outcome is the unintended death of the individual (Stauffer, 2004).

Other behaviours of concern include suicidal threats and ideation. Suicide threats refer to any interpersonal action, either verbal or non-verbal, without concurrent physical harm, which imply that the person has the intention of engaging in a suicidal behaviour in the near future (Stauffer, 2004; O'Carroll et al., 1996). Suicidal ideation, on the other hand, refers to self-reported thoughts of engaging in suicidal behaviour (O'Carroll et al., 1996; Stauffer, 2004). Such ideation may be persistent and enduring, or it may be transient (Stauffer, 2004).

### ***Self-harm***

Research has suggested that individuals who engage in non-suicidal self-injury, or acts of self-harm, are at an increased risk of future suicidal behaviours and completed suicide (Muehlenkamp & Gutierrez, 2007). Females are almost three times as likely as males to engage in self-harming behaviour (Sadock & Sadock, 2003). Harm usually takes the form of cuts made to the wrists, arms, legs and thighs, using a razor blade, knife, broken glass or mirror (Sadock & Sadock, 2003). Research has documented that childhood sexual abuse, depression, familial or interpersonal conflict, isolation or loneliness, impulsivity, Borderline Personality Disorder, and psychiatric illness are common risk factors for both self-harm and suicidal behaviours (Muehlenkamp & Gutierrez, 2007). Individuals who engage in self-harming behaviours may do so for a variety of reasons, with most claiming no experience of pain during the act. Common motivations for self-harm include anger directed towards the self or others, relief of tension, and a wish to die (Sadock &

Sadock, 2003). It is thought that participation in acts of self-harm desensitises an individual, such that they become habituated to fears and the physical pain associated with self-injury, and are thus may become more readily involved in potentially lethal suicidal behaviours (Muehlenkamp & Guitierrez, 2007).

### **Risk factors for suicide**

Suicide is often viewed as a response to a single stressful event, however it more often results from complex interactions between a number of different factors (Shen et al., 2006). An acute suicidal episode is often superimposed upon pre-existing or concurrent genetic and environmental factors, as well as prevailing psychosocial or circumstantial factors at the time of the final act (Klerman, 1987; Pirkola, Isometsä, & Lönnqvist, 2003). Some suicides are committed where the motivation behind the act is never discovered, others occur not for any deep-seated or long-existing reason, but rather occur on sudden impulse, under the influence of disinhibiting substances (Richardson & Breyfogle, 1946). In order to establish effective suicide prevention policies, it is important to know the etiological factors and causal relationships between suicide and modifiable individual behaviours (Shen et al., 2006; Klerman, 1987). A risk factor is defined as the association between some characteristic or attribute of the individual, group or the environment, and an increased probability of a particular disease or disease related phenomenon (Klerman, 1987). A number of high-risk background factors have been identified through suicide research, yet even amongst “high risk” groups, such as those with psychiatric illness, only a minority commit suicide (Petrie & Brook, 1992; Allen,

2000). Psychiatric, socioeconomic and affective factors have all been found to contribute to increased suicide risk (Allen, 2000).

### ***Psychiatric illness***

Perhaps the most important risk factor for suicide is the presence of a diagnosable psychiatric illness. Research has indicated that over 90% of individuals who commit suicide have some form of psychiatric illness (Deisenhammer et al., 2007; Goldstein, Black, Nasrallah & Winokur, 1991). Three psychiatric diagnoses have been noted to have a greater association with rates of suicide. These diagnoses include affective disorder, particularly bipolar disorder and recurrent unipolar depression; schizophrenia; and alcoholism (Klerman, 1987; Mittendorfer-Rutz, 2006; Miles, 1977). It has been noted that destructive ideas or impulses which may be ordinarily well controlled during the clinical course of these illnesses may be exacerbated by emotional stress, physical exhaustion or excessive alcohol use (Litman et al., 1963; Klerman, 1987).

Depression is one of the major risk factors for suicide morbidity and mortality. Research has suggested that around 30% of suicide completers are reported to be suffering from a mood disorder at the time of their suicide (Mittendorfer-Rutz, 2006). However, although depressive symptoms are a key feature in almost all suicides, of equal importance, especially with regard to suicidal intent, are feelings of hopelessness, despair, pessimism and helplessness (Klerman, 1987). It is of particular note that there is often a period of quiescence, or an improvement in an individual's depressive state, however this may also arise as a

reflection of the individual's decision to resolve an intense internal conflict by committing suicide (Klerman, 1987).

### ***Previous suicide attempt***

Previous research has consistently indicated that suicide attempts are a predictor of future completed suicides, with those who attempt suicide having a 0.5% to 2.0% increase in their risk of suicide within one year of their attempt (Diesenhammer et al., 2007; Beautrais, 2003). Research has also suggested that it is not only a history of suicide attempts which increases one's future risk of suicide, but also the number of attempts which have occurred, as the risk of future suicide completion increases with each subsequent attempt (Goldstein et al., 1991). Consequently, given that a previous suicide attempt predicts later suicide completion, studies of suicide attempters provide a useful insight into the risk factors and motivations of those who commit suicide (Allen, 2000).

### ***Substance use***

Research has regularly shown that individuals who abuse alcohol and other drugs are at an increased risk of committing suicide (Sadock & Sadock, 2003). Alcoholism is typically defined as excessive consumption of alcohol, with a corresponding decline in one's physical health, as well as an inability to fulfil one's social role (Miles, 1977; Selzer, 1969). Research has indicated that many alcohol dependent suicide completers have a concurrent mood disorder at the time of their suicide (Sadock & Sadock, 2003). It has also been reported that as many as 50% of alcohol dependent individuals who commit suicide have suffered the loss of a close

interpersonal relationship in the year prior to their suicide (Sadock & Sadock, 2003; Duberstein, Conwell & Caine, 1993). Such interpersonal losses, and other undesirable life events, such as unemployment, financial difficulties, interpersonal conflict, medical and legal issues, are typically brought about by the individual's alcohol dependence, and contribute significantly to concurrent mood disorder issues (Sadock & Sadock, 2003). Alcoholism may account for some of the gender difference seen in suicide completion, as about 80% of alcohol dependent suicide completers are male (Klerman, 1987; Sadock & Sadock, 2003).

Previous research has also suggested that there is an increased risk of suicide amongst the population who abuse drugs other than alcohol (Sadock & Sadock, 2003). For example, it has been reported that the suicide rate for intravenous heroin users is 20 times greater than the general population (Sadock & Sadock, 2003). It is thought a rise in drug abuse with increases in the prevalence of mood disorders has prompted a significant increase in youth suicide in recent decades (Klerman, 1987). The availability of lethal amounts of substances, intravenous use, associated antisocial personality traits, a chaotic lifestyle, and impulsivity are some of the key factors that predispose substance dependent individuals to engage in suicidal behaviour, especially during periods when they may be intoxicated and depressed (Sadock & Sadock, 2003).

### ***Social circumstance***

In addition to psychiatric illness, many social factors increase an individual's risk of suicide. These factors include unemployment, physical illness, marital

breakdown, legal issues, lack of social support and sudden changes in status (Allen, 2000; Klerman, 1987).

There is strong evidence to suggest that marriage and children, especially for men, act as a protective factor against suicide (Klerman, 1987; Sadock & Sadock, 2003). Individuals who have never married, or who are divorced, separated or widowed are more prone to suicide, especially if there is a co-existing mood disorder or other psychiatric illness (Klerman, 1987). Suicide occurs more frequently in individuals who are socially isolated, and is also more common in those who have a family history of suicide (Sadock & Sadock, 2003; Klerman, 1987). An increased risk of suicide occurs for such individuals around the anniversaries of the deaths of the individual's family, especially those of spouses or fathers (Imajo, 1983; Sadock & Sadock, 2003).

Changes in status, especially due to unemployment or undesired retirement, have been associated with an increase in suicide risk (Mittendorfer-Rutz, 2006). Research has indicated that men identify social position as being more dependent upon a particular working role than do women, such that unexpectedly losing a job appears to have a greater psychological and emotional impact upon males over their female counterparts (Mittendorfer-Rutz, 2006). Research has noted that the higher a person's social status, the greater the risk of suicide, yet a fall in status will also increase an individual's risk (Sadock & Sadock, 2003). Individuals in certain professions may also be at an increased risk of suicide, including physicians, musicians, psychiatrists, dentists, law enforcement officers, lawyers and insurance agents (Sadock & Sadock, 2003). The suicide rate has been noted to increase during

times of economic recession or depression, and high unemployment, and decrease during times of low unemployment and during wars (Sadock & Sadock, 2003).

### *Age*

Within countries which regularly gather statistics on suicide, nearly all report that rates of suicide rise with age, with the greatest proportion of suicides occurring in men aged over 75 years (Pearson et al., 1999; Sadock & Sadock, 2003). Research has indicated that older persons attempt suicide less often than younger persons, but have a higher rate of suicide completion than their younger counterparts (Sadock & Sadock, 2003; Pearson et al., 1999). For 10% of the population, elderly persons account for 25% of suicides (Sadock & Sadock, 2003). Elderly attempters are more likely to warn those around them of their impending actions, and are more likely to contemplate suicide over a period of weeks or months, while also being less likely to engage in behaviour designed to facilitate rescue once the attempt has been initiated (Frierson, 1991). Seriousness of intent, greater premeditation, ongoing medical problems, solitary living that delays discovery, and organic brain syndromes that impair judgement have all been postulated as contributing factors for older age suicide (Frierson, 1991).

In contrast to the high degree of suicide completion amongst the elderly, young adults have a much higher rate of attempted suicide (Pearson et al., 1999). Since the mid 1970s the rate of suicide for 15 to 24 year olds has risen dramatically, with suicide being the third leading cause of death for this age group (Sadock & Sadock, 2003; Cantor & Baume, 1998b; Apter, Bleich, King, Krong, Fluch, Kotler & Cohen, 1993). In Australia, suicide has now been identified as the leading cause of

death for men and women aged 15 to 34 and remains the leading cause of death for men through to the age of 44 (Lifeline, 2009). Unfortunately, there has been no clear explanation for this increase in youth suicide. It is possible that due to the work of national mental health organisations there is an increased recognition of the risk factors for suicide, the knowledge of which may have lead to an increase in the number of reported suicides, especially for young adults. Research has suggested that the bulk of the rise in suicide rates for young adults, and especially for males, may be attributed to increased substance use, increased availability of means of suicide, such as firearms, and increased vulnerability due to rapid social changes (Gould & Kramer, 2001; Mittendorfer-Rutz, 2006).

### ***Impulsivity***

For a determination of suicide to be made, it must first be established that the death was not only self-inflicted, but that it was also intentional (Rosenberg et al., 1988). One of the key factors in determining both self-infliction and intention is examining the degree of impulsivity within the fatal action. Definitions of impulsivity within the literature are, however, many and varied. Impulsive suicides may be defined as those which occur after only a short period of premeditation. Others regard impulsivity in terms of the degree of preparation made for the attempt (Baca-García, Diaz-Sastre, Basurte, Prieto, Ceverino, Saiz-Ruiz & de Leon, 2001). Research has indicated that females are more likely to make impulsive suicide attempts, most commonly after a significant frustration in an interpersonal relationship (Klerman, 1987). These attempts are, typically, of low lethality, such as the ingestion of pills or superficial wrist lacerations (Klerman, 1987). Research has also indicated that while impulsivity is a major risk factor in suicidal behaviour, impulsive suicides tend to be less lethal than non-impulsive attempts, and often



alcohol and other substances are used to facilitate the attempt (Baca-García et al., 2001).

### **Suicide statistics**

Suicide is one of the leading causes of violent death in Australia, with more deaths attributed to acts of deliberate self-destruction than to either homicide or motor vehicle fatalities (Byard & James, 2001). Rates of suicide and self-harm, however, are not static, and have in fact increased in recent years (Merrill & Owens, 1991). In 2007 in Australia, 1,881 deaths were a direct result of intentional self-harm, representing 1.4% of all deaths registered for that year (Australian Bureau of Statistics, 2009). Research has indicated that completed suicide is four times more common in males than in females, yet females typically attempt suicide at a rate that is three times that of men (Allen, 2000; Shen et al., 2006; Mittendorfer-Rutz, 2006).

Suicide was ranked as the 15<sup>th</sup> leading overall cause of death in Australia in 2007 (Australian Bureau of Statistics, 2009), yet a recent finding by mental health organisation Lifeline has placed suicide as the leading cause of death for men and women aged between 15 and 34, as of 2009 (Lifeline, 2009). Intentional self-destruction has been noted to be the 10<sup>th</sup> leading cause of death for males, who account for three quarters of all suicides (Australian Bureau of Statistics, 2009). In Australia in 2007, the median age of death by suicide was 42.5 years (males 41.7 years, females 44.5 years), yet the highest age-specific suicide rate for males was for those aged over 85, with 23 suicides per 100,000 population (Australian Bureau of Statistics, 2009). While this may be the case, suicide represented a very small proportion (0.2%) of all deaths for this age bracket, due primarily to the greater

proportion of death by natural causes seen in individuals of increased age (Australian Bureau of Statistics, 2009). Suicides made up a significant proportion of all deaths in males aged 15 to 24, with 12.5 suicide deaths per 100,000 population, accounting for 20.2% of deaths for this age cohort (Australian Bureau of Statistics, 2009). The most common method of suicide completion in 2007 was by hanging, which accounted for 54% of suicides, followed by self-poisoning by drugs, and poisoning by other methods including motor vehicle exhaust, which accounted for an additional 12% each of all suicide methods chosen (Australian Bureau of Statistics, 2009). Firearms were the method chosen in 8.9% of all suicide deaths in 2007 (Australian Bureau of Statistics, 2009).

The sum of all death certificates filed becomes the primary data source for mortality statistics (Rosenberg et al., 1988). These data not only affect the directions of new research for treatment for suicidal individuals, but also the flow of resources and public health policies created to combat the more common causes of death (Rosenberg et al., 1988). Consequently, it is of vital importance that each death certificate not only has the correct cause of death, but also the correct manner of death, whether it be natural, accident, suicide or homicide. The degree to which suicide is underreported, or misclassified, is unknown (Rosenberg et al., 1988). A primary source for the variability and error in suicide statistics may be attributed to the lack of standardised operation criteria for manner of death determination (Jobes et al., 1991; Mittendorfer-Rutz, 2006). Inconsistent reporting procedures to coroners (i.e., a lack of standardisation in the way investigative officers present evidence to the coroner) also contribute to this problem. Consequently, while some deaths are more readily identified as suicides than others, it is almost impossible to ascertain the exact number of suicide deaths each year (Rosenberg et al., 1988).

## **Means of suicide completion**

Despite the many potential means of suicide completion, only very few are commonly used. In developed countries these methods typically include self-poisoning by drugs, domestic gas or motor-vehicle exhaust emissions; hanging; firearms; cutting and piercing; drowning; jumping from high places; and jumping or lying in front of moving vehicles (Cantor & Baume, 1998a). An individual's choice of suicide method tends to be highly culturally specific, and is influenced by a complex constellation of social, cultural, psychological and physical factors, all of which may precede the individual's decision to end his or her life (Beautrais, 2000; Cantor & Baume, 1998a). Methods of suicide have been shown to differ depending upon the age of the individual, with accessibility to means of suicide and comprehension of the lethal outcomes of a particular method, being significant factors (Byard & James, 2001). Previous research has suggested that the choice of method of suicide is not likely to be random, however the factors influencing suicide mortality by one method may differ from those influencing mortality by another (Cantor & Baume, 1998a; Farmer, 1979; Pirkola et al., 2003).

## ***Availability of means of suicide***

Methods of suicide and overall suicide rates fluctuate in a dynamic, changing scenario (Cantor & Baume, 1998a). Physical availability of a particular method of suicide is an important determinant of method choice. Physical availability refers to the extent to which a particular agent of suicide is accessible to the individual (Cantor & Baume, 1998a). An association between the availability of means and the suicide mortality rate has historically been shown for only three methods: domestic

coal gas, barbiturate poisoning and firearms (Marzuk et al., 1992). Research has indicated that the detoxification of the domestic gas supply in England and Wales during the 1970s dramatically reduced the number of suicides by that method; however there was no subsequent reduction in the overall suicide rate (Lester, 1998). Increased restrictions on firearm ownership and registration, and tighter regulations concerning the packaging and prescription of certain medications have also prompted reductions in suicide by these specific methods, but there has, unfortunately, not been a corresponding reduction in overall suicide rates (Lester, 1998).

One approach taken by many suicide prevention strategies is to restrict the access the individual has to means of suicide completion (Beautrais, 2000; Isacson, 2000; Marzuk et al, 1992). The idea that suicides may be prevented by restricting the access an individual has to a particular method of suicide is intuitively appealing (Beautrais, 2000). Previous research has indicated that many commonly utilised methods of suicide are difficult to limit or restrict, however when restrictions are put into place, there is a reduction in the number of impulsive suicides committed using that particular method (Beautrais, 2000; Marzuk et al., 1992). One school of thoughts posits that the restriction of availability of a particular method will not only result in a reduction of suicides by that method, but that there will also be an overall reduction in the suicide rate (Cantor & Baume, 1998a; Marzuk et al., 1992; Beautrais, 2000). A second hypothesis suggests that if a means of suicide becomes unavailable, there will be a compensatory shift to other methods, with no overall decrease in mortality rates (Marzuk et al., 1992; Beautrais, 2000; Pirkola et al., 2003). While these two theories have gained prominence in the suicide literature, it would be erroneous to suggest that societies respond uniformly to changes in the availability of different methods of

suicide (Cantor & Baume, 1998a). The choice of method, and consequently the rate of suicide, varies widely according to age, sex, race, geography and the urban or rural nature of the population (Richardson & Breyfogle, 1946; Cantor & Baume, 1998a). Method choices in suicide behaviour tend to be highly culturally specific, and effective strategies used in one context to restrict the availability of suicide methods may be ineffective in others (Beautrais, 2000).

### ***Lethality of means***

Previous research has indicated that many suicide completers will choose a time and place to commit their act when they know their attempt will not be stopped, or where the deed will not be discovered until such time that any attempt to save them will fail (Richardson & Breyfogle, 1946). The suicide method chosen by the individual may vary in terms of the ‘lethality’, or the probability of death resulting from the action taken (Cantor & Baume, 1998a). Previous research has investigated the availability of lethal methods and suicide mortality rates, often classifying methods on the basis of their ‘activity’, such as firearms, or their ‘passivity’, such as self-poisoning with sedatives (Marzuk et al., 1992). More immediate and violent methods, those classed as being ‘active’ present little scope for intervention and possible rescue between the suicide action and death, and are more commonly utilised by males, which may partially account for the higher suicide completion rate for males compared to females (Cantor & Baume, 1998a; Mittendorfer-Rutz, 2006).

Research has also indicated that individuals who attempt suicide on more than one occasion often increase the lethality of the means by which they commit suicide (Beautrais, 2003). For example, Beautrais (2003) found that of 16 suicide

attempts, 11 made their initial attempt by self-poisoning, of which only two were fatal. The remaining nine individuals who used this method in their initial attempt increased the lethality of their means of suicide in subsequent attempts, by using more active means, such as vehicle exhaust gas or hanging, which ultimately resulted in their deaths. This research suggested that individuals learn about the lethality of different methods of suicide from failed attempts, and that those with a greater suicidal intent will alter their method to one more likely to result in suicide completion (Beautrais, 2003).

### **Intent**

Most philosophical analyses of suicide recognise that the crucial factor in ascertaining whether a person's death should count as a suicide is not whether the person caused his or her own death, but whether it was intended that the actions would cause death (Cholbi, 2007). Many suicidal behaviours exhibit features that fall short of intentional self-killing, but are none the less not genuinely accidental (Cholbi, 2007). Previous research has argued that a suicide implies the direct connection between the intention of the deceased and his or her self-destructive action and the subsequent death (Pompili et al., 2006). This is what many label as the deceased's *intent* to die.

It is recognised that people often intentionally destroy themselves. There is, however, an underlying presumption in society that suicide is an act which runs counter to an individual's natural instincts (Massello, 1986). Consequently, when suicide is suspected as the manner of death, the certification of death often requires a painstaking evaluative judgement of the deceased's intention in carrying out the act

(Litman et al., 1963). Intent, in this context, refers to both explicit verbal and non-verbal expressions of a desire to kill oneself, as well as implicit evidence of a wish to die (Rosenberg et al., 1988). Implicit evidence of an intent to die may include: preparations of death inappropriate to or unexpected in the context of the decedent's life; expressions of farewell; acknowledgements of impending death; expressions of hopelessness, great physical pain, or distress; efforts to procure or learn about means of death; precautions to avoid rescue; or evidence that the decedent recognised the high lethality of a particular action (Rosenberg et al., 1988).

### *Assessment of intent*

If an act of self-killing is to be called a suicide, it must be shown that it was done intentionally. In the absence of any explicit declaration prior to the suicidal action, intent must be inferred from the circumstances surrounding the death (Massello, 1986). Ultimately, intent requires that the decedent knew, or had in mind, that a specific act would probably result in death (Rosenberg et al., 1988). Proving intent in the majority of cases, where no note is left or communication is made, is difficult (Allen, 2000; Massello, 1986). Uncertainty about the correct certification of death is accentuated when the victim's intention is ambivalent, with co-existing wishes to both live and die, when the self-destructive action is in itself inconclusive, or when death follows after a considerable delay (Litman et al., 1963; Pompili et al., 2006). Consequently, it is important for the coroner or medical examiner to determine the likelihood or unlikelihood that the suicidal act was intentional, by examining the circumstances around the suicidal action, and whether the individual had the mental capacity to both form and carry out their intended self-destructive action (Richardson & Breyfogle, 1946; Rosenberg et al., 1988).

Some types of evidence may suggest that a death resulted from unintended or accidental injuries, despite the appearance of a self-inflicted intentional act (Rosenberg et al., 1988). Evidence may suggest that the decedent intended to live, they may have had a history of risk-taking behaviour, carelessness, poor judgement, or previous unintentional injuries similar to the fatal one (Rosenberg et al., 1988). Research has indicated that high risk behaviours are often regarded as indirect, or implicit, self-destructive behaviours, distinguishable from overt acts of self-destruction by the criteria of time and awareness (Pompili et al., 2006). The effect of such behaviour is usually long-term, and the individual may not be aware of, or care about, the possible fatal outcome of their actions (Pompili et al., 2006). This unconscious intention, in the guise of engaging in repeated high-risk fatalistic behaviours, represents one aspect of a non-suicidal route to self-destruction (Peck & Warner, 1995).

### **Vehicular fatalities**

In many industrialised countries motor vehicles are among the leading causes of death for individuals aged under 35, and are a particularly important source of injury especially for young men (Dumais, Lesage, Boyer, Lalovic, Chawky, Ménard-Buteau, Kim & Turecki, 2005). Many motor vehicle accidents are not, as the term may imply, simply a function of chance, although chance may play a role at times. Accidents rather, are more likely to be the result of a complex interaction of many variables, not only concerning the vehicle being driven and the road and weather conditions, but most importantly, the circumstances surrounding the drivers themselves (Conger, 1960). Research concerning vehicular fatalities has suggested that when, for any reason, an individual is more self-centred and indifferent to



others, when they are tense, anxious or angry, when they are preoccupied by worries, are tired or sick, they are more likely to violate standards of road safety, thus increasing their risk of engaging in a vehicular crash. (Conger, 1960).

There is significant concern in the elevated rate of motor vehicle fatalities amongst individuals who have previously attempted suicide (Beautrais, 2003). It has been suggested that some individuals with self-destructive impulses may attempt to injure or destroy themselves using an automobile as a means to that end (Pompili et al., 2006). These findings may indicate that some vehicular fatalities are not the accidents they appear to be at first glance, but are rather, suicides completed by way of a motor vehicle crash (Beautrais, 2003).

### ***Motor vehicle fatality statistics***

As noted above, motor vehicle fatalities account for a significant proportion of deaths in industrialised countries throughout the world. In Australia in particular, the most recent statistics on transport related fatalities indicated 1,361 deaths by this method in 2007, a rate of 1.0% of all deaths for that year (Australian Bureau of Statistics, 2009). Overall, transport related deaths were ranked as the 20<sup>th</sup> leading cause of death in Australia in 2007 (Australian Bureau of Statistics, 2009). Over three times as many males were killed in transport related deaths than females in 2007, with 1.4% of all male deaths attributed to this cause, compared to 0.5% of all female deaths (Australian Bureau of Statistics, 2009). Of all male deaths attributed to external causes, 20% were as a direct result of transport fatalities, the predominant age group for which was 15 to 44 years (Australian Bureau of Statistics, 2009). Overall, 298 persons (213 males and 85 females) were killed as an occupant of a car

which engaged in a collision with a fixed or stationary object (Australian Bureau of Statistics, 2009). Two hundred and seventeen persons (133 males and 84 females) were car occupants killed in a collision with another light vehicle, and 53 people (37 males and 16 females) were car occupants killed in a collision with a heavy vehicle or bus (Australian Bureau of Statistics, 2009).

These statistics follow the trend suggested in previous research which indicates that the relationship of age of death due to a motor vehicle crash for males is at its peak between the ages of 16 and 24, with the rate declining with age (Pokorny et al., 1972). Research has suggested that while inexperience behind the wheel may be a substantial factor for motor vehicle fatalities in this age group, individuals in this age bracket are also more likely to have been affected by drugs and alcohol at the time of the crash (Selzer, 1969; Dumais et al., 2005).

### ***Motor vehicles as a means of suicide***

Motor vehicle crashes are one of the leading causes of death and injury across all age groups. Previous research has investigated the validity of the claim that some motor vehicle fatalities are not the accidents they appear to be, but are instead conscious, goal directed suicides (Imajo, 1983; Litman & Tabachnick, 1967; Phillips, 1979). It has been suggested that some individuals with self-destructive inclinations may seek to injure or destroy themselves by way of an automobile accident, and that such actions are rarely perceived as suicide attempts by the public, the coroner, or even by the individual themselves (Selzer & Payne, 1962; Pompili et al., 2006; Peck & Warner, 1995; Schmidt et al., 1977). Of such vehicular fatalities, the single-car, single-occupant crash is particularly suspect (Schmidt et al., 1977;

Imajo, 1983; Rosenberg et al., 1988). While this may be the case, only a small percentage of vehicular fatalities, even single-vehicle fatalities, are suspected to be suicides (Schmidt et al., 1977). Research conducted primarily in the United States of America, has noted that the rate of vehicular fatalities in that country that were in fact suicides varied between 1.6% to 5.0% (Schmidt et al., 1977; Peck & Warner, 1995; Pompili et al., 2006).

It has been proposed that if a substantial number of single-vehicle, single-occupant vehicle fatalities were deliberate, goal-directed suicides that their seasonal variation and age distribution would be akin to suicides by other methods and occur independently of road conditions (Jenkins & Sainsbury, 1980). Jenkins and Sainsbury (1980) examined 528 single-vehicle, single-occupant road deaths in Great Britain over a two-year period. They highlighted that there was a significant seasonal variation in the manner of death, with the peak of vehicular suicides noted to be in April (northern spring), and the peak for fatal motor vehicle accidents in November (northern autumn). They also noted that the age distribution for accidental road deaths was greatest for the two youngest age brackets, namely 15 to 24 and 25 to 34, but that the incidence of suicide by motor vehicle increased with age, thus following the trend of suicide rates by other methods (Jenkins & Sainsbury, 1980).

The motor vehicle is considered to be an ideal means of self-destruction because of its availability and ease of access, the frequency of its use, the great number of inherent hazards involved in driving as well as the fact that motor vehicle crashes provide the driver with the opportunity to conceal or camouflage their suicidal intent (Boglioli, Taff, Green, Lukash & Lane, 1988; Peck & Warner, 1995). Research has indicated that carbon monoxide poisoning accounts for the vast

majority of suicides involving motor vehicles (Byard & James, 2001). The most commonly reported suicide method by vehicular crash is a head-on collision of a single-occupant vehicle with a fixed roadside object, or oncoming vehicle, in which the driver dies of multiple injuries (Hardwicke, Taff & Spitz, 1985). In such cases it would be witnessed that the driver accelerated towards a fixed target and made no attempt to brake or swerve to avoid the collision. Consequently, in many cases there would be no evidence of skid marks on the road, and in some cases there would be an imprint of the accelerator pedal on the sole of the driver's shoe (Hardwicke et al., 1985; Boglioli et al., 1988).

The accessibility of motor vehicles and the opportunity to drive to an isolated area which provides a sufficient time for death, are two major contributing factors which have resulted in the motor vehicle being used as a means of suicide (Byard & James, 2001). In many situations, it may be relatively clear that the motor vehicle is merely a means to an end, offering the depressed and suicidal individual an opportunity to destroy their life in a relatively expedient manner (Pokorny et al., 1972; Litman & Tabachnick, 1967). In other cases, however, individuals may wreck their vehicle seemingly on impulse, in response to many of the same risk factors which also predict suicide by other means, including rejection, stressful life events or increasing frustration. Alternatively, some individuals may choose to commit suicide by way of a motor vehicle crash as a demonstration of a violent or aggressive impulse, or in an attempt to go out in a burst of glory (Litman & Tabachnick, 1967; Imajo, 1983; Isherwood, Adam & Hornblow, 1982). Research has also indicated that a pattern of alcoholism, depression and significant life stressors are major characteristics of both drivers who cause fatal accidents, and individuals who commit suicide (Pokorny et al., 1972; Tsuang et al., 1985).

Consequently, although fatal injuries sustained through a motor vehicle crash are not a well recognised means of suicide, the lethality of such an action is substantial, to the point where motor vehicles can readily be considered as deadly weapons (Porterfield, 1960; Peck & Warner, 1995).

### ***Concealment of intent***

The self-destructive action which occurs as a result of a single-vehicle, single-occupant fatal crash may be the result of high-risk behaviour, the crucial factor of which is the driver's intent to die (Pompili et al., 2006; Peck & Warner, 1995). Some individuals may use their motor vehicle as a means of acting out temporary emotions, drinking heavily or driving at excessive speeds only when anxious, angry or depressed (Litman & Tabachnick, 1967). Consequently, the lines between the individual and the motor vehicle become blurred, and to some degree the motor vehicle becomes a part of the individual's self-image (Litman & Tabachnick, 1967). As previous research has suggested, some vehicular fatalities contain an underlying suicidal impulse and are the product of an unconscious intent, thus making the motor vehicle an ideal means of suicide for those with self-destructive tendencies (Peck & Warner, 1995). Undoubtedly some motor vehicle fatalities are conscious, goal-directed suicides; others however may merely represent the end result of an individual's self-destructive behaviour, where a completed act of suicide may never have been a conscious goal (Pokorny et al., 1972).

Without an explicit motivation, or evidence pointing towards the intention of the individual, it becomes more difficult for coroners to distinguish between a deliberate vehicular crash and an accidental one (Imajo, 1983). This ambiguity is

frequently capitalised upon by suicidal individuals who wish to conceal their self-destructive intent for reasons of insurance, pride or to avoid social stigma for themselves or their family (Imajo, 1983). Consequently, suicide by motor vehicle crash offers a unique opportunity as a means of self-destruction, especially for those who are intent upon camouflaging their suicidal motivations from others, and possibly also from themselves (Tsuang et al., 1985; Peck & Warner, 1995; Pokorny et al., 1972).

### ***Proof of law in determining suicide***

Some individuals intent on taking their own lives undoubtedly do so by way of a single-vehicle fatal crash. Without evidence pointing to intent, however, investigators are often hindered in rendering a true determination of the manner of death (Peck & Warner, 1995). As noted, for a determination of suicide to be made, intent as well as self-infliction, must be shown. However, as is often the case with single-vehicle crashes, the driver's intention behind the self-destructive action is often ambiguous (Peck & Warner, 1995). The decision to determine whether a vehicular fatality is an accident or suicide becomes less complicated if typical characteristics of a suicide are present, such as a suicide note, previous suicide attempts and a history of suicidal ideation, however it is often the case that none of these features are found (Byard & James, 2001). Research has suggested that there are several precipitating stress factors reported among individuals who commit suicide by motor vehicle which are shared by those who commit suicide by other means. These factors include interpersonal problems, alcoholism, previous suicide attempts, depression and personality factors (Boglioli et al., 1988).

Investigations into all vehicular fatalities are vital, but are especially so for single-vehicle crashes, in order to establish a determination of the manner of death. Such investigations typically examine the road and weather conditions at the time of the crash, the mechanical condition of the vehicle, the speed being travelled at the time of the crash, and the presence or absence of skid marks or attempts to avoid the crash (Byard & James, 2001; Imajo, 1983). Assessments of blood alcohol levels and drug use are conducted during all investigations of vehicular fatalities, to assist in the assessment of the driver's competence at the time of the crash (Byard & James, 2001). Unfortunately, the effects of most drugs are more difficult to interpret than the impact of alcohol, especially in relation to driving impairment. This is due to myriad factors, including idiosyncratic responses to the drugs taken, the degree of effect having little correlation with the concentration of the drug, disproportionate metabolic rates of different drugs, and the conditions in which the drugs were initially administered (Tsuang et al., 2006). Each of these factors may impair the individual's driving ability in a unique way. Alcohol is present in a large proportion of vehicular fatalities, and it is therefore important for any investigation to establish whether the use of alcohol at the time of the crash was in excess of their regular level of use. Research has suggested that the majority of individuals involved in fatal traffic accidents are more likely to be chronic alcohol users, yet there are still those individuals who will engage in excessive levels of alcohol use as a response to a stressful live event (Tsuang et al., 2006).

### *Psychological autopsy*

Whilst investigations into the physical aspects of vehicular fatalities are important, it is also vital to examine the psychological circumstances which preceded

the fatal crash. Edwin Shneidman coined the phrase ‘psychological autopsy’ to describe a post-death evaluation of the decedent’s intentions and motivations during the time leading up to his or her death (Scott et al., 2006). Psychological autopsies are often used to clarify the manner of death in equivocal cases (Boglioli et al., 1988). Equivocal deaths may be those that are undetermined, or deaths in which the cause of death is known, but the circumstances surrounding the death are unclear (Snider, Hane & Berman, 2006; Shneidman, 1981; Ebert, 1987). A psychological autopsy, therefore, refers to a comprehensive, retrospective collection of information concerning the deceased with the aim of developing a clear and accurate view of their life situation, personality and mental health in the lead up to their death (Isometsä, 2001; Ebert, 1987; Ogloff & Otto, 1993).

Despite numerous studies of psychological autopsies, their reliability and validity, there is no standardised format by which they take place (Ogloff & Otto, 1993). The end goal is to construct a detailed picture of the deceased’s psychological state before death, including any psychopathology, alterations in behaviour and the occurrence of stressful life circumstances in the weeks and months prior to their death (Pearson et al., 1999). Psychological autopsy studies have indicated that for the majority of suicide victims, the occurrence of stressful life events appears to cluster in the last three months of their life (Pouliot & de Leo, 2006).

To develop a picture of the deceased’s life, interviews are conducted with the deceased’s close friends and family and a thorough examination of any medical or psychological records concerning the deceased is also completed (Ogloff & Otto, 1993; Isometsä, 2001). The importance of the information collected cannot be



underrated, as the outcome may affect things such as insurance payments, homicide prosecution and even public health policy formation (Ebert, 1987).

One weakness of psychological autopsy is that the subject of the investigation is not able to be observed or interviewed and that any information collected may contain a bias, possibly in an attempt to paint the deceased in a favourable light (Snider et al., 2006). In addition, efforts to gather valid information on the deceased from their friends and family must be done in a manner that avoids discomfort for those being interviewed (Runeson & Beskow, 1991). Therefore, the experience of the interviewer and their ability to establish rapport with the interviewee are vital in conducting a psychological autopsy. Research has suggested, however, that many interviewees have a favourable response to being interviewed, with it being that in discussing the actions, feelings and attitudes of the deceased, the interviewee experiences a release of emotion or catharsis, allowing them to come to terms with the loss of a loved one (Beskow, Runeson & Åsgård, 1990; Ebert, 1987). In conjunction, psychological autopsies have provided crucial knowledge concerning the risk factors for suicide and data obtained from such interviews can be used to identify patterns of behaviour common to individuals who display suicidal intent (Ebert, 1987).

### ***Driver characteristics***

Previous research has investigated the hypothesis that high-frequency accident drivers have certain qualities in common which predispose them to traffic accidents, but which differentiate them from drivers who have few, if any, traffic accidents (McGuire, 1956). Previous research has suggested that a large proportion of motor vehicle accidents can be attributed to only a small proportion of the driving

population (Grimmond, 1974). Since most traffic accidents are initiated by driver action, or inaction, it is feasible to suggest that various physiological, psychological and social factors are open for examination, and that such qualities within an individual would be relatively stable and amenable to measurement (Selzer & Vinokur, 1974; McGuire, 1956).

A raft of personality factors have been noted to differentiate between drivers frequently involved in accidents and those who have no history of traffic accidents, yet it should be noted that these groups typically form the extremes of driver ability. The majority of drivers, however, fall within these two extremes and thus, any personality differences between them must be interpreted with due caution (Conger, 1960). Previous research indicates that drivers who are more likely to have accidents are also more likely to have such characteristics as emotional instability, impulsivity, egocentricity, poor social and vocational adjustment, extreme social deviance, low tension tolerance, latent aggression or hostility, dependency, hyperactivity and significantly, more symptoms of mental illness when compared to non-accident drivers (Conger, 1960; Pompili et al., 2006; Dumais et al., 2005; Schmidt, Perlin, Townes, Fisher & Shaffer, 1972; Selzer & Vinokur, 1974; Tsuang et al., 1985).

Differences have also been noted between drivers who are fatally injured in single-vehicle accidents, compared with those fatally injured in multiple-vehicle accidents (Schmidt et al., 1972). Fatally injured single-vehicle accident drivers have a tendency to be younger, unmarried, generally at fault for the accident, more likely to have a history of previous traffic violations and are more likely to be driving at a greater speed at the time of crash than those drivers fatally injured in multi-vehicle accidents (Peck & Warner, 1995).

Some influences on the rates of vehicular fatalities, however, may be other than the lack of driver education, fatigue or failures in vehicle mechanics or road construction (Porterfield, 1960). It is important to consider the disproportionate amount of serious or fatal accidents in which alcohol use is a significant contributing factor (Selzer & Vinokur, 1974). Alcoholic drivers have been noted to have been involved in significantly more single-vehicle accidents than non-alcoholic drivers (Schmidt et al., 1972). Selzer and Payne (1962) found that of 30 alcoholic drivers, 17 reported having prior serious suicidal thoughts, or had made at least one suicide attempt, and that these 17 individuals were responsible for 63 serious traffic accidents. The 13 non-suicidal alcoholics, in contrast, were responsible for 24 traffic accidents, yielding a mean rate of 3.70 and 1.77 accidents per person for each group respectively (Selzer & Payne, 1962). These findings indicate that while alcohol intoxication is a significant contributing factor to many serious traffic accidents, and indeed lends itself to a greater overall number of accidents, intoxication per se may not be the sole determining factor in traffic accidents caused by alcoholics (Selzer & Payne, 1962).

### **Suicide prevention**

Suicide is recognised as a major public health problem and comprehensive, effective strategies to lower the rates of suicide, especially youth suicide, are urgently needed (Isacsson, 2000). Unfortunately, an effective, all-encompassing prevention strategy has remained elusive; suggesting that our collective knowledge of the complex interplay of factors which eventuate in suicide is lacking (Apter et al., 1993). Research has suggested that the greatest potential for reducing suicide rates lies in the restriction of access to commonly used means of suicide completion

(Cantor & Baume, 1998a). However, many methods regularly utilised in suicidal acts are difficult to restrict or limit but where restrictions have been put in place, research has shown a decrease in the number of impulsive suicides utilising that method (Beautrais, 2000). In light of the difficulties in restricting access to certain means of suicide completion, previous research has suggested that suicide prevention strategies should target the underlying factors and life processes which increase an individual's risk of suicide (Beautrais, 2000). This notion has merit however; there are a great number of suicide risk factors, and many different populations which are at an increased risk of suicide to make funding and implementation of such a strategy unfeasible.

Suicide by motor vehicle crash poses a special problem for strategists concerned with suicide prevention. It is almost impossible to restrict the use of motor vehicles by depressed or suicidal individuals. Many previous road safety campaigns have been directed towards the driver of the vehicle, encouraging them to decrease their speed, rest if tired, or not drive whilst under the influence of drugs or alcohol (Schmidt et al., 1972). For the most part, these road safety campaigns have been met with success, and there has been an overall decrease in the number of motor vehicle fatalities on Australian roads over the last 15 years (Australian Bureau of Statistics, 2009). An extension of these campaigns has been suggested to target the 'significant others' of the at-risk individual, encouraging family and friends to remove any and all means of self-destruction during a period of crisis (Schmidt et al., 1972). While this notion may be effective in some limited circumstances, it not only requires the friend or family member to have the ability to remove the means of suicide completion, but also the awareness of when such an action is required.

## **Summary and Conclusions**

Suicide is, and will continue to be, a concerning public health problem. Recent research has shown an alarming increase in rates of suicide by young adults, a finding which runs counter to traditional suicide risk factors, which highlight increased age as a significant component of suicide rates in industrialised countries. Rates of vehicular fatalities in Australia have decreased steadily over the last 15 years, a fact which may be attributed to the introduction of more stringent safety measures in the design and manufacture of motor vehicles, and increased public road safety campaigns. Previous research has suggested that motor vehicles, with the inherent risks and hazards involved in their use, are an ideal means of suicide especially for those individuals who wish to conceal their suicidal intent from others, as well as possibly from themselves. Research has suggested that the rate of suicide by motor vehicle crash is between 1.5% and 5.0%, of which single-occupant, single-vehicle fatalities are particularly suspect, although due to the general underreporting of suicide and the individual differences in coroners' decision making processes in determining the manner of death may mean that these figures are not accurate. Research which has assessed the personality characteristics of high-accident drivers has revealed certain correlations between such individuals and those individuals who are at an increased risk of suicide. Whilst many methods of suicide are amenable to preventative public policies and strategies, motor vehicle suicides pose a significant problem. Where the restriction of access to means of suicide has been shown to reduce the rates of suicide for firearms, barbiturate poisoning and domestic coal gas, it is almost impossible to restrict the access of depressed or suicidal individuals to motor vehicles. Further research is required to investigate strategies of preventing suicide by motor vehicle crash, and to clarify the parameters by which coroners

determine an individual's manner of death. There is also a need to clarify the number of suicides which are hidden within motor vehicle fatalities, in order to not only improve the accuracy of suicide reporting, but also to develop appropriate strategies and public health policies enabling the prevention of such deaths.

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## **Empirical Study**

### **Vehicular Fatalities: Accident or Suicide?**

## **Vehicular Fatalities: Accident or Suicide?**

Caroline Gunn

### **Abstract**

An examination of 100 closed coronial case files was conducted, (N 100) involving vehicular fatalities (the death of the driver, passenger, pedestrian or cyclist). Ninety-five percent of cases were determined by coroners to be accidental deaths, 2% were deemed to be suicides and 3% were not attributed a manner of death. Key features of each vehicular fatality were identified, including; speed travelled at the time of the crash, road and weather conditions, seatbelt use, substance use and psychological history. Backwards stepwise logistic regression was performed to explore the influence of certain variables on the likelihood a fatality was the result of suicide or an accident. The model indicated a statement of suicidal intent and the presence of alcohol to be significant variables in differentiating between an accident and suicide. This model correctly identified 98% of cases as either accident or suicide, highlighting two discrepant cases where regression analysis suggested a manner of death determination in contrast to that provided by the coroner. The results presented are consistent with previously reported figures concerning the rate of vehicular suicide and are discussed in terms of the implications of public health and road safety campaigns, as well as improvements in accuracy and consistency in the determination of manner of death.



## **Vehicular Fatalities: Accident or Suicide?**

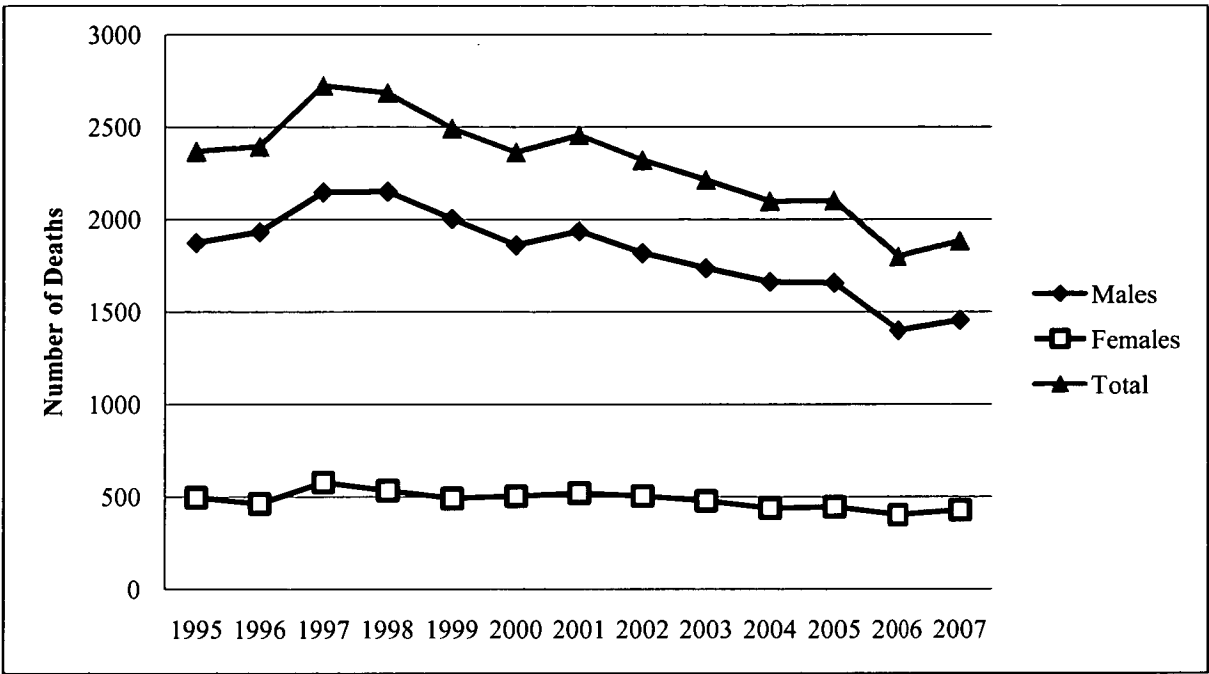
Caroline Gunn

### **Overview of suicide**

Suicide continues to be a concerning public health problem. In 2007, intentional self-harm, or suicide, accounted for 1,884 deaths in Australia, and was ranked as the 15<sup>th</sup> leading cause of all deaths (Australian Bureau of Statistics, 2009). A recent report by mental health service, Lifeline, indicated that suicide was now the number one cause of death in Australia for men and women aged 15 to 34, and remained the leading cause of death for men to age 44 (Lifeline, 2009). Males have been found to account for more than three quarters of all suicides in 2007 and a rising trend of youth suicide had also been noted (Australian Bureau of Statistics, 2009). Unfortunately, the true frequency of suicide within the population is unknown, as the operational criteria for determination of suicide varies both between coroners and the states and territories of Australia. Figure 1 shows the rate of suicide in Australia between 1995 and 2007. As can be seen, the rate of suicides for males is consistently higher than suicide rates for females. Previous research has indicated that completed suicide is four times more common in males than in females, yet females typically attempt suicide at a rate that is three times that of men (Allen, 2000; Shen, Hackworth, McCabe, Lovett, Aumage, O'Neil & Bull, 2006; Mittendorfer-Rutz, 2006).

Contemporary views of suicide suggest that it is a result of complications of various life conditions, and is, in fact, secondary to these conditions (Miles, 1977). Suicide has been proposed as a conscious act of self-annihilation, best understood as a multidimensional problem in an individual for whom such an act of self-

destruction was perceived to be the most appropriate solution (Pompili, Girardi, Tatarelli & Tatarelli, 2006).



**Figure 1. Intentional self-harm deaths in Australia by gender, 1995-2007.**

Suicide, however, still continues to carry a social stigma and is often viewed as being morally reprehensible (Cholbi, 2007). It is likely that because of the social stigma historically attached to suicide that many equivocal, or questionable, deaths are not determined to be suicides, but are rather deemed to be accidents, or are not attributed with a manner of death at all (Scott, Swartz & Warburton, 2006). In Australia, as with many other industrialised countries, there is no standardised set of operational criteria to assist coroners in determining the manner of death in equivocal cases, and it is likely that there are more ‘missed’ suicide deaths than deaths of other causes miscounted as suicides, as the decisions as to which deaths are attributed to be suicides is a difficult and complex one (Rosenberg, Davidson, Smith, Berman, Buzbee, Gantner, Gay, Moore-Lewis, Mills, Murray, O’Carroll & Jobes,

1988; Pokorny, Smith & Finch, 1972; Pearson, Caine, Lindsay Conwell & Clark, 1999). The two main criteria which must be satisfied for a determination of suicide to be made are: whether the action was self-inflicted and whether or not the deceased intended to die as a result of this action (Allen, 2000; Cholbi, 2007; Jobes, Casey, Berman & Wright, 1991; Litman, Curphey, Shneidman, Farberow & Tabachnick, 1963). Other criteria may also influence a coroner's decision, such as evidence of a suicide statement made to family or friends; however the criteria used to determine the manner of death may vary both between jurisdictions as well as between coroners within jurisdictions (Rosenberg et al., 1988; Jobes et al., 1991).

There is a range of suicide-related behaviours which are thought to exist upon a continuum, of which completed suicide is the most extreme and severe endpoint (Muehlenkamp & Guitierrez, 2007). However, there remains no generally accepted classification for the range of suicidal-related behaviours present in society (O'Carroll, Berman, Maris, Moscicki, Tanney & Silverman, 1996). There are some commonly utilised definitions nevertheless found within the suicide literature. Completed suicide characteristically refers to death resulting from a self-inflicted act, which occurred as a result of an intentional action designed to put one's life at risk (Stauffer, 2004; O'Carroll et al., 1996). Suicide attempt typically refers to a non-fatal action where there is evidence, either explicit or implicit, that the injury was self-inflicted, and that the individual intended, at some level, to end his or her life (Stauffer, 2004; O'Carroll et al., 1996). Ambivalent life-threatening gestures, where the individual appears to have little regard for the outcome of their actions, have been termed 'para-suicides' (Stauffer, 2004). Such actions are undertaken not with the purpose of causing one's own death, but rather as a means of expressing anguish and pain to others in the hope that they will offer aid, comfort or rescue (Cholbi,

2007). Suicidal behaviours refer to all behaviours that represent a person's intent to commit suicide or his or her desire to appear as if suicide was intended (O'Carroll et al., 1996; Stauffer, 2004). Such gestures are designed to give the appearance of intended self-harm, but lack any real intention to do so (Stauffer, 2004). Self-harm refers to damage typically inflicted upon one's wrists, arms, legs and thighs, using a sharp or hot implement (Sadock & Sadock, 2003). Research has shown that females are three times more likely to commit acts of self-harm than males, yet males are four times more likely to complete suicide (Sadock & Sadock, 2003; Allen, 2000; Shen, et al., 2006; Mittendorfer-Rutz, 2006).

Suicide is often viewed as a response to a single stressful event; however it more often results from complex interactions between a number of different factors (Shen et al., 2006). In order to establish effective suicide prevention policies it is important to know the etiological factors and causal relationships between suicide and modifiable individual behaviours, in other words, an understanding of the risk factors for suicide (Shen et al., 2006; Klerman, 1987). A risk factor is defined as the association between some characteristic or attribute of the individual, group or the environment, and an increased probability of a particular disease or disease related phenomenon (Klerman, 1987). Psychiatric, socioeconomic and affective factors have all been found to increase suicide risk (Allen, 2000). A history of psychiatric illness; previous suicide attempts; alcoholism; illicit drug use; unemployment; a marital status of divorced, widowed or separated; chronic physical illness; lack of social support; increased age and impulsiveness are risk factors which have been shown to increase an individual's risk of attempting or completing suicide (Klerman, 1987; Pearson et al., 1999; Allen, 2000; Sadock & Sadock, 2003; Diesenhammer, Huber,

Kemmler, Weiss & Hinterhuber, 2007; Beautrais, 2003; Goldstein, Black, Nasrallah & Winokur, 1991).

### **Means of suicide completion**

Means of suicide completion tend to alter with time, and despite the varied potential means available, only relatively few are used regularly (Cantor & Baume, 1998). In industrialised countries, these means typically include, self-poisoning by drugs, domestic gas emissions, motor vehicle exhaust emissions, hanging, firearms, cutting and piercing, drowning, jumping from heights, and jumping or lying in front of a moving vehicle (Cantor & Baume, 1998). Certain methods of death have typically been found to receive a determination of suicide over others. Causes of death where suicidal intent can be more definitively inferred, such as hanging, asphyxia by plastic bag, lacerations or firearms are more likely to be classed as suicides, than causes in which an accidental death is as statistically probable, such as drowning, poisoning, burning or vehicular fatalities (Marzuk, Leon, Tardiff, Morgan, Stajic & Mann, 1992).

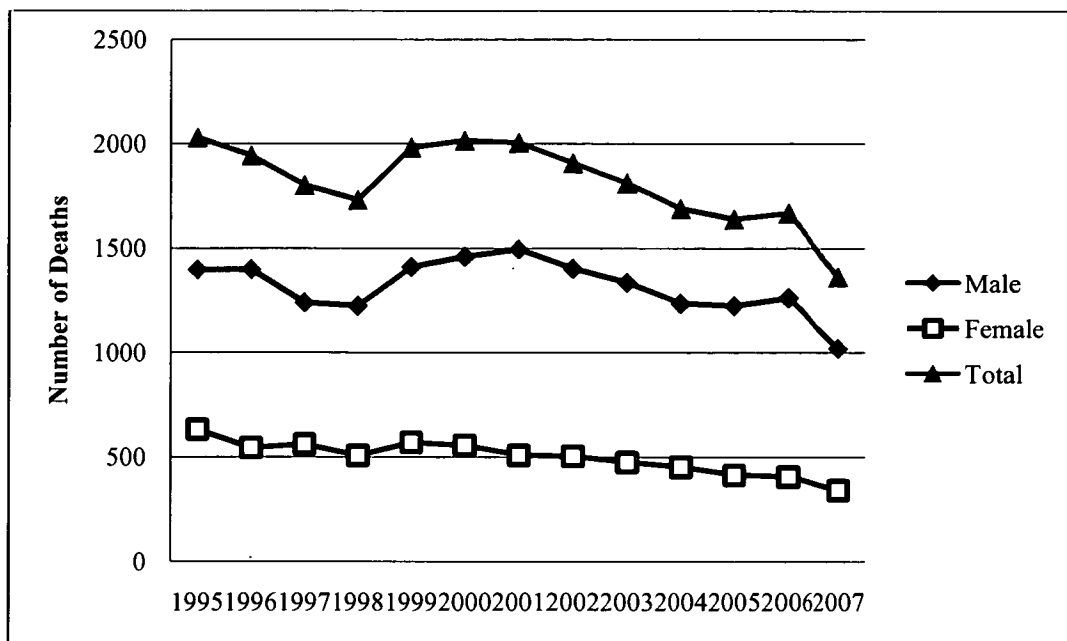
An individual's choice of suicide method tends to be highly culturally specific, and is influenced by a complex constellation of social, cultural, psychological and physical factors, all of which may precede the individual's decision to end his or her life (Beautrais, 2000; Cantor & Baume, 1998). Chosen methods of suicide have been shown to differ depending on the age of the individual, with accessibility to means of suicide, and comprehension of the lethal outcomes of a particular method being significant factors (Byard & James, 2001). Physical availability, or the extent to which a method of suicide is accessible by the

individual, is an important determinant of method choice (Cantor & Baume, 1998). Individuals are more likely to choose a method of suicide that is easily available to them, and with which they have some familiarity. The choice of suicide method, and consequently the overall rate of suicide, varies widely according to the age, sex, race, geography, and the urban or rural nature of the population (Richardson & Breyfogle, 1946; Cantor & Baume, 1998).

The suicide method chosen by the individual may vary in terms of its ‘lethality’, or the probability of death resulting from the action taken (Cantor & Baume, 1998). Previous research has classified means of suicide on the basis of their ‘activity’ such as firearms, or ‘passivity’ such as self-poisoning with sedatives (Marzuk et al., 1992). More immediate and violent methods, those classed as being more ‘active’, present little scope for intervention and possible rescue between the suicide action and death. Such methods of higher lethality are more commonly utilised by males, and may partially account for the higher suicide completion rate for males compared to females (Cantor & Baume, 1998; Mittendorfer-Rutz, 2006).

### **Motor vehicle suicides**

In Australia, as with many industrialised countries, motor vehicles represent a leading cause of death and injury for individuals, especially men under the age of 35 (Dumais, Lesage, Boyer, Lalovic, Chawky, Ménard-Buteau, Kim & Turecki, 2005), and accounted for 1,361 deaths registered in Australia in 2007 (Australian Bureau of Statistics, 2009). Figure 2 shows the rates of transport related deaths in Australia between 1995 and 2007. As can be seen, data from previous years has shown a consistent trend of males being three times as likely to be killed in a transport related crash, than females (Australian Bureau of Statistics, 2009).



**Figure 2. Transport related deaths in Australia by gender, 1995-2007.**

Previous research has suggested that some motor vehicle fatalities are not simply the function of chance, but may result from an individual's conscious, or unconscious, self-destructive motivation (Tsuang, Boor & Fleming, 1985). Motor vehicle fatalities are typically the result of a complex interaction of many variables, not only concerning the mechanics of the vehicle being driven, road and weather conditions, but also dependent upon the circumstances surrounding the driver themselves (Conger, 1960). Research has indicated that some individuals who have previously attempted suicide may attempt to injure or destroy themselves by means of a motor vehicle crash, and that such actions are rarely viewed as suicide attempts by the public, the coroner, or even by the individual themselves (Pompili et al., 2006; Selzer & Payne, 1962; Peck & Warner, 1995; Schmidt, Shaffer, Zlotowitz & Fisher, 1977). While this may be the case, only a small percentage of motor vehicle fatalities, even single-vehicle, single occupant fatalities, are suspected to be suicides (Schmidt et al., 1977). Research has suggested that the rate of suicide by motor

vehicle crash varies between 1.6% and 5.0% (Schmidt et al., 1977; Peck & Warner, 1995; Pompili et al., 2006).

The motor vehicle is considered to be an ideal instrument of self destruction because of its availability and ease of access, the frequency of its use, the great number of inherent hazards involved when driving, as well as the fact that motor vehicle crashes provide the driver with the opportunity to conceal or camouflage their suicidal intent (Boglioli, Taff, Green, Lukash & Lane, 1988; Peck & Warner, 1995). The accessibility of motor vehicles and the opportunity to drive to an isolated area, providing sufficient time for death, are two major contributing factors for motor vehicles being used as a means of suicide (Byard & James, 2001).

The coronial decision to determine a motor vehicle fatality as a suicide becomes less complicated if typical characteristics of suicide are present, such as a suicide note, a history of previous suicide attempts, or a history of suicidal ideation (Byard & James, 2001). It is more often the case, however, that none of these features are found. Without explicit motivation, or evidence pointing towards the intention of the individual, it becomes more difficult for coroners to distinguish between a deliberate vehicular crash, and an accidental one (Imajo, 1983). This ambiguity is often capitalised upon by suicidal individuals who wish to conceal their self-destructive intent for reasons of insurance, pride, or to avoid social stigma for themselves or their family (Imajo, 1983). Suicide by motor vehicle crash offers a unique opportunity as a means of self-destruction, especially for those who are intent upon camouflaging their suicidal motivations from others, and also possibly from themselves (Tsuang et al., 1985; Peck & Warner, 1995; Pokorny et al., 1972).



Investigations into vehicular fatalities are vital to determine the individual's manner of death. Typical investigations examine, among other things, the road and weather conditions at the time of the crash, the mechanical condition of the vehicle, the speed being travelled at the time of the crash, and the presence or absence of any skid marks or attempts to avoid collision (Byard & James, 2001; Imajo, 1983). Research has suggested that if a substantial proportion of single-vehicle fatalities were deliberate goal-directed suicides, that there would be a seasonal variation and age distribution amongst these deaths that would be akin to suicide deaths by other means, and would also occur independently of road conditions (Jenkins & Sainsbury, 1980). One such study, conducted by Jenkins and Sainsbury (1980), investigated 528 road deaths in the United Kingdom over a two year period. It was discovered that the peak of motor vehicle suicides was in April (northern spring), and the peak for fatal motor vehicle accidents was in November (northern autumn) (Jenkins & Sainsbury, 1980). It was also noted that fatal motor vehicle crashes were most common amongst the age brackets of 15 to 24 and 25 to 34, but that the incidence of motor vehicle suicide increased with age, as had also been noted with suicide by other means (Jenkins & Sainsbury, 1980). Consequently, it is important for investigators of motor vehicle fatalities to also examine the physical characteristics of the crash, as well as investigating characteristics of the individuals involved. Assessments of blood alcohol levels, and illicit drug use, are also conducted to assist in the analysis of the driver's competence at the time of the crash (Byard & James, 2001). Alcohol has a disinhibiting effect, and is not only a contributing factor to a large proportion of fatal and non-fatal vehicular crashes, but has also been indicated as a significant factor for an increased risk of suicide. It is therefore important for motor vehicle crash

investigators to establish whether the individual's use of alcohol at the time of the crash was in excess of their regular level of use (Tsuang et al., 2006).

While investigations into the physical aspects of fatal vehicle crashes are important, it is also vital to examine the psychological aspects of the individual's life in the days, weeks and months prior to their death. Edwin Shneidman coined the phrase 'psychological autopsy' to describe a post-death analysis of the decedent's intentions and motivations during the time leading up to his or her death (Scott et al., 2006). A psychological autopsy refers to a comprehensive, retrospective collection of information concerning the deceased, with the aim of developing a clear and accurate view of their life situation, personality and mental health in the lead up to their death (Isometsä, 2001; Ebert, 1987; Ogloff & Otto, 1993). To do so, interviews are conducted with the deceased's family and friends, with a concurrent examination of any medical or psychological records (Ogloff & Otto, 1993; Isometsä, 2001). Despite a raft of previous research on psychological autopsies, there is no standardised format by which they take place, therefore the skill of the interviewer and their ability to build rapport with the deceased's friends and family is important in order to not only gather as much relevant material about the deceased as possible, but to also prevent the deceased's loved ones from feeling pain and discomfort from the process (Runeson & Beskow, 1991). Psychological autopsies have the ability to provide investigators with insight into the deceased's motivations and emotional state prior to their death, which may, in turn, assist with the development of suicide prevention strategies, focusing resources and research on areas amenable to change.

In some cases, the motor vehicle is a means to an end, offering the depressed and suicidal individual an opportunity to end his or her life in a relatively expedient manner (Pokorny et al., 1972; Litman & Tabachnick, 1967). In other cases, however,

an individual may wreck their vehicle seemingly on impulse, possibly as a response to many of the same risk factors which precede suicide by other means. Alternatively, some individuals may choose to commit suicide by way of a motor vehicle crash as a demonstration of a violent or aggressive impulse (Litman & Tabachnick, 1967; Imajo, 1983; Isherwood, Adam & Hornblow, 1982). Others still, may use their motor vehicle as a means of acting out temporary emotions, drinking heavily or driving at excessive speeds only when anxious, angry or depressed (Litman & Tabachnick, 1967).

Consequently, although fatal injuries sustained through a motor vehicle crash are not a well recognised means of suicide, the availability and lethality of such an action is substantial, to the point where motor vehicles can be readily considered deadly weapons (Porterfield, 1960; Peck & Warner, 1995).

### **Suicide prevention strategies**

One approach to suicide prevention has been to restrict the availability of certain means of suicide (Beautrais, 2000; Isacsson, 2000; Marzuk et al., 1992). One school of thought posits that a restriction of access to a particular means of suicide will not only reduce the rate of suicide by that means, but will also produce a reduction in the overall suicide rate (Cantor & Baume, 1998; Marzuk et al., 1992; Beautrais, 2000). An alternative hypothesis states that if a means of suicide becomes unavailable, due to restriction of access, there will be a compensatory shift to other methods, with no overall decrease in suicide mortality rates (Marzuk et al., 1992; Beautrais, 2000; Pirkola, Isometsä & Lönnqvist, 2003).

Many current suicide prevention strategies focus on restricting the access one may have to different means of suicide (Beautrais, 2000). This policy proves to be especially problematic when discussing the use of motor vehicles as a means of suicide, due to the widely accepted inherent dangers involved in their use (Peck & Warner, 1995). The question that arises, therefore, is how public health policy may restrict access to such an easily available means of suicide, or in failing to do so, foster awareness in individuals who may be unconsciously motivated to use such methods as a means of ending their life. Many previous road safety campaigns have been directed towards the driver of the vehicle, encouraging them to decrease their speed, rest if tired, or not drive whilst under the influence of drugs or alcohol (Schmidt et al., 1972). For the most part, these road safety campaigns, in conjunction with more stringent manufacturing and testing of motor vehicles, have been met with success in reducing the overall road toll over the last 15 years (Australian Bureau of Statistics, 2009). While this may be the case, there are still individuals who exceed the speed limit, fall asleep at the wheel and engage in drunk or drug driving.

### **Aims and hypotheses**

This current study reports a post-hoc analysis of 100 vehicular fatalities that occurred in a regional centre of Australia between 2006 and 2007, providing some insight into the criteria that coroners utilise when determining the manner of death, and which criteria are statistically significant in cases deemed to be motor vehicle suicides. No external criteria are included in this study against which predictors of suicide can be evaluated. Rather, the coroner's verdicts concerning each vehicular fatality form the target variable for prediction, but are also, equally, under evaluation themselves. It was hypothesised that an analysis of the manner of death

determinations of motor vehicle fatalities would reveal a number of suicides by motor vehicle crash that concurred with estimates presented in previous research; that is, between 1.6% and 5.0% of motor vehicle fatalities. It was also hypothesised that there would be a number of cases determined to be an accident by the coroner, which would display many of the significant predictor variables which were statistically indicative of a suicide by motor vehicle. Finally, it was hypothesised that there were factors outside of the deceased's psychological state, namely physical crash variables, such as the speed being travelled at the time of the crash, and the mechanical state of the vehicle, which would be statistically significant in predicting the likelihood of the vehicular fatality being determined a suicide.

## **Method**

### **Data pool**

The coronial case files of 100 individuals (72 males, 28 females) who had died in circumstances involving a motor vehicle between 2006 and 2007 in a regional centre of Australia were examined. It was determined that a two-year sample of vehicular fatalities would provide a significant number of cases upon which statistical analysis could be conducted, whilst also providing relevancy and consistency in police investigation and coronial decision making procedures. Inclusion criteria required that each case involve the presence of a motor vehicle in the death of the individual, and that each case must be closed; that is, a coronial determination as to the mode of death must have been made. Files matching these criteria were highlighted using the National Coroner Information Service (NCIS),

which records pertinent details of all equivocal deaths in Australia. A manual examination of all relevant case files highlighted by this system was then conducted.

The age range of the decedents included in this study was between one year and 90 years, with an average age of 33.7 years ( $sd = 18.64$ ; males average 34.51 years, females 31.29 years). This sample included drivers, passengers, pedestrians and cyclists who had died in a manner involving a motor vehicle.

## **Procedure**

Ethical approval for this research was sought and obtained from the Human Research Ethics Committee of the University of Tasmania. Approval for the research was also sought and obtained from the Chief Coroner and Magistrate of the relevant state from which the data was obtained.

Information collected from the coronial files included the decedent's date of birth and death; occupation; marital status; past relevant medical and psychological history; the number and mechanical details of vehicles involved in the fatal crash; the decedent's position within the vehicle, or whether they were a pedestrian or cyclist; the time of the fatal crash; the estimated speed the vehicle was travelling at the time of the fatal crash; alcohol and drug concentrations of both the decedent and other individuals involved; details of physical injuries sustained; road and weather conditions at the time of the crash; whether the decedent was at fault for the crash; and whether the coroner's determination of manner of death was accidental death, suicide or undetermined.

All information was transposed into an Excel spreadsheet, prior to entry into SPSS 17.0 for statistical analysis. All information was de-identified at the time of

input into the Excel spreadsheet, and further de-identification took place upon transfer into SPSS.

## **Results**

Of the 100 cases of death involving a motor vehicle that were reviewed, coroners determined 95 (95.0%) to be accidental deaths. Only two cases (2.0%) were determined to be suicide, and three cases (3.0%) did not have a manner of death attributed. In 76 cases where a seatbelt was fitted and available for the decedent to wear, 17 decedents (22.4%) were not wearing a seatbelt at the time of the crash. The decedent in 59 cases (59.0%) was the driver of the vehicle.

Single vehicle fatalities accounted for 43 cases (43.0%). The frequency and percentages of variables examined in these single vehicle fatalities (n=43) are shown in Table 1. Of the single-vehicle fatalities, 23 decedents (53.5%) were driving the vehicle, and of this number, all (100.0%) were deemed to be at fault for the fatal crash. Males accounted for 21 single-vehicle driver fatalities (91.3%), and the mean age for drivers killed in single-vehicle crashes was 36.87 years (sd = 17.95).

The most frequent cause of death for drivers killed in single-vehicle crashes was multiple traumas to the head and chest, which accounted for 18 (78.3%) decedents. Alcohol was found to be present in 10 (43.5%) cases of drivers killed in single-vehicle crashes. Eight out of 23 drivers (34.8%) killed in a single-vehicle crash were found to have a blood alcohol concentration over 0.05. Four drivers (17.4%) were also noted to have illicit drugs present in their system at the time of their fatal crash, the most common of which was cannabis. Seventeen (73.9%) fatal single-vehicle crashes where the driver was killed, took place between 5pm and 7am.

**Table 1.** Frequencies and percentages of key characteristics of 43 single-vehicle fatalities in a regional centre of Australia 2006-2007.

Characteristic		Frequency	Percentage
Gender	Males	38	88.4
	Females	5	11.6
Coroner determination	Accident	38	88.4
	Suicide	1	2.3
	Undetermined	4	9.3
Decedent at fault		27	62.8
Position within vehicle	Driver/Motorcycle Rider	23	53.5
	Front seat passenger	8	18.6
	Back seat passenger	5	11.6
	Pedestrian/Cyclist	7	16.3
Decedent employed		24	55.8
Past criminal history		16	37.2
Past psychiatric history		7	16.3
Over speed limit		22	51.2
Skid marks present		26	60.5
Alcohol present		19	44.2
Illicit drugs present		9	20.9

Excessive speed was a factor of 12 (52.2%) fatal single-vehicle crashes where the driver was killed, and seven (30.4%) drivers were not wearing their seatbelts at the time of their fatal single-vehicle crash. Only 15 of the 23 (65.2%)



motor vehicles involved in fatal single-vehicle crashes where the driver was killed were roadworthy at the time of the crash. Skid marks, or signs of attempted collision avoidance and braking, were noted to be present in 13 cases (56.5%).

With regard to characteristics of the deceased individuals, seventeen decedents (73.9%) were employed at the time of the fatal crash, and only six (26.1%) were in a formal relationship, the remaining 17 (73.9%) were classed as separated, widowed, divorced or single. Four drivers (17.3%) killed in single-vehicle crashes had a psychiatric history, three of which consisted of medically treated depression. Three drivers (13.0%) had made a prior attempt at suicide, and two (8.7%) had a history of self-harming behaviour. It was found that three drivers (13.0%) had made a statement of suicidal intent to their family or friends prior to their death by motor vehicle crash, yet only one case (4.3%) was deemed to be a suicide by the coroner.

### **Logistic regression**

Logistic regression enables one to predict which of two categories a person is likely to belong to, given certain other information. Previous research has utilised logistic regression with a backward elimination procedure for the selection of demographic and clinical variables to be used in a scale to estimate suicide risk among patients hospitalised for depression and suicidal behaviour (Goldstein et al., 1991). It was reported that the resulting scale predicted the number of suicides reasonably well within each of the models developed upon the sample of high-risk psychiatric patients upon whom the scale was developed (Goldstein et al., 1991).

While this may be the case, it was stressed that the instrument utilised could only be considered as an adjunct to clinical judgment in the assessment of suicide

risk, and was not to be used to predict the risk of suicide in an individual patient (Goldstein et al., 1991).

Backwards stepwise logistic regression was performed to explore the impact of a number of factors on the likelihood that a particular vehicular fatality was an accident or a suicide. All 100 cases of vehicular fatalities between 2006 and 2007 from a regional centre of Australia were included in the analysis. It was theorised that in some instances individuals may commit suicide by deliberately placing their vehicle, or themselves, into the path of another oncoming vehicle. To account for this phenomenon, both single- and multi-vehicle fatalities, as well as fatalities involving pedestrians and cyclists, were included in the analysis. The initial model contained 12 variables (relationship status, presence of a suicide statement, presence of skid marks, whether the decedent was wearing a seatbelt, whether the road surface was wet or dry, the presence of alcohol, whether the decedent was at fault for the crash, whether the decedent had previously attempted suicide, history of psychiatric illness, history of self-harm, whether the decedent was employed, and whether the decedent was over the speed limit at the time of the crash). The full model containing all the variables was not statistically significant, yet the systematic, stepwise removal of all the variables, bar whether a suicide statement was made and whether alcohol was present, provided a statistically significant model,  $\chi^2 (2, N=100) = 29.00$ ,  $p > .001$ , indicating that when a suicide statement was made by a decedent, and when there was alcohol present in their system at the time of their death, the model was able to identify and differentiate between those cases which were more statistically similar to motor vehicle accidents, and those which indicated that the deceased committed suicide by way of a motor vehicle crash. This particular model explained between 25.2% (Cox and Snell R Square) and 69.0% (Nagelkerke R Square) of the

variance in the manner of death determination, and correctly classified 98.0% of the cases.

This statistical model deemed that two cases were mistakenly classified in their manner of death determination. One of the discrepant cases had originally been determined an accidental death by the coroner, yet from the statistical analysis conducted it was suggested that it contained a number of features similar to those indicated in cases of suicide by motor vehicle. The second discrepant case was not attributed with a manner of death determination by the coroner. Analysis indicated that this case was more statistically similar to an accidental motor vehicle fatality. A more detailed summary of these two cases may be found below.

Further analysis was conducted on the data using logistic regression to examine whether the statistical model could be improved by the addition of any single variable. Using a hierarchical model, single variables were added to the analysis to assess any improvement in the model's ability to predict group membership. The singular addition of certain variables, including whether or not the individual was driving the vehicle at the time of the fatal crash, whether or not the decedent was wearing a seatbelt at the time of the fatal crash, whether the vehicle involved in the fatal crash was roadworthy, and the time of day the crash took place, were all noted to improve the statistical model, yet not in any significant manner. Of the above variables, the one which indicated the greatest improvement of the model was that of the time of day in which the fatal crash took place, where  $\chi^2(3, N=100) = 29.38, p > .001$ , providing the indication that motor vehicle fatalities which are more statistically similar to accidents were more likely to take place during daylight hours. This particular model explained between 25.5% (Cox and Snell R Square) and 69.8% (Nagelkerke R Square) of the variance in the manner of death determination,

and correctly classified 98.0% of the cases. It did not identify any other cases which had been misclassified in their manner of death determination.

### **Case studies**

Of the 100 cases of fatalities involving a motor vehicle investigated, statistical analysis by logistic regression highlighted two cases (Cases A and B) which were suggested to have statistical membership to a different manner of death determination than that which had been established by the coroner.

#### *Case A: Motor vehicle accident*

Ms A, a 20 year old, single female, was deemed by the coroner to have died in a motor vehicle accident. On the night of her death, Ms A was travelling alone on a highway, at a speed in excess of 160km/h, well over the 100km/h speed limit set for the road. Ms A was a newly appointed provisionally licensed driver, who had previously been described as 'inattentive', who did not look far enough ahead, did not anticipate well, and had a tendency to drive too fast. Ms A had a history of psychiatric diagnoses, including depression and anxiety, and had suffered a miscarriage in the 12 months prior to her death. Ms A had previously attempted suicide, via superficial wrist lacerations, and had a history of self-harming behaviours. At the time of her death, Ms A was being treated by a psychologist and had been prescribed anti-depressant medication. The evening prior to her death, Ms A had been involved in a confrontation with a former partner, with whom she had only recently ended a tumultuous, verbally aggressive relationship. Ms A had been out with friends, and her blood alcohol level upon autopsy was recorded to be 0.141g/100mL, almost three times the legal limit for a fully licensed driver. Ms A

returned home in the early hours of the morning and then proceeded to leave her residence again, for an unknown reason. Whilst driving, Ms A made a phone call to a friend, asking, “How fast do you think I’m going now?” before losing control of her vehicle and crashing into an embankment along the side of the road.

The coroner determined Ms A’s death to be an accident, yet the statistical analysis completed above indicated that this case contained several features which were more commonly associated with that of a suicide by motor vehicle crash.

#### *Case B: Undetermined manner of death*

Mr B was a 28 year old orchard manager, with no known medical or psychiatric history, no previous attempts at suicide or self-harming behaviour. Mr B was driving along a highway late at night, at a speed not in excess of the 110km/h speed limit. Mr B had a blood alcohol level of 0.036g/100mL, which is not over the legal limit. Cannabis was also found to be present in his blood. Mr B was wearing his seatbelt at the time of the crash. He was travelling alone when his vehicle crossed over the centre line on to the right side of the road. He continued to travel off the right side of the road, leaving the bitumen, on to the gravel shoulder. Mr B’s vehicle then drove down a large embankment before colliding with a tree. There was no evidence of pre-impact braking and no skid marks were evident on the road, yet there was also no evidence of excessive speed as a contributing factor for the crash.

The coroner did not provide a determination of the manner of death, however the statistical analysis performed above suggests that this case is statistically similar to that of a motor vehicle accident, rather than a suicide.

Whilst many other cases of motor vehicle fatalities, deemed by the coroner to be either accidents or not attributed with a manner of death did not statistically differ from the coronial classification, several contained features which might suggest a greater degree of suicide risk for the individual. Cases C and D, presented below, are two such examples.

*Case C: Undetermined manner of death*

Mr C was a single 58 year old casual labourer, with no known medical or psychiatric history. Mr C had no family in the state, and was a known recluse with no real social support system. The day before his death Mr C had spoken to his employer about work being available for the next day, and was noted to be 'a little bit down'. Mr C left for work as normal early the next morning, along an ancillary road. Mr C veered off the side of the road 4.2 km from home, travelling 67 metres in a straight line along the gravel shoulder and grass verge before colliding with a tree. Mr C was travelling 8km/h over the 100km/h speed limit; however it was deemed that the road was of good condition allowing for safe travel even at a slightly increased speed. It had previously been reported that Mr C regularly consumed large amounts of alcohol, yet there was no alcohol in his system at the time of his death. Mr C was not wearing his seatbelt and there were no skid marks on the road, nor any evidence of pre-impact skidding. At the time of the crash the weather was fine and the road was dry. There was no secondary evidence to corroborate a determination of suicide, such as a history of previous attempts or the presence of a suicide note, and the coroner was unable to provide a determination as to the mode of death.

#### *Case D: Motor vehicle accident*

Mr D was a 31 year old unemployed single male. He had an extensive illicit substance use history, and was on the methadone program to combat morphine addiction, yet was still testing positive for cannabis use. On the day of his death, Mr D stole a vehicle during the morning, and was seen driving erratically for some hours; swerving back and forth across the road, stopping in the middle of the road, travelling at different speeds over short distances, braking suddenly and overtaking other cars in an unsafe manner. At one point, Mr D was seen driving towards a concrete road divider, before veering left at the last second to avoid a collision. During the evening, Mr D was driving along an ancillary road which had a speed limit of 80km/h, at a speed in excess of 112km/h. At the time the weather was fine, and the roadway was dry and in good condition. Mr D was not wearing his seatbelt. Mr D was seen to veer suddenly off the side of the road, with a witness stating that the change in direction was “as though it was intentional”, before the vehicle Mr D was driving collided with a large tree. There was no evidence that Mr D attempted to avoid the collision, nor was there any evidence of attempts at braking or any skid marks. The vehicle was noted to accelerate immediately prior to the impact with the tree. The coroner determined that Mr D’s death could be attributed to a motor vehicle accident.

The statistical analysis highlighted that the presence of alcohol in the deceased’s system, in conjunction with a statement of suicidal intent were the most significant predictors of motor vehicle suicides. While this may be the case, there is evidence that for a determination of suicide to be made by the coroner, and for the statistical model to be in agreement with this determination, both of these features

were not needed to be present in the one case. As Cases E and F illustrate, other possible risk factors than those illuminated by the statistical analysis may significantly contribute to a coroner's decision making process, especially when making a determination of motor vehicle suicide.

*Case E: Motor vehicle suicide*

Mr E, a 46 year old maintenance supervisor in a long-term de facto relationship, had been facing a number of stressors at work after having been recently appointed a team leader of 24 people. Mr E had been described as a perfectionist, who worked as a team player and got on well with his colleagues. Mr E had no reported psychiatric history. In the days prior to his death, Mr E reportedly had a heated conversation with his partner, suggesting separation due to a loss of affection, in conjunction with an unsubstantiated suggestion that Mr E had been having an affair with another woman. The day before his death, Mr E called his partner's son into his office and told him to take care of his mother, as the next few months would be hard for her. The following day, Mr E made contact with his employer telling him that he would not be coming into work that day. He also made phone calls to his partner and his partner's brother's wife. Mr E drove along an ancillary road, with a speed limit of 100km/h, at a speed in excess of 150km/h, before crashing his vehicle into a mature pine tree by the side of the road. Mr E was not wearing a seatbelt at the time of the crash, and there was no evidence of any skid marks or indications that the deceased had attempted to avoid the collision with the tree. The weather was fine and the road was dry at the time of the crash. There was no alcohol or illicit substances present in Mr E's system at the time of his death. Investigators later found notes in Mr E's home, written to friends and family,



reminiscent of suicide notes. The coroner determined that the deceased had committed suicide by motor vehicle crash.

#### *Case F: Motor vehicle suicide*

Mr F was a 30 year old married truck driver, with a psychiatric history of depression and anxiety. Mr F had been receiving treatment from his GP for his psychiatric problems in addition to psychiatric medication. Following a function at which Mr F had consumed a fair amount of alcohol; Mr F's wife reported a sudden and unexplained mood change in Mr F. Upon his return home, Mr F left his house again on his motorcycle, without wearing his helmet, and with no explanation to his wife as to his intended destination. Mr F was seen to be swerving across the road, travelling at a speed in excess of the posted limit, into the path of an oncoming truck. The truck driver took evasive action, attempting to avoid the collision with Mr F, however was unable to do so. Mr F had previously attempted suicide, and at the time of the crash had a blood alcohol limit of 0.167g/100mL, over three times the legal limit. Investigators could not locate any mechanical or road defect to account for the motorcycle being on the wrong side of the road at the time of impact. The coroner determined that Mr F had committed suicide by driving his motorcycle into the path of the oncoming truck.

### **Discussion**

Previous research has suggested that the motor vehicle lends itself admirably as a means of suicide completion due to the frequency of its use, ease of access, the inherent hazards involved in driving, and the opportunity for the individual to conceal his or her suicidal intent (Boglioli et al., 1988; Peck & Warner, 1995). To

this end, it has been suggested that between 1.6% and 5.0% of all vehicular fatalities are in actuality, completed suicides (Schmidt et al., 1977; Peck & Warner, 1995; Pompili et al, 2006). The current study hypothesised that within a two-year period in a regional area of Australia the rate at which coroners would determine vehicular fatalities to be completed suicides would fall within this margin. Of 100 vehicular fatalities examined, two (2.0%) were determined by the coroner to be completed suicides, supporting the hypothesis. An additional three cases (3.0%) were not attributed with a manner of death, primarily due to a lack of conclusive, explicit evidence pointing to the presence of suicidal intent or pointing to non-suicidal intent.

For a determination of suicide to be made there are two key criteria which must be met. To judge that a death is a suicide, the coroner must determine that the individual inflicted the fatal injury upon themselves; that they were the agents of their own destruction. The coroner must also find that it was the deceased's intention to carry out the potentially fatal act, to end his or her life, and that they undertook the action with the understanding of its fatal outcome. There is, however, no set method for determining an individual's intent, especially with reference to the decision making process prior to undertaking a potentially lethal action. Research has investigated the efficacy of 'psychological autopsies', or post-death analyses of the individual's psychological, social and emotional state in the lead up to the death, as a way in which intent may be inferred. Such investigations utilise information gathered from the deceased's friends and family, accompanied by any associated medical documentation, to ascertain the likelihood that the deceased's actions were intended to end his or her own life. Unfortunately, no set guidelines exist to assist in the undertaking of a psychological autopsy, and there has been much discussion concerning the most appropriate format and procedure of conducting a psychological

autopsy. More research into this process is needed, and how it may best be completed to not only yield the most accurate results concerning the deceased's state, but also to protect the friends and family of the deceased from untoward emotional and psychological distress.

Some motor vehicle accidents have been noted to not be as the term may imply; a function of chance, but are rather a complex interaction of variables concerning the vehicle being driven, road and weather conditions, and most importantly, circumstances surrounding the driver themselves (Conger, 1960). With the suggestion that some individuals may seek to destroy themselves using an automobile, it has been implied that in many cases the individual does so with the intent of concealing their suicidal motivations, for reasons of insurance claims, pride, or to avoid social stigma for themselves or their family (Imajo, 1983). Consequently, it is likely that there are many more 'missed' suicides amongst vehicular fatalities than those that are actually recorded. It was hypothesised that within the vehicular fatalities examined, and determined by the coroner to be either accidents or not attributed with a manner of death, that a number would contain variables which would be statistical predictors of motor vehicle suicides, thus placing them in the same statistical category as suicides by motor vehicle crash. Backwards stepwise logistic regression was performed to explore this hypothesis, and noted that of all the variables recorded, the presence of alcohol in the deceased's system and a statement of suicidal intent were the two most significant statistical predictor variables in determining whether an individual case was deemed to be an accident or a suicide by the coroner. The analysis correctly identified 98% of the cases, with one case (deemed by the coroner to be an accident) falling in the statistical realm of motor vehicle suicides, and one case, which had not been given a determination, found to

be statistically similar to other fatal motor vehicle accidents. The statistical identification of the motor vehicle suicide, which had been deemed to be an accident by the coroner, supports the stated hypothesis.

Suicide research has indicated that there are a number of factors which increase an individual's risk of committing suicide. Increased age, relationship status other than married or de facto, history of psychiatric illness, previous suicide attempts, substance use, straitened social circumstances and impulsivity have all been indicated as risk factors for suicide (Klerman, 1987; Pearson et al., 1999; Allen, 2000; Sadock & Sadock, 2003; Diesenthaler et al., 2007; Beautrais, 2003; Goldstein et al., 1991). Indeed, the statistical analysis conducted in this study highlighted the importance of two of these risk factors in differentiating between cases of motor vehicle suicide and fatal motor vehicle accidents. Alcohol use and a statement of suicidal intent were found to be statistically significant factors in judging suicide by motor vehicle. This finding, coupled with the ready availability of motor vehicles and the inherent hazards involved in driving suggest that motor vehicles, especially when used in conjunction with alcohol and at a time when the individual may be emotionally vulnerable, lend themselves to be an ideal means of suicide completion. Research has suggested that if a substantial proportion of single-vehicle fatalities are in fact deliberate goal-directed suicides that the seasonal distribution and age variation of the deceased would be akin to those of suicides by other means (Jenkins & Sainsbury, 1980). Consequently, it could be suggested that physical crash variables, those involving the vehicle, weather and road conditions, rather than the individuals involved, could be significant in differentiating between cases of motor vehicle suicide and fatal motor vehicle accidents. It was hypothesised, therefore, that factors outside of those recognised as psychological and social

suicide risk factors, such as road and weather conditions, vehicle roadworthiness, and the speed being travelled at the time of the crash, would be statistically significant in predicting cases of motor vehicle suicide.. Backward stepwise logistic regression indicated that the presence of alcohol in the deceased's system and a statement of suicidal intent were the only predictors of motor vehicle suicide for this sample, and as both have been noted to be psychological risk factors for suicide, this hypothesis was disproved.

Statistical analysis of 100 cases of motor vehicle fatalities from a regional area of Australia indicated that 2.0% of cases were determined to be suicides by the coroner. Backwards stepwise logistic regression was used to identify any discrepant cases; that is cases which were statistically classified in a manner that differed from the coronial determination. Two cases were found to be discrepant. The first had been determined an accident by the coroner, yet was found to be statistically similar to other cases of motor vehicle suicide. The deceased in this case also had a number of characteristics known, from previous research, to increase an individual's risk of suicide. These risk factors included a history of psychiatric illness, previous suicide attempts, history of self-harming behaviours, alcohol use, recent relationship breakdown, recent bereavement (of an unborn child), and impulsivity. Consequently, it is a distinct possibility that this individual committed suicide by means of a motor vehicle crash, however, due to absence of an explicit statement of suicidal intent and the deceased's relative inexperience behind the wheel, the coroner determined the death to be an accident. The second discrepant case had not been afforded a manner of death determination by the coroner. The statistical analysis concluded that this case was more statistically similar to fatal motor vehicle accidents than suicides. This case did not contain any of the known risk factors which increase an

individual's risk of committing suicide, thus supporting the notion that the deceased died as a result of a motor vehicle accident.

Of additional note is that those cases deemed to be motor vehicle suicides by the coroner also contained numerous other psychological, social and emotional factors known to increase an individual's risk of committing suicide. These factors include a history of psychiatric illness, prior suicide attempts, alcohol and substance use, impulsivity and breakdowns in interpersonal relationships. This finding suggests that it is not merely the presence of a statement of suicidal intent or the presence of alcohol, as suggested by the statistical analysis, which are used as criteria for coroners to determine whether a case should be classed as a motor vehicle suicide, but rather a conglomeration of suicide risk factors which prompt the individual to end his or her own life.

### **Limitations and future research directions**

The use of backwards stepwise logistic regression to identify suicide risk factors presents a number of potential analysis-related limitations. Stepwise procedures identify a model which is the "best fit" for the data, however they cannot distinguish causal relationships from those that are non-causal, but are yet related. Stepwise procedures are also heavily dependent upon tests of significance, which are, in turn, dependent upon the size of the sample under analysis. Therefore, in large samples, variables whose practical importance is minimal may be included in the model because of a high level of statistical significance. Conversely, in small samples, such as that which forms the basis for this study, variables with a great deal of practical importance, which may be statistically significant in a larger sample, may be excluded from the model, due to a low degree of statistical significance

(Goldstein et al., 1991). Consequently, in some cases of stepwise logistic regression, the model which provides the best statistical fit for the data may not make the most practical sense, and any conclusions drawn must be done with due care and attention.

The use of logistic regression in this study was done in an exploratory manner; as an attempt to ascertain those variables most likely to enable the differentiation between an accidental motor vehicle fatality and a suicide by motor vehicle crash in the coroner's determination. Whilst the presence of alcohol in the deceased's system and a statement of suicidal intent are logical and practical variables one might suggest would differentiate a suicide from an accident, the causal relationships between these variables and the outcome, in this case the coroner's determination of the manner of death, are far from assured. This is especially true for alcohol intoxication as it is often a significant contributing factor to accidental vehicular fatalities in and of itself. Future research would require a much larger sample size to be examined to allow for the increased efficacy of using such a statistical method.

In many societies suicide remains an almost taboo subject, with those individuals who exhibit suicidal tendencies, or who engage in suicidal behaviours stigmatised by society (Cholbi, 2007). In recent years, however, there has been a push to educate the public about suicide and suicide related behaviours, viewing them as a multidimensional problem which has most likely arisen as a consequence of other issues and concerns (Miles, 1977; Pompili et al., 2006). Consequently, research has been conducted into ways in which suicide may be prevented, and the amelioration of risk factors which may lead to suicidal behaviour. Many suicide prevention strategies have focused on restricting access individuals have to means of

suicide completion (Beautrais, 2000). This strategy is not easily implemented when the motor vehicle is used as a means of self-destruction. Road safety campaigns have been aimed, in the past, toward drivers; prevailing upon them to reduce their speed, not to drive under the influence of alcohol or drugs, and to rest if drowsy (Schmidt et al., 1972). These campaigns, in conjunction with improvements in vehicle safety standards have resulted in a decline in the overall number of motor vehicle fatalities over the last 15 years (Australian Bureau of Statistics, 2009). Unfortunately, as it is almost impossible to restrict the use of motor vehicles, thus preventing the depressed or unconscious motivated suicidal individual from driving, further research is required to not only establish suicide prevention strategies applicable for cases of motor vehicle suicide, but also road safety campaigns targeted at the friends and family of the individual who may use their vehicle to end their own life.

## **Conclusion**

Motor vehicle crashes offer individuals a simply means by which to commit suicide. Readily available and frequently used, automobiles are one of the leading causes of death and injury in Australia, especially for young men (Dumais et al., 2005). Previous research has estimated the rate of suicide by motor vehicle crash is between 1.6% and 5.0%, of all vehicular fatalities (Schmidt et al., 1977; Peck & Warner, 1995; Pompili et al., 2006). This current study has replicated this finding, examining 100 vehicular fatalities in a regional area of Australia over a two-year period, with two cases (2.0%) being determined to be suicide by the coroner. Backwards stepwise logistic regression was used to explore which variables contributed to the differentiation between accidental vehicular fatalities and motor vehicle suicides. The model created correctly identified 98% of cases, using a model



where the presence of alcohol in the deceased's system and a statement of suicidal intent acted as the predictors of motor vehicle suicide. Of the two discrepant cases, one case had been determined as an accident by the coroner, yet was statistically classed in the same category as other motor vehicle suicides. The second of the discrepant cases had not been attributed with a manner of death by the coroner, but was found to be in the same statistical category as fatal motor vehicle accidents. The statistical model noted that the presence of alcohol in the deceased's system and a statement of suicidal intent were the significant factors in differentiating between cases of motor vehicle suicide and fatal motor vehicle accidents. It was noted that further research is required to improve the validity of the statistical analysis, using a larger sample size, to gain further understanding of the variables which contribute a particular motor vehicle fatality being determined as a suicide, and to determine the impact the presence of other psychological, social and emotional risk factors for suicide has on the determination of manner of death.

Currently, there is no standardised manner in which coroners determine an individual's manner of death. This study examined the possible indicators of suicide in vehicular fatalities, using as the target variable the best guess of the coroners making their mode of death determination. Due to the absence of standardised criteria, this determination arises only from the information presented to the coroner throughout the investigation and their own judgment concerning the deceased's intent. Consequently, based on the limited evidence available to the coroner, there is a degree of variation both between coronial jurisdictions and between individual coroners as to what criteria are required for a determination of suicide to be made. In addition, many cases of motor vehicle suicide are not classed as such, due to the absence of explicit evidence, such as the self-infliction of fatal injuries or the

assessment of intent, which may prompt such a decision to be made if death was by alternative means. As a result, current statistics on suicide rates do not always include many of the 'hidden' suicides; that is, those fatalities where there is the possibility of death arising from self-inflicted wounds, yet there is no explicit evidence to support that determination. Coroners are therefore relied upon to provide their best guess when determining the mode of death, based on the evidence available, and their own individual judgement. One recommendation could be the creation of a set of criteria which coroners could follow in order to establish a manner of death determination. Using the psychological, social and emotional risk factors for suicide as a guide, coroners could ascertain the likelihood a particular death was self-inflicted and intended by the deceased to end his or her life. Using such guidelines could assist coroners with objective determination of suicide in equivocal cases, however, there would have to be the opportunity for coroners to deviate from these guidelines if the need arose. Provision should also be made for coroners to engage the services of trained professionals in conducting psychological autopsies to gather additional information concerning the deceased's intentions and motivations in the days and months before their death. Using such a strategy could result in an improvement in the accuracy of suicide reporting, and consequently reduce the number of misclassified suicides, especially if death has occurred as a result of a single-vehicle fatality.

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