**Appendix 1 Literature review summary**

Summary of the 16 reviewed manuscripts ordered from most recent to oldest and then alphabetically based on the last name of the first author

| Publication, study design | Results | Characteristics of suicide crashes |
| --- | --- | --- |
| **Okolie et al. (2020), reviewing studies worldwide**  *Objectives/aims*  Evaluate the effectiveness of interventions to restrict availability of, or access to, means of suicide on roads  *Method*  Systematic literature review into controlled trials or intervention studies, before-after studies and studies using interrupted time series designs which evaluated the interventions to restrict means of, or access to, suicide on roads | * Of the 2185 screened records resulting from the literature search 36 full-text articles were assessed for eligibility but none of the articles reported on the effectiveness of an intervention to restrict availability of, or access to, means of suicide on roads |  |
| **Radun et al. (2019), Finland**  *Objective/aims*  Explore road traffic suicides involving collisions with heavy vehicles, with a focus on the drivers involved as the second party, i.e. the heavy vehicle driver.  *Method*  Analysed 138 road suicides from 2011 to 2016 involving a passenger car crashing into a heavy vehicle using road crash investigation data from the Finnish Crash Data Institute. Suicide cases were identified using an “intentional action” category in an “immediate risk factor” variable in this database | * Of the 180 Finnish road suicides in the period 2011-2016, 138 involved a car crashing into a heavy vehicle | * Two vehicle head-on collision with mass differential |
| **Breen et al. (2018), Norway**  *Objective/aims*  Update knowledge and elucidate the characteristics of culpable and nonculpable drivers and the causes of deaths in motor vehicle crashes with a focus on identifying suicides and pathological conditions predictive of incapacitation and toxicological substances in driver fatalities  *Method*  Analysed data from road traffic fatalities from January 2000 to December 2014. Drivers of cars, vans and lorries that were in motion on roads and died within 30 days of the crash were included; drivers found dead in stationary cars were excluded. Suicide cases were identified based on the following criteria (by Svensson et al, 2015):   * Oral or written farewell message * (In-) directly communicated imminent suicidal intent prior to the collision * Previous depression or life crisis, or known suicide attempts in the past * Witness accounts supporting the traffic event was a suicidal act | Of the 406 fatal crashes included in the study, 37 were thought to be suicides | * More likely to be male * Mean age 40.5 years * More often during spring months * More often on straight roads * More likely to be speeding at the time of the crash * More often involving a collision with a lorry/truck/bus * More likely to have consumed alcohol prior to death * More likely levels of antipsychotics or antidepressants were present * History of psychiatric disease * History of suicide attempts |
| **Pridmore, Varbanov & Sale (2017), Australia**  *Objectives/aims*  Explore the phenomenon of suicide by driving one vehicle into another, and draw attention to the cost to occupants of targeted vehicles.  *Method*  Examination of academic literature, court and newspaper reports and online sources. Seven cases from press reports or unpublished correspondence are discussed in more detail. | Choice of suicide by driving one vehicle into another:   * Vehicles are widely available * Determining suicide by motor vehicle is difficult, increasing the chance of: compensation for the family, less stigmatisation of the family, and less social damage for the family | * More likely to be male * More likely to have consumed alcohol prior to death * More likely to have experienced adverse life events   From 7 specific cases:   * Mostly male * Ages ranging from 25-40 years * Two vehicle collisions * Two vehicle collisions with mass differential * Suicide note * Recent adverse life event * History of psychiatric disease * History of suicide attempts * Speeding |
| **Gauthier et al. (2015), Switzerland**  *Objectives/aims*  Determine characteristics of road traffic suicides in Switzerland in the decade between 2000 and 2010.  *Method*  Suicide data from between 2000 and 2010 were extracted from the database by Swiss institutes of forensic medicine. The characteristics of crash suicides (n = 53) were compared to suicides by other means (n = 4,885), where forensic experts determined death by suicide. | * The mean age of the crash suicide victims was 44 years * Crash suicides occurred most often along main highways * Compared to other cases of suicide, people who died by suicide by crash were less likely to be under the influence of drugs * Suicide notes were left less often by crash suicides compared to suicides using other means | * Mostly unmarried males * 73% of crash suicides were collisions with another car, a truck, or an object * Mostly employed (versus unemployed, pensioner or other) * Testing for alcohol was negative during an autopsy |
| **Pompili et al (2012), reviewing studies worldwide**  *Objectives/aims*  Review the current literature on the association between single-car crashes and driver’s suicidal intent.  *Method*  Review literature found with PubMed and PsychInfo from the period 1955-2011. Studies were included that were published in English peer-reviewed journals and added an original contribution to the literature. | * The overview of the literature indicates that over 2% of the traffic crashes are suicide behaviours; however, the phenomena may be underreported * The association between crash-processes and unconscious self-destructive impulses is an issue that is difficult to determine * The existence of an association between single car crashes and suicide is not firm as yet |  |
| **Henderson & Joseph (2012), Australia**  *Objectives/aims*  Explore the prevalence of crash suicides and examine the risk factors associated with crash suicide.  *Method*  A single case study of an attempted suicide crash, and an international literature review were undertaken. Suicide attempts were determined by a survey of the patient and a psychiatric assessment. | * The case study highlighted that identifying a car crash as a driver suicide is difficult * Many national road safety strategies have failed to reach their target reduction in road fatality rate, especially for the young/male group. Authors suggest a significant proportion of these fatalities could be unrecognised suicides | *Characteristics identified in the literature review*   * Male * Aged between 25 and 34 * Single occupant crash * Not wearing a seat belt * Absence of skid marks or other evidence for loss of control over the vehicle * Alcohol intoxication/abuse * Significant recent psychosocial stress * Mental disorders * Previous suicide attempt * Impulsivity and low distress tolerance personality trait |
| **Milner and De Leo (2012), Australia**  *Objectives/aims*  Understand the individual and situational characteristics of suicides involving a road crash in Queensland, Australia, in the 18 years between 1990 and 2007.  *Method*  Data from the Queensland Suicide Register (QSR) and forensic crash investigation case records were used in this study. The characteristics of confirmed driver suicide cases were compared with those from possible driver suicides cases. Confirmed suicide crashes were those where evidence, such as suicide notes, statements of intent, previous suicide acts, critical live events, and/or psychiatric disorder, was of a high enough probability to indicate suicide. Possible suicides were those where the available information was suggestive of a suicide but was insufficient to exclude the chance of death being due to another cause. | * 52 confirmed cases and 29 possible cases of driver suicide were found * Three confirmed cases of suicide involved a motorcycle, and the remaining confirmed/possible suicides occurred in cars or vans | Characteristics of confirmed driver suicides:   * Male drivers * Single car occupant * Speeding * Collisions with mass differential * Suicide note * Verbally communicated suicide intentions * History of past suicide attempts * Relationship problems * More likely to be employed * Consumed alcohol prior to death |
| **Hernetkoski, Keskinen & Parkkari (2009), Finland**  *Objectives/aims*  Determine the prevalence of driver suicides in Finland for the period 1974 – 2006  *Method*  In Finland, all fatal motor vehicle crashes are investigated by a multidisciplinary team resulting in case reports, these reports were reviewed. For a case to be classified as a suicide, the course of the events had to be notably influenced by the driver’s intention, and the background of the driver had to suggest suicidal intent.  *Data*  3508 fatal crashes in total for the years 1974 – 1975, 1984 – 1985, 1987 – 1988, 1991 – 1992, 1993 – 1994, 1997 – 1998, and 2005 – 2006 | * For the years under study there were 227 driver suicides, this is 6.5% (227/3508) of the total number of fatal crashes * For the years 2005 – 2006 there were 45 driver suicides, 8.5% (45/528) of the total number of fatal crashes * The proportion of driver suicides had increased in 2 phases, the first increase from 1.1% to 5.8% happened between the 1970s and 1980s and the second increase was from 5.8% in the 1980s to 8.4% in the 1990s. Since then, driver suicide has been constant at around 8%, approx. 20 driver suicides per year * There was no significant difference in mean rate of driver suicides per 100,000 persons between northern and southern Finland. In absolute numbers, more driver suicides had happened in Southern Finland | * No skid marks * Average 35 years of age * Mostly male * Mostly single or divorced * Sober at time of crash * Summer months * Weekdays |
| **Wyatt et. al. (2009), Scotland**  *Objective/aims*  Examine the rate and circumstances surrounding apparently suicidal deaths in south-east Scotland between 1993 and 2003.  *Method*  Detailed background information was obtained for each death, using a variety of sources, including police reports prepared upon the instructions of the Procurator Fiscal, ambulance records and hospital case notes. Suicide was determined when there was supporting evidence both in terms of the circumstances of the collision and in terms of background information (e.g. recently stated suicide intention or suicide note) | * Of 597 road traffic deaths, 17 (2.8%) appeared to be suicides * Of these 17 suicides, toxicology of body fluids was performed in 12 cases (71%). Of these, only two (17%) had significant levels of alcohol within the bloodstream | * Majority of fatalities were male * Ages ranged from 20-67 years * Single vehicle crash * Diagnosis of psychiatric disease * Chronic alcohol problems * Adverse life event * Life-threatening and/or chronic illness |
| **Murray & de Leo (2007), Australia**  *Objective/aims*  Examine and discuss the prevalence and characteristics of driver suicide plans and attempts.  *Method*  A survey – the Gold Coast Suicide Prevention Community survey - was conducted with 8677 respondents in the Gold Coast Health Distract, Queensland, Australia  *Data*  1196 of the respondents had a history of suicidal ideation or behaviour. Of these, 412 planned/ are planning a suicide (34.4%). Of these, 61 (14.8%) reported planning or making arrangements to suicide by crashing a motor vehicle. | *Crash suicide planners*   * Almost 1 in 5 male planners and 1 in 10 female planners planned to suicide by crashing a motor vehicle   *Suicide attempters*   * Of the 228 respondents who had previously attempted suicide, 8.3% were driver suicide attempters * Driver suicide was the third most likely method of attempting suicide mentioned * Driver suicide attempters were more likely to repeat suicide attempts compared to other attempters | *Crash suicide planners*   * Majority were male * Majority were in the 25-34 year age group * Majority were employed full-time * Majority had a partner and children   *Crash suicide attempters*   * Males report to have used this method more than females * Self-reported mental and emotional problems at the time of the attempt |
| **Lam et al. (2005), New Zealand**  *Objectives/aims*  Investigate the association between suicidal ideation, anti-depressant medication, and the risk of a car crash resulting in serious injury.  *Method*  A population-based case-control study was conducted in the Auckland region of New Zealand between April 1998 and July 1999. Suicide ideation was asserted as positive when drivers answered “yes” on the question if they had considered taking their own life during the 12 months prior to the crash. Drivers where classified into three categories: drivers who had previous suicidal ideation with current treatment, drivers who had previous suicidal ideation without current treatment, and drivers without suicidal ideation.  *Data*  588 control drivers and 571 cases sustaining an injury while controlling a vehicle. | * The odds of being involved in a car crash was 4 times more likely for people with suicide ideation who were not on anti-depressant medication compared to people who never had suicidal ideation (after adjusting for driver sleepiness and alcohol consumption prior to driving) | * Suicide ideation in the past 12 months |
| **Hernetkoski & Keskinen (1998), Finland**  *Objective/aims*  Follow up to an earlier study by Keskinen and Pasanen (1990) with more recent data to determine if and how the prevalence of suicides and other self-destructive behaviour in traffic has changed over the period 1974 to 1992.  *Methods*  A crash investigation team investigated all fatal crashes involving the death of a driver or passenger. The team produced a final report including a description of the course of events and the key occurrence. To be determined a suicide crash, two criteria had to be met: the circumstances of the crash had to be such that it was certain the driver had intentionally influenced the course of events, and background information on the driver had to support the possibility of a suicide.  *Data*  2240 fatal crashes were investigated. | * The proportion of identified suicides statistically significantly increased from 1.1% (1974-1975) to 7.4% (1991-1992) * In the suicide group, 49% of drivers were assessed as depressed * 11% of drivers who died by suicide had been previously convicted of drunk driving, and 59% of the drivers had traffic penalties * 22% of the suicide cases were under the influence of alcohol at the time of the crash | * Young males * Collisions with another moving vehicle * Stressful life events * Mental disorders |
| **Ohberg, Penttila & Lonnqvist (1997), Finland**  *Objectives/aims*  Study driver suicides by comparing data collected by crash investigation teams with the number of diver suicides reported in the official statistics.  *Methods*  All fatal crashes involving the death of a driver or passenger were investigated by a crash investigation team, resulting in a report including a description of the course of events and the key occurrence. Of these fatal crashes, 99 were possible suicides. Two forensic pathologists assessed these 99 possible suicide crashes according to the ICD-9 and classified 84 cases as suicides, which were include in this study. For each of these cases a control driver was randomly selected from all traffic fatalities with no suspicion of suicide as the key occurrence of the crash. | * At least 5.9% of motor vehicle driver fatalities over the five-year period were suicides, this proportion is significantly greater than the 2.6% given in official statistics * Compared to the official statistics, the ‘additional’ suicides found by the study involved more middle-aged and sober drivers * 13% of the cases but none of the controls had previously attempted suicide | * Young man * Single occupant of car * Driving a passenger car * Head-on collision between two vehicles with a large weight disparity * Stressful life events * Mental disorders * Long-term problems with alcohol * Previous suicide attempts |
| **Peck & Warner (1995), USA**  *Objectives/aims*  Sought to address research questions:  What criteria can ben used to determine suicide was intent of crash?  How can death by automobile crash could be determined a suicide?  *Methods*  Review examples of crashes where suicidal intent may have caused the crash. Cases were selected when the file suggested suicidal intent was strong or because the author was advised by the investigators that the death might have been by suicide.  *Data*  Medical examiner reports were reviewed for six example crashes, of which four were identified as a suicide crash | * Evidence to confirm suspicion of suicidal intent is difficult to obtain * Conflicting social evaluations, legal system of torts and insurance companies add to difficulties encountered in evaluating suicidal intent * Investigators might fail to document evidence in fear of it being used in a court hearing | From 4 cases:   * Male * Two vehicle crash * Two vehicle crash with mass differential * Speeding * Adverse life events * Intent of suicide discussed * High blood alcohol/drug percentage at time of crash * History of psychiatric disease * No skid marks |
| **Connolly, Cullen & McTigue (1995), Ireland**  *Objectives/aims*  Examine circumstances of single road traffic deaths in Country Mayo, Ireland to determine unidentified suicides  *Method*  Examine coroner’s files from 1978 to 1992. Of the 134 single road traffic deaths, six were identified as suspected suicides (4.5%) based on circumstances of the crash and evidence of psychotropic medication. Criteria such as a suicide note or other indication of intent were absent. | * 6 out of 134 deaths were identified as suspected suicides | * Dry straight road in daylight * Incidents with lower alcohol levels involved * Evidence of use of psychotropic medicine |
| **Nelson (1994), USA**  *Objectives/aims*  Showcase 26 cases of suspected suicide/murder using motor vehicles the author encountered during their career and examine features of these cases to help crash investigators to classify these as murder or suicide instead of an accident.  *Method*  Description of 26 murder/suicide cases using a motor vehicle. | * Out of the 26 suspected murder/suicide cases, 15 were suicides or suicide attempts with the crash as a contributing factor * Many of these suspected suicides and suicide attempts were reported as an accident, even though in a number of cases a note or verbal statement of intention were present | Of the 15 suspected suicides or suicide attempts:   * 9 involved single vehicle crashes and 6 two vehicle crashes * 8 male drivers and 7 female * 3 drivers aged under 30 years, 5 between 30 and 60 years, and 2 over 60 years, for the other cases no age indication was given * 7 cases had suicide notes or an oral statement indicating intent * 9 involved single vehicle occupant crashes and 6 with multiple occupants (their partner, children, or siblings) * 8 cases were recorded as high speed crashes * 8 cases recorded no intent to break and/or steer away from the object of the crash * 5 cases recorded no seat belt use * Alcohol and/or drug intoxication was suspected in 4 cases * In 7 cases the subjects had an indication of mental illness or depression * 3 cases reported previous suicide attempts * 5 cases were related to marital or relationship issues * 6 cases noted adverse life events for the subjects other than marital/relational problems |