MONASH University
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SUICIDE AND NATURAL DEATHS IN ROAD TRAFFIC – REVIEW

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Title and sub-title:
Suicide and Natural Deaths in Road Traffic: Review

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Abstract:
Aim: To determine current knowledge concerning incidence and prevention, data collection practices and any associated inadequacies, relating to suicide and natural deaths in road traffic.
Method: The research involved (1) a review of literature from refereed journals, electronic resources and appropriate agency reports, (2) a search of international road safety and vital statistics data available from the internet, published reports and other sources to determine the extent to which suicide and natural death crashes are included and (3), emailing questionnaires to vital statistics and road traffic organisations to collect information on current practices in the treatment of suicide and natural deaths in national data systems.
Results: Relative to other methods of suicide and injury, literature on suicide and natural deaths in road traffic was scarce, particularly for pedestrian suicides. Available data and literature suggested that driver suicides and natural driver deaths are relatively minor components of road traffic fatalities but may be underestimated. Driver suicides are mostly male and aged 25-34 years. Risk factors are previous suicide attempts, a history of mental illness and the presence of alcohol. Most natural driver deaths are male, aged 50 to 70 years, caused by cardio-vascular disease and involve little or no property damage.
Data on driver but not pedestrian suicide or natural deaths was located on some electronic national vital statistics sites. The data located on national and international road safety electronic sites appeared to be unintentional and no more detailed than conveyance eg pedestrian hit by truck. The ICD-10 definitions and codes appear to be more detailed, comprehensive and uniformly adopted than those of road safety data systems. Australia has an electronic National Coroners Information System which provides detailed fatality data to approved users.
Responses were received from all 10 national vital statistics and 16 of the 22 national road traffic organisations surveyed. Vital statistics respondents used ICD-10, unspecified location coding commonly hindered pedestrian suicide identification and only half of the respondents used multi-cause coding (natural deaths). Responding road safety statistics organisations mostly excluded suicides and natural deaths. The Czech Republik, Sweden, Switzerland, Poland and Finland were exceptions. In almost all road safety systems, suicides and natural deaths were treated similarly. Pedestrian and driver protection measures which may be applicable to suicide prevention are outlined.
Conclusion: Literature on road traffic suicides and natural deaths, especially pedestrian suicides, is scarce. Road safety data systems mostly exclude these deaths. The ICD-10 vital statistics coding system has the most potential for identifying relevant data. Reported cases are a small proportion of total road traffic deaths but are probably underestimated. Prevention measures should be drawn from general driver and pedestrian injury prevention measures since specific measures were not noted in the literature.

Key Words:
Deliberate crash, intentional crash, driver suicide, pedestrian suicide, driver natural death, driver natural cause

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Glossary

ABS	Anti-lock brake systems
ACC	Accident Compensation Commission (New Zealand)
ACEA	European Automobile Manufacturers Association
ACME	Automated Classification of Medical Entities
ABS	Australian Bureau of Statistics
ATSB	Australian Transport Safety Bureau
CARE	Community Road Accident Database (Europe)
DRL	Daytime running lights
ECMT	European Conference of Ministers of Transport
EMS	Emergency Medical Systems
EU	European Union
FARS	Fatality Analysis Reporting System, NHTSA (USA)
ICD-9	The International Statistical Classification of Diseases and Related Health Problems, 9th Revision
ICD-10	The International Statistical Classification of Diseases and Related Health Problems, 10th Revision
IRTAD	International Road Traffic Accident Database
MUNCCI	Monash University National Centre for Coronial Information (Australia)
NCHS	National Center for Health Statistics (USA)
NCIS	National Coroners Information System (Australia)
NCSA	National Center for Statistics and Analysis (USA)
NHTSA	National Highway Traffic Safety Administration (USA)
OECD	Organisation for Economic Co-operation and Development
RTA	Road traffic accident
RTI	Road traffic injury
SAAQ	Societe de l'assurance Automobile du Quebec (Canada)
SNRA	Swedish National Road Administration
TAC	Transport Accident Commission (Victoria, Australia)
WHO	World Health Organisation
WISQARS	Web-based Injury Statistics Inquiry and Reporting System, National Center for Injury Prevention and Control

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EXECUTIVE SUMMARY

The study is one of a series initiated and funded by the Traffic Safety Department of the Swedish National Road Administration (SNRA) to systematically review, analyse and compile the scientific literature published in the field of road safety. The development of road safety improvements needs to be based on high quality statistics, and it is necessary to have a clear understanding of the nature of cases included in the statistics. This study addresses the question of whether, nationally and internationally, road fatality statistics include or exclude deaths of drivers or pedestrians due to suicide, and deaths of drivers due to natural causes. The report discusses issues and practices related to the identification and classification of deaths on roads involving suicidal intent or natural causes. The report also reviews the incidence, risk factors and prevention of these forms of road fatality.

The aims of the study are to:

- Determine current knowledge concerning incidence and prevention of suicides and death from natural causes in road traffic
- Determine current data collection practices, nationally and internationally, relating to suicide and natural deaths on roads
- Identify any inadequacy of current data practices relating to suicide and natural deaths on roads

CURRENT KNOWLEDGE

A comprehensive review of research and information was undertaken using a range of resources including refereed journals, electronic resources and reports of appropriate agencies. The following issues were addressed:

- incidence, risk factors and prevention of driver suicide
- incidence, risk factors and prevention of pedestrian suicide
- incidence and risk factors associated with natural deaths of drivers
- treatment of suicide in life insurance and transport accident specific schemes
- general suicide and specific road traffic prevention strategies

Relative to other methods of suicide and injury, there appears to be very sparse literature on suicide, especially pedestrian suicide, and natural deaths in road traffic. Available data and literature suggest that driver and pedestrian suicides and natural driver deaths are relatively minor components of total road traffic fatalities.

Many deaths that would be termed suicide according to medico-psychological criteria are reported as accidental or from undetermined causes. The difficulty of positively identifying a death as suicide is complicated by the complexities of determining true intent and psychological motivation. Previous research into suicide by motor vehicle crash has identified a reluctance to classify cause of death as suicide without concrete evidence such as a suicide note, and this piece of evidence is rarely found in single-vehicle crashes. There is a belief that suicide by motor vehicle crash is a preferred method for disguising suicidal intent as an accident.

Driver suicide

Literature shows suicides by motor vehicle crash to be a small proportion of the total road toll with estimates of between 1% and 7% of all motor vehicle crash fatalities. Official statistics suggest a lower proportion (0.8% of motor vehicle fatalities (Canada, Australia, Sweden) and 0.5% of suicides (Australia)).

Suicide by motor vehicle crash typically involves either a single vehicle, single occupant crashes, or a head-on collision of a single occupant vehicle with a heavy goods truck. Most cases of suicide through a motor vehicle crash are male (approximately 90%). The majority of victims are in the 25-34 age group and 24% of all victims have attempted suicide on at least one previous occasion. Approximately half the traffic suicide victims have a psychological state ranging from "mental disturbance" to being "depressed". A common theme presenting throughout the literature is the involvement of alcohol in traffic-related suicides. Whilst not solely related to traffic suicide, as high as 85% of all single-vehicle traffic fatalities were found to have drivers who had been drinking prior to their crash.

Pedestrian suicide

Relative to suicide by vehicle crash, pedestrian suicide has received little research attention. However, it has been shown that in many of these cases there was a history of mental illness, and the presence of alcohol use. One study has identified the main mode of suicide among pedestrians to be to walk or jump into the path of a heavy vehicle.

Natural driver deaths

Identification of non-traumatic natural death of drivers appears to be made on the presence of pathology detected by autopsy, medical history, or absence of injury that could account for the death. Estimates of the incidence of sudden natural death at the wheel indicate that it is an infrequent event and a relatively minor proportion of all traffic related fatalities (2% road fatalities, 1.3% of driver deaths).

However, it has been suggested that the incidence of natural driver deaths may be underestimated. When a serious collision occurs, the driver's death may be incorrectly attributed to trauma and even when natural death is suspected, the post-mortem examination may be inconclusive or lead to conflicting opinions. Hospital treatment, where it occurs, may complicate accurate identification and documentation of natural causes.

The main risk factors identified for non-traumatic driver death are:

- *Gender*: all studies show a strong predominance of males
- *Age*: most non-traumatic driver deaths are between 50 and 70 years of age
- *Medical condition*: Most deaths are caused by cardiovascular disease and many have no prior knowledge of the presence of the condition. Many cases are associated with obviously enlarged hearts

Many of the traffic incidents associated with natural driver deaths involved little or no injury or property damage. It has been suggested that this may indicate that drivers have some warning and are able to reduce speed or to stop the car. As many as 50% of natural driver deaths took place in a stationary vehicle.

The main focus of most of the reviewed studies was the issue of fitness to drive for high-risk groups. Consequently, little attention is paid to methodological or other issues that may be pertinent to the incidence and classification of natural deaths.

CURRENT TREATMENT OF SUICIDE AND NATURAL DEATHS IN ROAD TRAFFIC IN DATA SYSTEMS

A search was undertaken of international road safety and vital statistics data available from the internet, published reports and other available sources to determine the extent to which suicide and natural death crashes are included or excluded. This was supplemented by a questionnaire sent to vital statistics and road traffic organisations to collect information on the treatment of suicide and natural deaths in national data systems.

Vital statistics data

Vital statistics data is usually based on death certificates and utilises the World Health Organisation's International Classification of Diseases (WHO ICD) coding system. The most recent version is ICD-10. Relevant codes are X81 for "*intentional self-harm by jumping or lying before a moving object*" which includes mostly rail but some road pedestrian suicides and X82 for "*deliberate crashing of a motor vehicle*". ICD-10 potentially allows pedestrian suicides to be identified as X81.4 ie *hit by a moving object on a street or highway* and driver suicide as occurring on a street or highway (X82.4). Y31.4 and Y32.4 are the unknown intent equivalents. The earlier version of ICD (ICD-9) did not have this fourth digit to specify location.

In the ICD-10 system accidental transport fatalities are allocated codes between V01 and V89 with a fourth digit to identify if traffic or not (eg *V04.1 Pedestrian injured in collision with a heavy transport vehicle or bus in traffic*). A limitation however, is that determination of intent is usually based on a coronial decision which is generally considered conservative, and particularly so for this type of suicide. These suicide cases may therefore be determined to be "an accident".

The multi-cause coding feature of ICD-10 enables natural road traffic deaths to be identified.

The highest level of suicide data available on national statistical websites was to three digits only (eg 190 suicides from *deliberate crashing of a motor vehicle* (X82) for the US in the years 1999-2000). These suicides were not specifically traffic and pedestrian suicide data could not be located. International suicide data in WHO publications (eg WHO Statistics Annual) provided no higher level of detail than national frequencies and rates for suicides and motor vehicle crash fatalities (eg Russian Federation 49 per 100,000 population unintentional motor vehicle fatalities, 87 per 100,000 suicides).

The responses to the questionnaires indicated that:

- All responding countries currently use the ICD version 10 coding system, with the exception of Italy, which will upgrade from ICD-9 for its 2002 data.
- In ICD-10, the fourth character sub-division represents location for both suicides and unknown intent, and for transport accidents to identify if traffic or non-traffic. All respondents reported their ICD-10 data systems as having the facility to be coded to this fourth character sub-division. In practice for suicide the fourth digit tended to have a large proportion of cases assigned to 0.9 ie *unspecified place* (Canada 38%, Catalonia often). In

France the fourth digit data is difficult to access. Transport fatality data was complete to the fourth digit. In most cases both suicide and transport fourth digit data is not published but is readily available.

- Identification of natural death is facilitated with multi-cause coding. France, Sweden, USA, Australia, the UK and Scotland reported using multi-cause coding whereas Canada, Spain, Italy and Germany do not. Germany however will practise it in one or two years.

Road safety statistics

National road safety data is usually based on police reports and the internationally commonly adopted definition refers to a road traffic fatality ie “Any person who was killed outright or who died within 30 days as a result of an accident.” A few countries have modifications of this definition. The coding system however used by road sector fatality data systems has not the level of detail or adoption of ICD.

International fatality data was available from the IRTAD and European Conference of Ministers of Transport (ECMT) websites and publications for no higher level of detail than pedestrians and drivers, presumed unintentional. Unfortunately the researchers were not able to obtain data from the CARE website. It appeared to be the only national or international road traffic website to refer to suicide and natural deaths in its data definitions.

Sixteen road safety organisations responded to a survey of their practices concerning the identification of road suicides and natural deaths. In summary, they indicated that:

- In the road traffic fatality data suicides and natural deaths are mostly excluded. The Czech Republic and Sweden include and are able to identify suicides and/or natural deaths, Finland excludes natural deaths but does not determine suicide and Switzerland and Poland do not determine and therefore include suicides and natural deaths.

- The data in almost all responding countries are initially based on police reports. Where there is suspicion of suicide this will usually be referred to a coroner with the exception of several countries where police determine intent. In two countries ‘suspected’ suicide cases are not included in road traffic databases until a coroner has determined they are not suicide.

- A number of countries indicated that they are able to adjust statistics, until some months into the following year, to exclude cases from road fatality statistics if required.

- With the exception of Sweden and the Czech Republic, it is not possible to identify suicides or suspected suicides involving a heavy vehicle.

- The practices with regard to natural deaths are very similar to those for suicides.

Other sources

The Australian National Coroners Information System, a recently introduced computerised inquiry system managed by the Monash University National Centre for Coronial Information, is able to provide Australia-wide road traffic driver and pedestrian suicide data, for approved users, at a detailed level.

PREVENTION

Expert opinion was sought and literature reviewed for pedestrian and driver injury prevention measures that may apply to road traffic suicide. General suicide risk factors and recently introduced prevention measures were briefly noted.

Prevention of driver suicides

General measures that provide protection for vehicle occupants may have a role in preventing driver suicides. Road safety technological innovations currently in place and therefore available to prevent driver suicides are alcohol interlock systems; passive, non-tamperable vehicle design features such as airbags and survival cell design plus road side barriers. Automated emergency MayDay systems could assist in survival of suicide attempters post-crash. Strategies however requiring driver compliance are unlikely to be beneficial.

Prevention of pedestrian suicide

A number of currently available countermeasures have possible application to the prevention of pedestrian suicides. These include pedestrian friendly car front features, anti-locking braking systems, all-wheel drive, night vision systems and, as for driver suicides, automated MayDay systems and alcohol interlock devices.

Prevention of natural deaths

Prevention of natural deaths would require a medical and public health response to the predisposing medical, genetic or lifestyle conditions.

CONCLUSIONS

Road traffic suicides and natural driver deaths appear, from the available data and literature, to comprise a very minor proportion of both total suicide statistics and road fatality statistics. Between 1% and 7% of driver fatalities have been noted as possible suicides. It has been suggested however, that current statistics may underestimate the incidence of these deaths.

Vital statistics best practice will result when ICD-10 coded suicide data is completed accurately to the fourth digit (location public highway) and multi-cause coding is widely practised. This should enable road traffic driver suicide "*intentional self-harm by crashing of a motor vehicle on a public highway*" and pedestrian suicide ie "*intentional self-harm by jumping or lying before a moving object on a street or highway*" to be specifically identified. Additionally, ICD-10 multi-cause coding enables identification of death from natural causes in road traffic.

Most national road safety organisations responding to the survey excluded suicides and natural deaths from their road fatality statistics, thereby producing relatively accurate unintentional road traffic fatality statistics. Accuracy is enhanced when this data is updated following on suicides or natural deaths being determined.

The internationally accepted road crash fatality definition is "Any person who was killed outright or died within 30 days as a result of an accident" (Convention of Road Traffic, Vienna, 1968).

Hence natural deaths should not be included in the official road traffic fatality count and suicides included depending on whether “accident” is a synonym for “crash” or implies lack if intent.

A recent innovation in Australia is an electronically based National Coroners Information System which enables coroners, researchers and other approved persons access to more detailed and timely information on injury deaths than data systems had previously supplied. Aside from aggregate data, with more limited access, the system enables text searches of findings, police circumstances, toxicology and pathology reports.

The most complete ascertainment of suicide deaths is likely to occur in systems where suicide is determined, there is little or no stigma associated with suicide and there is no financial or other imperative for concealing the intentional nature of the death.

There were no measures, able to be located in the literature, which were specifically directed at road traffic suicides, however, a number of general road traffic injury prevention strategies were considered to have application to driver and pedestrian suicide.

1. INTRODUCTION

1.1 BACKGROUND TO THE REVIEW

The development of road safety improvements needs to based on high quality statistics concerning information such as incidence, risk factors, characteristics and circumstances of road traffic fatalities. The adequacy of the available data has been questioned [1]. In many countries suicide deaths and deaths due to natural causes are included in the official figures and not specifically identified. As these deaths may involve substantially different factors to those of general road fatalities, their inclusion degrades the value of the data for general prevention purposes. It would be desirable to have these causes of death clearly identified to enable:

- their exclusion from statistics being used to address the issue of general road safety
- research directed specifically at the issues of suicide and natural death on the roads, to enable development of measures appropriate to these.

Therefore, it is important to determine how suicide and natural deaths are being represented in road fatality data. This report discusses issues and practices related to the identification and classification of deaths on roads involving suicidal intent or natural causes.

While suicide and natural deaths are relatively minor aspects of road related fatality, they are nevertheless important issues in their own right, and therefore this report includes reviews of their incidence, associated risk factors and prevention.

The study is one of a series initiated and funded by the Traffic Safety Department of the Swedish National Road Administration (SNRA), the purpose being to systematically review, analyse and compile the scientific literature published in the field. Additional information has been provided by reviewing a sample of national and international data systems to determine current practice.

1.2 AIMS OF THE STUDY

The aims of the study are to:

1. Determine current knowledge concerning incidence and prevention of suicides and death from natural causes in traffic
2. Determine current data collection practices, nationally and internationally, relating to suicide and natural deaths on roads
3. Identify any inadequacy of current data practices relating to suicide and natural deaths on roads

The specific issues addressed by the study are:

1. What is known about suicides in traffic?
2. How is suicide in traffic defined?
3. How is suicide handled in official statistics (included or excluded)?
4. How is natural death defined and presented in different countries' statistics?
5. If a distinction is made from suicides, how is this done?
6. For the correlation between heavy vehicles and serious accidents (suspected suicide) – how big is this problem?
7. What view is taken on this issue in different countries?
8. What is being done to counteract suicide in traffic?
9. What can be learned from other sectors preventive actions to handle the problem (benchmarking)?

1.3 PROJECT METHODOLOGY

1.3.1 Review of literature

A comprehensive review of research and information was undertaken using a range of resources including refereed journals, electronic resources and appropriate agencies. The following issues were addressed:

- incidence, risk factors and prevention of driver suicide
- incidence, risk factors and prevention pedestrian suicide
- incidence and risk factors associated with natural deaths of drivers
- treatment of suicide in life insurance and transport accident specific schemes
- general suicide and specific road traffic prevention strategies

1.3.2 Review of data resources

To determine the availability of epidemiological data relating to road suicides:

- A search was undertaken of international road safety and vital statistics data available from the internet, published reports and other available sources to determine the extent to which suicide and natural death crashes are included or excluded.
- Two questionnaires were formulated to collect information on the treatment of suicide and natural deaths in data systems from vital statistics and road traffic organisations.

1.3.3 Specific procedures

1. Definitions of terms were located in medical dictionaries, International Classification of Diseases version 10 (ICD-10) manuals, International Road Traffic Accident Database (IRTAD) publications and publications from vital statistics organisations.

2. A comprehensive literature search was undertaken including Medline, suicide and road safety conference papers, Australian Road Research Board's Australian Transport Index and Transport CD-ROM, the Suicide Information & Education Centre's SuicideInfo_ca (Canada) on-line database and the bibliographies of selected references for any information on suicide and natural deaths in road traffic. Terms searched for suicide information included (metasuicide, suicide) and (road traffic, pedestrian, crash, vehicle, truck, car, bus). Terms searched for natural deaths were (heart, cardiac, epilepsy, natural death, pulmonary, stroke, diabetic, epileptic) and (crash, road traffic fatality, road traffic death, motor vehicle death, motor vehicle fatality).

3. The literature was reviewed into both summary tables and text.

4. A search was undertaken of international road safety and vital statistics data available from the internet, published reports and other available sources to determine the extent to which suicide and natural death crashes are included or excluded.

5. International road safety and vital statistic data systems were searched to determine the rationale for whether suicides and natural deaths are included or excluded using information available from the internet and published reports.

6. Two questionnaires were formulated to collect information from vital statistics and road safety organisations on the treatment of suicide and natural deaths in data systems in

selected countries. The vital statistics questionnaire was reviewed and amended according to advice from the Australian Bureau of Statistics (ABS).

The vital statistics questionnaires (Appendix 6a) were emailed to ten international vital statistical agencies (Appendix 8), contact details having been provided by the Australian Bureau of Statistics.

The road statistics questionnaires (Appendix 6b) were distributed to IRTAD member representatives at a IRTAD meeting held in Paris on 17^{th} March 2003 or by email.

Non-respondents of vital statistics organisations were followed up and all responses compiled and analysed.

7. The treatment of suicide in life insurance and transport accident specific schemes was reviewed.

8. Prevention strategies for general suicide and vehicle related suicides were reviewed.

9. The report was prepared, reviewed by a senior academic panel and an executive summary was translated into Swedish

1.4 SOURCES OF DATA

Traffic fatality data is derived from two general sources of routinely collected data. The first source includes data from death certificates, these being completed by coroners, medical examiners or medical practitioners and is utilised predominantly by the health sector. The second general source includes crash reports by police, these are often entered and stored in special computer databases by sectors, such as the Department of Transport.

The two different data sources contribute to vital statistic and road traffic accident data systems. These have their local, national and international counterparts. Examples of each are shown in Table 1.

Table 1.1 Examples of data systems

	Vital (Based on death certificates)	**Road Traffic (Based on police reports)**
Local	Victorian Registry Births, Deaths & Marriages Catalonian Mortality Register	VicRoads Servei Catala de Transit
National	Office National Statistics (UK) National Center for Health Statistics (US) Australian Bureau Statistics Statistics Canada National Board of Health & Welfare - Sweden	Department for Transport, STATS 19 (UK) NHTSA, FARS (US) Australian Transport Safety Bureau Transport Canada Statens Institut fur Kommunikation (Sweden)
International	World Health Organisation (WHO)	IRTAD CARE

1.4.1 Vital statistics

Coding system

WHO regulations specify that member nations classify and code causes of death in accordance with the current revision of the International Classification of Diseases (ICD). The ICD provides the basic guidance used in virtually all countries to code and classify causes of death. The latest version is ICD-10, however ICD-9 remains in use in some countries and even earlier versions in others [2].

The ICD provides definitions, tabulation lists, the format of the death certificate and the rules for coding cause of death. In ICD-10 external cause of death can be coded as both underlying and multiple cause.

Injuries are the only disease group to have two separate coding systems under ICD. The Nature of Injury and the body parts injured are classified using diagnosis codes from the ICD. These codes describe the type of injury sustained such as a fractured humerus. A separate classification, the Supplementary Classification of External Causes, describes the cause of injury, such as a motor vehicle crash or fall. The major categories of the ICD external cause classification system provide a basis for standardisation and international comparability. National and international standardisation, comparability of classification, and coding of various data sources facilitate coordination of data systems within different sectors of a country and allows comparison among regions or countries.

External cause codes divide injuries into the broad category of unintentional and intentional: the latter include suicide in addition to homicide and war injuries. There is also a category of intent called "undetermined". This category may be large if there are cultural factors that influence accurate reporting of suicides [3]. Since suicides are considered *intentional* and motor vehicle accidents *unintentional*, by ICD definition, suicides and motor vehicle accidents are mutually exclusive.

Cause of death coding

Under ICD-10, causes of death can be coded as underlying or contributory. The underlying cause is defined by the WHO as the disease that initiated the train of events leading directly to death, or the circumstances of the accident or violence which produced the fatal injury. It is selected from the conditions entered by the physician, coroner or medical examiner in the cause-of-death section of the death certificate. When more than one cause or condition is entered, the underlying cause is determined by the sequence of conditions on the certificate, provisions of the ICD, and associated selection rules and modifications. Generally, more medical information is reported on death certificates than is directly reflected in the underlying cause of death. In ICD-10 this is captured in multiple cause-of-death statistics [2].

The coding rules are somewhat complex and the correct manner of coding the underlying cause of death may not be obvious if injury occurs in conjunction with a medical disorder, alcohol intoxication or drug addiction. For example injuries that occur during a seizure of a person with epilepsy should be coded with epilepsy as the underlying cause, whereas injuries that occur in association with most other medical conditions, such as a myocardial infarction, should be coded with the injury as the underlying cause. An exception would be a case in which there was evidence that death from the medical condition occurred before the injury event, such as the victim of a traffic crash who shows evidence of a myocardial infarction but no blood loss from severe injuries.

The ICD-10 cause of death codes and their respective definitions relevant to suicide are X81 *Intentional self-harm by falling, lying or running before or into a moving object* and X82 *Intentional self-harm by crashing a motor vehicle.* The respective undetermined intent equivalents areY31 and Y32. A decimal fourth digit designates location, and, of these, .4 ie 'street or highway' is relevant to the project. Unintentional transport related cause codes lie between V03 and V57. A decimal fourth digit designates if they are traffic or non-traffic.[1] (See appendices 2 and 3 for further coding details, definitions and ICD-9 equivalents).

Road traffic accidents associated with death from natural causes can be determined from ICD-10 multi-cause coding such that traffic codes appear alongside other codes.

1.4.2 Fatality statistics of road traffic organisations

The transport sector does not yet appear to have an international equivalent to ICD. The most advanced are the IRTAD definitions.

International Road Traffic Accident Database (IRTAD)

The IRTAD is maintained by BASt, located in Germany, under the auspices of the Organisation for Economic Co-operation and Development (OECD). It comprises road traffic and crash data for 29 countries from 1970 onwards. Its principal data sets include fatality frequencies and rates with breakdowns by type of road user, age and network area. The data provided by relevant national institutes are checked for consistency within countries and over years. IRTAD is a traffic accident analysis tool that stimulates international standard definitions and spurs improvements in data collection and comparison eg definitions of fatally and seriously injured persons. The IRTAD database is used as a prime source of international data required for annual reports and ad hoc studies at the aggregated level. The main advantage lies in it being an analytic tool for quick reference. It is the quickest way to achieve the goal of reliable, comparable and consistent traffic and fatality data for nearly all OECD countries. It is open to both OECD and non-OECD member countries.

The international definition of a road fatality, as defined at the Convention of Road Traffic in Vienna 1968, is "Any person who was killed outright or who died within 30 days as a result of an accident." Although most countries adhere to this definition, not every country does so eg France, Italy, Portugal. Correction factors are applied by IRTAD, eg France (+5.7%), Italy (7 day definition, +8%), Portugal (24 hours definition, +30%). The IRTAD special report on Definitions and Data Availability (1998) found the definition of traffic accident in use to be highly variable between countries.

CARE (Community Road Accident Database)

The CARE database comprises statistical information of reported road crashes in the European Union resulting in injury or death. The database comprises annual national sets of accident data in their original form supplied by all the 15 Member states without harmonisation of individual variables. Crash reports contain detailed information on location, injuries and vehicles but the level of detail, the definitions and the number of variables vary significantly between the member states. The database differs from other international databases in that it contains data on

[1] There is one discrepancy however. The definition of a transport accident specifically excludes cases coded as *Intentional self-harm by crashing a motor vehicle* (X82) and *Intentional self-harm by other specified means* (X83) and their undetermined intent equivalents (Y32 and Y33) but does not exclude X81 and Y31 ie intentional and unknown intent *Falling, lying or running before or into a moving object*. Investigation has found these mostly to include rail suicides but also some pedestrians.

individual crashes ie disaggregated data. The national data sets are integrated into CARE in their original national structure and definitions but without any confidential data. Access to the data is enabled at European Union (EU) level but not to road safety research institutes. Due to its disaggregation it is richer than the IRTAD database. The main sources of data are traffic police accident reports and national road transport statistics at the base level; traffic police accident reports, observations at sites, additional evidence from police officers or witnesses and judicial reports at the intermediate level and at the in-depth level. Not all Members States conduct post-mortem fatalities routinely. The most recent data is 2001 [4]). Statistical access appears to be limited to member organisations. Anecdotally maintenance and interest in the database has not been consistently applied since its creation.

1.4.3 Ascertainment of fatalities

The completeness and accuracy of police reporting of deaths is considered to be good, compared with that of less serious injuries. However, the completeness and validity of reports vary substantially depending on the number of police officers in the area and the time they have available to investigate crashes (Adams, 1988 in Barss [3]).

It is generally believed that almost all fatalities are registered, but a German study [5] on linked hospital data and police data estimated that up to 5% could be missing from police data. A French study [6] for the region of Lyon established that as many as 12% of fatalities were under-reported in the official police based registration [7].

A 1991 review on under-reporting worldwide included studies from the UK, USA and Canada that reported complete coverage of road crash fatalities while in Germany 5-9% of road crash fatalities were not reported to the police [8]. A 1994 IRTAD Special Report on the under-reporting of road traffic crashes quoted studies indicating a 3% level of fatality under-reporting in Spain and 2% in Switzerland. Research in Western Australia has also found that 5% of road crash deaths were unknown to the police [9]. In a comparison of official police reported fatalities with those reported by WHO based on death certificates, USA figures were similar but WHO statistics were 26% higher than police reported fatalities in Italy [10]. For less motorised countries there were much more extreme examples of under-reporting. For example only 1 in 5 medically reported fatalities in the Philippines were included in police statistics [11].

Crash reports are generally prepared by police. Reports are generally more complete and detailed for severe crashes and for crashes involving motor vehicles. However if deaths that occur after hospitalisation are not reported back to police, those deaths may not be included in police reports [3]. One study of international data has reported the presence of such follow-up problems, with a small proportion of fatalities being under-reported due to the failure of hospitals to report a subsequent death to police [12]. Therefore best estimates have associated errors.

To exemplify the extent of under-reporting of injury fatalities internationally, the 1990 World Health Statistics Annual included data from only 2 countries in Asia and from no countries on the mainland of Africa. International and inter-provincial cooperation is needed to establish adequate uniform injury reporting procedures within and among nations [3].

2. FACTORS WHICH INFLUENCE CHOICE OF SUICIDE METHOD

In order to prevent or discourage intentional self-harm, it is important to understand why victims choose a particular method of suicide. This chapter considers factors that may have a role in leading a victim to choose vehicle collision as a suicide method.

2.1 GENERAL

Little is known about the determinants of the choice of method of suicide. Researchers have suggested physical availability and socio-cultural acceptability are necessary preconditions for the choice of suicide methods [13, 14]. Socio-cultural acceptability is a measure of the extent to which a person's choice of method is shaped and circumscribed by the norms, traditions and moral attitudes of their culture. The existence of one without the other is unlikely to result in the potential method being selected eg fire is widely used for suicide in certain Asian [15] but is rare in most OECD countries despite the ready availability of matches and petrol. To date, most research into suicide methods has focussed on availability and method choice, without simultaneously considering socio-cultural acceptability [16].

Clarke and Lester [13] synthesised the results of numerous studies and determined a list of ‘choice structuring properties’ or key factors presumed to influence method choice. These were familiarity with the method, technical skills, planning, courage needed (high buildings, train), likely pain, disfigurement after death, danger/inconvenience to others (car crash, subway leap), messiness, gender association, scope for second thoughts, chances of intervention, certainty of death, contamination of the “nest”, discovery of the body (loved ones or strangers), scope for concealing or publicising death (shame, insurance - car-crash, drowning), time taken to die while conscious (poisons, wrist cutting), symbolism (cleansing by fire) and dramatic impact [13, 16].

Methods chosen vary considerably in ‘lethality’ - the probability of death. Males have a propensity to use more immediate and violent methods than females (eg firearms, hanging) and this partially accounts for their higher overall suicide rates. Road traffic suicides are likely to be a particularly lethal form due to the potential exchange of large amounts of energy, and may therefore attract those seeking a more violent or certain death.

Road traffic suicides are more easily disguised as accidental than many other methods of suicide. Classification of a death as ‘accidental’ rather than ‘suicide’ saves the decendent’s family from any stigma, shame, guilt and anger of suicide and allows them the financial security of insurance [17-21].

2.2 INSURANCE, COMPENSATION AND SUICIDE

Insurance and compensation payments are relevant to the issue of suicide in several ways. For many insurance policies, a finding suicide can invalidate the policy and prevent dependants of the deceased receiving financial benefits from the death. This has several possible consequences of relevance to road suicides. Firstly, it can cause an intending suicider to choose a road collision as the mode of suicide in preference to other forms that would more easily be identified as intentional. As death by motor vehicle collision is a relatively common form of unintentional death, this method may be chosen to conceal the intentional nature of their actions.

Secondly, it increases the likelihood that a suicide will be incorrectly classified as unintentional or undetermined. As the welfare of the deceased’s dependants is affected by the classification of a death as suicide, there would be considerable pressure on decision-makers to opt for a classification of unintentional or undetermined in the absence of overwhelming evidence of suicide.

In contrast those road injury systems having no fault policies, for which suicide is not an exclusion, may have the undesirable consequence of providing an incentive for suiciders to choose road suicide in order to secure financial benefits for dependants.

The following sections discuss these issues more fully.

2.2.1 Motor vehicle accident insurance

Most compensation payment systems are fault based and have the provision to sue under common law. Most, therefore, provide no compensation for suicide eg dependants of suiciders are excluded under Canada's Autoplan. However, there are some examples of no fault systems such as the Transport Accident Commission (TAC) in Victoria, Australia and the Societe de l'assurance automobile du Quebec (SAAQ) plus the Accident Compensation Commission (ACC) (New Zealand) which is no fault for injury but not fatalities (Appendix 4). With Victoria's TAC system it is possible for a dependant family of a young adult suicider to receive approximately US$ 650,000 over the lifetime of the family. This includes payments for funeral, medical and counselling expenses, lump sum payments and weekly benefits for dependants and an education allowance for dependant children.

For these no fault systems, possible substantial compensation for dependants could provide an incentive to select this method of suicide in preference to other more commonly selected methods such as hanging, exhaust gassing and overdose. Additionally, with both methods of road traffic suicide, unless a note is left, a coronial decision will be unlikely to determine suicide resulting in dependants being eligible for life insurance and other compensation payments. If intent were able to be determined "on the balance of probability" rather than "beyond reasonable doubt" and intent introduced into the no fault systems then this method of suicide may have relatively less appeal as it would remove the financial incentive to choose this form.

2.2.2 Life insurance

In an attempt to remove insurance benefits as a contributing motivator in suicide, insurance companies have placed exclusion clauses relating to suicide on most life insurance policies. Policies vary across countries (and to a lesser extent, across companies), however, most companies within the same country tended to have the same exclusion clauses. Within the United Kingdom, major insurers will not pay any benefit if suicide occurs in the first 12 months of the date of policy commencement. In Australia, there is an exclusion clause on the first 13 months of the date of policy commencement, and in Canada, the exclusion period is 24 months of the date of policy commencement. With all of these policies, if there has been an increase in policy coverage for the stated period (ie, 12, 13 or 24 months), only the original amount will be paid. After this period, insurance benefits are honoured as per normal. The rationale behind these exclusions is to prevent the individual from taking out life insurance, then immediately suiciding.

In the USA, if suicide occurs within the first 2 years, the beneficiary may receive the premiums paid minus any outstanding loans and/or withdrawals taken. A different slant was taken with a particular Swedish insurance company. They would not pay any benefit if it could be proven that the suicide was planned at the time the coverage commenced. If however, they deemed that the deceased was going to suicide regardless of whether they had insurance coverage or not, then it may still be honoured. Some companies will judge each case on an individual basis, and if it could be proven that the deceased had a long history of depression or previous suicide attempts, then no benefit would be paid.

3. LITERATURE REVIEW OF SUICIDES IN ROAD TRAFFIC

3.1 NATURE OF LOCATED INFORMATION

Suicide by motor vehicle crash is a recognized phenomenon, however the precise extent of the issue, and its impact on other road users, to date is unknown. References located on the issue focus mainly on single-vehicle crashes, and the process undertaken to determine the suicidal intent of the driver. Very little information was identified regarding pedestrian suicides. It is assumed, throughout this section, that the researched crashes have occurred in road traffic rather than on private property. The term "road traffic suicide" where used in this section therefore refers to "suicide by crashing of a motor vehicle". The following terms were searched: suicide; motor vehicle; car; crash; pedestrian; road and accident. A selection of the located articles is summarised in Table 3.1. Much of the literature dated back to pre-1990, suggesting that there may in fact be few new insights or directions into the issue. It is possible that the lack of recent research has been driven by the fact that suicide by motor vehicle crash appears to remain a minor subset of both suicides and road traffic crashes.

3.2 OPEN VERDICTS

Many fatalities from motor vehicle crashes, where it is difficult to determine whether the death was intentional or accidental, are returned an open verdict by the coroner or medical examiner [17, 18, 20-25]. This creates a problem, as accurate classification of all modes of suicide is important for research, public health policy and insurance purposes and there is evidence to suggest that many of those cases assigned an open verdict are likely to have been suicides.

A number of studies have re-examined open verdict cases to determine how many deaths could be excluded, that is, impossible or unlikely to be suicide. A study in South Yorkshire (UK) re-examined 330 open verdicts and found that only 117 (35%) of these could be excluded, leaving 213 open verdicts (65%) as likely suicides [26]. Another study found that only 11.3% of open verdicts could be excluded (Appleby et al, (1999) in Linsley [27]), and similarly, a Newcastle-upon-Tyne (UK) study of open verdicts for the period of 1985-1994, found that only 14% could be excluded, leaving 86% of cases as probable suicides [27].

This suggests that most open verdict cases are actually unidentified suicide cases, and therefore official suicide rates, which exclude open verdict cases, would be substantial underestimates of the real incidence. Linsley et al [27] found that the number of suicide cases apparently misclassified as open (159), was almost as high as the number of correctly classified suicide cases (185) suggesting that the actual suicide rate may be almost double that of the reported rate.

However, it is not clear how general these findings are. If there were regional differences in coronial classification practices and criteria, corresponding differences in suicide ascertainment rates would be expected. Further, it has been reported that there are substantial differences in ascertainment rates depending on mode of suicide. For example, while hanging and carbon monoxide poisoning have been found to be associated with high ascertainment levels, drowning, poisoning using solids or liquids, self-immolation and jumping from a height were associated with marked under-reporting [26].

It has been suggested that there is the need to develop objective criteria to decide which open verdicts should be included as suicides, and which excluded, in order to produce a more reliable picture of the epidemiology of suicide to permit comparisons between populations [27].

3.3 PROBLEMS ENCOUNTERED IN SUICIDE RESEARCH

3.3.1 Ascertaining intent

Every death is eventually classified into one of four categories by coroners, medical examiners or medical practitioners – natural, intentional (including suicide), accidental or unknown intent [28-33]. Commonplace amongst all aspects of suicide research is the difficulty in ascertaining the level of intent [27-34]. It is impossible to be completely certain of the decedent's intent, however the goal in certifying deaths is not absolute certainty, more a judgement made after reviewing all the available evidence [29]. Many deaths that would be termed suicide according to medico psychological criteria are reported as accidental or from undetermined causes. The difficulty of positively identifying a death as suicide is further complicated by the complexities of determining true intent and the psychological motivation one may have had for ending one's life.

It has long been recognised that there are difficulties in obtaining valid mortality rates for suicide (Sainsbury 1983 in Barss [3]). In some countries most suicides are reported in the category of undetermined intent, or as unintentional injury deaths (Diekstra & Gulbinat, 1993 in Barss [3]). There are often substantial pressures on coroners and lay juries at coroner's inquests to report a suicide as an unintentional death (Jacobson et al, 1976 in Barss [3]). Such pressures can result from religious and social considerations, as well as from the financial implications of a verdict of suicide on life insurance payments ([3, 17, 34-37].

Internationally, it has been found that Austria and the Netherlands generate excellent quality suicide data, while other countries such as Finland, Greece, Israel, Ireland and the United Kingdom have potential for gross misclassifications [30]. It is thought that societal attitudes and values may have contributed to these findings. In attempting to determine the reliability of suicide classification, Rockett found the Netherlands had the highest quality suicide data, possibly because suicide is less socially stigmatized in that country (emphasized by their stance on euthanasia)[30]. Statistical evidence of the actual suicide rate for a specific population is difficult to compile because of the ambiguity of the term (Appendix 1), a lack of criteria by which a death may be judged suicidal, and a lack of agreement among those reporting deaths as to what does, indeed, constitute a suicide (Encyclopaedia and Dictionary of Medicine, Nursing and Allied Health, Miller & Keane, Saunders, 1987). The assignation of suicide to a death by a medical practitioner or coroner is influenced by legal, cultural, moral, financial, religious and personal factors.

Currently, and in the past, there is worldwide a broad array of legal positions on suicide and attempted suicide. In the USA, completed suicide is not against the law in any state (Victoroff, 1983 in Hawton [38]). However, there are local variations and six states have current penalties for attempting suicide. Neither suicide nor attempted suicides are illegal in Japan, Australia, Cuba or Lithuania. Ireland was the last European country to decriminalise suicide which it did in 1993 [38]. For countries which follow Islamic law, suicide and attempted suicide are illegal and punishable.

Previous research into suicide by motor vehicle crash has identified a reluctance to classify cause of death as suicide without concrete evidence such as a suicide note [20, 21, 25, 39]. While it is estimated that between 11.3% [27] and 25% [20] of all methods of suicides involve the leaving of a note, this piece of evidence is rarely found in single-vehicle crashes [20]. Other reasons for the non-classification of suicide by authorities include apathy and ignorance [24]. Certain countries may not have the resources available to investigate the deaths to the extent required to identify suicides from accidents. Most of the least developed countries are not able to provide any suicide data [3].

There is a belief that perhaps suicide by motor vehicle crash is a preferred method for disguising suicidal intent as an accident [18-20, 22]. This has the benefit of saving the decedent's family from the stigma of suicide [17-21]. Common grief reactions associated with bereavement by suicide are shame, guilt and anger [40].

3.4 MEANS OF DETERMINING SUICIDAL INTENT

The possible inclusion of suicides in traffic deaths data has prompted a number of retrospective studies that attempt to identify the extent of these suicides [17, 25, 39, 41-48]. Of the studies reported, a number of different methods were used to investigate suicidal intent.

In Finland, a road accident investigation team (a traffic police officer, a vehicle and road engineer, a physician, and sometimes a psychologist) visit and report on all fatal motor vehicle crashes, with the purpose of identifying the risk factors that led to the crash [17, 41]. Physical evidence such as pictures from the crash scene, estimation of the speed, condition and movements of the vehicle, and weather and road conditions at the time of the crash are investigated. Complementing these data are interviews with passengers, eyewitnesses and relatives of the decedent. The background of the driver is studied to identify factors such as mental state, alcohol or drug use, recent life changes and previous attempts / threats of suicide. Also in Finland, cause and manner of death investigations are performed by a medical officer [49]. The authors analysed the information in the case files and if certain criteria were met, the death was categorised as suicide.

An investigation team in the USA was referred cases from the Chief Medical Examiner's office. As well as physical evidence (similar method to the above cases), comprehensive psychological interviews were conducted with relatives and friends of the victim, along with the physical autopsy of the decedent [39]. Similar methods were employed in studies in Monroe County (USA) [24], and in Houston (USA) with the addition of engineering and automotive specialists to investigate the vehicle [25]. In Scotland, medico-legal case files, including autopsy and police reports were used to identify suicides [50]. Forensic pathologists were also often called upon to identify cause of death in traffic fatalities [24, 46].

3.5 INCIDENCE OF SUICIDE BY MOTOR VEHICLE CRASH

A summary of findings of studies, which have investigated the cause of death in traffic fatalities is shown in Table 3.1. The results show a substantial range of incidence of driver suicide: 1.1% to 7.4% of all traffic fatalities, 0 to 5.9% of drivers and 2.7 to 14.3% of drivers at fault. Since the largest percentage was an in-depth study of only 28 driver at fault fatalities [25] the resulting 14.3% of suicides is unlikely to have statistical significance. Connolly et al. [44] were unable to conclude that any of the 134 traffic deaths in county Mayo, Ireland were suicides, however there was a suspicion of suicide in six of these deaths. This suggests that techniques used to investigate the road fatalities may be different to those used elsewhere. Ohberg et al. [46] observed the largest number of driver fatalities (n=1,419) and subsequently the largest number of driver suicides (n=84; 5.9%).

Table 3.1 Studies reporting traffic suicides as a percentage of traffic fatalities

Ref	Country	Year	Fatalities (n)	Suicides (n)	%
Pokorny [25]*	USA	1967-68	28 drivers at fault	4	14.3
Hernetkoski [17]	Finland	1992	328	24	7.4
Keskinen [41]	Finland	1984-85	410	28	6.8
Ohberg [46]	Finland	1987-91	1419 drivers	84	5.9
Ahlm [43]	Sweden	1999	580	18	3.1
Imajo [36]**	USA	1978-81	187 drivers at fault	5	2.7
Edland [24]	USA	1968	112	3	2.7
Alvestad [45]	Norway	unspecified	230 drivers	6	2.6
Morild [47]	Western Norway	1986-90	133	3	2.3
Schmidt [39]***	USA	1968-75	182 drivers	3	1.7
Kuroda [50]	Scotland	1989-91	268	4	1.5
Keskinen [41]	Finland	1974-75	527	6	1.1
Connolly [44]****	Ireland	1978-92	134 drivers	0	0

* all single vehicle fatalities where the driver was deemed to be at fault

** 182 crashes represented over 90% of all driver fatalities in the study period

*** suspicion of suicide in six (4.5%) of the fatalities

3.6 CHARACTERISTICS OF SUICIDES BY MOTOR VEHICLE CRASH

3.6.1 Mode of suicide

Research has identified two crash types involved with motor vehicle suicide: (1) single vehicle, single occupant crash and (2) head-on collision of a single occupant vehicle with a heavy goods truck [51]. However, the relative incidence of these two modes of suicide is unclear. One Finnish study reported a predominance of latter type of case with 68% of vehicle suicide cases involving a collision with oncoming traffic, and 80% of these choosing to collide with heavy goods vehicles [41]. This pattern differs markedly from that observed in a study of equivocal road fatalities (intent is unknown but thought to be likely to be intentional) [18]. In this study the majority of cases involved leaving the road (67%), colliding with non-motor vehicles (11%), colliding with fixed objects (11%) or falling from moving vehicles (1%).

3.6.2 Characteristics of victims

While most published studies, to date, reported only a small number of motor vehicle suicides; the two Finnish studies were able to provide important epidemiological data about the suicide victims. Males were significantly more likely to commit suicide through a motor vehicle crash than females. One study found that 95% of traffic suicide victims were male [41], while another found 90% were male [17]. Interestingly, the proportion of male suicides in general in Finland was 79% in 1983 [41], suggesting that males were over-represented in this particular method of suicide.

The majority of victims were in the 25-34 age group [17], or 20-34 age group [41], and 24% of all victims had attempted suicide on at least one previous occasion [41]. Approximately half the traffic suicide victims had a psychological state ranging from "mental disturbance" [41] to being "depressed" [17]. Although Edland (1972) could certify only 3 of 112 traffic fatalities as suicides (another 3 probable and 2 equivocal), he found 33 of the fatalities had previous psychiatric histories, which was "way out of line with our experience in other areas of traumatic death" [24]. Depression has also been identified as risk factor associated with fatal single vehicle crashes in general [52] [53], with 13% of cases having a recent history of severe depression. This raises the question as to whether these cases may have actually been suicides rather than unintentional deaths.

3.6.3 Alcohol

A common theme presenting throughout the literature is the involvement of alcohol in traffic-related suicides. Whilst not solely related to traffic suicide, as high as 85% of all single-vehicle traffic fatalities were found to have drivers who had been drinking prior to their crash [24]. The influence of alcohol may cloud the investigation into the level of suicidal intent. Alcohol itself is known to be a contributing factor to crashes. However, those with a history of alcohol abuse are also more likely to suicide (Ritson cited in [25]) Investigators are left with the task of distinguishing between suicides and crashes under the influence of alcohol. Alcohol may in fact provide the impetus for an individual to act upon impulses which could otherwise be controlled [18, 22]. As well as facilitating the impulsive decision to suicide, alcohol can also promote "Dutch courage" which may help facilitate the fatal action [54]. Difficulties in classifying suicides when alcohol is involved led to Huffine (1971) eliminating drivers who had been drinking from that aspect of her study [18].

3. 7 PEDESTRIAN SUICIDES

Whilst most research on intentional road death has focussed on driver suicide, pedestrian suicidal intent has received much less attention. Recognition of suicide by pedestrians was only acknowledged in studies which provided case details about a small number of fatalities [21, 24, 50, 55]. In many of these cases, there was a history of mental illness, and the presence of alcohol in the decedent [24, 50, 55]. One study has identified the main mode of suicide among pedestrians to be to walk or jump into the path of a heavy vehicle (Lamble, 1982 in [51]).

The scarcity of research into this form of suicide may be related to several methodological issues. The ambiguity of intent makes it difficult to classify pedestrian death as suicide, in much the same way as some motor vehicle deaths [21].

Further, difficulties in identifying pedestrian suicides for research purposes arise because the previous version of the International Classification of Death coding system (ICD-9) does not code suicide by a pedestrian on the road specifically, such suicides being included in "lying or jumping in front of a moving vehicle" (E958.0). Alternatively suicide by deliberate crashing of a motor vehicle was assigned a specific code (E958.5), thus facilitating research into this method. Difficulties in coding pedestrian deaths under a specific method of suicide has made it almost impossible for any meaningful research to be undertaken based on existing data sources, thus highlighting the lack of peer-review papers addressing the issue. The introduction of ICD-10 with its more specific codes should facilitate identification in the future.

3.8 CONCLUSION

While a number of peer review papers have investigated the issue of suicide by motor vehicle crash, such cases are a small proportion of the total road toll. It would appear that between 1% and 7% of all motor vehicle crash fatalities could have been suicides. Difficulties arise because of a reluctance to classify these deaths as suicides. It seems easier on the family involved if the death is certified as accidental rather than having deliberate intent. The ambiguity of these kinds of deaths makes it difficult to accurately determine the intent, unless a suicide note is found. Cultural factors may also affect the accuracy of suicide classification. Research into pedestrian suicides is sparse, and without more data, no reliable conclusions can be reached.

4. LITERATURE REVIEW OF NATURAL DEATHS IN ROAD TRAFFIC

4.1 INTRODUCTION

There have been a number of published studies investigating motor vehicle driver deaths associated with a sudden illness event. A summary of these studies and their findings is shown in Appendix 4. The main focus of most of the reviewed studies was the issue of determining the risk to others posed by older drivers or those with known medical conditions.

The driver fatalities addressed in these studies are of two types: non-traumatic and traumatic vehicle related deaths.

4.1.1 Non-traumatic vehicle related death

In these cases the driver has "died at the wheel" due to sudden illness. Death is unrelated to traumatic injuries associated with a vehicle collision.

Büttner et al [48] identify 5 subcategories of this type of fatal event:

- Persons found dead in the driving seat of a parked vehicle but who were not known to be driving at the onset of the terminal event.
- Sudden natural death while driving and able to stop the vehicle
- Sudden natural death while driving and the vehicle could be stopped by a passenger
- Sudden natural death while driving and not involved in a collision
- Sudden natural death while driving and either involved in a collision with another vehicle or with property damage: other vehicle, property, pedestrian

4.1.2 Traumatic vehicle related death

These cases involve a collision caused by the driver being affected by a physical or mental condition. The death results from the physical trauma of collision, rather than the condition.

The main focus of this review is non-traumatic driver deaths. However, while some studies in this review focus on only non-traumatic fatalities, others include both types of fatalities and some of these fail to clearly distinguish between the two types.

4.2 INCIDENCE OF NON-TRAUMATIC DRIVER DEATHS

Estimates of the incidence of sudden natural death at the wheel indicate that it is an infrequent event and a relatively minor proportion of all traffic related fatalities. The most recent estimate, based on a German study of 34,455 autopsied deaths, suggests that 0.4% of all autopsied deaths and 2% of all autopsied driver deaths were sudden deaths of drivers from natural diseases [48]. A similar proportion was reported in a British study which found that 0.2% of all traffic related hospital presentations (30,000 cases) died of natural causes [56]. Similarly, an Australian study has reported that 1.3% of all road fatalities are associated with natural death [57].

Copeland [37] estimated that, in the USA, medical related traffic deaths occurred at a rate of 2.2 per 100,000 compared to the USA population death rate of 22.2 per 100,000 population for motor vehicle deaths. Similarly, an earlier study reported that collisions resulting from natural deaths were infrequent, constituting less than 6/10,000 accidents reported [58].

Many of the studies do not report sufficient information to enable an estimation of broader population incidence. For these studies, incidence estimation is based on specific reference populations and therefore needs to be interpreted with caution. A summary of findings relating to incidence of driver deaths from natural causes is shown in Table 4.1.

Table 4.1 Incidence of driver deaths from natural causes

Study	**Size and/or nature of reference population (period of study)**	**% natural driver deaths**	**Comments**
Peterson & Petty, 1962 [58]	All fatalities where driver was at fault, Baltimore City (1957-1960)	19	
Christian, 1988 [56]	267 road traffic fatalities (1978-1987) All traffic related presentations (30,000)	19 0.2	Not clear whether sudden death or delayed death
West, 1968 [60]	1,026 single vehicle deaths (1963-1965)	15	Analysis included both non-traumatic and traumatic deaths
Copeland, 1987 [37]	1,933 motor vehicle related deaths (1980-1984)	10	
Ahlm, 2001 [43]	580 traffic deaths	10	Swedish language paper. Only abstract available in English.
Hossack, 1980 [61]	102 drivers who died at wheel (2-year period)	9	
Osawa, 1998 [[62]]	188 driver victims of traffic accidents (1992-1997)	8	
Myerburg & Davis, 1964 [63]	1,348 sudden and unexpected deaths due to coronary heart disease aged 65 and under (1956-1962)	4	
Büttner et al, 1999 [48]	7,350 vehicle related deaths (1982-1996) All autopsied deaths (34, 554)	2 0.4	
Wood et al, 1994 [57]	2,876 cases. All road fatalities in Australia, 1988	1.3	

Further, it has been suggested that the incidence of natural driver deaths may be underestimated. When a serious collision occurs, the driver's death may be incorrectly attributed to trauma [59] and even when natural death is suspected, the post-mortem examination may be inconclusive or lead to conflicting opinions.

4.3 RISK FACTORS

The main risk factors identified for non-traumatic driver death are:

4.3.1 Gender

All studies show a strong predominance of males among driver deaths as shown in Table 4.2. However, this may reflect a general pattern of driver death and not be specific to sudden death cases. Peterson and Petty [58] found a predominance of males in both traumatic driver deaths (90%) and non-traumatic driver deaths (96%).

Table 4.2 Proportion of males among non-traumatic driver deaths

Study	Proportion of males %
Schmidt et al (1990) [64]	97
Krauland (1978) [65]	97
West et al (1968) [60]	96
Peterson & Petty (1962) [58]	96
Cheng et al (1998) [66]	95
Büttner (1999) [48]	91
Antecol & Roberts (1990) [67]	90
Copeland (1987) [37]	85

It has been suggested that the predominance of males may reflect in part more driving hours by men [58]. This would be expected to be more marked in the earlier studies, where driving participation of women was relatively lower. However, the increased participation of women in more recent years does not appear to have been matched by a reduction in the gender imbalance for this type of death, suggesting that this factor does not make a substantial contribution to the data.

Further, this level of predominance of males appears to be unexpectedly high. While males do predominate in sudden cardiac deaths in the general population, it is at a substantially lower rate than that observed for natural driver deaths. It has been reported that 75% of sudden deaths in the general population are male [68]. This is considerably less that that reported for natural driver deaths (Table 4.2).

4.3.2 Age

Non-traumatic driver deaths showed a marked difference in age distribution compared to traumatic driver deaths. While most deaths due to trauma occur to drivers under the age of 40 years [58], by contrast most non-traumatic driver deaths are between 50 and 70 years of age (Figure 3.1). Further, one study has shown that while the peak for natural death driver cases is in the 60's age group, those cases with ischaemic disease peak in the 70's age group [65].

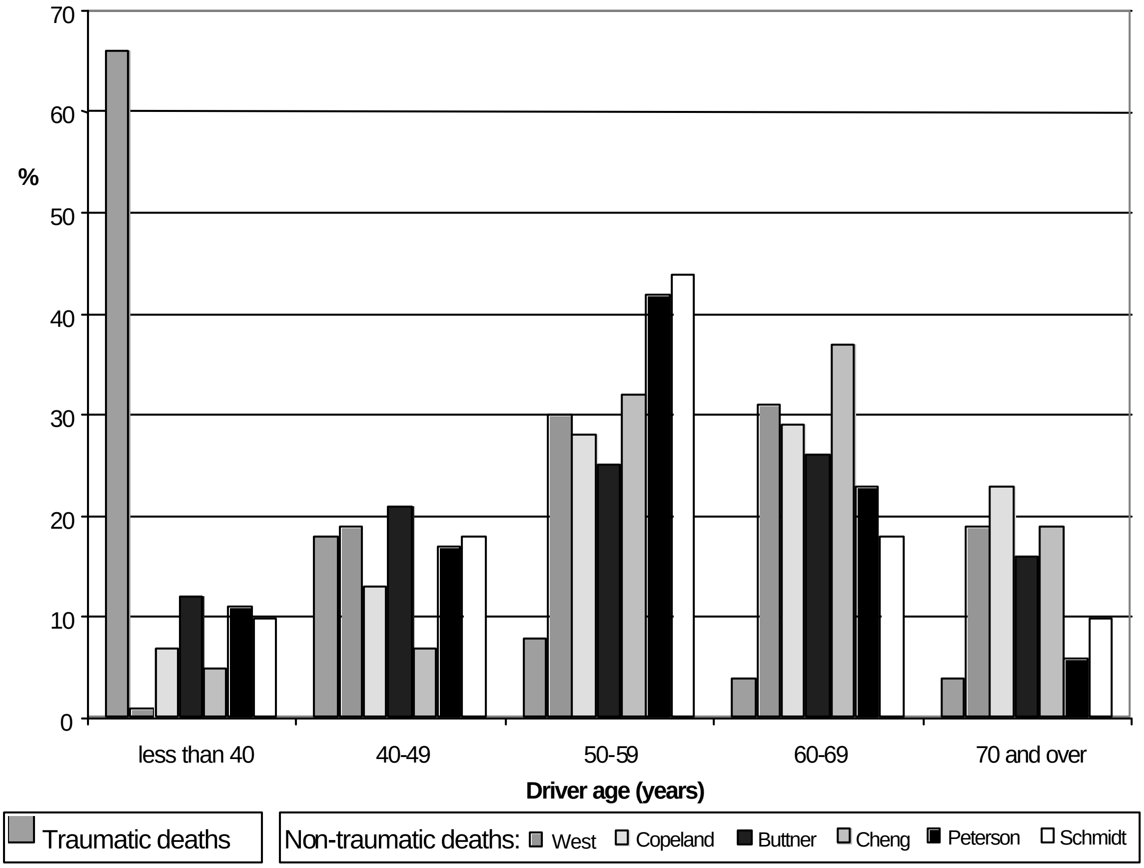

Figure 4.1 Age distribution of drivers - comparison of traumatic driver deaths with non-traumatic deaths reported in individual studies

(These are approximations only as there are some slight differences in age groupings across studies)

4.3.3 Medical condition

The medical conditions underlying natural driver deaths mainly encompass cardiovascular and cerebrovascular diseases and rarely seizures and diabetes [48]. Most deaths are caused by cardiovascular disease (77% [48] to 94% [60]), and many have no prior knowledge of the presence of the condition (50% [56]; 40% [60]). Autopsy examination has revealed that many cases are associated with obviously enlarged hearts (greater than 400g) [48] and severe coronary artery disease [37] [69]. Increased heart weight was also report by Cheng et al [66] and Büttner [48].

Other causes of death identified included: epilepsy [48]; diabetes [48]; bronchial asthma [48]; pulmonary artery embolism [37, 48]; bronchopneumonia [48] [37, 66]; ruptured abdominal aortic aneurism [48, 56, 60, 66]; alcoholism [37]; malignancies [37]; respiratory failure [66]; gastrointestinal haemorrhage [66].

4.3.4 Time of day

The role of the time of day is not clear, possibly due to insufficient frequencies. While one study reported that most cases occurred from midday to 8 pm [60] another found the peak occurrence to be in the morning (6 am to midday) [48] and another found a midday peak [70].

4.3.5 Alcohol

Alcohol was not considered to be a significant contributory factor to sudden death in drivers [37, 48, 58] A summary of the results of blood alcohol analyses is shown in Table 4.3.

Table 4.3 Summary of blood alcohol analyses

	% of drivers		
Study / **Blood alcohol content**	Peterson & Petty [58] *(N=36)*	Büttner [48] *(N=106)*	Copeland [37] *(N=92)*
Negative	75	89	83
0.01-0.1%	11	0	11
0.1% or greater	14	11	6

The level of alcohol involvement in non-traumatic driver deaths has been found to be substantially lower than for traumatic driver deaths. Peterson et al [58] reported that while 75% of those drivers who died of natural disease processes had no alcohol in the blood stream, only 15% of traumatic driver deaths were associated with a negative blood alcohol reading.

4.4 CIRCUMSTANCES

Many of the traffic incidents associated with these deaths involved little or no injury or property damage. It has been suggested that this may indicate that drivers have some warning and are able to reduce speed [48]. One study found that 19% of drivers were able to stop the car [48]. A review of articles published prior to 1978 identified as many as 50% of cases took place in a stationary vehicle [65].

Many of the vehicles are parked at the roadside or come slowly to a halt on grass verges, kerbs, pavements, hard shoulders or central reservations of motorways. Some are found with engines running in neutral gear [56]. Several studies have found that less than half the vehicles are involved in collisions [37, 48].

4.5 TYPE OF VEHICLE

Most deaths involved 4 wheeled passenger vehicles, as indicated in Table 3.4.

Table 4.4 Type of vehicle driven

	% of vehicles				
Study / **Type of vehicle**	**Büttner** [48] N=146	**Ostrom et al** [70] N= 126	**West et al** [60] N=155	**Cheng** [66] N=85	**Christian** [56] N=60
Car	89	55	80	86	75
Trucks/ commercial	9	6	19	14	8
Other*	2	39	1	<1	17

* *Motor bike, bicycle, electric cart, snowmobiles etc*

4.6 IDENTIFICATION OF NATURAL DRIVER DEATHS

Identification of non-traumatic natural death appears to be made on the presence of pathology detected by autopsy, medical history, or absence of injury that could account for the death. Postmortem examinations of driver deaths, particularly of men aged over 40, are a valuable means of determining the occurrence of a natural death [60]. Natural deaths may be missed if postmortem examinations are not performed, as many of those who died of cardiovascular disease had no prior knowledge of their condition.

The types of information employed in the studies include: coroner, pathology reports; witness accounts; police reports, information from general practitioners, ambulance personnel and relatives.

However, the identification of cause of death in some cases presents difficulty and it has been suggested that there is the need for the development of internationally accepted criteria for the classification of the manner of death in “borderline” cases [43].

4.7 CONCLUSION

The main focus of most of the reviewed studies was the issue of fitness to drive for high-risk groups. Consequently, little attention is paid to methodological or other issues that may be pertinent to the incidence and classification of natural deaths, and this may limit the usefulness of the studies for the current purposes. Nevertheless, the published studies give a clear picture of the characteristics of drivers associated with natural deaths in motor vehicles.

The most common characteristics of a driver at risk of dying from natural causes while driving are: male aged between 50-69 years, suffering from cardiovascular disease, which may be undiagnosed, and enlarged heart.

Prevention of such deaths would require a medical and public health response to the predisposing medical, genetic or lifestyle conditions.

5. TREATMENT OF SUICIDES & NATURAL DEATHS IN ROAD TRAFFIC DATA SYSTEMS – AVAILABLE DATA

To determine how suicides and natural deaths are treated in road traffic data systems, national and international data practices were reviewed. The results of this review are reported in this and the following chapter.

This chapter summarises the findings of a review of published and publicly available information. Data could not be located on natural deaths.

To determine specific current practices, surveys were conducted among organisations responsible for collection of data. Chapter 6 reports the results of the surveys of national vital statistics organisations and national road traffic organisations.

5.1 VITAL STATISTICS ON SUICIDE

5.1.1 International

According to the World Health Organisation International Classification of Diseases (WHO ICD), 'suicide' and 'motor vehicle fatalities' are broad categories for injury reporting (Figure 5.1, Table 5.1). 'Suicides by motor vehicle crash' are included under the broad heading of 'suicide' rather than 'motor vehicle' or 'other injury' in the all injury data reported by the WHO. Worldwide, in recent years, there have been more deaths from road traffic injury than suicide (1,1170,694 v 947,697 fatalities; 1998 estimates). However in developed countries, despite the high level of vehicle ownership, the trend is for suicide rates to be higher than those of unintentional motor vehicle crashes (Table 5.1).

Table 5.1 Deaths per 100,000 of population for suicides and motor vehicle crashes in 1993.

	Suicides		Motor vehicle crashes	
	Male	**Female**	**Male**	**Female**
Sweden	22	10	9	4
Australia	19	5	16	6

Unfortunately more detailed suicide data is not available on WHO websites or publications [3].

Deaths from Road Traffic Injuries (RTIs) (formerly Road Traffic Accidents, RTAs), suicide and ischaemic heart disease are leading causes of death internationally. In 1998 ischaemic heart disease was the leading cause of death for all ages with 7.38 million deaths, RTIs tenth with 1.17m and intentionally self-inflicted injuries twelfth with 0.95m deaths. In the 15-44 age group RTIs and intentionally self-inflicted injuries were leading causes of death, ranking second and fourth respectively. Rankings were similar for high- and low-income countries as a whole, although suicide ranked slightly higher for high-income countries (11^{th} high-income v 13^{th} low-income).

Suicide is a major cause of potential life lost in industrialised countries and many developing countries and has often increased as other causes of injury death have begun to be controlled. The underlying determinants and motivations of this act vary from a true wish to end life to a desire to communicate anger or hopelessness (Diekstra & Gulbinat, 1993 in Barss [3]). It is considered that there are at least 10 times as many persons engage in non-fatal suicidal behaviour as those who complete suicide [38].

5.1.2 National

USA

National Center for Health Statistics (NCHS)

Vital statistics data recorded on this database are based on information from all death certificates filed in the 50 States and the District of Columbia. Death statistics are completed by funeral directors, attending physicians, medical examiners and coroners [2].

Prior to 1968, mortality medical data were based on manual coding of an underlying cause of death for each certificate in accordance with WHO rules. Effective from data year 1968, the NCHS converted to computerised coding of the underlying cause and manual coding of all causes (multiple causes) on the death certificate. In this system, called "Automated Classification of Medical Entities" (ACME) multiple cause codes serve as inputs to the computer software that employs WHO rules to select the underlying cause. Many States have implemented ACME and provide multiple cause and underlying cause data to NCHS in electronic form. For those States that have not, NCHS coded the mortality medical data using ACME.

The ACME system is used to select the underlying cause of death on all death certificates in the US. In addition, NCHS has developed two computer systems as inputs to ACME MICAR and SuperMICAR. These provide more detailed information on the conditions reported on death certificates than is available through the ICD coding structure [2]. The most relevant data provided in reports however divides suicide into firearms and other.

The Centers for Disease Control National Center for Injury Prevention and Control has a Web-based Injury Statistics and Reporting System (WISQUARS). Available data on suicides from deliberate crashing of a motor vehicle (X82) revealed 190 suicides (age-adjusted rate of 0.04 per 100,000) for the US in the years 1999- 2000. Males in the 35 to 44 age group had the highest rate (0.11 per 100,000) (WISQARS).

Australia

All deaths due to violent or unnatural causes are required to be referred to State Coroners who provide the information to the registrar of Births, Deaths & Marriages (BD&M) in each State or Territory. For natural deaths, medical practitioners are required to lodge Medical Certificates of Cause of Death with the Registrars of Births, Deaths & Marriages. After registration of the death the Registrars General pass the information from the death certificates to the Australian Bureau of Statistics (ABS), where staff code the multiple causes of death according to ICD-10 criteria for underlying and contributory causes. Coders may query the Coroners if the causes are not clear.

State and Territory laws govern Coronial investigations and the administrative and legal powers for conducting Coronial investigations. These coronial legislations however have not clearly defined suicide for legal purposes nor are there any operational criteria set out to conduct investigations and recording of suicides [71].

For external causes of death, multiple cause of death coding covers nature of injury and any other disease related condition reported on the death certificate. [71]

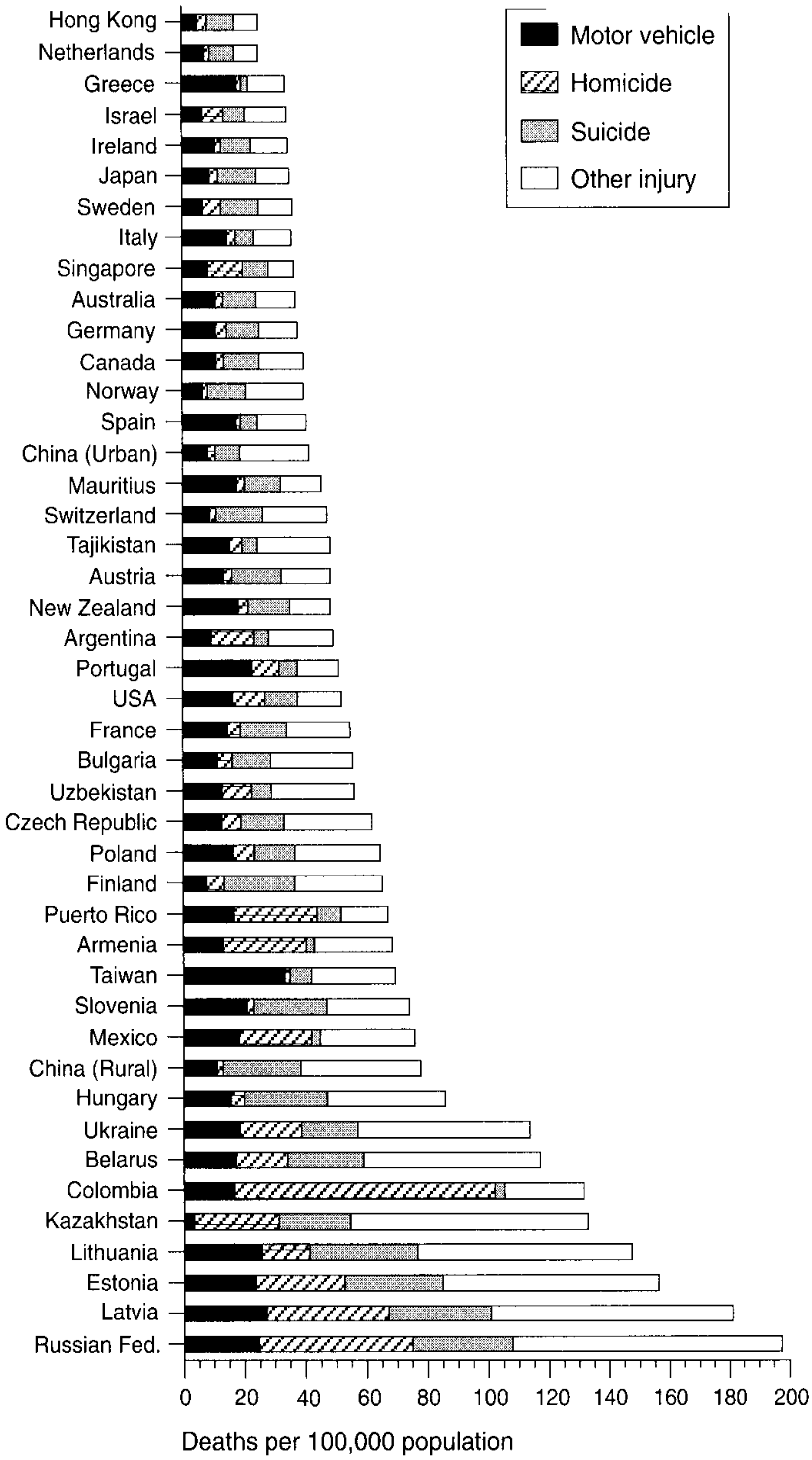

Figure 5.1 Death rates from injuries by country, and cause of injury.
Source: WHO Statistics Annual, 1994.

Table 5.2 Unadjusted injury mortality rates by sex per 100,000 population for various developing countries, with other countries for comparison Source: WHO Statistics Annual (1986-1996)

	Total all injuries		*Unintentional*				*Intentional*						
			Motor vehicle		*Non-motor vehicle*		*Suicide*		*Homicide*		*Other violence*		
	m	*f*	*m*	*f*	*m*	*f*	*m*	*f*	*m*	*f*	*m*	*f*	*Year*
AFRICA													
Mauritius	71	21	27	5	22	10	20	4	2	2	0	0	1994
SOUTHEAST ASIA													
China, rural	90	63	20	9	43	55	24	31	3	1	0	0	1994
China, urban	48	31	16	7	22	16	7	7	4	1	0	0	1994
Sri Lanka	116	39	4	1	47	15	47	19	12	2	6	2	1986
Thailand	106	30	21	6	31	11	8	7	47	5	0	0	1981
EASTERN MEDITERRANEAN													
Egypt	50	28	10	3	15	8	0	0	1	0	24	17	1987
AMERICAS													
El Salvador	188	32	20	7	43	11	15	6	66	5	45	3	1984
Colombia	234	32	22	7	36	11	5	1	168	13	4	1	1991
Mexico	106	23	25	7	39	12	5	1	32	3	5	1	1993
Chile	104	28	18	5	21	10	8	1	5	1	51	11	1992
Guatemala	86	17	2	1	26	7	1	0	5	1	52	7	1984
Uruguay	91	34	18	7	50	21	17	4	7	2	0	0	1990
Panama	80	21	28	6	25	10	6	2	12	2	10	2	1987
Argentina	76	29	14	5	30	15	9	3	7	1	15	4	1991
Costa Rica	62	17	21	5	23	8	7	1	7	2	4	1	1991
Paraguay	61	19	14	5	26	9	3	2	12	2	5	2	1987
Peru	46	15	10	3	27	8	1	0	4	1	5	3	1986
COMPARISON													
Russian Federation	415	102	38	11	191	49	74	13	53	14	59	14	1994
Venezuela	99	23	33	8	27	10	8	2	22	2	9	1	1989
United States	84	31	22	10	25	12	20	5	16	4	2	1	1992
Sweden	67	37	9	4	26	19	22	10	2	1	7	3	1993
Kuwait	45	14	28	6	14	5	1	1	1	0	1	2	1987
Australia	56	22	16	6	19	10	19	5	2	1	1	0	1993

Deliberate crashing of a motor vehicle
The Australian Bureau of Statistics had 126 cases of "deliberate crashing of a motor vehicle" and 10 cases of 'unknown intent, crashing of a motor vehicle' registered over the years 1990-2001. These together accounted for a very minor proportion of both suicides and motor vehicle fatalities, representing 0.8% of motor vehicle fatalities and 0.48% of suicides (Table 5.2). Data analysis yielded the following results:

- Younger age groups dominated with 20-24yrs (17.5%), followed by 30-34yrs (14.3%) and 15-19yrs and 35-39yrs (both 13.5%). More than half the suicides were aged under 35 years, and 90% were under the age of 55.

- Frequencies ranged from 5 in 1990 to 17 in 1994.

- Males accounted for the majority (82.5%) of these suicides.

- More of these 136 suicides occurred on Mondays (19.8%) and Saturdays (16.7%) than any other day, with the least occurring on Wednesdays (11.1%).

Table 5.3 Suicides by crashing of motor vehicle compared with all suicides and motor vehicle fatalities - Australia.

Year	Suicides by Crashing of Motor Vehicle	All Suicides	%	Road Traffic Fatalities	%
1990	6	2161	0.28	1821	0.33
1991	9	2360	0.38	1700	0.53
1992	9	2294	0.39	1565	0.58
1993	7	2081	0.34	1520	0.46
1994	17	2258	0.75	1458	1.17
1995	16	2368	0.68	1506	1.06
1996	11	2393	0.46	1455	0.76
1997	13	2720	0.48	1191	1.09
1998	12	2683	0.45	1243	0.97
1999	17	2492	0.68	1293	1.31
2000	11	2363	0.47	1414	0.78
2001	8	2454	0.33	1242	0.64
Total	**136**	**28,627**	**0.48**	**17,282**	**0.79**

Source: Australian Bureau of Statistics 1990-2001

Canada
Statistics Canada's Death Database collects information annually from all provincial and territorial vital statistics registries on all deaths in Canada.

In most provinces and territories, the personal information part of the death registration form is completed by an informant, usually a relative of the deceased. The part of the form comprising the medical certificate of death is completed by the medical practitioner last in attendance or by a coroner, if an inquest or inquiry was held.

The central vital statistics registry in each province and territory provides copies of the registration document and data from death registration forms to Statistics Canada.

Information on cause of death is coded according to the International Classification of Diseases (ICD). The 9th Revision (ICD-9) is used in Canada for deaths which occurred from 1979 to 1999. Information is currently coded by ICD-10.

Intentional injury data is available for the year 2000. During this period there were 26 cases of *intentional self-harm by crashing of motor vehicle* (X82) which was 0.8% of the total number of transport accident deaths. There were also 69 cases of *intentional self-harm by jumping or lying before moving object* (X81) but the 4th digit to specify public highway was not present. These are likely to be mostly rail suicides.

Sweden
Statistics on causes of death have annually been published between 1911-1993 by Statistics Sweden (SCB). The National Swedish Board of Health and Welfare has been responsible for publication since 1994. Statistics Sweden is however entrusted by the National Swedish Board of Health and Welfare with the actual compilation of the statistics.

The main variables included in the register are: social security number, home district, sex, date of death, underlying cause of death, nature of the injury, multiple causes of death, marked if autopsied or not and if so what kind, marked if operated within four weeks before death, marked if injury/poisoning, marked if alcoholic related, marked if narcotic related and code for diabetes.

Swedish versions of ICD-10 have been in use since 1997.

Intentional injury data is available for the year 2001. During this period there were 6 cases of intentional self-harm by crashing of motor vehicle (X82) which was 0.9% of the total number of transport accident deaths. There were also 61 cases of intentional self-harm by jumping or lying before moving object (X81) but the 4th digit to specify public highway was not present. These are likely to be mostly rail suicides.

5.2 ROAD TRAFFIC FATALITY DATA

5.2.1 International

The International Road Traffic Accident Database (IRTAD) contains the most recent comparable data for 28 Organisation for Economic Co-operation and Development (OECD) nations and one non-OECD nation. Current members generally consist of the national bodies for transport safety from each nation. While national definitions might differ, comparisons of the data may still be made by means of internationally agreed upon correction factors. The definition of a traffic fatality adopted by the majority of IRTAD member countries, is that presented in the UN Convention of Road Traffic (1968) – "Any person who was killed outright or who died within 30 days as a result of the accident" (Appendix 1). For the 12 countries that have adopted a slightly different definition, a correction factor has been included in the data. By obtaining an international perspective, it becomes possible to accurately assess national developments in traffic safety.

Those countries with the highest recorded traffic fatalities per 100,000 population, for the year 2000 were Korea (21.8), Portugal (21.0) and Greece (20.1). The USA recorded 15.2 fatalities per

100,000 population, Australia 9.5 fatalities and Sweden and the UK had the lowest recorded traffic fatalities with 6.7 and 6.0 per 100,000 population respectively. A summary of the total traffic fatalities and traffic fatalities per 100,000 population are shown in Table 5.3.

Table 5.4 IRTAD - Road traffic fatalities for the year 2000

Country	Pedestrians	Total Fatalities*	Fatalities/ 100,000 Population
Australia	287	1,818	9.5
Austria	140	976	12.0
Belgium	142	1,470	14.4
Canada	-	-	9.8
Czech Republic	362	1,486	14.5
Denmark	99	498	9.3
Finland	62	396	7.7
France	838	8,079	13.6
Germany	993	7,503	9.1
Greece	-	-	20.1
Hungary	346	1,200	12.0
Iceland	1	32	11.3
Ireland	85	415	11.0
Italy	-	6,410	11.0
Japan	2955	10,403	8.2
Luxembourg	11	76	17.5
Netherlands	106	1,082	6.8
New Zealand	35	462	12.1
Norway	-	341	6.8
Poland	2256	6,294	16.3
Portugal	382	1,860	21.0
Republic of Korea	3764	10,236	21.8
Spain	898	5,776	14.6
Sweden	73	591	6.7
Switzerland	130	592	8.3
Turkey	1139	5,123	7.6
United Kingdom	889	3,580	6.0
USA	4739	41,821	15.2

Source: www.bast.de/htdocs/fachthemen/irtad/english/
*Various correction factors had been applied.

There was data supplied detailing the fatalities by traffic participation, i.e. occupants of passenger cars, occupants of motorised two-wheelers, cyclists and pedestrians. There was, however, no visible distinction between single-occupant vehicle fatalities, or indeed suicides.

Europe

The European Conference of Ministers of Transport (ECMT) is an intergovernmental organisation, with one of its objectives being to meet the highest possible safety standards for transport throughout Europe. Members consist of 42 full member countries, 6 associate countries (including Australia, Canada, Japan, Korea, New Zealand and United States) and two observer countries (Armenia and Morocco). Like the IRTAD data, there was no mention of suicide as a cause of death. Fatality data was available for pedestrians, cyclists, mopeds, motorcycles, car drivers, car passengers and others. *[72]*

5.2.2 National

USA

The US National Safety Council released the American National Standard Manual on Classification of Motor Vehicle Traffic Accidents (Sixth edition) in 1996. Within this manual, the classification of deliberate intent regarding a motor vehicle accident is recognised. Suicide is included in this definition, and in theory should be easy to identify and be removed prior to providing statistics to IRTAD.

The National Center for Statistics and Analysis (NCSA) (a branch of NHTSA) released a report in April 2003 on pedestrian fatalities, in which it was identified that alcohol was present in 40% of all pedestrians who had died on the roads. Whilst alcohol can be a contributor to suicide, there was no reference to the intent of the pedestrian in NCSA statistics.

NHTSA published a Traffic Safety Facts 2000 titled “Large Trucks”. It reported that in the year 2000, the latest available data year, there were 4,930 large trucks involved in fatal traffic crashes in the US. There was no reference to suicide. However the following is of some relevance. Of the fatalities from crashes involving large trucks, 78% were occupants of other vehicles, 8% were non-vehicle occupants eg pedestrians, bicyclists and 8% were occupants of large trucks. Drivers of large trucks involved in fatal collisions were less likely to be intoxicated (1% of drivers) compared with passenger cars (19%), light trucks (20%) and motorcycles (27%). Additionally large trucks were much more likely to be involved in a fatal multiple-vehicle crash, as opposed to a fatal single-vehicle crash, than were passenger vehicles (84% of all trucks involved in fatal crashes, compared with 62% of all passenger vehicles) (www.nhtsa.dot.gov).

The National Highway and Traffic Safety Administration manages a Fatality Analysis Reporting System (FARS). The most relevant data referred to drivers and pedestrians. There were 25,840 driver and 4,882 pedestrian victims in 2001 representing 68% and 13% of fatal crashes respectively. Suicides however, where determined, are excluded from this database.

Australia

The Australian Transport Safety Bureau (ATSB) is responsible for providing data to the IRTAD. Through their website, current data on types of road user, speed limit, crash type, time of day and time of week are presented for traffic fatalities. Interestingly, the definition used in the ATSB’s “Road crash data and rates: Australian States and Territories, 1925-2001” of a fatal crash is “Any road crash occurring on a public road which resulted in the death of a road user within 30 days which directly or indirectly occurred due to vehicle movement”. Applying this definition, a traffic suicide should be included in this data, however there was no mention of the inclusion or exclusion of suicide across any of the ATSB data.

National data provided in road traffic questionnaire responses (chapter 6)

Three countries provided available data. The Netherlands respondents noted that suiciders represented 1% of fatalities and natural deaths 4%. In the Czech Republic the Police registered 4 cases of pedestrian suicide attempts by jumping under a motor vehicle, all resulting in only slight pedestrian injury. In 3 cases the pedestrian had chosen a passenger car and once a lorry. A Norwegian study on deaths in road traffic accidents on high class, 2 lane roads with speed limit of 80 or 90 km/h, showed a suicide incidence of approximately 10%.

5.3 OTHER DATA SYSTEMS

In Australia, the National Centre for Coronial Information (NCIS) is the world's first electronic national database of coronial information. Details of reportable deaths since July 2000 are stored on this database, managed from the Monash University National Centre for Coronial Information (MUNCCI). It is now possible to systematically identify and retrieve clusters of similar cases within coronial offices around Australia. Until the NCIS was established, the information was kept in paper files and separate case management systems all over the country. The database contains information which includes date of death notification, age, sex, time/location of incident, intent (both suspected at time death reported and final), vehicle type, driver/passenger, context and ICD-10 cause of death. Higher level access is available for police narrative of circumstances, name, place of usual residence, pathology and toxicology reports and coronial findings.

The NCIS has much potential for providing considerable detail about relatively rare injury deaths such as road traffic suicides, and also suspected road traffic suicides that have not clearly been determined as such. It may also identify natural deaths of drivers among all cases of sudden and unexpected death that are required to be reported to the coroner (www.vifp.monash.edu.au/ncis).

There were 33 motor vehicle suicides registered on this database for Australian fatalities between mid July 2000 and October 2002. Of these 14 were motor vehicle drivers, 18 pedestrians and 1 a heavy vehicle.

Many countries have expressed interest in this system and New Zealand may join. However this type of system requires a considerable level of coronial co-ordination exchange and standardisation. As yet this does not appear to exist in most countries. [73].

6. DATA SYSTEMS TREATMENT OF SUICIDE AND NATURAL DEATHS IN ROAD TRAFFIC – QUESTIONNAIRE RESPONSES

To determine current practices in the treatment of suicide and natural deaths in road traffic data systems, two surveys were conducted. This chapter presents the responses to questionnaires distributed to national vital statistics organisations and national road traffic organisations.

6.1 VITAL STATISTICS

Officers in charge of data analysis for the major vital statistics organisations in ten countries were sent questionnaires developed by the researchers (Appendix 6c). The countries to whom these were sent were: USA, Canada, Spain (Catalonia), Germany, England, France, Italy, Scotland, Sweden and Australia. These countries' vital statistics organisations are all users of the Automating Mortality Statistics Bulletin Board, a User Group internet facility which provides a forum for discussion between both existing and potential users of ICD-10.

A list of participating organisations and details of responses are shown in Appendix 8.

6.1.1 Summary of responses

1. Please confirm that ICD-10 coding is used by your organisation for the classification of injury deaths. If so, when did it commence?

All responding countries currently use the ICD version 10 coding system, with the exception of Italy, which will upgrade from ICD-9 for its 2002 data. Sweden was the first of the respondents to introduce ICD-10 and applied this latest version to its 1997 death data, followed by Australia to its 1998 data.

2. Does your system allow aggregated data to be reported separately for X81 "intentional self-harm by jumping or lying before a moving object" and X82 "intentional self-harm by crashing a motor vehicle" and Y31 and Y32, the equivalent codes for unknown intent?

All responding systems do allow for aggregated data to be reported to the maximum level of detail for ICD-10, as above, and the ICD-9 equivalent for Italy. France noted that Y31 and Y32 are seldom used since there is no corresponding cause mentioned on the death certificate.

3. Can it also provide data to a fourth character sub-division for: (1) the above four codes and (2) transport accidents (V01-V99)?

In ICD-10 the fourth character sub-division represents location for suicides and unknown intent, and for transport accidents to identify if traffic or non-traffic. All respondents reported their ICD-10 data systems as having the facility to be coded to this fourth character sub-division.

How complete is this four digit data?

The fourth digit suicide data tended to have a large proportion of codes assigned to 0.9 ie unspecified place (Canada 38%, Catalonia often). In France the fourth digit data is difficult to access. Road traffic fatality data was complete to the fourth digit.

Is the four digit data actually published or readily available?
In most cases the data is not published but is readily available.

4. In your system does multi-cause coding enable natural causes of death to be identified where the underlying cause of death is a road traffic accident or alternatively road traffic accidents where the underlying cause of death is a natural cause?

Multi-cause coding (a possible feature of ICD-10) is currently practised in some of the responding countries. France, Sweden, USA, Australia, the UK and Scotland reported practising multi-cause coding whereas Canada, Spain, Italy and Germany do not. Germany however will practise it in one or two years. Scotland noted that the number of cases is very small and in Australian this was also found to be the situation (10 cases over the two year period 1999 to 2000 where the victim was injured in a road crash but died of another cause eg myocardial infarction).

6.2 ROAD SAFETY STATISTICS

6.2.1 Summary of responses

Questionnaires were distributed to representatives of road safety organisations of 22 countries (Appendix 6b). Responses were received from 16 of these. A list of responding organisations and details of responses are shown in Appendix 7.

1. What is your organisation's policy regarding the inclusion of deaths resulting from suicide in the road traffic fatality count your country provides to IRTAD (International Road Traffic Accident Database)? Examples are pedestrians jumping under a truck, a single vehicle occupant driving into a pole.

In the majority (eleven) of the sixteen countries that responded, suicides are excluded from road traffic fatality counts. The countries which do not exclude suicides are the Czech Republic, Sweden, Switzerland, Finland and Poland. Several countries (4) elaborated to note that whereas suicides are not included, others killed in the crash are regarded as road traffic fatalities. No country noted that other traffic fatalities caused by the suicide were excluded from the road traffic fatality count.

2. How is this policy implemented in practice? ie
- *a) What is the data source eg police reports, coroners reports?*

The data in almost all responding countries are initially based on police reports. Where there is suspicion of suicide this will usually be referred to a coroner for determination of intent with the exception of Germany, Denmark, Austria and Norway where police determine intent (for the purposes of the road traffic fatality count). In at least Spain and New Zealand suspected suicide cases are not included in road traffic fatality databases until a coroner has determined they are not suicide. In the US, police reports are supplemented by coronial, medical examiner, Emergency Medical Systems (EMS) and hospital reports, systems varying between states.

- *b) Is the intention to commit suicide determined and if so, on what basis?*

Mostly a coroner will determine a suicide. However in Germany, Denmark, Austria and Norway, police make that decision. In Sweden the SNRA determines suicide based on coroners reports, the treating physician and the police. A system based solely on coronial reports is under investigation. In Australia it is known that there are some inconsistencies between states: in some states suicide crashes are determined by data managers, some states apply a criminal standard of proof and others rely on coronial findings.

- *c) Are statistics adjusted if a road traffic fatality is found to be suicide after a considerable lag?*

A number of countries can adjust statistics until a particular date. The deadline for adjustment of the previous year's statistics in France is April 30th, March 1st in the Netherlands, May in Norway and May or June in Denmark. In Great Britain, cases can be removed until close of the database for the year. In Germany alterations cannot be made after accident data is transferred from police to the statistical offices of the Länder. Australia and New Zealand can adjust at any time. Sweden does not adjust after publishing and the Czech republic can adjust yet these countries both include suicides in their road traffic fatality counts so a decision of suicide would not affect their traffic fatality count. The USA noted death within 30 days as being a factor. That this is the IRTAD definition of a road traffic fatality (Appendix 1) could be a cause of statistical adjustment which presumably applies to all countries but is not specific to suicide.

3. *What is your organisation's policy regarding the inclusion of natural deaths in the road traffic fatality count your country provides to IRTAD? An example is a death resulting from a cardiac arrest prior to or post a road traffic accident.*

As with suicides in all countries, which responded, natural deaths are not included in the road traffic fatality count, with the exception of the Czech Republic, Sweden, Switzerland and Poland. However Sweden does exclude natural deaths who died within 30 days at a hospital. Road fatalities who die a natural death prior to hospitalisation are flagged. Sweden is negotiating a system where all natural deaths that have been flagged are excluded. Finland includes suicides but not natural deaths. As with suicides, several countries noted that fatalities in a crash, other than the person who died of natural causes, are included in the road traffic fatality count.

4. *How is this policy implemented in practice? ie*
   - *What is the data source eg police reports, coroners reports?*
   - *Are statistics adjusted if a road traffic fatality is found to be a natural death after a considerable lag?*

The responses were very similar to those for suicides. The Netherlands noted that a death from natural causes in hospital post crash counted as a hospitalised death, not a road traffic fatality. In Sweden natural death cases are counted as injured in road traffic statistics. In Finland natural deaths are excluded on the basis of police reports and death certificates. Statistics can be adjusted until August of the following year.

5. *In your more detailed data could suspected suicide or suicide by a pedestrian involving a heavy vehicle be identified?*

With the exception of Sweden and the Czech Republic, it is not possible to identify such suicides or suspected suicides since these have been excluded or as for Finland, Switzerland and Poland intent has not been determined.

7. PREVENTION MEASURES

7.1 GENERAL SUICIDE

Suicide is frequently an individual response to perceived intolerable conditions. Factors associated with suicide are easy access to a lethal agent, publicity about a suicidal act and psychological risk factors including mental and physical illness, alcoholism, financial problems and interpersonal disputes. While alcoholism and binge drinking are frequently associated with suicide they may not be the underlying cause. Nevertheless inappropriate use of alcohol may be a major contributor to suicides [3].

Numerous activities are being undertaken world-wide in attempting to understand the risk factors, detection of potential suicides and treatment of underlying causes. Recent developments are the acceptance of deliberate self-harm and suicidal ideation as being indicators of suicidal intent, lithium combined with Cognitive Behaviour Therapy for bipolar disorder and the widespread use of more effective anti-depressants and other medication with less serious side-effects. Several countries (eg Australia, UK) have introduced Suicide Prevention Strategies and are devoting considerable resources to these. There has been some success in reducing suicide by reducing access to the means with reduced paracetamol availability in the UK, firearms in Australia and less recently coal gas in the UK and barbiturates in Australia [74].

Unfortunately removing access to the means, for this project, ie vehicles from road traffic, is for obvious reasons not generally a feasible solution. Nevertheless, barriers can be implemented for high-risk individuals and situations eg alcohol interlock.

There are however pre-crash, crash and post-crash methods which will improve detection of pedestrians, increase the likelihood of survival of suicide attempting drivers and pedestrians during the crash and reduce the time between the injury event and treatment.

7.2 PEDESTRIAN PROTECTION

There are a number of aspects of general pedestrian protection that have relevance to the prevention of pedestrian suicide.

Strategies to provide protection to all pedestrians against collisions with vehicles have received attention in recent times, following the issuing of a directive by the European Parliament relating to the protection of pedestrians and other vulnerable road users [75]. The Directive, which applies to passenger cars and light vans, lays down requirements for the construction of vehicles in order to improve pedestrian protection by mitigating the severity of injuries in the event of a collision. It contends that modified frontal structures of vehicles, in the circumstances of collisions at speeds below 40 km/h, may significantly reduce the levels of injury sustained by pedestrians. The directive resulted in obtaining a commitment from the European Automobile Manufacturers Association (ACEA) [76] to meet a number of objectives relating to pedestrian safety. The ACEA commitment aimed to comply with the vehicle-front design requirements of the directive and implement other protective strategies. These strategies included the requirement that for all new vehicles:

- Vehicles must be equipped with Anti-lock Brake Systems (ABS) from 1 July 2004
- Vehicles must be equipped with Daytime Running Lights (DRL) from October 2003
- Installed bull bars would be non-rigid in nature from 1 January 2002

7.2.1 Prevention of pedestrian injury

Identification of injury prevention strategies, ideally, is supported by a thorough body of knowledge concerning the risk factors and circumstances of the injury type in question. As little in known about intentional pedestrian injury, it is necessary to draw on strategies designed for the prevention of unintentional pedestrian injury. However, while many of the pedestrian protection strategies may be appropriate for both unintentional and intentional pedestrian injuries, some are unlikely to be so. For example, while Daytime Running Lights may make a vehicle more conspicuous to a pedestrian and therefore prevent an unintentional collision, they would not have the same advantage in the case of intentional injury. It is unclear whether such a strategy would deter, facilitate or have no effect on a person choosing to inflict self-harm. The following review identifies pedestrian protection strategies currently available, or under development, which may be applicable to the prevention of intentional pedestrian injury.

It is useful to consider interventions that can occur at the various stages of the pedestrian-vehicle interaction: prior to the collision, during the collision and after the collision.

7.2.2 Prior to collision

Pre-collision strategies seek to prevent the collision. They focus on improving the chances that (1) the driver will detect the presence of a pedestrian and take appropriate avoidance action (*pedestrian detection*), and/or (2) the vehicle will be able to stop, reduce speed or take appropriate avoidance measures (*effective vehicle and driver performance*).

(1) PEDESTRIAN DETECTION

Improving the visibility of pedestrians in these situations may result in the driver having sufficient time to either take successful evasive action or enable a reduction in speed. There are a number of strategies that may have the potential to improve driver detection of pedestrians.

Active or adaptive headlight systems

These systems aim to improve driver night vision by directing and/or modifying the light beam of the headlights to take account of the road layout and the speed of the vehicle. Honda has tested a system of active lights where the upper reflectors of the headlights move in accordance with the turn of the steering wheel and the speed of the vehicle [77]. Road vehicle tests indicated that the active headlight system produced improved advanced object detection times. While advanced detection times for passive headlights were approximately 1.3 seconds, active headlights increased advanced detection times to 1.9 seconds which closely matches that achieved in daylight (2 seconds). It was also found that the illumination provided by the active system resulted in the need for smaller evasive steering movements.

Similarly, Mazda and Volvo are developing adaptive headlight systems [78, 79]. The earlier detection of pedestrians, enabled by such systems, would be expected to improve chances of collision avoidance.

Night vision systems

A number of night vision enhancement systems have been proposed. One such system is currently commercially available in Cadillac's DeVille model. This system uses infra-red detectors to survey the road ahead and produces a digitised visual image, which is projected onto the base of the windscreen [80].

Collision avoidance warning

Forward collision warning systems, employing sensors to detect and warn of imminent collisions are available commercially [81]. While such systems are thought to have potential in the reduction of collisions with parked vehicles and fixed objects, their applicability to the protection of pedestrians is not clear. It is considered that pedestrian warning systems may suffer from excessive false alarms in areas of high pedestrian activity [82].

Ford, Mazda and Honda are developing pedestrian warning systems [77, 78] [83]. Honda is developing a night vision system that also incorporates pedestrian collision warnings [77]. Honda's system uses stereoscopic infra-red cameras to detect pedestrians and provide voice and head-up display visual information to prompt driver caution if a collision is possible. Simulator tests have indicated that this system resulted in both faster and more accurate recognition of the presence of pedestrians. Similarly, Ford and Mazda are testing systems using scanning radar to detect pedestrians in front of the vehicle producing auditory and visual warnings.

Ultraviolet headlights

Tests have been conducted looking at the value of enhancing headlights with ultraviolet light. Ultraviolet light has been found to produce luminosity in clothing that is light coloured and made of cotton or synthetic fabric and clothing containing residue of conventional laundry detergent. Testing with ultraviolet headlamps found that this luminosity substantially improved the detection of pedestrian dummies [84] and thus may have application in the prevention of pedestrian injury.

(2) EFFECTIVE VEHICLE AND DRIVER PERFORMANCE

Once a pedestrian has been detected in the path of the vehicle, pedestrian protection depends on the ability of the vehicle to stop, reduce speed or take avoidance action. Successful completion of these measures depends on the performance of the vehicle and driver and the speed of the vehicle.

General measures that improve the effectiveness of the vehicle in stopping or avoidance manoeuvres have relevance to this situation: for example, anti-locking braking systems and all-wheel drive. Excessive speed can be controlled by speed delimiters which prevent a vehicle travelling over a specified speed and excessive speed warning systems.

Effectiveness and appropriateness of pre-collision phase strategies for intentional injury, however, may be limited. The question arises as to whether such strategies, which may be effective for the prevention of unintentional injury, may be readily compromised in the case of intentional injury. If a pedestrian intends to inflict self-harm, it would be expected that they might employ strategies that minimise the likelihood of collision avoidance. If a person chooses to leap from a concealed location into the path of a fast moving vehicle, there is very little that either a driver or an advanced warning system can do to prevent a collision.

Consequently, the strategies discussed in the following sections, relating to the collision phase, may be more appropriate to the prevention of intentional pedestrian injuries as they operate regardless of the intentions of the pedestrian.

7.2.3 At collision

Strategies at this stage seek to reduce the incidence and severity of injury.

Certain characteristics of vehicle design have a marked effect on the nature and severity of injuries sustained by a pedestrian when struck by a vehicle [85]. Impact speed of the vehicle, the geometric and mechanical characteristics of the impact surfaces and structures and the physical dimensions of the pedestrian all play a role in the nature and severity of pedestrian injuries.

Changes in these factors have been shown to influence injury outcomes of pedestrian-vehicle collisions. The reported trend for more recent cars to have a decrease in bumper height, hood height, bumper lead, hood length and lead angle compared to older models has been found to be associated with changes in injury patterns [86]. The newer vehicles were found to be associated with an increase in injuries caused by the bumper/valence, windshield, hood and A-pillars, with a resulting increase in frequency of injuries to the head, neck, back, upper and lower extremities.

Although severe head injury can result when the pedestrian is thrown onto the roadway, after striking the bonnet, most cases of severe head injury can be attributed to the earlier head contact with the vehicle [85]. As the majority of pedestrian fatalities are associated with head injuries [87] changes that increase these injuries need to be redressed.

The vehicle components likely to cause severe pedestrian head injury are the 'A' pillar, lower glass at the bottom of the windscreen, bonnet hinges, fender flange, wiper pivots, front suspension, engine and other components in the engine compartment, bonnet, bonnet leading edge, front bumper and headlights [88]. Modification of, or protection against, these structures is the main focus of prevention strategies focussing on the collision phase. Providing a soft impact area for the head is the primary pedestrian safety design [89].

Construction materials

Application of new materials technology to automobile use is being explored. For instance in the UK the Foresight Vehicle program is developing a new composite, impact energy absorbing material that can automatically alter its stiffness to cope with different types of impact [90].

Bonnet

The shape, material and degree of clearance between the bonnet and underlying hard structures are thought to determine degree and type of injury. Improvements to bonnet design include reducing stiffness of the leading edge, location of bonnet latch inner structure rearward or to the sides and moving transverse stiffeners back from the leadings edge [88], increasing under bonnet clearances, locating softer components at the top of the engine and avoiding localised stiffness of the bonnet in favour of a more distributed structure [87].

As serious head injury can occur when the head hits a region of the bonnet with stiff underlying structures [89], increasing the clearance between bonnet and engine components is desirable and has been addressed in several ways. Honda's 2003 Accord models incorporate an 80mm gap between the bonnet and engine block [83]. Alternatively, a pop-up bonnet system has been developed in Sweden [91] to decrease the severity of head-to-bonnet impacts. The system, which is activated at impact by a sensor in the bumper, lifts the rear of the bonnet approximately 100mm. Headform testing showed that the system reduced head injury criteria (HIC) values to below 1000 with reductions ranging from 18% to 90% compared to a standard bonnet. This active bonnet design has been further enhanced by the addition of a pair of airbags, one at each windshield pillar [92] to reduce the risk of pedestrians hitting the hard structures around the windshield. Ford is also developing a similar airbag system to provide protection at the windshield base [93]

Other external front-of-vehicle airbags are also being developed. Ford is also testing an over-the-hood airbag that deploys from above the bumper and is activated before impact by a sensor [93].

Bull bars

Although the magnitude of the additional risk to pedestrians posed by bull bars is as yet undetermined [94], there is evidence to indicate that pedestrians killed by bull bars are more likely to sustain severe abdominal and chest injury in addition to head injuries. While the banning of all bull bars has been called for [95], attempts have been made to design safer bull bars. Comparative testing of bull bar types found that while steel bull bars showed a high risk of serious and life threatening injuries, plastic bull bars were found to be comparably safe [96]. Several bull bars that are commercially available have been designed with pedestrian safety as a priority, and claim to have demonstrated their superiority over the traditional bull bar [97, 98]. One of these [98], also claims that, in addition to performing better (as measured by HIC) than steel or aluminium bars, the new design of bull bar recorded better or similar HIC safety values than the unprotected vehicle.

Underrun guards

Although most pedestrian-vehicle collisions involve the vehicle effectively running under the pedestrian [85], there are also instances where pedestrians are at risk of being run over by the vehicle. It has been suggested that there is the need to develop a device for employment under the front bumper to prevent pedestrians from being swept under the vehicle [99, 100].

Headlights

In most pedestrian-vehicle collisions the primary contact zone is in the corner areas of the front end, and the vehicle headlights are often hit. In response to this, pedestrian friendly headlights are being developed seeking to optimise headlight construction with regard to energy absorption and deformation behaviour in the event of a collision [101].

Speed reduction

The travelling speed of vehicles has been identified as an important factor in pedestrian fatalities. As the braking distance is proportional to the square of the initial speed, small differences in travelling speed can result in large differences in impact speed. It has been estimated that a reduction of 5km/h in vehicle travelling speeds could result in a 30% reduction in the incidence of fatal pedestrian collisions. [102] A reduction in speed gives the driver a better chance of avoiding the collision, and reduces the level of pedestrian injury sustained in the collision.

Therefore, any strategies that bring about a reduction in vehicle travelling speeds may have benefit in prevention of intentional pedestrian fatalities.

7.2.4 After collision

Post-collision strategies are concerned with maximising the chances of survival and recovery from the injuries received.

Emergency MayDay Systems

The timely arrival of emergency services can be a critical factor in survival of traffic collision victims. It has been estimated that for victims with theoretically survivable injuries, up to 17% die before receiving treatment [103]. A combination of Global Positioning System (GPS) and cellular phone technologies has been used to develop emergency MayDay systems which are triggered by airbag activation and alert central control which can immediately dispatch assistance [81]. The vehicle's location is provided by the GPS system and is automatically relayed to the control centre. Such a system would be expected to improve the likelihood of survival of pedestrian injury victims.

7.3 PREVENTION OF DRIVER SUICIDES

Several studies of this method of suicide were reviewed in Chapter 3. Being male, aged between 20 and 34, having a mental disturbance or psychiatric history, involvement of alcohol and difficulty of determination of intent were all discussed as being important factors. The manner however in which these suicides were undertaken was not discussed in any of the articles reviewed.

General measures that provide protection for vehicle occupants may have a role in preventing driver suicides. There has been considerable development in vehicle occupant protection strategies over recent years and many of these will provide driver protection in the event of an intentional collision (eg airbags, impact absorbing vehicle construction, survival cell design, roadside barriers). However, those strategies requiring driver compliance are unlikely to be beneficial, as, for instance, the driver can choose to not wear a seat belt or can ignore a collision warning signal.

Nevertheless, there are several technological innovations that may have application to the prevention of driver suicides in particular.

Alcohol interlocks

The abuse of alcohol has been identified as a strong factor in driver suicide and single-vehicle crashes overall (Section 2.6). The atypical almost complete absence of a suicide note in this type of suicide suggests that there may be a degree of impulsivity associated with motor vehicle suicide. As the likelihood of acting impulsively, and suicide ideation, may be exacerbated by the use of alcohol [104], prevention of vehicle use by intoxicated drivers may reduce this form of self-harm.

Devices that prevent cars from being driven by intoxicated drivers are commercially available, and may have a role in the prevention of driver suicide.

Intelligent speed adaptation systems

Intelligent speed adaptation technology is being trialed in a number of countries [81]. One version of this technology uses transmitters to communicate with the vehicle to indicate the speed required for a location, and actively limits the vehicle's speed accordingly. Such limiters may reduce the opportunity for drivers to intentionally collide with an object at high speed on the average urban roadway. The delay produced, by a driver being required to find a roadway that will allow sufficient speed, may act as a deterrent or circuit breaker to suicide ideation or impulsive desire.

Smart licences

Access to, and use of, vehicles could be restricted by the use of electronic driving licences. The system, based on Smart Card technology, replaces the mechanical key system and has a built-in chip containing information about the driver and driving restrictions [105]. The system, which is primarily designed to prevent unlicensed or drunk driving, may also have application to people known to be at risk of suicide.

Driver monitoring
There are a number of systems that monitor driver behaviour and performance [81] that may have potential for application to the prevention of driver suicide. While, at this stage, it is unknown whether drivers intending to suicide exhibit abnormal driving patterns or warning behaviours, it is conceivable that they may do so. Therefore, detection of risky patterns could be used to trigger for reduction of speed and/or an appropriate intervention signal.

The technology being developed is designed to detect driver fatigue, but its adaptation to suicide prevention may be worth addressing.

Emergency MayDay systems
As the chances of survival are thought to be improved by the timely arrival of emergency services, the employment of an automatic MayDay system may be beneficial in preventing death due to intentional vehicle collisions. This is discussed more fully in Section 7.1.3.

8. CONCLUSION

8.1 LITERATURE

Relative to other methods of suicide and injury there appears to be very sparse literature on suicide and natural deaths in road traffic. Such cases have been difficult to identify, and there are several factors acting as a disincentive to facilitating this. Available data and literature suggest that driver and pedestrian suicides and natural driver deaths are relatively minor components of total road traffic fatalities.

Most research on intentional road death has focussed on driver suicide, with pedestrian suicide receiving little attention. While specific vehicle suicide prevention measures were not found in the literature, a number of general vehicle safety strategies were identified as having relevance to the prevention of intentional vehicle related injuries.

Research on natural driver deaths has been primarily concerned with issues of "fitness to drive" and risks to other road users.

8.2 DATA AND ASCERTAINMENT

Relevant fatality data systems can be sourced from either police, medical examiner or coronial data for suicide and police or medical data for natural deaths. There are various leakages in these systems, particularly in reporting coronial suicide verdicts back to police based databases and deaths in hospital back to police as fatalities rather than them remaining reported as injuries. In developing countries fatalities are frequently unreported.

The vital statistics WHO ICD coding system is extremely comprehensive. Relevant codes are X81 for "intentional self-harm by jumping or lying before a moving object" which includes some pedestrian suicides and X82 for "deliberate crashing of a motor vehicle". Utilising ICD-10, in best practice, pedestrian suicides can be identified as X82.4 ie *hit by a moving object on a street or highway*. Y31 and Y32.4, respectively, are the unknown intent equivalents. Accidental transport fatalities are coded between V01 and V89 with a fourth digit to identify the injured person.

A limitation however, will be that determination of intent is usually based on a coronial decision which is generally considered conservative, and particularly so for this type of suicide, which, for reasons of insurance, stigma, guilt and being more equivocal than other methods of suicide, may be determined to be "an accident". Both life and motor vehicle accident insurance do not generally cover suicide, especially when undertaken within 13 months of signing up for a policy. Motor vehicle accident insurance will not cover a death from natural causes.

Natural deaths should be identifiable where ICD-10, with its multi-cause coding, has been introduced.

Alternatively, in RTA databases, the definition of a road traffic fatality as "died within 30 days" is the most accepted international definition and, even then, there are exceptions, to which correction factors must be applied.

8.3 QUESTIONNAIRE RESPONSES

The questionnaires to national vital statistics organisations revealed that, of the ten mostly European respondents, all would, from 2002 data, utilise ICD-10 for coding of road traffic fatalities, thus enabling X81 and X82 to be reported separately. Apparently the fourth digit to specify “street or highway” usually had a substantial “unspecified” component and although mostly accessible was not published. Hopefully, as time progresses, this “unspecified” component will reduce and the data will become more meaningful, such that pedestrian and driver road traffic suicides can be clearly identified.

In police based road traffic fatality data suicides and natural deaths were mostly excluded. Of the sixteen responding countries, the Czech Republic, Sweden, Switzerland, Poland and Finland appeared to be exceptions. The Czech Republic and Sweden included and could identify suicides and/or natural deaths, Finland excluded natural deaths but did not determine suicide and Switzerland and Poland did not determine and therefore included suicides and natural deaths. Data could usually be adjusted to accommodate suicide until data closure in the following year.

The Australian NCIS has the potential to allow electronic interrogation of road traffic suicide case data and suspected suicide cases for fatalities from July 2000 in considerably greater detail than has occurred anywhere to date.

8.4 SIZE OF THE PROBLEM

Although both suicides and road traffic fatalities are the major causes internationally of injury fatality, identified road traffic suicides and natural deaths appear, from the available data and literature, to be a very minor proportion of each.

8.5 COUNTERMEASURES

Several countermeasures were outlined pertaining to suicide generally, pedestrian protection and prevention of driver suicides. They are summarised in the next section.

9. BEST PRACTICES

9.1 DATA SYSTEMS

9.1.1 When the ICD-10 coding system becomes widespread and completed accurately to the 4th digit, especially for suicide data, it will represent best practice. This should enable "intentional self-harm by crashing of a motor vehicle" and pedestrian suicide ie "intentional self-harm by jumping or lying before a moving object, location is street or highway" to be specifically identified. Additionally ICD-10 multi-cause coding enables identification of death from natural causes in road traffic.

9.1.2 The responding countries, other than the Czech Republik, Sweden, Switzerland, Poland and Finland, excluded suicides and/or natural deaths from their road traffic data and thus probably had lower road traffic fatality counts than they would have otherwise. (A Swedish study [43] found 13.6% of their 1999 traffic deaths were suicides or natural deaths).

9.1.3 Australia has introduced an electronically based National Coroners Information System which enables coroners, researchers and other approved persons access to more detailed and timely information on injury deaths than data systems had previously supplied. Aside from aggregate data with more limited access the system enables text searches of findings, police circumstances, toxicology and pathology reports.

9.2 ASCERTAINMENT

9.2.1 There are several factors relating to ascertainment which are possibly worth investigating further for their influence on suicide ascertainment. These are: 1) the reputably lesser stigma attached to suicide in countries such as the Netherlands, 2) the TAC and SAAQ victim and their dependents' compensation schemes which do not consider intent in determining payments and 3) the German Federal Highway Research Institute's suicide and natural death determination by police only and thus the non-involvement of the reputably conservative coronial decision.

9.3 COUNTERMEASURES

9.3.1 There were no measures located in the literature specifically directed at road traffic suicides. Therefore of relevance are suicide prevention strategies directed at males aged 20-34 years, with a psychiatric and possible alcohol abuse history.

9.3.2 Road safety technological innovations currently in place and therefore available to prevent driver suicides are alcohol interlock systems; passive, non-tamperable vehicle design features such as airbags and survival cell design plus road side barriers. Automated emergency MayDay systems could assist in survival of suicide attempters post-crash.

9.3.3 A number of currently available countermeasures have possible application to the prevention of pedestrian suicides. These include pedestrian friendly car front features such as clearance between the bonnet and engine block, and bull bars that have been designed with pedestrian safety as a priority, anti-locking braking systems, all-wheel drive, night vision systems and, as for driver suicides, automated MayDay systems and alcohol interlock devices.

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APPENDICES

APPENDIX 1

DEFINITIONS

ICD10 TRANSPORT DEFINITIONS

Traffic accident
Any vehicle accident occurring on the public highway (ie originating on, terminating on, or involving a vehicle partially on the highway). A vehicle accident is assumed to have occurred on the public highway unless another place is specified, except in the case of accidents involving only off-road motor vehicles, which are classified as nontraffiic unless the contrary is stated.

Public highway (trafficway) or street
The entire width between property lines (or other boundary lines) of land open to the public as a matter of right or custom for purposes of moving persons or property from one place to another. A **roadway** is that part of the public highway designed, improved and customarily used for vehicular traffic.

Heavy transport vehicle
A motor vehicle designed primarily for carrying property, meeting local criteria for classification as a heavy goods vehicle in terms of kerbside weight (usually above 3500kg and requiring a special driver's licence).

Bus
A motor vehicle designed or adapted primarily for carrying more than 10 persons and requiring a special licence.

Pedestrian
Any person involved in an accident who was not at the time of the accident riding in or on a motor vehicle, railway train, streetcar or animal-drawn or other vehicle, or on a pedal cycle or animal.

Suicide
There does not appear to be a WHO definition of suicide nor a standard definition used internationally by coroners. Some examples of available definitions are:

- Suicide is generally accepted to mean the fatal, and suicidal attempt the non-fatal act of self-injury, undertaken with more or less conscious self-destructive intent, however vague or ambiguous [106].

- Suicide is intentionally self-inflicted injury that results in death. (CDC National Center for Injury Prevention & Control (WISPARS Fatal))

- Suicide can be defined as the deliberate taking of one's life. To be recognised as a suicide a death must be recognised as due to other than natural causes. It must also be established by a coronial inquiry that death results from a deliberate act of the deceased with the intention of ending his or her own life [71].

ROAD TRAFFIC ACCIDENTS

Road crash fatality

The international definition of a road crash fatality, as given in the Convention of Road Traffic (Vienna 1968) is "Any person who was killed outright or who died within 30 days as a result of an accident".

In recent years, due to this clear definition, fatalities have been the only injury category which is reliable for international comparisons. A few countries only have a different standard (France, Italy, Portugal, Turkey and Korea) and correction factors are usually applied to adapt these data to the 30 days definition.

Traffic accident

According to an IRTAD survey undertaken in 1998 there were as many responses to the definition of traffic accidents as there were countries surveyed (n=27). There was no reference made to suicide (or natural deaths) and the Luxembourg, Canadian and US definitions could be interpreted as including suicides since the terms accident or unintentional were not used (IRTAD special report, Definitions & Data availability, 1998)

APPENDIX 2A

RELEVANT ICD-10 CODES

Definition	3 digit code	4th digit code
Suicide		
Intentional self-harm by jumping or lying before a moving object	X81	.4 Location is street or highway
Intentional self-harm by crashing a motor vehicle	X82	.4 Location is street or highway
Undetermined intent*		
Falling, lying or running before or into moving object	Y31	.4 Location is street or highway
Crashing of motor vehicle	Y32	.4 Location is street or highway
Transport accidents**		
Pedestrian injured in collision with	V03 car, pickup truck or van V04 heavy transport vehicle or bus	.1 Traffic accident, .9 Unspecified whether traffic or non traffic
Pedal cyclist injured in collision with	V13 car, pickup truck or van V14 heavy transport vehicle or bus V17 fixed or stationary object	.4 Driver injured in traffic accident, .9 Unspecified pedal cyclist injured in traffic accident
Motorcycle rider injured in collision with	V23 car, pickup truck or van V24 heavy transport vehicle or bus V27 fixed or stationary object	.4 Driver injured in traffic accident, .9 Unspecified pedal cyclist injured in traffic accident
3 wheeled motor vehicle injured in collision with	V33 car, pickup truck or van V34 heavy transport vehicle or bus V37 fixed or stationary object	.5 Driver injured in traffic accident, .9 Unspecified car occupant injured in traffic accident
Car occupant injured in collision with	V43 car, pickup truck or van V44 heavy transport vehicle or bus V47 fixed or stationary object	.5 Driver injured in traffic accident, .9 Unspecified car occupant injured in traffic accident
Pickup truck or van occupant injured in collision with	V53 pickup truck or van V54 heavy transport vehicle or bus V57 fixed or stationary object	.5 Driver injured in traffic accident, .9 Unspecified car occupant injured in traffic accident

* These categories are used when after a thorough investigation by the medical examiner, coroner, or other legal authority it cannot be determined whether the injuries are accidental, suicidal, or homicidal. They include self-inflicted injuries, but not poisoning, when not specified as accidental or as intentional.
** Excludes events of intentional self-harm (X82-X83) and undetermined intent (Y32-Y33) **but not** X81and Y31. Intentional self-harm and undetermined intent by other specified means are coded X83 and Y33 respectively.

APPENDIX 2B

RELEVANT ICD-9 CODES

Definition	3 digit code	4 digit code
Suicide		
Suicide and self-inflicted injury by other and unspecified means	E958	
Jumping or lying before a moving object		E958.0
Crashing of motor vehicle		E958.5
Undetermined intent		
Injury by other and unspecified means, undetermined whether accidentally or purposely inflicted	E988	
Jumping or lying before a moving object		E988.0
Crashing of motor vehicle		E988.5
Motor vehicle traffic accidents		
Motor vehicle traffic accident involving collision with other vehicle	E813	**Person injured** .0 Driver of motor vehicle other than motorcycle .2 Motorcyclist .6 Pedal cyclist .9 Unspecified person
Motor vehicle traffic accident involving collision with pedestrian	E814	**Person injured** .7 Pedestrian .9 Unspecified person
Other motor vehicle traffic accident involving collision on the highway (includes collision between motor vehicle and abutment (bridge, overpass), guard rail or boundary fence)	E815	**Person injured** .0 Driver of motor vehicle other than motorcycle .2 Motorcyclist .6 Pedal cyclist .9 Unspecified person
Motor vehicle traffic accident due to loss of control, without collision on the highway (includes motor vehicle failing to make curve or going out of control due to driver inattention or excessive speed or failure of mechanical part and colliding with object off the highway)	E816	**Person injured** .0 Driver of motor vehicle other than motorcycle .2 Motorcyclist .6 Pedal cyclist .9 Unspecified person

APPENDIX 3

SUMMARY OF FINDINGS FROM STUDIES INVESTIGATING ROAD TRAFFIC SUICIDES

Reference	Study Type	Cases	Findings	Comments
Ahlm et al (2001)[43]	Analysis of Swedish traffic accident fatalities	580 traffic fatalities	• 3.1% of road fatalities were suicide • 2.1% indeterminate causes • 10.2% natural deaths • 84.5% were actual "accidents"	Need to utilise police and autopsy reports to obtain accurate traffic death data
Alvestad & Haugen (1999)[45]	Retrospective study of 230 fatal car crashes in Norway	230 driver fatalities	• suicide reported in 6 crashes (2.5%)	No report of indeterminate causes of death
Connolly (1995)[44]	Investigation of coroner's files in County Mayo, Ireland	134 driver fatalities	• no evidence that some accidental fatalities may have been suicides. • suspicion of suicide in 4.5% of 134 fatalities	Dated information – collected 1978-92. No conclusive results
Edland (1972)[24]	Review of the reporting of traffic suicides in Monroe county, West Virgina (USA) (1968).	112 traffic fatalities	• 19 homicides • 3 unequivocal suicides • 3 probable and 2 equivocal suicides	Probable and equivocal suicides do not have family consent to rule suicide, therefore cause is registered as undetermined. Appears to be a continuum for how much the deceased contributed to his/her own death – makes classification difficult.
Ferrada-Noli (2002)[42]	Cross-cultural breakdown of the epidemiology of single-vehicle fatalities in Sweden	873 traffic fatalities	• Immigrants - 90% driver fatality • Swedes - 78% driver fatality	Small number of immigrant cases (10) compared to Swedes (95). Introduces concept of metasuicide (making it look like an accident)
Ford & Moseley (1963)[55]	Case report of vehicular suicides (USA)	9 cases of attempted and completed vehicular suicides	• suicide by motor vehicle occurs among drivers and pedestrians	Recognition of vehicular suicides depends upon the finding of notes, examination of the scene and anamnestic data.

Appendix 3 continued

Reference	Study Type	Cases	Findings	Comments
Grimmond (1974)[107]	Comparison of 3 case reports of suicidal behavior in a motor vehicle, and 50 drink driving cases (New Zealand)	3 suicides & 50 driving under the influence of alcohol	• observed similarities between the groups	Suggested links of the aggressive, self-destructive nature of drink drivers with those with suicidal intent. Only used case studies from the author's clinical practice.
Hernetkoski & Keskinen (1998)[17]	Investigation of fatal crashes in Finland over two four-year periods (spanning 1974-1992)	2440 fatal crashes	• motor vehicle suicides increased from 1.1 to 7.4% • predominantly male drivers • collisions more likely than single-vehicle accident • depression evident amongst suicide drivers	Other factors were popularity of cars, and peaking suicide rates in the late 1980s. Also unclear what impact the recent decrease in road fatalities will have on road suicide data. Identified the need to report traffic suicides in suicide statistics rather than statistics of traffic fatalities.
Huffine (1971)[18]	Retrospective study of all single vehicle fatalities from the Californian Highway Patrol (USA)	782 single vehicle fatalities	• 115 equivocal accidents (where the evidence points to no explanation for the occurrence) • 82% are males • no conclusive evidence pointing towards suicide	Suggested suicide may be a factor in some equivocal accidents, but no significant findings. Suggested white-collar workers may be more prone to commit suicide in a "hidden" manner.
Imajo (1983)[36]	Review of 5 cases of vehicular suicides in Cuyahoga county, Ohio (USA)	5 vehicular suicides	• highlights that vehicular suicide does exist and needs to be thoroughly investigated to be reported accurately.	Identified the need for more publications from medical examiners or coroners (as they have greater access and more responsibility for classifying cause of death) rather than psychiatrists or psychologists
Jenkins & Sainsbury (1980)[23]	Comparison of epidemiology of single vehicle crashes and suicide (seasonal variations; age distributions etc) (1969-70) (UK)	528 single vehicle, single occupant fatalities	• single car, single occupant road fatalities differed from suicides overall on the 3 variables – age distribution, seasonal variation and road conditions	Highlights the difficulties in classifying road suicides. Even with accurate reporting, the national suicide rate would change only marginally.

Appendix 3 continued

Reference	Study Type	Cases	Findings	Comments
Keskinen & Pasanen (1990)[41]	Investigation of fatal crashes in Finland over two two-year periods (spanning 1974-1985)	937 fatal crashes	• increase in traffic suicides between the 2 periods. • 34 fatal crashes were considered suicides • 95% males	Accepted that many suicides identified in the study were classified as road accidents. Neither the coroner nor police have as much information as the investigation team - difficult to accurately classify traffic suicides
Kuroda & Pounder (1994)[50]	Retrospective review of all road traffic fatalities in Tayside and North East Fife (Scotland) 1989-91	268 traffic fatalities	• (1.5%) suicides – 2 pedestrians, 2 drivers • the 2 driver suicides represent 1.9% of all driver fatalities	Authors scrutinized files – some of which were acknowledged as incomplete, thus difficult to identify all suicides. Small case numbers – no broad conclusions.
MacDonald (1964)[20]	Reports from survivors, witnesses, family etc. Colorado (USA)	N/A	• suggests previous suicide attempts are common • barriers to authorities investigating suicidal intent include grieving relatives and serious injury	Of 62 drivers blamed for fatal crashes, 3 were former psychiatric patients and the circumstances suggested suicide.
Morild (1994)[47]	Analysis of traffic fatalities in Western Norway	133 traffic fatalities	• 3 suicides (2.3%)	Low numbers for a 5 year period (1986-1990)
Murphy (1989)[108]	Investigation of a single-vehicle crash in Dayton, Ohio (USA)	1 fatality	• self-inflicted fatal gunshot wound, gun found next to vehicle. Suicide note in purse – previously attempted suicide twice	Reports 10-30% of single-vehicle fatalities may be suicide – unclear where these statistics come from
Ohberg et al (1997)[46]	Analysis of all motor vehicle driver fatalities in Finland between 1987-91	1419 driver fatalities	• official statistics – 2.6% all driver fatalities were suicides • actual findings – 5.9% • 50% males aged 15-34 • usually head on collision with a heavy vehicle	Identified the misclassification of driver suicides
Peck & Warner (1995)[21]	Review of various case studies of single-vehicle crashes (USA)	N/A	• difficult to empirically confirm single-vehicle fatalities as suicide • suicide notes are found in less than 25% of cases	Intent is an ambiguous term. Data cannot confirm the relationship between car crashes and intentional suicide – can only suggest the link.

Appendix 3 continued

Reference	Study Type	Cases	Findings	Comments
Phillips (1977)[109]	Study of traffic fatalities (presumably including suicides) in the week following suicides published in daily newspapers in California (USA)	N/A	• observed a 9.12% increase in traffic fatalities in the week following a suicide story.	Links the rise in imitative suicides after a publicised suicide, and as traffic suicide is one method, it is thought that traffic fatalities should rise in the same period.
Pokorny, Smith & Finch (1972)[25]	Investigation into 28 auto fatalities in Houston, Texas during 1967-68 (USA)	28 fatalities	• 15% (4 of 28) of the studied fatalities were considered suicides	Dated information. The authors felt that the attitude of the time was highlighted by a reluctance to label fatalities as suicides
Rasanen et al (2002)[49]	Study of seasonal distribution of suicide methods (Finland)	20,234 suicides over 1980-95 (all methods)	• substantial winter troughs in traffic suicides • males: 17.9% Winter (74) (p=0.048) 25.9% Spring (107) 31.9% Summer (132) 24.4% Autumn (101) • may parallel the seasonal variations in alcohol use	Found a relatively low percentage of traffic suicides (included driving and jumping/lying in front of car) in the summary of overall suicide rates (between 2.6% to 3.6% of all suicides)
Schmidt et al (1972)[110]	Retrospective review of the characteristics of drivers involved in single vehicle crashes in Baltimore county, Maryland (USA)	22 single vehicle (SV) driver fatalities; 11 multiple vehicle (MV) driver fatalities	• MV drivers significantly older than SV drivers • more SV drivers were "at fault" and had "traffic violation convictions	Didn't address suicide – attempted to make comparisons between single vehicle accidents and possible suicides.
Schmidt et al (1977)[39]	Evaluation of fatally injured and non-fatally injured drivers over a 6-year period in Baltimore county, Maryland (USA)	182 fatalities 96 non-fatalities	• 1.7% of fatalities considered suicides • 2.7% of single-vehicle fatalities were suicides • 1% of non-fatalities considered suicide attempts	Performed physical inspection including the crash, plus psychological autopsy. All 3 fatalities considered suicides were certified as accidental deaths by the Medical Examiner's office. Potential sampling bias in participation of decedent's families.

Appendix 3 continued

Reference	Study Type	Cases	Findings	Comments
Selzer & Payne (1962)[22]	Comparison of alcoholic and non-alcoholic male psychiatric patients (USA)	N/a	• 33 had seriously considered or attempted suicide, 27 had not • suicidal men were responsible for 89 crashes (2.7 per person), • non-suicidal men were responsible for 36 crashes (1.3 per person)	Concluded that unconscious self-destructive impulses, sometimes with alcohol included, are a major factor in the aetiology of some crashes. Highlights the effect of destructive behaviour as opposed to suicidal intent.
Tabachnick & Wold (1972)[111]	Interview with hospital patients – 3 groups: serious single vehicle crashes, prior suicide attempts, and post- appendectomy group (USA)	Unknown	• no suspected suicide attempts in single vehicle crash victims	Used psychoanalysts to conduct interviews which may have introduced a bias
United Nations (1949)[112]	Convention on Road Traffic	N/A	• no mention of road suicides	

APPENDIX 4

SUMMARY OF FINDINGS FROM STUDIES INVESTIGATING ROAD TRAFFIC DEATHS FROM NATURAL CAUSES

Reference	Study Type	Cases	Findings	Circumstances	Comments
Ahlm et al (2001)[43] *Sweden*	Analysis of registered traffic deaths in 1999	580 traffic deaths	• 59 natural deaths • 18 suicides • 490 accidental deaths	•	Abstract only. Swedish language paper
Büttner et al (1999) [48] *Germany*	Retrospective study from 1982 to 1996 – autopsy series	147 sudden deaths at wheel identified *Data source:* Files of Institute of Legal Medicine, Ludwig-Maximilians University, Munich	• About 2% of traffic autopsy cases were natural deaths • 91% male • 76.9% were associated with ischaemic heart disease, and 80% of these in fifth-seventh decade of life • Other causes evenly distributed between third to eighth decade • Peak incidence between 6am and midday • 21% between 18:00 and midnight	• 29.2% found dead in vehicle • 19% driver able to stop vehicle • <1% passenger able to stop vehicle • 8.2% unknown *Effect on others or property* • <1% no collision • 17.7% collision with other vehicle • 18.4% collision with property • <1% collision with pedestrian	
Cheng & Whittington (1998) *[66]* *UK*	Retrospective study	86 cases of non-traumatic driver death, 79 of whom died at scene or dead on arrival *Data sources:* Coroner reports; Police; Witness General practitioner; Relatives	• 95% male • 93% cardiovascular disease • 88% over 50 years of age	*Effect on others or property* • 42% managed to stop or come to halt without damage	
Osawa et al (1998) *[62]* *Japan*		188 driver fatalities *Data sources:* Post-mortem examinations	• 8% (n=15) died of natural causes	*Effect on others or property* 53% collided with object or vehicle	Abstract only. Japanese language paper

Appendix 4 continued

Reference	Study Type	Cases	Findings	Circumstances	Comments
Halinen (1994) [113] Part A *Finland*	6-year retrospective study Natural deaths in vehicles involved in collisions 1984-1989	1,181 driver deaths (traumatic and non-traumatic) *Data sources* Results of investigation team: police officer, motor engineer, traffic engineer, forensic scientist	• Incidence of all driver deaths 40 per million annually • 3.7% (n=44) driver deaths due to sudden illness-caused incapacity • 25 probable cardiac arrest cases (0.83 deaths per million annually) • 5 possible cardiac arrest (0.17/million)	•	Traumatic and non-traumatic deaths not separated
Halinen (1994) [113] Part B *Switzerland*	All accidents attributable to sudden illness 1985-1989	170 driver deaths (traumatic and non-traumatic) *Data sources* Data of the federal office of statistics	• Incidence of all driver deaths 78 per million annually • 8.8% (n=15) driver deaths due to sudden-illness caused incapacity • 8 cases probable cardiac arrest (3.6/million) • 4 cases possible cardiac arrest (1.6/million) • 27% had prior history of coronary heart disease • mean age 67 years	•	Traumatic and non-traumatic deaths not separated
Antecol & Roberts (1990) [67] *USA*		Study of hearts of 30 people who died suddenly in driver's seat of an automobile, truck or bus *Data sources:* Records of Pathology Branch of National Heart, Lung and Blood Institute: clinical, autopsy and police records	• 80% deaths caused by coronary artery disease • 90% male • 50% 50-59 years of age • Most had enlarged hearts	• 67% died while driving • 33% died while sitting in driver's seat of parked vehicle *While driving:* 35% no collision 45% minor damage to other vehicles 5% major damage to other vehicle	
Schmidt et al (1990) [64] *Germany*	Analysis of autopsies 1979-1989	5727 autopsy cases *Data sources:* Autopsy reports of Dusseldorf University Institute of Forensic Medicine	• 39 cases of sudden natural death at the wheel • 97% male • 97% cardiovascular disease	•	

Appendix 4 continued

Reference	Study Type	Cases	Findings	Circumstances	Comments
Christian (1988) *[56]* *UK*	10-year prospective study (1978-1987)	267 road traffic fatalities brought in dead or died within 2 hours *Data sources:* East Berkshire Coroner's necropsy reports; general practitioners, relatives, ambulance personnel, police and witnesses	• 64 (24%) died of natural causes or killed in incident resulting from condition • 12 of these sustained serious • injury • 90.6% male • 95.3% over 40 years of age • 87.5% cardiovascular disease related • 50% of cardiovascular cases unaware of medical problem	• 14% drivers found in stationary vehicle • 59% parked or come slowly to halt on grass • verges, kerbs, pavements, hard shoulders, or central reservations of motorways • some cars found with engines running in neutral gear *Effect on others or property* • 25% impact with other vehicle • 25% impact with other object	Sample includes intentional and unintentional, traumatic and non-traumatic deaths, pedestrians, motorcyclists and cyclists
Copeland (1987) *[37]* *USA*	5-year study of autopsied cases (1980-1984). Quantify the severity of the disorder affecting victims	133 died from a natural process in which the terminal incident occurred in a motor vehicle *Data source:* Office of Medical Examiner, Florida	• low relative rate: 2.2 per 100,000 compared to 22.2 per 100,000 motor vehicle deaths for USA population • 85% male • 79.6% over 50 years of age • 79.7% white • 82% cardiovascular disease • enlarged hearts • alcohol not contributory factor	• 38.5% found collapsed in vehicle *Effect on others or property* • 23.3% veered off road without collision • 37.6% veered off road with collision	Sample included passengers (14.3%).

Appendix 4 continued

Reference	Study Type	Cases	Findings	Circumstances	Comments
Ostrom & Erikson 1987 [70] *Sweden*	1980-1985	126 cases of natural death while driving	• 69 car drivers • 97% male • Mean age 59 years • 97% cardiovascular disease • 25% known to have symptoms • no car driver under influence of alcohol	• 32% urban road network • 25% country roads • 17% parking lots and terminal areas • 13% forest roads • 10% highways *Effect on others or property* • only minor passenger injuries • no injury of other road users	
Hossack 1980 [61] *Australia, Victoria*	2-year study	600 drivers found dead at site of accidents in Melbourne	• 54 drivers who died suddenly while driving cars • 98% males • 36% between 50 and 60 years of age • 96% acute heart failure		
Krauland (1978) [65] *Germany*	Review of literature		• 97% male • Frequency peak in 60's age group • 83% ischaemic heart diseases • Ischaemic disease cases peak in 70's age group	• 50% death took place in stationary vehicle *Effect on others or property* • serious accidents seldom occurred	German language paper. Only abstract available in English.
Hossack (1974) [69] *Australia Victoria*	1-year study	102 drivers who were road accident victims in Melbourne region Post mortem examinations, medical histories	• 11 (9.2%) died of natural causes • all natural death cases were male • 64% were 50-70 years of age • 82% had enlarged hearts • all cases showed evidence of heart disease	*Effect on others or property* • 5 cases able to stop the car, no collision • 6 cases minor collision • no injury of others	

Appendix 4 continued

Reference	Study Type	Cases	Findings	Circumstances	Comments
Bowen 1973 [114] *UK*	15-year study	222 automobile drivers	• 98 natural deaths • 69% in 50-70 years age group • Advanced coronary artery disease in every case • 37% known previous history • 90% heart weighed greater than 400 g	*Effect on others or property* • 53% virtually stationary at time of death – no collision • 47% roadside collision • minor injuries only	
West et al (1968) [60] *USA*	2-year study (1963-1965)	1,026 Single-vehicle deaths *Data sources:* Coroner's report, traffic accident report, death certificate, results of blood alcohol and drug test, questionnaire sent to driver's next of kin	• 15% (n=155) died of natural causes or the accidents which resulted • 96% male • 80% 50 years of age or older • 94% cardiovascular disease • 40% unaware of condition • mostly between 6am and 8pm • 70% no, minor or moderate injury only		Both traumatic and non-traumatic included

Appendix 4 continued

Reference	Study Type	Cases	Findings	Circumstances	Comments
Myerburg & Davis (1964) [63] *USA*	7-year study (1956-1962)	1,348 natural deaths due to coronary heart disease	• 72 died of natural causes while driving a vehicle - 52 automobile - 15 in trucks - 5 other (taxi, bus etc) *Automobile drivers* • 39% known heart disease • 23% symptomatic but undiagnosed • 38% no symptoms	*Effect on others or property* • 61% able to stop vehicle without accident • 29% minor damage and no injury • 10% minor injury • no instances of major property damage or major injury or fatality	
Peterson & Petty (1962) [58] *USA*	4-year study (1957-1960)	All driver fatalities in which deceased driver was at fault. Included only minor damage collisions. *Data source:* Office of the Chief Medical Examiner, Baltimore	• 81 cases of sudden death of drivers • 99% cardiovascular disease • 50% had previous pertinent symptoms • 35% had consulted doctor • alcohol not a contributory factor	*Effect on others or property* • 44% involved in minor collisions	
Gissane & Bull (1961) [115] *UK*	1960	183 road deaths in and around Birmingham	• 2 male drivers died of natural causes at wheel of vehicle	*Effect on others or property* • both collided with other vehicles • no serious injury to any road user	

APPENDIX 5

INTERNATIONAL ROAD ACCIDENT STATISTICS ORGANISATIONS

Acronym	Full title	Web address	Organisation	Comments
CARE	Community data bank on road traffic accidents in Europe	europa.eu.int/comm/transport/home/care	Statistical Office of the European Communities	Main sources of data are traffic police accident reports and national road transport statistics
ECMT	European Conference of Ministers of Transport	www.oecd.org/cem/		
IRTAD	International Road Traffic Accident Database	www.irtad.com	German Highway Research Institute (BASt)	

APPENDIX 6A

QUESTIONS FOR VITAL STATISTICS ORGANISATIONS

The Swedish National Road Administration has commissioned Monash University Accident Research Centre to assess the current treatment of road traffic suicides and deaths from natural causes, in mortality statistics. The Centre is therefore undertaking a review of literature and systems documentation for a sample of major international and national road safety and vital statistic data systems. The draft report is to be completed by late April 2003.

As a representative of one of the key data organisations your response to the following brief questions would be greatly appreciated:

1. Please confirm that ICD-10 coding is used by your organisation for the classification of injury deaths. If so, when did it commence?

2. Does your system allow aggregated data to be reported separately for X81 "*intentional self-harm by jumping or lying before a moving object*" and X82 "*intentional self-harm by crashing a motor vehicle*" and Y31 and Y32, the equivalent codes for unknown intent?

3. Can it also provide data to a fourth character sub-division for: (1) the above four codes and (2) transport accidents (V01-V99)?
How complete is this four digit data?
Is the four digit data actually published or readily available?

4. In your system does multi-cause coding enable natural causes of death to be identified where the underlying cause of death is a road traffic accident or alternatively road traffic accidents where the underlying cause of death is a natural cause?

Thankyou very much for your participation. Please email your responses to *virginia.routley@general.monash.edu.au* by mid April.

APPENDIX 6B

QUESTIONS FOR INTERNATIONAL ROAD TRAFFIC DATA ORGANISATIONS

The Swedish National Road Administration has commissioned Monash University Accident Research Centre to assess the current treatment of road traffic suicides and deaths from natural causes, in road traffic statistics. The Centre is therefore undertaking a review of literature and systems documentation for a sample of major international and national road safety and vital statistic data systems. The draft report is to be completed by early April 2003.

As a representative of one of the key organisations your response to the following brief questions would be greatly appreciated:

1. What is your organisation's policy regarding the inclusion of deaths resulting from suicide in the road traffic fatality counts you prepare? *Examples are pedestrians jumping under a truck, a single vehicle occupant driving into a pole.*

2. How is this policy implemented in practice? ie Are there any requirements you place on organisations which supply you with data regarding inclusion or exclusion of suicides?

3. What is your organisation's policy regarding the inclusion of deaths from natural causes in the road traffic fatality count you prepare. An example is a death arising from a cardiac arrest prior to or post a road traffic accident.

4. How is this policy implemented in practice? ie Are there any requirements you place on organisations which supply you with data regarding inclusion or exclusion of deaths resulting from natural causes?

Could you please email responses to *virginia.routley@general.monash.edu.au* preferably before mid-March.

Thankyou for your participation.

APPENDIX 7

NATIONAL ROAD TRAFFIC ORGANISATIONS – QUESTIONNAIRE RESPONSES

Responding organisations:

Australia	ATSB - Australia Transport Safety Bureau
Austria	Institut fur Verkehrstechnik und Unfallstatistik
Czech Republik	CDV Brno
Denmark	Danish Road Directorate
Finland	Statistics Finland
France	L'Observatorie national interministeriel de securite routiere
Germany	Federal Highway Research Institute
Great Britain	Department for Transport
Netherlands	Transport Research Centre (AVV)
New Zealand	Land Transport Safety Authority
Norway	Norwegian Public Roads Administration
Poland	Motor Transport Institute
Spain	Direccion General de Trafico
Sweden	Statens institut för kommunikationsanalys
Switzerland	Swiss Council for Accident Prevention
USA	NHTSA - National Highway & Traffic Safety Authority

Appendix 7

Question	France	USA	Netherlands
	L'Observatorie national interministeriel de securite routiere	**NHTSA** **National Highway & Traffic Safety Authority**	**Transport Research Centre (AVV)**
1. What is your organisation's policy regarding the inclusion of deaths resulting from suicide in the road traffic fatality count your country provides to IRTAD (International Road Traffic Accident Database)? Examples are pedestrians jumping under a truck, a single vehicle occupant driving into a pole.	Suicides are not included but the consequences for other road users are	Suicides are not included but others killed in the accident are counted as accident fatalities	Suicides excluded from official road accident statistics. However crashes sometimes included when vehicle damage or injury to other than suicider (suiciders represent 1% of fatalities). Other occupant fatalities are included.
2. How is this policy implemented in practice? ie - What is the data source eg police reports, coroners reports? - Is the intention to commit suicide determined and if so, on what basis? - Are statistics adjusted if a road traffic fatality is found to be suicide after a considerable lag?	Police reports	Police accident reports supplemented by medical examiner, coroner, EMS & hospital reports Death within 30 days	Police supply data, not considered relevant how they get this data. All annual statistics can be adjusted until March 1st of following year.
3. What is your organisation's policy regarding the inclusion of natural deaths in the road traffic fatality count your country provides to IRTAD? An example is a death resulting from a cardiac arrest prior to or post a road traffic accident.	Natural deaths are not included but the consequences for other road users are	Natural deaths are not included but others killed in the accident are counted as accident fatalities	Natural deaths also excluded from official road accident statistics.
4. How is this policy implemented in practice? ie - What is the data source eg police reports, coroners reports?	Annual statistics can be adjusted until the end of April	Police accident reports supplemented by medical examiner, coroner, EMS & hospital reports Death within 30 days	As for suicide natural death can be included if property damage or injury to other occupants (4% fatalities). Other occupant fatalities included.

Appendix 7 continued

Question	**France** continued	**USA** continued	**Netherlands** continued
4. continued - Are statistics adjusted if a road traffic fatality is found to be a natural death after a considerable lag?			Death from natural causes in hospital post crash counted as hospitalised death not road traffic fatality. Annual statistics adjusted until end of March.
5. In your more detailed data could suspected suicide or suicide by a pedestrian involving a heavy vehicle be identified?			Cannot be identified. *

* In this situation unlikely to be material damage to vehicle or other persons but would be psychological damage to driver as for rail

Question	**Spain**	**Germany**	**Czech Republik**
	Direccion General de Trafico	**Federal Highway Research Institute**	**CDV Brno**
1. What is your organisation's policy regarding the inclusion of deaths resulting from suicide in the road traffic fatality count your country provides to IRTAD (International Road Traffic Accident Database)? Examples are pedestrians jumping under a truck, a single vehicle occupant driving into a pole.	Road traffic suicides are not included in the Spanish database of traffic accidents with casualties and, therefore, they are not submitted to IRTAD.	According to the German Law on Statistics of Road Traffic Accidents only those accidents are recorded which are due to vehicular traffic and only persons injured or killed as a result of the accident are included. Therefore suicides are not part of road traffic accidents statistics and not provided to IRTAD.	Our statistics also include cases of suicide. The real consequences of all possible accidents are recorded in the statistics. Only the basic condition of an accident definition, i.e. given accident occurred on the road by vehicle operation has to be fulfilled. As far as single vehicle accidents, total accident consequences are also recorded, i.e. including vehicle occupants.
2. How is this policy implemented in practice? ie - What is the data source eg police reports, coroners reports? - Is the intention to commit suicide determined and if so, on what basis? - Are statistics adjusted if a road traffic fatality is found to be suicide after a considerable lag?	When the police reckons that a road traffic death may involve suicide, the matter remains subject to a coroner's report who determines if the death was caused by suicide or as a result of a traffic accident. The judicial decision is based on expert evidence. The accident statistical questionnaire is only filled in by the police when the Judge determines that the death was not caused by suicide, which is why the data base on traffic accidents with victims does not record any death by suicide.	According to the Law, the police authorities whose officers attended the accident are liable to report. No other data source is used. It is the task of the police to exclude suicides from accident statistics (with all the difficulties). After the transfer of the accident data from police to the statistical offices of the "Länder" there is no possibility of adjusting the official statistics.	The data are acquired exclusively from police sources through investigation of specific events and from coroners reports. Our accident statistics have provision for updating observed accident data.

Appendix 7 continued

Question	**Spain** continued	**Germany** continued	**Czech Republik** continued
3. What is your organisation's policy regarding the inclusion of natural deaths in the road traffic fatality count your country provides to IRTAD? An example is a death resulting from a cardiac arrest prior to or post a road traffic accident.	People killed by natural causes in road traffic accidents are not included in the Spanish database of traffic accidents with victims and therefore they are not sent to IRTAD.	According to the German Law on Statistics of Road Traffic Accidents only those accidents are recorded which are due to vehicular traffic and only persons injured or killed as a result of the accident are included. Therefore natural deaths are not part of road traffic accidents statistics and not provided to IRTAD.	Our statistics also include cases of natural deaths (cardiac arrest etc.). The real consequences of possible accidents are indicated in the statistics. i.e. including persons who have died from natural causes. Only the basic condition of an accident definition, i.e. given accident occurred on the road by vehicle operation, has to be fulfilled. In 2002, 22 of these accidents occurred in the Czech Republic resulting in 19 deaths.
4. How is this policy implemented in practice? ie - What is the data source eg police reports, coroners reports? - Are statistics adjusted if a road traffic fatality is found to be a natural death after a considerable lag?	When the police consider that natural causes were the reason of death for the victim of a traffic accident, the matter remains subject to the relevant report of the coroner, who determines if the death was caused by natural death or by a road traffic accident. The judicial decision is based on forensic evidence. The accident statistical questionnaire is only filled by the police when the Judge determines that the death was not caused by natural causes, which is why the data base on traffic accidents with victims does not record any death by natural causes	According to the Law, the police authorities whose officers attended the accident are liable to report. No other data source is used. It is the task of the police to exclude natural deaths from accident statistics (with all the difficulties). After the transfer of the accident data from police to the statistical offices of the "Länder" there is no possibility of adjusting the official statistics.	The data are acquired exclusively from police sources through investigation of specific events and from coroners reports. Our accident statistics have provision for updating observed accident data.
5. In your more detailed data could suspected suicide or suicide by a pedestrian involving a heavy vehicle be identified?		There is no possibility to identify suicides or natural deaths in the German detailed accident data.	In 2002 the Police registered 4 cases of pedestrian suicide attempts by jumping under a motor vehicle - all these accidents concluded with only slight pedestrian injury. In 3 cases the pedestrian had chosen a passenger car and once a lorry.

Appendix 7 continued

Question	Sweden	New Zealand	Australia
	Statens institut för kommunikationsanalys	**Land Transport Safety Authority**	**ATSB** **Australia Transport Safety Bureau**
1. What is your organisation's policy regarding the inclusion of deaths resulting from suicide in the road traffic fatality count your country provides to IRTAD (International Road Traffic Accident Database)? Examples are pedestrians jumping under a truck, a single vehicle occupant driving into a pole.	Cases of suicide are not excluded from the statistics.	Suicides excluded	In order for a fatality to be included in the traffic fatality count a death can not have been premeditated, ie. Suicide or homicide. All Australian state/territory road authorities/police exclude crashes involving suicides from their road crash data. If in the undertaking of an intended act another death occurs that goes beyond the original intent, these deaths are included in the count. For example, in the unlikely event that a truck driver is killed in a collision with a pedestrian committing suicide the truck driver fatality will be included in the count while the pedestrian fatality will not.
2. How is this policy implemented in practice? ie - What is the data source eg police reports, coroners reports? - Is the intention to commit suicide determined and if so, on what basis? - Are statistics adjusted if a road traffic fatality is found to be suicide after a considerable lag?	The data source is investigations from the national road administration, based on a variety of sources; in some cases coroner reports, in some cases the treating physician, in some cases the police. We are negotiating a system where the source is solely coroner reports. The intention is in cause of suspicion determined by police investigations. The statistics are not adjusted retrospectively after publishing.	Final decision on suicide is made by the coroner (apparent suicides will be omitted from official fatality statistics on the advice of police pending the results of the coroners inquest) Yes – statistics are adjusted once we are informed of the coroners decision	Fatality data provided to IRTAD is based on state road authority/police data and compiled by the ATSB into a national database. Australia does not provide injury data to IRTAD. -Although all state/territories apply the same standard (see answer to question 1), it is known that there are some inconsistencies in the methods states/territories use to identify and exclude suicide crashes. For example, suicide crashes are determined in some states by data mangers, some states apply a criminal standard of proof while others rely on coroners' findings. -Relying on coronial findings can be problematic in that data may not be

Appendix 7 continued

Question	**Sweden** continued	**New Zealand** continued	**Australia** continued
2. continued			revised for some time, resulting in either inappropriate exclusions or inclusions of crashes. There is also evidence that in some cases coroners are unwilling to make a finding of suicide due to the impact the finding may have on the community. -State/territory data are compiled from police and coronial documents. -The State/territory road authorities inform us of any changes to their data. The data can be revised any time. -It is generally accepted that a percentage of suicide crashes do remain in the fatal crash databases, however, due to the nature of determining suicide it is very difficult to quantify the problem.
3. What is your organisation's policy regarding the inclusion of natural deaths in the road traffic fatality count your country provides to IRTAD? An example is a death resulting from a cardiac arrest prior to or post a road traffic accident.	“Natural” deaths are today only to some extent excluded from the statistics. That is for persons deceased late, within 30 days, at a hospital. But other natural deaths are possible to identify because they have a “flag” in the database. We are negotiating a system where all “natural” deaths are excluded.	If a death is determined by the coroner to be the result of natural causes rather than the result of injuries received in the crash then it is not included in the official road toll.	All deaths from natural causes are excluded from the fatality count. Fatalities directly resulting from a crash event, even if the crash involved a natural death, are included in the crash data.
4. How is this policy implemented in practice? ie - What is the data source eg police reports, coroners reports? - Are statistics adjusted if a road traffic fatality is found to be a natural death after a considerable lag?	Cases of “natural” death among the deceased are determined in investigations by Statistics Sweden from coroner reports and from death certificates, and if no data is available further investigation is made by the national road authority. These identified cases of natural death are classified as injured in the statistics. Other than these late natural deaths, the	If a death is determined by the coroner to be the result of natural causes rather than the result of injuries received in the crash then it is not included in the road toll (apparent natural deaths are omitted on the advice of police and postmortem results pending	-The data provided to IRTAD is based on state/territory road authority/police data and compiled by the ATSB into a national database. Australia does not provide injury data to IRTAD. -All Australian state/territory road authorities/police exclude natural deaths from their road crash data.

Appendix 7 continued

Question	**Sweden** continued	**New Zealand** continued	**Australia** continued
4. continued	ones not excluded but "flagged", are investigated by the national road administration. The data sources differ for these; in some cases coroner reports, in some cases the treating physician, in some cases the police, in some cases the national road administration. We are negotiating a system where the source is solely coroners reports combined with death certificates. All investigations are made before the statistics is produced, therefore adjustments of published data retrospectively is not necessary. Retrospective adjustments are not done after publishing data.	results of the coroners inquest) Yes statistics are adjusted	The method for determining natural deaths for each state/territory is unknown however it is based on both police and coronial documents which generally contain an autopsy report. The State/territory road authorities inform us of any changes to their data. The data can be revised at any time.
5. In your more detailed data could suspected suicide or suicide by a pedestrian involving a heavy vehicle be identified?	Yes it should be possible to identify these in the database.		The ATSB does not have access to this level of detail in the state/territory data. It is unlikely that all states/territories collect this data although some may. The ATSB also compiles a database using original Coronial documents however there is no method for identifying suspected suicide and all suicides are excluded from the database.

Appendix 7 continued

Question	Great Britain	Denmark	Norway
	Department for Transport	**Danish Road Directorate**	**Norwegian Public Roads Administration**
1. What is your organisation's policy regarding the inclusion of deaths resulting from suicide in the road traffic fatality count your country provides to IRTAD (International Road Traffic Accident Database)? Examples are pedestrians jumping under a truck, a single vehicle occupant driving into a pole.	Suicides are excluded from figures for Great Britain.	Known suicides are not counted as fatalities in road traffic accident statistics.	Our policy is to exclude deaths resulting from suicide in the road traffic fatality count.
2. How is this policy implemented in practice? ie - What is the data source eg police reports, coroners reports? - Is the intention to commit suicide determined and if so, on what basis? - Are statistics adjusted if a road traffic fatality is found to be suicide after a considerable lag?	All unnatural deaths are examined by a Coroners' court with the assistance of the police. When suicide has been confirmed by a Coroners' court, they are removed from the database. There can be a long delay. However, it is rare that we are advised of a confirmed suicide after the GB database is closed for the year. However, there may be a very few confirmed suicide cases remaining in the database. Confirmed suicides should have been removed. If a suicide has not been confirmed by a Coroner, then legally it has not occurred. There is no marker on the database to indicate such an investigation has taken place.	The intention to commit suicide is determined by police investigation into the cause of the accident and noted in the police report but not included in the accident statistics information. There can be a coroners report. About May or June we have a deadline for accident statistics for the previous year. After that there will be no corrections. Suicide or suspected suicide is not registered in the statistics for traffic accidents. There are separate statistics about suicides but that does not include the wanted information	Our source is the police reports. It is the police who determine wether it is a suicide or not. They base their judgement on physical evidence and interviews with other participants in the traffic accident (if any) and some times also family and friends. The police are in general restrictive in classifying a death as suicide unless they are absolutely sure. As a result we know we have high under-reporting of suicide in road traffic. A Norwegian study on deaths in road traffic accidents on high class, 2 lane roads with speed limit 80 or 90 km/h, shows approximately 10% suicide. If a death is reclassified as a suicide, we can and do adjust our statistics at any time up until the time we release the official annual statistics in May the following year.
3. What is your organisation's policy regarding the inclusion of natural deaths in the road traffic fatality count your country provides to IRTAD? An example is a death resulting from a cardiac arrest prior to or post a road traffic accident.	Natural deaths are excluded from figures in Great Britain. However, if the natural death of a driver results in a road accident which causes the deaths of other people, then the other deaths would be included.	Known natural deaths are not counted as fatalities in the road accident statistics.	Our policy is to exclude deaths resulting from natural causes in the road traffic fatality count.

Appendix 7 continued

Question	**Great Britain** continued	**Denmark** continued	**Norway** continued
4. How is this policy implemented in practice? ie - What is the data source eg police reports, coroners reports? - Are statistics adjusted if a road traffic fatality is found to be a natural death after a considerable lag?	Similar to the above unless a doctor at scene has established that death occurred before a collision took place.	See 2.	Our source is the police reports, but the police are obliged to check with the coroner or the hospital if there is any doubt about the cause of death, but we know that they don't always do that. If a death is reclassified as natural death, we can and do adjust our statistics at any time up until the time we release the official annual statistics in May the following year.
5. In your more detailed data could suspected suicide or suicide by a pedestrian involving a heavy vehicle be identified?			It is possible to add comments on suspected suicide in a free text part of the police report and also in our database, but this is not reflected in any statistics.

Appendix 7 continued

Question	Austria	Finland
	Institut fur Verkehrstechnik und Unfallstatistik	**Statistics Finland**
1. What is your organisation's policy regarding the inclusion of deaths resulting from suicide in the road traffic fatality count your country provides to IRTAD (International Road Traffic Accident Database)? Examples are pedestrians jumping under a truck, a single vehicle occupant driving into a pole.	If the police notice that a traffic accident victim wanted to make suicide (if they find a letter or so) and this caused the accident, then this victim will be removed from the traffic fatality statistic and not send to IRTAD. The statistic will be also adjusted if there is a lag.	Road traffic fatality counts of Finland provided to IRTAD include suicides.
2. How is this policy implemented in practice? ie - What is the data source eg police reports, coroners reports? - Is the intention to commit suicide determined and if so, on what basis? - Are statistics adjusted if a road traffic fatality is found to be suicide after a considerable lag?		Main data source is police reports. We are not interested in distinguishing between death resulting from suicide and normal road traffic accidents. Even in more detailed data suicide does not have its own variable, so we have not any definitions for them.
3. What is your organisation's policy regarding the inclusion of natural deaths in the road traffic fatality count your country provides to IRTAD? An example is a death resulting from a cardiac arrest prior to or post a road traffic accident.	In Austria we have the completely the same policy for natural deaths as for suicide.	Road traffic fatality counts of Finland provided to IRTAD don't include natural deaths.

Appendix 7 continued

Question	**Austria** continued	**Finland** continued
4. How is this policy implemented in practice? ie - What is the data source eg police reports, coroners reports?		Data sources are police reports and death certificates we get from statistics/data on causes of death. Statistics are adjusted if a road traffic fatality is found to be a natural death until data is final. For a very considerable lag, for instance two years, data is not adjusted. Our statistics/data is final in the end of august 2003 for year 2002. Used definition of "killed in road accident": *any person who died within 30 days as a result of the accident.*
5. In your more detailed data could suspected suicide or suicide by a pedestrian involving a heavy vehicle be identified?	We (with our data) are not able to identify the number of suicide involved with heavy vehicle.	No, even in more detailed data we don't have any information about suicides.

Countries with insufficient data to be able to respond to questions

Poland	**Switzerland**
Motor Transport Institute	**Swiss Council for Accident Prevention**
In Poland we do not have policy regarding the inclusion of deaths resulting from suicides and natural causes in road traffic fatality. In police reports you can't find information about this problem. So I'm afraid we will not be able to answer your questions. This information is not available in Poland. Driver suicides in road traffic are counted in Polish road traffic fatalities but not identified as suicides.	The data source for Swiss statistics are police reports. Every fatal accident gets registered by the police. Neither the intention to commit suicide nor natural death are determined. So we aren't able to make any statement on behalf of this thematic.

APPENDIX 8

NATIONAL VITAL STATISTICS ORGANISATIONS – QUESTIONNAIRE RESPONSES

Responding organisations:

Australia	Australian Bureau of Statistics
Canada	Statistics Canada
France	CepiDc – INSERM
Germany	Federal Statistical Office of Germany
Italy	ISTAT
Scotland	General Register Office for Scotland
Spain	Catalonian Mortality Register
Sweden	National Board of Health & Welfare
United Kingdom:	Office of National Statistics
United States of America	National Center for Health Statistics

Appendix 8

Question	Scotland	UK	Australia
	General Register Office for Scotland	**Office of National Statistics**	**Australian Bureau of Statistics**
1. Please confirm that ICD-10 coding is used by your organisation for the classification of injury deaths. If so, when did it commence?	Yes, since 2000	Yes but do not code through the PCACCS automated system	Yes the ABS uses ICD 10 and has collected this data since 1997.
2. Does your system allow aggregated data to be reported separately for X81 "*intentional self-harm by jumping or lying before a moving object*" and X82 "*intentional self-harm by crashing a motor vehicle*" and Y31 and Y32, the equivalent codes for unknown intent?	Yes, publish at the 3 character level		Yes we process and tabulate to the maximum level of detail available in ICD 10
3. Can it also provide data to a fourth character sub-division for: (1) the above four codes and (2) transport accidents (V01-V99)? How complete is this four digit data? Is the four digit data actually published or readily available?	Can supply 4th character detail for the relevant codes. Relatively complete since compare death records with police accident records. 4th digit data not published.	Yes, 4th digit indicates place of occurrence	(1) The above 4 codes are 3 digit codes and can have a place of occurrence code appended as the fourth character. We do process place of occurrence codes but have treated this as a separate field rather than append to the ICD code. (2) Where applicable transport accidents have been coded to the fourth digit as per the classification. We do not publish data at the 4 digit level but it is available as a consultancy.
4. In your system does multi-cause coding enable natural causes of death to be identified where the underlying cause of death is a road traffic accident or alternatively road traffic accidents where the underlying cause of death is a natural cause?	Yes multi cause coding allows such information to be recorded though the number of cases is very small.	Any traumatic death is reported to a coroner and we code these deaths manually using an on-line system, according to the verdict given. This allows us to code all the conditions mentioned in multi-cause, and our underlying cause is based on the coroner's verdict - whether it be natural, accidental, suicide or open - and the secondary cause is the main injury.	Yes all factors contributing to death are recorded in our system eg MVTA as a result of a heart attack would hold codes for the heart attack, the road traffic accident and the resultant injuries.

Appendix 8 continued

Question	Sweden	Italy	Germany
	National Board of Health & Welfare	**ISTAT**	**Federal Statistical Office of Germany**
1. Please confirm that ICD-10 coding is used by your organisation for the classification of injury deaths. If so, when did it commence?	We have used ICD-10 since the 1997 data.	Still using ICD-9, currently coding 2001. ICD10 for 2002 data	The change-over from ICD-9 to ICD-10 happened in 1998.
2. Does your system allow aggregated data to be reported separately for X81 "*intentional self-harm by jumping or lying before a moving object*" and X82 "*intentional self-harm by crashing a motor vehicle*" and Y31 and Y32, the equivalent codes for unknown intent?	Yes, we publish underlying causes in full (four or five character) detail.	As for ICD –9 ie E958.0, E958.5 etc	Yes
3. Can it also provide data to a fourth character sub-division for: (1) the above four codes and (2) transport accidents (V01-V99)? How complete is this four digit data? Is the four digit data actually published or readily available?	a) Yes, we have the fourth character. b) Of 617 transport accidents in 2000, we used the .9 (unspecified) fourth character in 45 cases. c) Yes, the data are available in our internet publication.	4 digit ICD 9 data	Yes, our system provides data to a fourth character sub-division of these codes. The 4th character sub-division is complete, published and available.
4. In your system does multi-cause coding enable natural causes of death to be identified where the underlying cause of death is a road traffic accident or alternatively road traffic accidents where the underlying cause of death is a natural cause?	Yes, we could retrieve this data since we store all conditions reported on the death certificate and the position of each reported condition.		We have no possibilities to generate data based on multi-cause coding. We are now at the beginning of the implementation of an automated coding system which will enable us to generate data from multi-cause coding (in one or two years)

Appendix 8 continued

Question	Canada	Spain	France
	Statistics Canada	**Catalonian Mortality Register**	**CepiDc - INSERM**
1. Please confirm that ICD-10 coding is used by your organisation for the classification of injury deaths. If so, when did it commence?	ICD-10 is the Canadian national standard for mortality classification, including deaths due to external causes, and was implemented for deaths occurring in 2000.	We are already using ICD-10 coding for mortality statistics. We started for the 1999 mortality data. We have available the years 1999, 2000 and 2001 in brief.	2000 (data year)
2. Does your system allow aggregated data to be reported separately for X81 "*intentional self-harm by jumping or lying before a moving object*" and X82 "*intentional self-harm by crashing a motor vehicle*" and Y31 and Y32, the equivalent codes for unknown intent?	Canadian detailed cause-of-death data are collected and tabulated at the ICD-10 third and fourth character level meaning that aggregated data is available for each of the ICD-10 codes X81 and X82 as well as Y31 and Y32.	We are using every detailed code, thus our system allows us to provide separately those codes, nevertheless, by convention, when the intention of the injury is not specified, it is considered accidental. Furthermore we are not sure about the quality on which the accidental causes are declared by the physicians, because the information is not very specific.	Yes. But in fact Y31 and Y32 are never or seldom used since there is no corresponding cause mentioned on the death certificate.
3. Can it also provide data to a fourth character sub-division for: (1) the above four codes and (2) transport accidents (V01-V99)? How complete is this four digit data? Is the four digit data actually published or readily available?	(1) The fourth character subdivision for ICD-10 codes X81, X82, Y31 and Y32 is the place of occurrence code which is collected as a separate variable in Canada. The place of occurrence data are complete as it is a required variable in the mortality database but close to 38% of the codes assigned are .9, unspecified place. It is not published but is readily available. 3.(2) The fourth character subdivision for ICD-10 codes V01-V99 is part of the code itself so it is included in our detailed cause tabulation. It is readily available.	It can provide data to a fourth character sub-division but the fourth digit is not very complete. The .9 code which means "unspecified" is often used. The four digit data is not published but it is available under special request, as aggregated data (not individual).	3. It can provide data to a fourth character sub-division. However this four digit data is difficult to assess. It is not published or readily available.

Appendix 8 continued

Question	**Canada** continued	**Spain** continued	**France** continued
4. In your system does multi-cause coding enable natural causes of death to be identified where the underlying cause of death is a road traffic accident or alternatively road traffic accidents where the underlying cause of death is a natural cause?	4. Although we make use of the Mortality Medical Data Software (MMDS), an automated mortality classification system developed by the National Center for Health Statistics (NCHS) in the US, we do not have a national multiple causes of death file. Our cause-of-death data are based on the underlying cause of death as defined by the WHO so each death is classified as either due to a disease condition or as due to an external cause of death.	We are presently not using the multi-cause coding system for the ICD-10 version.	Yes

Appendix 8 continued

Question	USA
	National Center for Health Statistics
1. Please confirm that ICD-10 coding is used by your organisation for the classification of injury deaths. If so, when did it commence?	ICD-10 coding is currently used in the US for classification of all deaths. ICD-10 was introduced beginning with 1999 mortality data.
2. Does your system allow aggregated data to be reported separately for X81 "*intentional self-harm by jumping or lying before a moving object*" and X82 "*intentional self-harm by crashing a motor vehicle*" and Y31 and Y32, the equivalent codes for unknown intent?	Aggregated data can be reported separately for X81, X82, Y31 and Y32
3. Can it also provide data to a fourth character sub-division for: (1) the above four codes and (2) transport accidents (V01-V99)? How complete is this four digit data? Is the four digit data actually published or readily available?	In the US, we code place of occurrence separately from the ICD and thus, 4th digit categories are not applicable in the US for X81, X82, Y31 and Y32. 4th digit categories are applicable in the US for V01-V99 where appropriate. The 4th digit data is complete for V01-V99, i.e., information reported on the death certificate typically allows for the use of the specified 4th digit categories. The 4th digit data is not readily available in published tabulations, but is included as part of an individual-record, public-use electronic data file. These data can also be tabulated using a web utility available at http://wonder.cdc.gov.
4. In your system does multi-cause coding enable natural causes of death to be identified where the underlying cause of death is a road traffic accident or alternatively road traffic accidents where the underlying cause of death is a natural cause?	Multiple causes of death are coded in the US system.

APPENDIX 9

INTERNATIONAL VITAL STATISTICS ORGANISATIONS

Acronym	Full title	Web address	Organisation	Comments
International				
WHO	World Health Organisation's Mortality Database	www.ciesin.org/IC/who/ World Health Statistics Annual	WHO	Unintentional motor vehicle, intentional suicide. No more refined located. Multi-cause not located on web

**Suicidal explosions that lack a terrorist background are only rarely encountered in the field of forensic pathology (Tsokos et al AmJ Forensic Med Pathol 2003; 24(1):55:63).*

APPENDIX 10

ROAD TRAFFIC ACCIDENT INSURANCE SUICIDE POLICIES

Country	Organisation	Suicide compensable for dependents	Natural death compensable for dependents	Comments
Australia	Scheme regulator for each state. Either state monopolistic licensed insurer or various private licensed insurers	Yes Vict, Tas and NT. – no fault system No (fault based system) NSW, Qld, WA and SA.	No	
Quebec	Societie de l'assurance automobile du Quebec (SAAQ)	Yes - no fault		No fault system
British Columbia	Autoplan	No	No	Medical, wage loss, rehab, death
New Zealand	Accident Compensation Commission	No	No	Covers all injury, not just road injury