

**Primary and Secondary Data Sources for the Study of Road Crashes in Australia**

*By*

Margaret J. Giles  
School of Finance and Business Economics  
Faculty of Business and Public Management  
Edith Cowan University

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Correspondence author and address:  
Margaret J. Giles  
Edith Cowan University  
School of Finance and Business Economics  
Churchlands Campus  
CHURCHLANDS WA 6018  
Phone: 61 (8) 9273 8047  
Fax: 61 (8) 9273 ????  
Email: m.giles@ecu.edu.au

## **Abstract**

The purpose of this study is to document the variety and relative usefulness of road crash databases in Australia. Analyses of some of these databases have been published in a variety of Australian and overseas publications, and their existence is known generally within the road crash research community in Australia. However, a comprehensive and comparative overview has not been previously documented in this way.

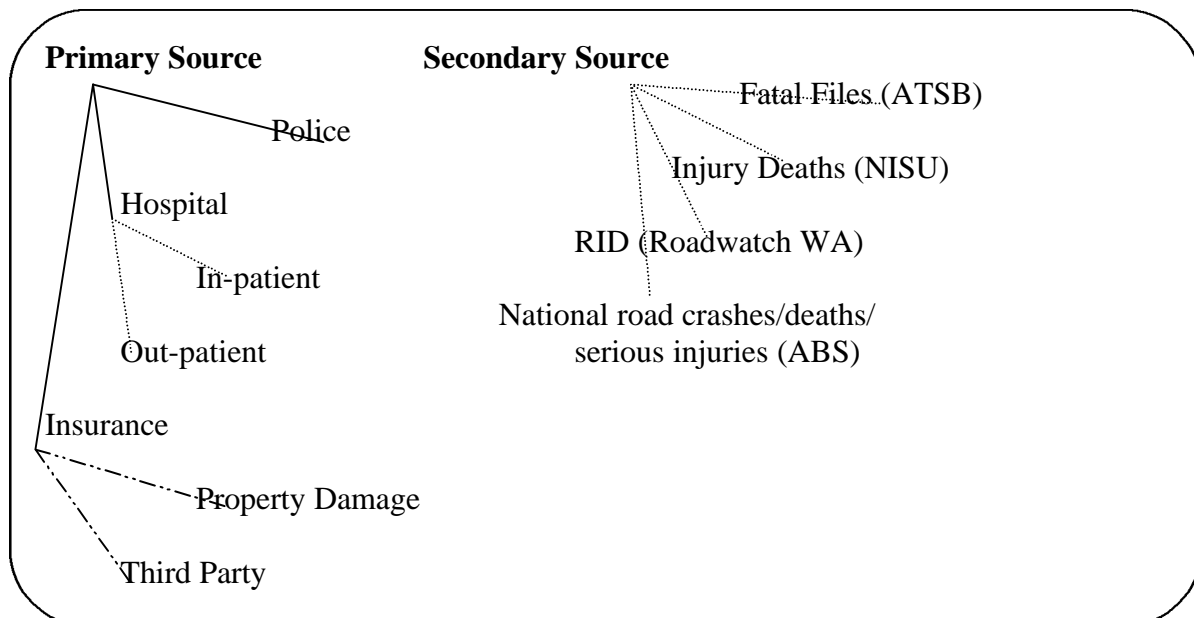
This paper examines these primary and secondary sources of road crash data and the use of these sources in both aggregate road crash costings and cost-benefit analyses of road crash prevention and injury reduction programmes in Australia.

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## 1. Introduction

The data sets used in social science research are of two broad types, censuses and samples. Only one collection of a census of road crashes has ever been attempted in Australia. This was in the Australian Capital Territory (ACT) in 1965/66 (Troy & Butlin, 1971). All other road crash databases in Australia are non-random samples of the total population of road crashes. Whilst there is considerable overlap between these samples, the level and accuracy of reporting of crash details is not uniform. These samples can be considered as being either primary or secondary source databases. Figure 1 provides a summary.

Figure 1: Primary and Secondary Source Road Crash Databases in Australia, 2000



In terms of primary source databases, there are two types. Firstly, some databases are specifically constructed from road crash information. For example, Main Roads, Transport, Traffic or Urban Services authorities in each State and Territory house and maintain databases of reported (to the Police) road crashes on behalf of their respective Police Services. These in

authorities can use this road crash information to identify and treat black spots<sup>1</sup> the road environment as per their legislative responsibility. The road crash information can also be used to assess trends in road crash incidence over time that might assist in the determination of the penalties that may be imposed on drivers and/or vehicle owners following appraisal of driving misconduct and lack of vehicle roadworthiness.

A second type of primary source database is that pertaining to data collections made for purposes other than the collection and analyses of road crash statistics. Four examples of this are detailed in this paper. Firstly, State and Territory Health Departments collect, for accounting and medical purposes, In-patient data for public and private hospitals. Some of these data can be identified as pertaining to injured road users who are hospitalised as a result of a road crash.

A second example of primary source data collected for reasons other than road crash analysis is that compiled by Accident and Emergency (A & E) Departments of metropolitan public hospitals. These Departments collect, also for accounting and medical purposes, Out-patient data which include data on injured road users who present at A & E and may or may not be subsequently hospitalised.

Third party injury claims data is the third example of primary source data collected for purposes other than the collection of road crash statistics. All States and Territories in Australia require motor vehicle owners to pay premiums for compulsory, no-fault, third party injury insurance. In some States/Territories, these premiums are included with motor vehicle registration fees; in others, owners can arrange their own insurer and provide evidence of paid premiums for registration renewals. Compensation payments with respect of road users injured or killed in motor vehicle accidents are funded from these premiums. Data compiled from these compensation payments include injury type and hospital/medical treatment together with demographic information related to the claimant.

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<sup>1</sup> Road sites (such as intersections or road lengths) with histories of a high number of casualty crashes (Australian Transport Safety Bureau, 1999).

A fourth example pertaining to data collections made for purposes other than the collection of road crash statistics is motor vehicle damage claims data. Motor vehicle insurance companies collect, for accounting, cost management and actuarial purposes, data on motor vehicle damage claims where the damage results from, *inter alia*<sup>2</sup>, road crashes.

A number of secondary source road crash databases have been or continue to be maintained. Between 1925 and 1990, the Commonwealth Bureau of Census and Statistics, later the Australian Bureau of Statistics, collected and published (on a monthly, quarterly or annual basis) Police reported data from States and Territories. There are three currently maintained secondary source databases. The first of these is a national road crash fatalities register which is maintained at the Australian Transport Safety Bureau (previously the Federal Office of Road Safety (FORS)) in Canberra. Records in this register date back to 1991 and the most current year of data is 1998. A second currently maintained secondary source database is the national injury (including motor vehicle crash causes) deaths database at the National Injury Surveillance Unit (NISU) at Flinders University in Adelaide. This database has records for the years 1979 to 1997 inclusive. Finally, a computer-linked Police/Hospital In-patient/A & E Out-patient/Register-General of Deaths database is maintained by the Road Accident Prevention Research Unit (Roadwatch) at the University of Western Australia in Perth. This linked database currently includes records from years from 1987 to 1996 inclusive.

All of the above data sets have been used in various ways by researchers interested in a range of issues. Foremost among these is placing a value on the total cost of road crashes in Australia. Other uses have been evaluating road crash prevention and injury reduction programmes (such as mandatory seat-belt usage and random breath testing) and identifying black spots in the road environment.

The features of each of these types of road crash databases are reviewed in Sections 2 to 4. Section 5 contains a detailed comparison of the Police, Hospital In-patient and Insurance databases. Section 6 discusses a number of secondary source databases that have been or

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<sup>2</sup> Thefts, vehicle fires and windscreen only damage made up about 11% of these claims in 1987/88 in Western Australia (Giles, 1994).

continue to be maintained, whilst Section 7 contains a brief summary and recommendations for future data collections of road crash statistics in Australia.

## 2. Police Road Crash Data

Police authorities in each State and Territory in Australia collect road crash data in various forms. These data are intended to meet the national guidelines for reporting and classifying road crashes as defined by the (then) Federal Office of Road Safety.

These guidelines include the following criteria (Cercarelli, Kirov, Legge, & Rosman, 1998):

- The crash has been reported to the Police, including those crashes reported by Police officers who may have attended the crash scene. However, only 54% of crashes for which motor vehicle insurance damage claims are made are reported to the Police (Giles, 1994).
- The crash occurred on a public thoroughfare. However, thirty percent of crashes for which motor vehicle insurance damage claims are made occur off public thoroughfares (Giles, 1994).
- The crash involved a moving motor vehicle.

Other criteria, such as the vehicle being towed, injuries to road users being sustained and/or property damage being over some minimum limit, were applied by individual States and Territories prior to December 1 1999. At that date, all States and Territories agreed to a set of national road rules, one of which pertained to crash reporting criteria. The pre-December 1 criteria for each State/Territory are given in Table 1.

Table 1: State/Territory Criteria for Police Notification of Road Crashes  
pre-December 1 1999

State/Territory	Reporting Criteria
ACT	All crashes.
NSW	Crashes involving fatality/injury/total property damage over \$500.
Northern Territory	Crashes involving fatality/injury or property damage, including vehicles and animals.
Queensland	n.a.
South Australia	Crashes involving fatality/injury/total property damage over \$1,000.
Tasmania	Crashes involving fatality or injury.
Victoria	Crashes involving fatality/injury, or property damage where the owner of the property /representative of the owner/police are not present at the crash scene.
Western Australia	Crashes involving fatality/injury/total property damage over \$1,000.

Notes: n.a. not available at the time of publication

Table 1 shows, for example, that in Western Australia and South Australia, only crashes involving injury or total property damage over \$1,000 were required to be reported to the Police prior to December 1 1999. In the ACT, all crashes were required to be reported.

From December 1 1999, the reporting criteria for all States and Territories are:

- a vehicle needs to be towed away,
- any driver involved in a crash fails to provide his/her details,
- any person involved is killed or injured; or
- if the crash causes \$2,500 or more damage to property (other than the driver's vehicle) (Queensland Transport, 2000).

The bias in the Police databases (either the pre- or post-December 1999 databases) is thus towards the more serious 'accidents'. It is also possible that crashes falling inside the legislative requirement remain unreported due to ignorance of the law or resolute non-compliance by particular drivers (Giles, 1994).

Table 2 summarises the Police authorities in Australia, their road crash databases and their respective database managers.

The Police database in Western Australia, TAS, is reasonably representative of this category of primary source data. It is compiled from information concerning crashes reported to, or attended by, the Police. The data itself resides with, and is managed by, Main Roads (WA). This arrangement enables linkage of the crash data with the geographical/land use database of the Western Australian public road network, thus enabling expeditious 'black spot' investigations. However, whilst some of these data may be reported, it cannot be interrogated directly by researchers. There are two ways to access the data. Firstly, a request to Main Roads (WA) for specific statistics can be made. Depending on the difficulty of obtaining these, a service charge may be invoiced. Secondly, a request for a subset of the data could be made. In this case, some crash identification information, such as road user names, may be excluded as per the legislation pertaining to this data collection. However, this second approach will enable researchers to get a feel for the data and hence a better focus for the hypotheses upon which their statistical analyses are based.

Table 2 Police Road Crash Databases and Database Managers in Australia 2000

State/Territory	Police Department	Road Crash Database	Database Manager
Australian Capital Territory (ACT)	Australian Federal Police <a href="http://www.afp.gov.au/actregion/roadsafe.htm">www.afp.gov.au/actregion/roadsafe.htm</a>	ACTRAMS - ACT Road Asset Management System - incidents including road crashes	ACT Department of Urban Services <a href="http://www.act.gov.au/urbanservices/">www.act.gov.au/urbanservices/</a>
New South Wales	NSW Police Service <a href="http://www.police.nsw.gov.au">http://www.police.nsw.gov.au</a>	COPS - Computer Operational Policing System (NSW Police Service) - all incidents, including road crashes TADS - Traffic Accident Database System (RTA Of NSW) - subset of COPS which are fatal/injury/tow-away crashes* Vehicle Accident Database	Roads and Traffic Authority of NSW <a href="http://www.rta.nsw.gov.au">www.rta.nsw.gov.au</a>
Northern Territory	Northern Territory Police, Fire and Emergency Service <a href="http://www.nt.gov.au/pfes/">www.nt.gov.au/pfes/</a>		Department of Transport and Works <a href="http://www.nt.gov.au/dtw/roadsafe/">www.nt.gov.au/dtw/roadsafe/</a>
Queensland	Queensland Police Service <a href="http://www.police.qld.gov.au">www.police.qld.gov.au</a>	Road Crash Information System	Queensland Transport <a href="http://www.roadsafety.net">www.roadsafety.net</a>
South Australia	South Australia Police <a href="http://www.sapolice.sa.gov.au">www.sapolice.sa.gov.au</a>	Road Crash System	Transport SA <a href="http://www.transport.sa.gov.au">www.transport.sa.gov.au</a>
Tasmania	Tasmania Police <a href="http://www.police.tas.gov.au">www.police.tas.gov.au</a>	Traffic Accident Database	Department of Infrastructure, Energy and Resources <a href="http://www.transport.tas.gov.au">www.transport.tas.gov.au</a>
Victoria	Victoria Police <a href="http://www.police.vic.gov.au">www.police.vic.gov.au</a>	Accident Database - all reported crashes CrashStats - fatal and injury crashes <a href="http://www.vicroads.vic.gov.au/road_safe/index.htm">www.vicroads.vic.gov.au/road_safe/index.htm</a>	VicRoads <a href="http://www.vicroads.vic.gov.au">www.vicroads.vic.gov.au</a>
Western Australia	Western Australia Police Service <a href="http://www.wapol.gov.au">www.wapol.gov.au</a>	Traffic Accident System (TAS)	Main Roads (WA) <a href="http://www.mrwa.wa.gov.au">www.mrwa.wa.gov.au</a>

Notes: \* TADS has standardised and enhanced the COPS data (Anastas, 1999).

In Australia, both the Police Departments and the Database Managers report various road crash statistics such as the incidence of fatal and injury crashes, and the number of fatalities in particular years. These are reported in print and/or web versions of Annual Reports. They are also reported in various other print or web (html or pdf) publications related to specific plans or actions of either authorities. Only one State/Territory, Victoria, has a publicly available interactive database. Named Crashstats, this database is accessible via the web. Table 2 includes the URL for this site. Crashstats allows users to interrogate its records of fatal and injury crashes at various disaggregated levels - age, gender, crash type and location. The location variable is accessed via a mapping format that allows the user to pinpoint a specific location (for example, a particular intersection in downtown Melbourne) and find a summary of the crash incidence at the site in terms of other variables. Whilst this database allows cross-tabulation of crash information, it is limited in two respects. Firstly, only a small number of driver/vehicle/environment variables are available for interrogation. Secondly, only simple statistics (frequencies) for each variable or cells in a cross-tabulation can be derived.

Police data are useful to the extent that they contain detailed information on crash sites, including road conditions, traffic controls and road features, and the make, model types and colour of vehicles involved in the crashes. However, the Police accident records from which the Police database is constructed are fraught with problems of data integrity and reliability. Four of these problems are discussed here.

The first problem with Police data has to do with reasons allied with mass data collections generally and road crash reporting specifically. Accordingly, accident reports can be completed either by an attending Police Officer or by persons involved in the crash. Giles (1991a: 12) states that whilst Officers might record the information reasonably accurately (although ages and crash severity are often incorrect), "the public may make more errors of omission and commission merely because they are inexperienced in completing the form". In addition, there may be no way of obtaining all the information if it isn't obtained in a timely manner at the crash scene. Thus, Police records tend to have many blank fields. For example, both gender and age of drivers were recorded in only 67% of Police accident records (Giles et al., 1991a: 12)

The second problem follows from the first in that the accident reports are generally encoded without internal verification procedures for either the data collection or the data entry

procedures. In terms of the former, a disagreement between the values of two variables might arise. For example, 4.5% of records pertaining to pedestrian accident data showed differing values for the two accident site variables (Giles et al., 1991a).

A third problem with Police data is "the absence of information about a number of variables commonly associated with accident causation and injury outcome (such as alcohol and drug involvement and seating position)" (Giles et al., 1991a). However, given the size of the Police database collection and the broad descriptive statistics produced annually from it, these concerns are sometimes overlooked.

A fourth problem with Police data has to do with the recording of variable values. These variables include date (and time) of crash, age and gender of drivers, vehicle make, model and type, type of crash, and crash severity. Some of these variables appear to be recorded accurately. For example, vehicle details are often cross-checked with vehicle registration information which is also maintained by the Police. Other variables appear to be recorded less reliably. For example, the severity of a crash is usually defined in terms of the most severe injury outcome for road users involved in the crash. In Western Australia, the categories of crash severity, recorded in TAS, are fatal, hospitalised, injured and not medically treated, injured and untreated, and uninjured. According to Rosman and Knuiman (1994), the reliability of this variable for the analysis of crash severity is questionable. Two examples in particular highlight this concern.

Firstly, these authors found that only 53% of crashes that were recorded as having at least one injured road user who was admitted to hospital following the crash had hospital In-patient records. This discrepancy is thought to arise as Police officers at the crash scene witness injured road users being taken to A & E departments ostensibly for admission. Instead these injured road users receive Out-patient or first aid treatment before being allowed home. Giles et al (1991a: 9) reported that only 29% of casualties transported by ambulance were subsequently hospitalised. A second example, also noted by Giles et al (1991a: 9), is that 29% of hospitalised road crash casualties had only been reported in the Police database as being in crashes whose highest casualty outcome was either injured and receiving medical treatment only or injured with no treatment given. Use of this crash severity variable can thus be erroneous. However, it was used until 1990 by the CBCS/ABS as a selection criterion for the reporting of fatal crashes and crashes involving hospitalised casualties.

The WA Police Service also maintains a database of 'Fatal Files' of road crashes in which one or more road users are killed. The crash/driver/vehicle characteristics in this database are much broader than those in the more general data set described above. For example, blood alcohol levels (BALs) for involved vehicle occupants and pedestrians are recorded.

In Western Australia, both sets of Police road crash data (from TAS and 'Fatal Files') are reported annually in Police Department road crash statistical publications and in that Department's Annual Reports. Monthly and year-to-date data are also regularly reported. Media reports of the rising/falling road toll in Western Australia are sourced from this data.

Aggregate road crash cost studies in Australia between 1971 and 1992 have tended to use Police reported crash data to reflect the numbers of crashes, vehicles involved in crashes, fatalities and seriously injured road users. Other data on total injured road users (from third party injury insurance claims) (Bureau of Transport and Communications Economics (BTCE), 1992), uninjured vehicle occupants (from average vehicle occupancy studies) (Hensher, 1989), and unreported crashes (from motor vehicle insurance claims studies) (Searles, 1980), are then used to increase these numbers to the total road crash picture for Australia. The following table shows the road crash cost estimates derived by each of these studies.

Table 3: Aggregate Road Crash Costs in Australia, 1971-1992

Author	Date of Publication	Included Costs	Base Year	Ex post Cost Estimate
Troy and Butlin	1971	ACT only	1963	A\$4.1m
Atkins	1981	Australia	1978	A\$1,591.1m
Steadman and Bryan	1988	Australia	1985	A\$5,233.7m
BTCE	1992	Australia	1988	A\$6,130.8m

Sources: (Atkins, 1982), (Bureau of Transport and Communications Economics (BTCE), 1992), (Steadman & Bryan, 1988), (Troy & Butlin, 1971).

### **3. Hospital Data**

Two types of patients present at hospitals. Less serious injury cases such as fractures, contusions and mild concussion may be dealt with in the Out-patient or A & E departments of

the large metropolitan teaching hospitals or country hospitals. Limited patient, diagnostic and treatment information is collected. For example, injured Out-patients rarely have their cause of trauma (for example, a road crash) identified. These Out-patient data, without linkage to other road crash databases, are of little use in road crash studies.

The other type of patients are those that present with more serious injuries requiring hospitalisation of at least one day. Details for these patients are recorded in In-patients<sup>3</sup> data. Hospital In-patient separations (discharged In-patients, including patients who are transferred to other hospitals or who die during their hospital stay) or morbidity data are collected in Australian States and Territories by the respective public health authorities. These are shown in Table 4. The patient details include a range of information such as socio-demographic patient information, and diagnosis and treatment information.

Table 4: State/Territory Public Health Authorities 2000

State/Territory	Public Health Authority
ACT	ACT Department of Health and Community Care <a href="http://www.health.act.gov.au">www.health.act.gov.au</a>
NSW	NSW Health <a href="http://www.health.nsw.gov.au">www.health.nsw.gov.au</a>
Northern Territory	Territory Health Services <a href="http://www.nt.gov.au/nths">www.nt.gov.au/nths</a>
Queensland	Queensland Health <a href="http://www.health.qld.gov.au">www.health.qld.gov.au</a>
South Australia	SA Department of Human Services <a href="http://www.health.sa.gov.au">www.health.sa.gov.au</a>
Tasmania	Tasmania Department of Health and Human Services <a href="http://www.dchs.tas.gov.au">www.dchs.tas.gov.au</a>
Victoria	Victoria Department of Human Services <a href="http://www.dhs.vic.gov.au">www.dhs.vic.gov.au</a>
Western Australia	Health Department of WA <a href="http://www.health.wa.gov.au">www.health.wa.gov.au</a>

<sup>3</sup> In fact, In-patient data are not included in Hospital databases until patients are discharged (including transfers and deaths) or 'separated' from the hospital.

The health authorities shown in Table 4 produce summaries of patient information for their Annual Reports. These include annual In-patient admissions, same-day admissions, Out-patient occasions of service, principal diagnoses or trauma, and average lengths of stay. Some health authorities report other details. For example, the Department of Human Services in Victoria (1998) reports emergency medical treatments by elapsed time and elective patients. Another example is the SA Department of Human Services (1998) which reports bed occupancy rates and admissions per 1000 population. These aggregate figures tend to be part of systems of performance indicators that these authorities include in their forward planning. They are not particularly useful for detailed examination of the costs or outcomes of hospital treatments of injured road users. More useful to road crash researchers would be the information contained in the hospital databases, such as In-patient data for injured road users.

There are two strengths of the Hospital In-patient data. Firstly, it appears that these data can expose gaps in the Police road crash database. According to the legislative requirement for crash reporting, all accidents involving death or injuries should be reported to the Police. Hospital In-patient data reveal that this is not the case. Three examples of this follow. The first two examples were reported by Rosman and Knuiman in relation to their linkage of Police and Hospital In-patient data in Western Australia (Rosman & Knuiman, 1994). Firstly, they found that only 97.8% of road crash deaths were recorded as such by the Police. Secondly, they found that 36% of hospitalised road crash casualties did not have matching Police road crash records. The third example was given by Steadman and Bryan, who reported that 40% of persons claiming compensation for injuries received in road crashes in Victoria did not report their crashes to the Police (Steadman & Bryan, 1988).<sup>4</sup>

A second strength of the Hospital In-patient data lies in its diagnosis and treatment information. Up to three diagnoses, three medical interventions and three surgery procedures are recorded in order of importance for each In-patient. In terms of addressing the injury costs of crashes, such information is invaluable.

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<sup>4</sup> Australia is not alone in reporting this finding. Studies in the UK (Bull & Roberts, ), US (Barancik & Fife, 1985) and Europe (Schlep & Ekman, 1990), (Maas & Harris, 1984), (Harris, 1990) found similar under-reporting of casualty crashes.

Despite the above mentioned strengths, there are weaknesses of the Hospital In-patient data. Three of these are summarised here. Firstly, although the hospital morbidity data has been subjected to encoding and key-punch validations<sup>5</sup> which may insure that the hand-written notes of hospital staff are accurately entered into the computerised database, the accuracy of the notes themselves are rarely questioned. Human error may result in the misrepresentation of any of the noted information, either the socio-demographic and/or the diagnosis/treatment information (Campbell & Johnston, 1990). For example, a road user admitted with a minor crash injury may have a more acute and serious pre-existing medical problem unrelated to the injury. Treatments may refer to this problem and ignore the injury that might only require bed-rest.

Secondly, hospitalised road crash casualties can be identified within the Hospital In-patients database by using the International Classification of Diseases – Clinical Medicine (ICD-CM) (World Health Organisation, 1988) which has codes for external causes of injury, a number of which relate to motor vehicle traffic accidents (E810 -817 and E819). However if these codes are not present (no external cause is given on the patient record), then the crash victim/patient information is not included in any subset which is defined by road crash external cause codes. This can happen when, as mentioned above, despite presenting with road crash trauma, the patient is recorded with a principal diagnosis (and hence treatment) of a non-trauma morbidity, such as a pre-existing condition.

Thirdly, the ICD-CM External cause codes only generally describe crash type and occupant status. For example, the hospitalised road user was a driver of a motor vehicle involved in a road crash. Other information related to the patient (age, gender, race, occupation, admission date, discharge date, etc.), the diagnosis and treatment are better described (Giles, Kroll, Harris, & Lam, 1991b).

A number of studies have examined the hospitalisation costs of road crashes. These studies fall into two groups. The first group of studies has included such costs in aggregate road crash cost estimates. They have necessarily used average costs per average length of stay or per injury severity category. In Australia, such studies include those by Atkins (1981; 1982),

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<sup>5</sup> This procedure is not undertaken with the Police data in WA

Steadman and Bryan (1988) and the BTCE (1992). The second group of studies examined hospital costs in greater detail, using actual lengths of stay across more defined injury severity groups. For example, Giles (1990) produced the first estimates of the hospital costs of road crashes for Western Australia in 1988 using Roadwatch's linked Road Injury Database (RID). Hendrie (1993), using an updated RID and revised unit costs, provided similar estimates.

In general, ethical issues related to Hospital Morbidity databases preclude them from being accessed directly by researchers. However requests can be made for various statistical analyses and, depending on the source of the request, payments need to be made on a cost recovery basis. For example, a university researcher preparing a grant application for a project that requires a subset of a particular year's Hospital Morbidity data would need to include a cost for the extraction and analysis of the data. Alternatively, a joint health department and research unit project may only require ethics committee approval for the data to be shared. This was the case for the early years of data linkage for the Road Injury Database discussed in Section 5. In recent years, the linkage is conducted by the Health Department of WA and the results are forwarded to Roadwatch for analysis.

As with the Police data, the Hospital In-patient data are a non-random subset of the true population of road crashes. It is also biased towards the more serious crashes and injury outcomes. Linked Police and Hospital In-patient databases provide better information on each identified crash - its circumstance (not its cause), the road environment, the vehicles involved, and the casualties and their injury outcomes. One such linked database mentioned earlier, the Road Injury Database (RID) is discussed in more detail in Section 5.

#### **4. Insurance Data**

There are two types of insurance data. Firstly, there are data related to third party injury compensation claims. Each State/Territory in Australia has mandatory third party premiums associated with motor vehicle registration. These premiums are either included with the registration fees (Northern Territory, South Australia, Tasmania, Victoria and Western Australia), or managed via the registration system but paid through licensed third party insurers (Australian Capital Territory, New South Wales and Queensland). The funds from these premiums and the compensation payments made from them are the legislative responsibility of other government entities in each State and Territory. Both the compulsory third party (CTP)

insurance premium collection bodies and the third party injury compensation administrators for each of the States and Territories are listed in Table 5.

**Table 5: State/Territory CTP Insurance Premium Collection Bodies and Third Party Injury Compensation Administrators, 2000**

State/ Territory	CTP Insurance Premium Collection Bodies	Third Party Injury Compensation Administrators
ACT	National Roads and Motorists Association (NRMA) (1) <a href="http://www.nrma.com.au/insurance/policy-info/compulsory.html">www.nrma.com.au/insurance/policy-info/compulsory.html</a>	National Roads and Motorists Association (NRMA) <a href="http://www.nrma.com.au/insurance/policy-info/compulsory.html">www.nrma.com.au/insurance/policy-info/compulsory.html</a>
NSW	CTP insurers listed with MAA, including National Roads and Motorists Association (NRMA) (2)(3) <a href="http://www.nrma.com.au/insurance/policy-info/compulsory.html">www.nrma.com.au/insurance/policy-info/compulsory.html</a>	Motor Accidents Authority (MAA) <a href="http://www.maa.nsw.gov.au">www.maa.nsw.gov.au</a>
Northern Territory	Department of Transport and Works (4) <a href="http://www.nt.gov.au/dtw/">www.nt.gov.au/dtw/</a>	Territory Insurance Office <a href="http://www.tiofi.com.au">www.tiofi.com.au</a>
Queensland	CTP insurers registered with Queensland Transport (3) <a href="http://www.transport.qld.gov.au">www.transport.qld.gov.au</a>	Motor Accident Insurance Commission <a href="http://statauth.premiers.qld.gov.au/stat/board-details.html?bid=540">http://statauth.premiers.qld.gov.au/stat/board-details.html?bid=540</a>
South Australia	Transport SA (4) <a href="http://www.transport.sa.gov.au/rls/services_fr.html">www.transport.sa.gov.au/rls/services_fr.html</a>	Motor Accident Commission (5) <a href="http://www.austlii.edu.au">www.austlii.edu.au</a>
Tasmania	Registrar of Motor Vehicles, Transport Division, Department of Infrastructure, Energy and Resources (4) <a href="http://www.transport.tas.gov.au">www.transport.tas.gov.au</a>	Motor Accidents Insurance Board <a href="http://www.maib.tas.gov.au">www.maib.tas.gov.au</a>
Victoria	VicRoads (4) <a href="http://www.vicroads.vic.gov.au">www.vicroads.vic.gov.au</a>	Transport Accident Commission <a href="http://www.tac.vic.gov.au">www.tac.vic.gov.au</a>
Western Australia	Department of Transport (4) <a href="http://www.transport.wa.gov.au">www.transport.wa.gov.au</a>	Insurance Commission of WA <a href="http://www.icwa.wa.gov.au">www.icwa.wa.gov.au</a>

- Notes:
- (1) Sole licensed CTP insurer.
  - (2) The largest single CTP insurer with 32.3% market share in 1997/98. This and other CTP insurers can be identified via the MAA web site.
  - (3) Motor vehicle registration requires the payment of a CTP premium through a recognised/registered CTP insurer.
  - (4) CTP premium included with car registration fees.
  - (5) There is no web site for the MAC. However, the web site given will link to the SA Motor Accident Commission Act 1992 that gives some details of the SA CTP fund and its administrator.

Data related to injured road users that are collected by the CTP insurance administrators are important for two reasons. Firstly the numbers of injured road users accessing the compensation schemes, when compared with the published (Police) figures for fatalities and injuries, show a different distribution of injury severity. For example, BTCE (1992: 20), after an assessment of Victoria's TAC data, found that hospital admissions were overstated by up to 45% and length of stay in hospital was underestimated. The first finding was identified in Section 2, namely that some injured road users were incorrectly identified in the Police data as having been admitted to hospital when in fact they may have only received Out-patient treatment. The second finding results from some hospitalised road users having more than one hospital admission following a road crash.

Secondly, the hospital/medical/rehabilitation/payout cost data for various injury severity levels is useful for estimating the cost of crashes. For example, BTCE used Victoria's TAC data on average medical and hospital and rehabilitation costs for fatalities, hospitalised casualties and non-hospitalised but medically treated casualties in its estimation of the total and average costs of road accidents in Australia in 1988 (Bureau of Transport and Communications Economics (BTCE), 1992).

The second type of insurance data are those that relate to motor vehicle damage claims. Some of the information in these files is computerised to keep track of repair payments and other costs related to insured vehicles. No information in these computerised files pertains to the type, severity or location of the crash, the number of casualties or the severity of injuries. Even if such information is asked on the claims form, rarely is it checked unless ambiguities relating to fault or damage repair cost arise. The claims forms are usually archived, together with any other paperwork pertaining to the claim, when the claim is finalised (paid out, withdrawn or rejected). This other paperwork might include copies of vehicle registration papers, Police reports, statements from witnesses, reports by investigating teams, etc. Some of these papers contain conflicting information related to details such as the driver's date of birth, crash type and vehicle details.

Samples of motor vehicle insurance claims data have been used in the past to provide information on vehicle damage costs. These costs are input into accident cost studies. Such samples have also been used to predict the total number of road crashes and the incidence of non-casualty or property damage only (PDO) crashes.

In terms of total crash numbers, Searles (1980) and Giles (1994) confirmed that many more crashes occur than are known to the Police. Searles found that about half of the motor vehicle damage claims in his insurance data set for Sydney in 1975 had been reported to the Police. Moreover, he was able to use insurance data to find that under-reporting differed by crash type. As stated in Section 2, Giles reported that 54% of crashes involving motor vehicle claims made to insurance companies in Western Australia in 1987/88<sup>6</sup> were also not reported to the Police. Steadman and Bryan argued that the lack of reliable data on PDO crashes is a major difficulty in deriving reasonable estimates of the overall number of road crashes (Steadman & Bryan, 1988).

A comprehensive collection of insurance data covering vehicle, driver and crash information in Western Australia was undertaken in 1990/91. This Property Damage Database (PDD) comprises 10% of claims records for 1987/88 from the four major motor vehicle insurance companies in Western Australia. At the same time, a crash cost-based investigation Australia-wide using a similar collection of insurance data was undertaken and subsequently completed in 1992. Whilst both the State and the Australia-wide studies have produced better information on the property damage costs of crashes and crash profiles, they fall short of overcoming the aforementioned inherent biases of insurance data (Andreassen, 1993) (Harris, Giles, Hendrie, & Kroll, 1991).

Several Australian studies have agreed that the under-reporting of PDO crashes is widespread<sup>7</sup>; however there is considerable disagreement as to the extent of this under-reporting. The samples of motor vehicle insurance claims data used in these studies are however themselves biased due to insurance company claim requirements and the nature of insurance coverage itself. Not all vehicle owners have insurance. Those that do may be covered for third party or comprehensive. In the latter case there is often a choice of the maximum pay-out for the insured's vehicle. If involved in a crash, the insured may decide not to claim, especially if the repair cost is less than the policy excess or low in relation to the value of the reduction in the insured's no-claim bonus.

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<sup>6</sup> This data set is discussed later in this Section.

<sup>7</sup> Ratios of PDO to total crashes estimated in previous Australian studies are 6.8:1 (Troy & Butlin, 1971) (Atkins, 1982) (Steadman & Bryan, 1988), 40:1 (Nicholson, 1981), and 42:1 (James, 1983).

## 5. Comparison of Police, Hospital and Insurance Databases

None of these data sources are sufficient to describe the true incidence and cost of carnage, injury and damage on our roads. Hospital data necessarily say more about the injuries and treatment than about the crash circumstances, whilst the reverse applies to Police data. Insurance data emphasise vehicle and driver information with limited reliable crash environment and cause information and almost no injury facts (Giles, 1994; Harris et al., 1991; Sanderson & Hoque, 1987).

Table 6 shows if and how crash/vehicle/driver information is included in each of these databases.

Not included in Table 6 (because they are not found in any of the databases) but of interest to researchers looking at crash prevention and injury reductions are variables that describe:

- \*the level of alcohol involvement<sup>8</sup>,
- \*the speed of the vehicle(s),
- \*road user culpability,
- \*the use of seat-belts, child restraints, helmets and other safety devices,
- \*occupant seating positions,
- \*the current mechanical state of the vehicle, and
- \*personal characteristics such as educational attainment.

Inasmuch as the Police database comprehensively describes crashes reported to the Police, it cannot be used to infer any profile for crashes not reported to the Police. Similarly, the Hospital database can describe injured road users and their treatments in hospital, but it cannot be used to infer details of uninjured, or injured but not hospitalised, road users. The Insurance database is limited by the problems of self-reporting and the superficiality of the crash/driver/vehicle information sought by the insurance companies.

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<sup>8</sup> Whilst this variable does not show up in the Police road crash databases, it is often included separately in records pertaining to road crashes involving fatalities.

Table 6: Comparison of Police, Hospital and Insurance Databases, 1987/88

Variables	Police	Hospital In-patient	Motor Vehicle Insurance
Address of driver	Yes	Yes	Yes
Age of driver	DOB (1)	DOB	DOB or age
Casualty status	Fatal, Hospitalised, Medically treated, Uninjured	ICD9-CM (2) can be linked to AIS (3) or DRG (4) codes	No
Casualty treatment	No	Yes, including diagnoses, operations, conditions, complications	No
Crash location	Yes	No, but hospital is identified	Postcode
Crash type	11 codes as per Road User Movements (RUM)	ICD9 – CM External Cause Code (ECC)	Yes, can be re-coded as RUM, MG (5) or ICD9-CM (ECC)
Date of crash	Yes	Yes if date of crash is the same as date of admission	Yes
Driver occupation	No	Yes	No
Gender of driver	Yes	Yes	Yes
No. of occupants	Yes	No	No
No. of vehicles	Yes	One, two, or more than two	Yes
Police Notified	Reported crashes only	Not known	Yes
Race of driver	No	Yes	No
Road environment (6)	Yes	No	Sometimes
Road user type	Yes	Yes but limited to ECC categories	Yes but limited
Time of crash	Yes	No, but time of admission to hospital is coded	Yes
Vehicle colour	Yes	No	Sometimes
Vehicle make/model/body type	Yes	No	Yes
Vehicle year of manufacture	Yes	No	Yes

Notes: (1) DOB = date of birth  
 (2) ICD9-CM = International Classification of Disease (Clinical Medicine) (World Health Organisation, 1988)  
 (3) AIS = Abbreviated Injury Scale  
 (4) DRG = Diagnosis Related Groups  
 (5) MG = Model Guidelines (Andreassen, 1991)  
 (6) Road environment = road conditions, traffic controls, road features (Giles et al., 1991b)

## 6. Secondary Source Road Crash

A number of secondary source databases have been or continue to be maintained. These include a national road crash fatalities register (1981 - 1998), a national reported road crashes

register (1925 - 1990), a national injury deaths database (1979 - 1997), and a computer-linked road crash database (1987 - 1996).

The Australian Transport Safety Bureau (ATSB) (previously the Federal Office of Road Safety (FORS)) maintains a register of road crash fatalities from 1981 to 1998. Additional years are added as the data become available from the States and Territories.

The Commonwealth Bureau of Census and Statistics (CBCS) and its successor the Australian Bureau of Statistics (ABS) published reported road crash figures (Police data) between 1925 and 1990. When the series was commenced, the statistics were thought to cover all road crashes involving motor vehicles in the Australian States and Territories. By the 1950s, the coverage had been reduced to road traffic accidents known to the Police, occurring on public thoroughfares and resulting in death or serious bodily injury to an extent requiring medical or surgical treatment. By 1990, when the responsibility for publishing road crash statistics was transferred to the (then) Federal Office of Road Safety, the coverage of road crashes had further diminished to fatalities and hospitalised injured road users (as identified by Police databases). In the interim decades the CBCS/ABS acknowledged, albeit retrospectively, deficiencies in their previously published road crash records. However no attempts were ever made to revise the relevant past published figures (excluding revisions of seasonally adjusted statistics) (Giles, 1996).

There are three complications arising from this data series degradation. Firstly, it is virtually infeasible to describe, for Australia, reliable trends in road crash incidence or severity over the period 1925 to 1990. Secondly, at the national level, it appears that the degree of under-reporting is not attributed to any particular class of road crashes. Thirdly, assessment of road crash prevention and injury reduction programmes over the period using these data becomes at best difficult or at worst impossible.

The National Injury Surveillance Unit (NISU) at Flinders University maintains a comprehensive national injury deaths database for 1979 - 1997. This database is compiled from information supplied by the ABS, the State and Territory Registrars of Deaths and State and Territory Coronial authorities (National Injury Surveillance Unit, ). A subset of this database refers to road crash fatalities. Whilst the NISU and the ATSB/FORS road crash fatalities should equate, there is often a discrepancy. For example, Police reported road crash deaths are treated

as such if they occur within 30 days of the crash. Coronial reports generally do not have this cut-off point.

Reference has been made earlier to the computer-linked Road Injury Database (RID) maintained by the Road Accident Prevention Research Unit in WA. This database contains linked casualty road crash information for 1987 to 1996. The information results from the linkage of four databases - the WA Police reported crashes database (TAS), the Hospital Morbidity (In-patient) database of the Health Department of WA, St John Ambulance records for WA and the WA Registrar-General's Death index. Although name, gender, age and date of crash are used in the linkage procedure, all names, hospitals, and doctor identifiers are excluded from RID.

Reference was made in Section 3 of the use of RID for estimating the hospital costs of road crashes in Western Australia. Other uses of RID have targeted hospital costs and outcomes related to specific injuries or road user groups. For example, Cercarelli (1999) compared the hospitalisations and fatalities due to road crashes for Aboriginals and non-Aboriginals in Western Australia for the years 1988 to 1996. Hendrie (1999) included hospitalisations from RID in estimations of the cost of road injury in Western Australia for the years 1989 to 1997. Her study identified average costs of injury for different groups of road crash casualties and for different groups of injuries.

## **7. Conclusions**

Existing road crash databases in Australia appear to be useful in estimating the magnitude of the road crash problem, albeit in terms of minimum crash numbers and outcomes. However these databases are deficient in two ways. Firstly, they have limited use in definitively identifying crash causation, such as vehicle, driver and road environment features that are most likely to result in particular outcomes. Secondly, crash information for the purpose of introducing specific crash prevention and injury reduction strategies appears to be limited, at best, or unreliable, at worst.

These databases could be improved in three ways. Firstly, additional variables could be included. For example, one of the key variables from a crash management point of view, which is currently missing from Police, hospital and insurance records, is alcohol consumption by

drivers. In the event of blood alcohol readings being taken after a road crash, the information may be included in Police fatal files. It might also be used for prosecuting traffic violations. However it is not encoded in the total database of road crashes reported to the Police. Cercarelli in her report to the Road Safety Council of WA also highlighted the need to collect blood alcohol information (Cercarelli, 1998).

Another omitted variable relates to injury outcomes. Even in the hospital database, there is no encoding of longer term outcomes for injured road users. These include requirements for rehabilitation over a short, medium or long term, further surgery or medical recommendations, and recovery outcomes, such as 50% usage of injured limbs. Such details would enable better estimations of the cost of crashes and hence more accurate spending of public funds for crash prevention and injury reduction programmes.

Educational attainment is a third omitted variable. The aggregate road crash costings in Australia, shown in Table 3, use earnings projections adjusted only for age (and working life left) and gender. This contrasts with the human capital literature where a large number of factors, including level of education, have been shown to influence wages (Miller, Mulvey, & Norris, 1997; Preston, 1997). Indeed both the Preston and Miller et al. studies show that educational attainment is one of the strongest influences on earnings outcomes, with the earnings differential between the better educated and their less well educated counterparts exceeding 50 per cent. Importantly, as many of the characteristics established as important in studies of earnings determination also impact on the incidence and cost of road crashes, the estimates of the cost of road crashes which ignore these characteristics will be biased. However, level of educational attainment is not a variable collected routinely in Police road crash reports, as shown in Table 6. Hospital In-patients databases may have patient occupation as a variable, also shown in Table 6, but it is unknown whether this field is accurately recorded if at all. Moreover, the link between occupation and educational attainment is not definitive.

A second improvement to existing road crash databases is for variables across all databases to be similarly recorded. For example the use of the model guide-lines (Andreassen, 1991) for the encoding of crash types would afford a much more comprehensive picture of road crash circumstances. Another example is the use of injury coding. Research in this area has shown clearly that Abbreviated Injury Scale (AIS) groupings are inferior to Diagnosis-Related Groups (DRG), so the use of the latter should become standard across all hospital databases in

Australia in the future. The adoption of national road rules from December 1 1999, discussed in Section 2 in relation to requirements for reporting road crashes to the Police being standardised across all States and Territories in Australia, should improve both comparisons and aggregations.

A third improvement that is well overdue is the coverage of road crash records. Hospital and insurance databases can only ever be samples of road crashes because of their intrinsic nature. Police databases, on the other hand, could be improved. There are three ways to do this. One way is to ensure that every road crash occurring on public<sup>9</sup> thoroughfares is recorded each year. Given that recording of road crashes is estimated at 25% of all road crashes<sup>10</sup>, the administration of such an increase in the size of the Police-reported database would require considerable increases in Police (and Main Roads/Transport/Traffic authority) resources!

A second way to improve road crash coverage would be to hold a census of road crashes at suitable, say five-yearly, intervals. As with the above option, this would, at best, be a costly exercise.

A third means of improving the Police road crash data would be to attempt, at reasonable intervals, a sample survey of road crashes. This would need to be large enough to ensure statistical significance for testing of subsets of the sample. Survey results could be compared with the profile in the regular Police database in order to adjust for biases in the latter.

In summary, the current road crash databases fall short of providing accurate information at both a disaggregated level and in terms of the big picture of road crash incidence. Instead of continuing to use questionable assumptions to adjust the information that is currently available, the quality and/or quantity of this information needs to be improved. For the sake of safer roads, this should be done sooner rather than later.

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<sup>9</sup> Indeed, if the legislation was amended to include crashes occurring off public thoroughfares, then the true incidence and cost of collisions is more likely to be discovered.

<sup>10</sup> Searles (1980: 73) estimated that "more than four times as many crashes occur as those which are included in the official statistics".

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