



Estimating under-reporting of road crash injuries to police using multiple linked data collections



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ABSTRACT

The reliance on police data for the counting of road crash injuries can be problematic, as it is well known that not all road crash injuries are reported to police which under-estimates the overall burden of road crash injuries. The aim of this study was to use multiple linked data sources to estimate the extent of under-reporting of road crash injuries to police in the Australian state of Queensland. Data from the Queensland Road Crash Database (QRCD), the Queensland Hospital Admitted Patients Data Collection (QHAPDC), Emergency Department Information System (EDIS), and the Queensland Injury Surveillance Unit (QISU) for the year 2009 were linked. The completeness of road crash cases reported to police was examined via discordance rates between the police data (QRCD) and the *hospital* data collections. In addition, the potential bias of this discordance (under-reporting) was assessed based on gender, age, road user group, and regional location. Results showed that the level of under-reporting varied depending on the data set with which the police data was compared. When all *hospital* data collections are examined together the estimated population of road crash injuries was approximately 28,000, with around two-thirds not linking to any record in the police data. The results also showed that the under-reporting was more likely for motorcyclists, cyclists, males, young people, and injuries occurring in Remote and Inner Regional areas. These results have important implications for road safety research and policy in terms of: prioritising funding and resources; targeting road safety interventions into areas of higher risk; and estimating the burden of road crash injuries.

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1. Introduction

Police reported crash data are the primary source of crash information in most jurisdictions (International Traffic Safety Data and Analysis Group (IRTAD), 2011). However, the reliance on police data for the counting and analysis of road crash injuries can be problematic, as it is well known that not all road crash injuries are reported to police (Alsop and Langley, 2001; Amoros et al., 2006; Boufous et al., 2008; Langley et al., 2003a). This under-reporting can have impacts not only on the overall measure of the impact of road crash injuries, but could potentially introduce biases relating to particular groups of road users.

In the area of road crash incidents and injuries, a variety of data linkage projects have been conducted (Abay, 2015; Alsop and Langley, 2001; Amoros et al., 2006; Aptel et al., 1999; Boufous et al., 2008; Cercarelli et al., 1996; Elvik and Mysen, 1999; Hauer and Hakkert, 1988; Langley et al., 2003a). Abay (2015) merged

emergency room data with police-reported crash data in a region in Denmark. It was found that there was significant bias in reporting to police including a severity bias (i.e., higher severity injuries are more likely to be reported). Alsop and Langley (2001) used linkage of police and hospital records in New Zealand. They found that less than two-thirds of all hospitalised road crash casualties were recorded in the police data. They also found that this varied based on the number of vehicles involved, the geographical location, age and injury severity. Amoros et al. (2006) conducted a similar study looking at the under-reporting of road crash casualties in France. They used probabilistic methods to link police crash data with the road trauma registry in Rhone County. The results showed a police reporting rate of around 38%. However, this rate varied according to injury severity, the road user type, and the location of the crash (i.e., metropolitan vs. rural). Another French study conducted by Aptel et al. (1999) found that after linking police and hospital data, only 37% of non-fatal road crash injuries were recorded by police. Similar to other studies, they found that rate of reporting varied depending place of crash, the type of vehicle involved, and the injury severity. They also determined that police-reports tended to over-estimate the

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severity of the injury sustained. Langley et al. (2003a,b) conducted linkage between hospital records and police records to specifically examine the potential under-reporting of cyclist injuries in New Zealand. The results showed that only 22% of cyclists that crashed on a public road could be linked to the police records. Of the crashes that involved a motor vehicle, 54% were recorded by police. They also found that age, ethnicity, and injury severity predicted whether a hospitalised cycle crash was more likely to be recorded in the police data. Within Australia, Cercarelli et al. (1996) linked police reports, hospital admissions and accident and emergency (A&E) department data from a single hospital in Western Australia. The researchers found that around 50% of attendances at the A&E were recorded by police, and that around 50% of cases recorded by police as being admitted to hospital were actually admitted. The researchers argue that while the discrepancy between the data sets does represent an under-reporting of cases, it suggests that differences in coding systems may also lead to cases not being linked. Another Australian study conducted in NSW by Boufous et al. (2008) linked hospital admissions data (Inpatient Statistics Collection [ISC]) with the Traffic Accident Data System (TADS). The researchers matched 56.2% of hospitalisations as a result of road crash with a record in TADS. The researchers also found that the linkage rate varied according to age (i.e., lower linkage rate for younger age groups), road user type (e.g., lower linkage rate for cyclists), severity (i.e., higher linkage rates with increased severity) and geographical location.

While these studies highlight the issues of under-reporting and bias within police data systems, many of these studies tended to limit data linkage to only two data sets (e.g., hospital and police data) rather than exploring the methods, issues and findings from the linkage of several data sets at a state-wide level to obtain a more comprehensive understanding of road crash injury. The aim of this study was to use multiple linked data sources to better estimate the extent of under-reporting of road crash injuries to police in Queensland. There has been no research of this nature conducted in the jurisdiction of Queensland, Australia and it is important to assess whether the under-reporting that has been found elsewhere applies here. In addition, there may be some unique features of this jurisdiction (i.e., a large and decentralised state with a significant rural and remote population) that may influence the level of under-reporting and/or the patterns of this under-reporting. Also, this jurisdiction is part of the larger picture of the road trauma problem and the under-reporting needs to be quantified to inform the reporting of road crash injuries in Australia.

2. Methods

Ethics approval was obtained from the Queensland Health Human Research Ethics Committee (#HREC/12/QHC/45).

2.1. Data collections

Data were provided from the Queensland Road Crash Database (QRCD), Queensland Hospital Admitted Patients Data Collection (QHAPDC), Emergency Department Information System (EDIS), and Queensland Injury Surveillance Unit (QISU) by each relevant custodian for the specified cases for 2009. The year 2009 was used as it was the most recently available data for all collections at the time the linkage was commenced. There are often significant delays with data being available to researchers. Also, gaining the necessary custodian approvals and the data linkage (conducted by the Queensland Health Record Linkage Group) took twenty months to complete.

The QRCD includes all road crash injuries reported to police in Queensland in 2009. This includes information about all persons

injured on public roads, including drivers, passengers, motorcycle riders, cyclists, and pedestrians. It should be noted that the following major exclusions apply:

- The incident occurs in an area outside the road or road related area.
- There is no moving vehicle involved.
- The incident is not attributable to vehicle movement.

It should be noted that the definition of what constitutes a road crash injury in this study is based on this QRCD definition.

QHAPDC contains data on all patients discharged, statistically separated, died, or transferred from a Queensland hospital permitted to admit patients (including public hospitals, licensed private hospitals, and day surgery units). External cause of injury information is captured in three data fields (i.e., external cause, place, and activity) using International Classification of Diseases, 10th Edition, Australian Modification (ICD-10-AM) (National Centre for Classification in Health, 2004).

The Emergency Department Information System (EDIS) includes all emergency department presentations in twenty-nine hospitals across Queensland (approximately 75% of Queensland emergency departments). This collection does not code cause of injury information and requires the use of the 'presenting problem' text description to identify transport-related cases.

The Queensland Injury Surveillance Unit collects data on injuries presenting at seventeen Queensland emergency departments (nine of the QISU hospital emergency departments are not included in EDIS). This collection captures cause of injury information in several data fields both coded and text-based, including: mechanism, external cause, major injury factor, place, activity, and an 'injury description' text field.

The following was determined by the researcher as the selection criteria for each collection for the data linkage:

- RCD: all injury cases
- QHAPDC: all admitted patients cases coded as transport-related (ICD-10-AM External Cause Codes from V00–V99)
- EDIS: all emergency department presentations coded as an injury (discharge diagnosis S00–S99 and T00–T98)
- QISU: all emergency department injury presentations cases coded as transport-related (external definition of 'motor vehicle–driver'; 'motor vehicle–passenger'; 'motorcycle–driver'; 'motorcycle–passenger'; 'pedal cyclist or pedal cyclist passenger'; and 'pedestrian')

It should be noted that for the data linkage component (conducted by the Queensland Health Record Linkage Group), all injury cases in EDIS and all transport injury cases in QISU and QHAPDC were processed for linkage. This was done as there was some question over the accuracy of the coding of traffic (road-related) injuries in QHAPDC and QISU and the selection of transport injuries in EDIS (as this data collection only contains cause of injury information in an unstructured text field as described above). So, in order to capture those cases that may still link to the QRCD (police-reported data) despite not being coded or identified as a road crash in the three hospital data sets, a broader approach to the linkage was used. The researchers then applied the refinements described in Section 2.4 to identify relevant road crash cases for analysis.

2.2. Data linkage process

The Population Health Research Network (PHRN) was established by the Australian Government's National Collaborative Research Infrastructure Strategy with the aim to oversee the

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