

An Overview of Bicycle Crashes and Injuries in Western Australia

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Abstract

The aim of this study was to examine the trends in bicycle crashes in Western Australia. Police reports and hospital admissions from the Western Australian Road Injury Database for the period of 1987 to 2000 were analysed. There were 11,114 crashes reported to police involving 11,385 cyclists over the study period. Of these cyclists 81 were fatalities and 1,851 hospitalised. There was a significant decrease in the number of police reported crashes involving cyclists, from 1,012 in 1987 to 612 in the year 2000. The hospital admissions data shows a different trend. Over the study period 9,878 cyclists were admitted to hospital, increasing from 630 in 1987 to 913 in 2000. It was concluded that the use of both police reports and hospital admissions data is crucial to providing an accurate picture of bicyclist crashes. Serious cyclist injury seems to be under-reported in the police data. This is highlighted with the reduction in the number of bicycle crashes reported in the police data, compared to the significant increase in the number of cyclists admitted to hospital.

Notation

<i>ATSB</i>	Australian Transport Safety Bureau
<i>ICECI</i>	International Classification of External Causes of Injuries
<i>HMDS</i>	Hospital Morbidity Data System

Introduction

Bicycle riding is one of the most popular recreational activities in Australia and is fast becoming an increasingly popular form of transportation [1,2]. However cyclists have a higher risk of being injured than any other group of road users [3,4]. They are “unprotected” in traffic, despite being capable of reaching high speeds.



Most studies investigating the age and gender distribution of people involved in bicycle crashes have found that the majority of casualties are less than 20 years old and are predominantly male. In a study of bicycle crashes in New Zealand, young males and children in the 5 to 14 year age group were identified as having the highest rates of injury [5]. In Western Australia, Piggott et al [6] demonstrated that injury rates of police-reported and hospitalised casualties were highest for young cyclists, although there were variations in rates by age in the police and hospital data.

Information about factors associated with bicycle crashes is mainly derived from police reports of crashes. These data are known to under-estimate the actual number of bicycle crashes as certain types of crashes involving bicyclists are not reported such as those deemed relatively minor by those involved or those that are not legally required to be reported (e.g. minor, off-road incident without serious injury). There is evidence of low level of completeness in accident databases involving cyclists in many countries. For example, Stutts

et al [7] found that only 11% of crashes involving cyclists receiving treatment at hospital emergency rooms in North Carolina (US) were reported to the police. This study also found that the police-reporting rate for crashes involving a motor vehicle was 60%, while those not involving a motor vehicle the reporting rate was less than 1%. In developing countries bicycle injuries are also seriously underreported. In Colombo, Sri Lanka 92% of children and 54 % of adults who were hospitalized for bicycling injuries were not included in police reports [8]. In Australia, studies of the reporting rate of bicycle crashes to the police have also shown under-reporting. In Western Australia, Hendrie and Ryan [9] found the reporting rate of injury crashes involving a cyclist was 2.2% if all injured cyclists were used for the denominator, and 3.5% if only cyclists injured on-road were used for the calculation.

The aim of this study is to provide an overview of bicycle crashes in Western Australia. This will utilise both police reported crash data and hospital admissions data due to an understanding of the under-reporting of bicycle crashes to police, and examine the trends of bicycle crashes over the 14 year period of 1987-2000.

Methods

The study population is derived from Police reports and hospital admissions records contained in the Western Australian Road Injury Database and covers the 14-year period from 1987-2000. In Western Australia all road crashes are required to be reported to police if a person was killed or injured, or the crash results in property damage of \$1,000 or more. This data source contains detailed information on the characteristics of the people and vehicles involved in road crashes and the crash circumstances. Crashes involving cyclists were identified using the unit type classification in this data source.

The hospital admission records were obtained from the Hospital Morbidity Data System (HMDS). The Road Injury Database contains a subset of the HMDS that contains all hospital admissions that were as a result of a road traffic crash. The hospital admission data provides only limited information about crash circumstances but detailed information about the injuries sustained by casualties. Another benefit of the HMDS is that it contains records from all hospital admissions in Western Australia [10]. This is especially important for this study because many road crash casualties are not reported to police, and as previously mentioned under-reporting of bicycle crashes is significant [11,12]. Hospitalised bicyclists were identified using external cause of injury codes of the ICD-9-CM (E810 to E825 using the fourth digit classification of ‘.6’ relevant to bicyclists and E826 to E829 using the fourth digit classification of ‘.1’) and ICD-10-AM (V10.0 to V19.9 excluding V10.3 to V18.3).

Results

Trends in reporting and hospitalization from 1987 to 2000

The number of cyclists involved in police reported crashes from 1987-2000 was 11,385 (Figure 1). The number significantly decreased from 1,044 in 1987 to 625 in 2000 ($p=0.001$) which represents a decrease of approximately 32 cyclists involved in crashes per year. Over this period, the share of cyclists reported as a percentage of all people involved in police reported crashes was 1.0% and decreased from 1.3% in 1987 to 0.7% in 2000 ($p<0.001$). Of these 11,385 cyclists involved in police reported crashes, 81 were fatally injured and 1,851 reported as hospitalised (see Table 1). In comparison the number of hospital admissions for bicycle crashes from 1987-2000 was 9,897. Figure 1 illustrates a significant increase in hospital admissions ($p=0.001$) from 630 in 1987 to 913 in 2000. Cyclist related admissions as a proportion of all admissions due to road injury showed no significant change. Cyclists contributed 14.0% of all road injury hospital admissions, fluctuating from 12.7% in 1987 to 15.8% in 2000 (n.s, $p=0.061$).

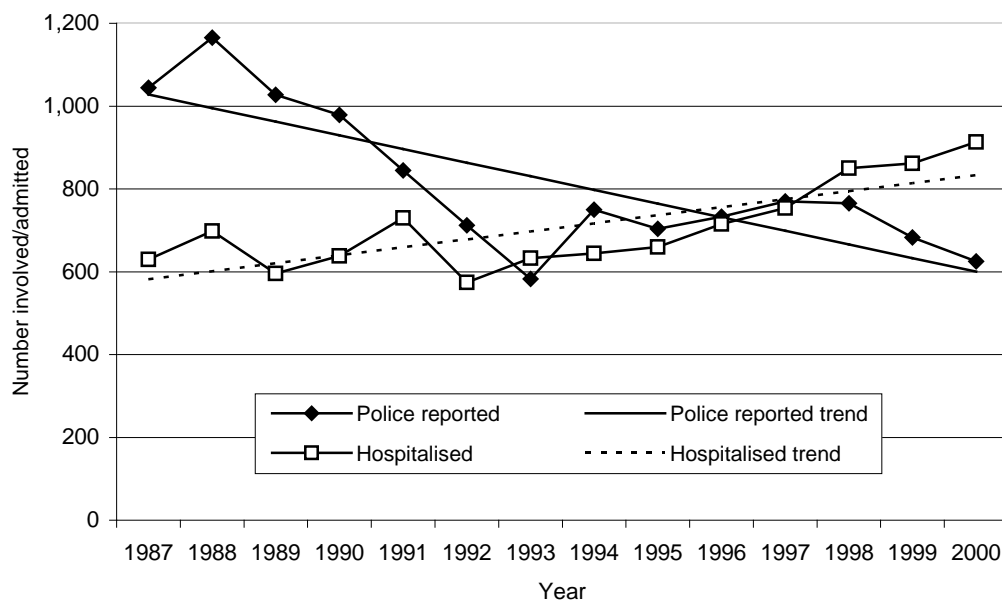


Figure 1: The number of bicyclists involved in police reported crashes and hospitalised with associated trends, 1987-2000

Table 1: Characteristics common to police reports and hospital admissions data for bicyclists, 1987-2000

Bicyclist/environment characteristics	Data source			
	Police (n = 11,385)		Hospital (n = 9,878)	
	n	%	n	%
<i>Road User Group</i>				
Bicyclists	11,385	1.0	9,878	14.2
Other road users	1,128,455	99.0	59,594	85.8
<i>Injury Severity</i>				
Fatal	81	0.7	N/A	N/A
Hospitalised	1,851	16.3	9,878	100.0
Medical attention	4,486	39.4	N/A	N/A
Other	4,967	43.6	N/A	N/A
<i>*Gender</i>				
Male	8,457	81.2	7,495	75.9
Female	1,955	18.8	2,383	24.1
<i>*Age (years)</i>				
0-5	84	1.0	1,011	10.2
6-12	1,346	16.5	3,429	34.7
13-16	1,940	23.8	2,183	22.1
17-24	1,720	21.1	950	9.6
25-39	1,859	22.8	1,090	11.0
40-59	891	10.9	770	7.8
60+	301	3.7	442	4.5
<i>*Location</i>				
	1987-2000		1993-2000	
On-road	10,657	93.6	2,373	40.0
Off-road	728	6.4	3,558	60.0
<i>*Region</i>				
Metropolitan	9,552	84.2	7,055	71.4
Regional	1,798	15.8	2,823	28.6

* Unknown values are not included in the analysis

Common characteristics in both data sources

Table 1 shows that bicycle casualties were less likely to appear in police records than hospital admissions. Both police reports and hospital admissions show that males are more likely to be involved in crashes as a cyclist, 81.2% of cyclist casualties with known gender in police reports were males and 75.9% of hospital admissions were for males.

The age group distributions between bicyclists involved in police reported crashes and those hospitalised were also different (see Table 1). The hospital admissions for age groups 0-5 and 6-12 years of age accounted for 10.2% and 34.7% of cyclists admitted to hospital respectively, while these age groups accounted for 1.0% and 16.5% of cyclists in their respective age groups involved in police reported crashes. Conversely, 21.1% of cyclists involved in police reported crashes were aged 17-24 years and 22.8% aged 25-39 years, compared to 9.6% and 11.0% of hospital admissions to cyclists in the respective age groups.

Another important contrast between the data sources is the location of the crash (see Table 1). Police reported bicycle crashes occurred mainly on roads open to public access (93.6%), with

a small proportion (6.4%) occurring in off-road locations such as private driveways, recreation areas, bike paths and other off-road locations. This distribution is markedly different to that of bicycle riders admitted to hospital. Where the location was known 60.0% of bicycle riders admitted to hospital were injured in off-road locations.

Table 1 shows that most of the reported crashes were in the metropolitan areas. Bicycle riders involved in police reported crashes were more likely to be in the metropolitan area than those admitted to hospital, with 84.2% and 71.4% from metropolitan areas in the respective data sources. It must be noted that the police reported data contains the location of the crash, while hospital admission location indicates the location of residence.

Helmet wearing

Figure 2 presents the helmet wearing status of cyclists in police reported crashes. This information is not available in the hospital admissions data. The police crash data does not record helmet wearing status for the majority of cyclists, although this information has been available for a higher percentage of cyclists in recent years. In 2000, helmet wearing status was unknown for 55.7% of cyclists involved in police reported crashes compared to 72.0% in 1994 and 100.0% in 1987. In 1992 - the year that compulsory helmet wearing was introduced - helmet wearing status was unknown for 76.3% of cyclists involved in police-reported crashes, 14.5% were known to have been wearing a helmet, and 9.3% were known not to have been wearing a helmet. This implies a helmet wearing rate of 60.9% for cyclists, whose helmet wearing status was known. In 2000, 33.6% were known to have been wearing a helmet, and 10.7% were known not to have been wearing a helmet. For the cyclists whose helmet wearing status was known, this indicates a helmet-wearing rate of 75.8%.

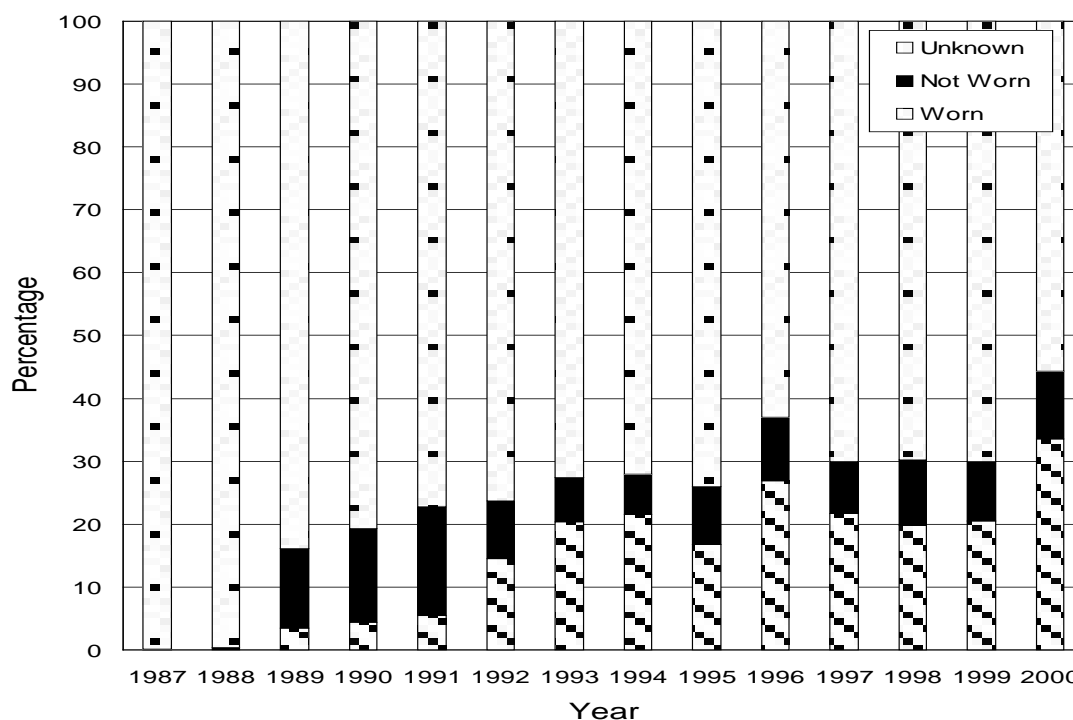


Figure 2: Percentage of bicycle riders by helmet wearing status, police reported crashes 1987-2000

Length of stay in hospital

Information about the length of stay for cyclists admitted to hospital is only available in the hospital admissions data. Over the 14-year period 56.9% of cyclists spent one day in hospital, 33.4% of cyclists spent between two and seven days in hospital, 8.3% spent between eight

and 30 days in hospital and 1.3% spent more than 30 days in hospital. Figure 3 examines length of stay by age group. The percentage of casualties with lengths of stay of one day or less decreased with age from 67.5% for cyclists aged 6 to 12 years of age to 28.3% for cyclists in the 60 years and older group. On the other hand, 26.7% of cyclists aged 60 years and older stayed in hospital between eight and 30 days compared with 4.8% of cyclists in the 6 to 12 year age group.

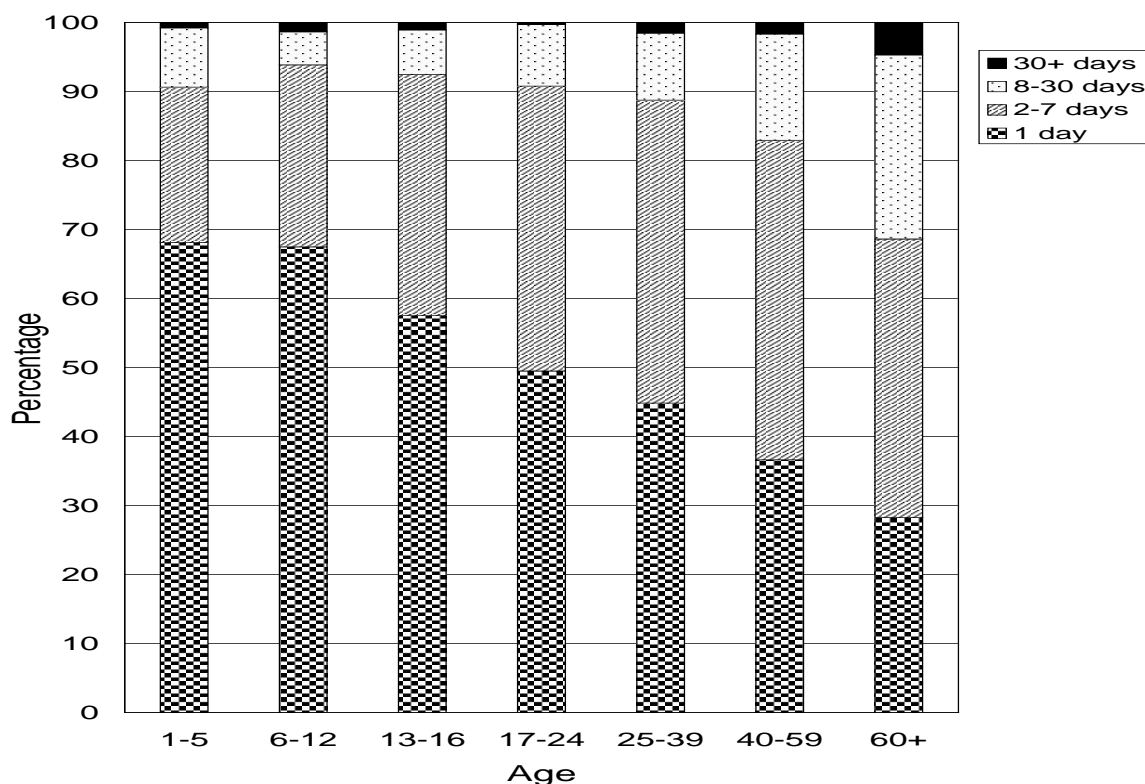


Figure 3: Percentage distribution of cyclists by age and length of stay, hospital admissions 1987-2000

Discussion

The main purpose of this study was to analyse police and hospital data relating to bicycle crashes in Western Australia over the period 1987 to 2000. Cyclists involved in crashes were generally young and male. The age distribution of hospitalised cyclists compared to those reported to police differed, with hospitalised cyclists considerably younger than those reported to police. In terms of age and gender distribution the results are generally consistent with other Australian and international studies that have investigated police and hospital data for bicycle crashes [7-9].

Over the 14 year period there were 9,897 hospital admissions for cyclists while there were 11,385 cyclists reported to police as involved in a crash, with 1,851 of these reported as hospitalised. The hospital admissions data captures a larger proportion of cyclists involved in crashes (14.0%) compared to police reports (1.0%). It is clear from these figures that bicycle crashes are under-reported to police and that it is inappropriate to use this data source as an indicator of the size of the bicycle related road safety problem.

This point of view is further enhanced with the knowledge that police reported bicycle crashes have shown a significant decrease from 1987 to 2000 whilst there has been a significant

increase in hospital admissions over the same time period. Whilst it has long been known that police reports under-estimate the true number of injured bicyclists [11,12], the magnitude of this under-reporting appears to be increasing.

One important difference between the two data sources is that the police reported crashes occurred most often on-road (93.6%) compared to the hospital admissions where 59.9% are due to crashes in off-road locations. This may in part be due to the hospital data including admissions relating to crashes that are not 'reportable' (which includes some locations that are deemed off-road). Previous research has shown that bicycle crashes are consistently under-reported even when the hospital admissions data is restricted to casualties in 'reportable' road crashes [11,12].

One limitation of this study is the lack of reliable cycling exposure data. This limitation has been highlighted recently at a national level by the ATSB (ATSB, 2004). Without this information it is not possible to determine if bicycle related deaths, hospitalisations and police reported crashes are increasing, decreasing or remaining stable in comparison to cycling activity.

Conclusions and Recommendations

This study has highlighted some important findings regarding bicycle crashes in Western Australia. The contrasting trends in the police and hospital data have given greater support for the use of hospital admissions as the primary source of serious bicycle crashes, with the exception of fatalities which are well documented in police reports. It is recommended that the reduction in the number of bicycle crashes reported in the police data should be examined, especially as hospital admissions for bicycle crashes increased over the same time period.

Along the same lines it is further recommended that in assigning priority to cyclists as a target group in road safety programs, the under-reporting of serious injuries involving cyclists to the police should be recognized. The extent of this under-reporting of serious injuries to cyclists is considerable. It is recommended that further analysis of this data in Western Australia, and other states, be conducted. This analysis should utilise the linkage of the police and hospital data sources and use a capture-recapture methodology that is potentially useful for evaluating the completeness of data sources and identifying biases within datasets. This methodology has traditionally been employed to estimate animal populations [13], and has increasingly been used in health studies to generate more accurate rates of disease and disability [13,14]. More recently a small number of studies have employed capture-recapture in the field of road injury [15].

Due to the under-reporting in police data it is recommended that other data sources such as those maintained by hospital emergency departments be explored in order to provide more information relating to the magnitude and nature of bicycle crash and injury problem in Western Australia. This recommendation may be possible due to the recent implementation of the International Classification of External Causes of Injuries (ICECI) in Perth metropolitan teaching hospital emergency departments to code injuries [16]. The use of emergency department data will assist in providing a more reliable measure of less serious cycling related injuries.

This study has draw attention to the fact that cycling safety programs, particularly ones targeting helmet wearing, should be aimed at children aged 16 or younger as this age group constitutes 67% of cyclists admitted to hospital. It has also highlighted that a large number of bicycle crashes occur in off-road locations such as private driveways, recreation areas, bike paths and other off-road locations, and not on the general road network.

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