Trends in the incidence of hospitalisation for injuries resulting from non-traffic crashes in New South Wales, July 1998 to June 2007

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ABSTRACT

Objective: To describe changes in the incidence of hospitalised injury for New South Wales residents involved in non-traffic crashes for the period 1 July 1998 to 30 June 2007.

Design, setting and participants: This study identified 37 480 NSW residents admitted to hospitals for injuries resulting from non-traffic crashes from the NSW Admitted Patients Data Collection during the study period. Injury rates were calculated by applying 2001 census-derived estimates of NSW population figures as the denominator, and directly adjusting to the age distribution of the 2001 Australian population. The significance of trends in rates was assessed by the per cent change annualised estimator.

Main outcome measures: Age-standardised rates of hospitalisation for injuries, and trends by inpatient demographics, travel mode and severity of injuries.

Results: The annual rate of hospitalisation for injury showed a significant increase of 0.7% per annum (95% CI, 0.2% to 1.2%) for NSW residents involved in non-traffic crashes over 10 years. Annual hospitalisation rates for serious injuries increased by 2.2% (95% CI, 0.9% to 3.6%). The hospitalised injury rate for motorcyclists and pedal cyclists increased significantly by 3.3% per annum (95% CI, 2.4% to 4.2%) and 3.7% (95% CI, 2.6% to 4.9%), respectively, but the rate declined significantly for car occupants and pedestrians by −8.3% per annum (95% CI, −9.5% to −7.0%) and −2.2% (95% CI, −4.2% to −0.2%) respectively.

Conclusions: The rate of hospitalisation for injury from non-traffic crashes increased significantly over time for NSW residents from 1998–99 to 2007–08, especially for serious injuries and injuries to motorcyclists and pedal cyclists. These findings call for continuing and specific effort to prevent road non-traffic injuries.

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Road crashes are one of the leading causes of injury-related deaths and hospitalisations in Australia, resulting in around 1600 deaths and 22 000 serious hospitalised injuries each year.[1]

During the financial year 2006–07, 32 777 people were admitted to hospital in Australia due to road crashes.[2] Between the 2002 and 2007 financial years, the number of fatalities due to road crashes declined by 0.9% per annum in Australia despite increases in population.[3] A variety of prevention initiatives, such as improved vehicles, enforcement of speed limits and helmet use, as well as improved trauma-care services, may have contributed to this reduction in fatalities.[1]

However, it is often not clear how many of these road crashes are traffic crashes, and how many are non-traffic crashes. According to the International Classification of Diseases, Australian modification (ICD-10-AM), traffic crashes are those involving any vehicles that occur on a public highway (all public roads, including local roads and motorways).[4]

Non-traffic crashes are those involving any vehicles that occur anywhere other than on a public highway[4] (see Box 1 for examples of location). Non-traffic crashes are an important group of road crashes that impose a heavy burden of injury. For example, non-traffic crashes result in an estimated 98 000 injuries annually in the United States.[5] In Australia, non-traffic crashes resulted in 12 837 people being hospitalised due to serious injuries during 2003–04,[6] and 13 639 people being hospitalised due to injury during 2006–07.[2] Many road safety initiatives (eg, enforcement of speed limits) may not influence non-traffic crashes directly. Despite the substantial number of patients hospitalised with serious injuries due to non-traffic crashes in Australia, no study has directly evaluated whether road safety initiatives have reduced injuries due to non-traffic crashes. This study aims to examine the trends in hospitalisation rates for injuries due to non-traffic crashes among New South Wales residents.

METHODS

Data sources

We used hospitalisation data from the NSW Admitted Patients Data Collection (APDC) from 1 July 1998 to 30 June 2008. The APDC includes information such as patient demographics, diagnoses and clinical procedures for inpatient separations from NSW public and private hospitals, private day procedures and public psychiatric hospitals.[7]

Case definition

Patients hospitalised with injuries resulting from non-traffic crashes were selected employing the following criteria: (1) NSW resident; and (2) the ICD-10-AM primary diagnosis code S00-T98 (whose definition is "injury, poisoning and certain other consequences of external causes") with an ICD-10-AM external cause code of non-traffic crash.[4]

Episodes of care relating to transfers or statistical discharges (eg, a change from acute care to rehabilitation) were excluded, in order to minimise the multiple counting that occurs when an individual has more than one episode of care for a single injury event.[8]

Mode of travel

Travel modes were categorised, based on the second digit of ICD-10-AM external causes,[4] as car, motorcycle, pedal cycle, pedestrian, off-road vehicle (including special all-terrain or other motor vehicle designed primarily for off-road use), heavy vehicle (including pick-up trucks, vans, heavy transport vehicles and buses), specialised vehicle (including construction vehicles, vehicles mainly used in agriculture and on industrial premises) and other vehicle (including street car, three-wheeled motor vehicle and unknown vehicle type).

Injury severity

Injury severity was categorised using the ICD-based injury severity score (ICISS), which is an estimate of the probability of survival of an injured person at admission, ranging from 0 (death) to 1 (complete recovery).[9,10] Patients with an ICISS score ≤ 0.941 (ie, a probability of death of at least 5.9%) were defined as having a serious injury.[11] Other patients were defined as having a non-serious injury.

Statistical analysis

Statistical analyses were performed using SAS 9.1.3 for Windows (SAS Institute Inc, Cary, NC, USA). To allow for changes in the

1 Frequencies of non-traffic crashes by place of occurrence, July 1998 to June 2007

Place of occurrence (ICD-10-AM code)	Frequency	%
Home, residential institution, school, other institution and public administrative area (Y92.0–Y92.2)	2737	7.3
Sports and athletics area (Y92.3)	2328	6.2
Street and highway (Y92.4)	6015	16.0
Trade and service (Y92.5)	346	0.9
Industrial and construction area (Y92.6)	379	1.0
Farm (Y92.7)	2894	7.7
Other specified place of occurrence (Y92.8)	4060	10.8
Unspecified place of occurrence (Y92.9)	11589	30.9
Missing/unknown	7132	19.0
Total	37 480	100.0

ICD-10-AM = International statistical classification of diseases and related health problems, 10th Revision, Australian modification. ◆

age group (0–14 years, 15–64 years, ⩾65 years) and sex structure of the population over time, age-adjusted rates of patients hospitalised with injuries were calculated using direct age-standardisation and employing the estimated Australian residential population at 30 June 2001 as the standard population.[12] Annual change in age-adjusted rates and associated 95% confidence interval were estimated using the per cent change annualised (PCA) estimator, which is robust regardless of whether or not the annual change in rate is linear.[13] A PCA estimator-associated P-value < 0.05 was considered statistically significant.[13]

RESULTS

Box 1 shows there were a total of 37 480 people hospitalised for injuries due to non-traffic crashes between July 1998 and June 2007. Most of those casualties injured in non-traffic crashes were males (81.0%), and aged between 15 and 64 years (64.9%). Among these, about 40.0% were motorcyclists, 26.9% were pedal cyclists, 15.0% were car occupants, 6.1% were pedestrians, 4.1% were occupants in heavy vehicles, 3.4% were occupants in off-road vehicles, 2.9% were occupants in specialised vehicles and 1.7% were occupants of other vehicles. About 14.9% of those injured had serious injuries. Box 1 gives an indication of the place of occurrence, although this data field was often coded as "missing" or "unspecified".

Box 2 shows that the overall rate of hospitalisation of people injured in non-traffic crashes increased significantly by 0.7% per annum (95% CI, 0.2% to 1.2%) over the 10-year period. The rate among males increased significantly by 1.3% per annum (95% CI, 0.7% to 1.9%), but among females, it decreased significantly by −1.5% per annum (95% CI, −2.7% to −0.4%). The rate of hospitalisation for injuries sustained in non-traffic crashes shows an upward trend over time in each of the three age groups, but only significantly for adults (aged between 15 and 64 years) by 0.8% per annum (95% CI, 0.1% to 1.4%).

The annual rate of hospitalisation for injuries sustained in non-traffic crashes (Box 2) increased significantly for motorcyclists by 3.3% (95% CI, 2.4% to 4.2%) and pedal cyclists by 3.7% (95% CI, 2.6% to 4.9%), but decreased significantly for car occupants by −8.3% (95% CI, −9.5 to −7.0), pedestrians by −2.2% (95% CI, −4.2% to −0.2%), specialised vehicle occupants by −3.7% (95% CI, −6.6% to −0.8%), and other vehicle occupants by −8.4% (95% CI, −12.2% to −4.6%).

Box 2 shows the trend in the rate of hospitalisation for serious injuries sustained in non-traffic crashes (ICISS ⩽0.941), which increased significantly by 2.2% per annum (95% CI, 0.9% to 3.6%).

DISCUSSION

Non-traffic crashes are crashes involving any vehicles that occur anywhere other than on a public highway. This study showed a significant overall increase in the rate of hospitalisation for injuries resulting from non-traffic crashes among NSW residents over the 10-year period July 1998 to June 2007. Although mortality appears to be low for non-traffic injuries (with the highest being 0.5 per 100 000 motorcyclists),[14] there are substantial and increasing rates of injuries for non-traffic crashes. Moreover, while those with non-serious injuries (ICISS >0.941) comprised the largest group of people hospitalised as a result of non-traffic crashes, and demonstrated a constant annual rate, the rate for serious injuries (ICIS ⩽0.941) increased significantly over the 10 years. These findings suggest that the road safety initiatives which have contributed to a significant reduction in overall road-related injuries in NSW from 1989–90 to 2003–04[15] are less effective in preventing non-traffic injuries, especially for users of motorcycles, pedal cycles and off-road vehicles.

To minimise multiple counting when an individual has more than one episode of care for an injury event, we excluded episodes of care relating to transfers or statistical discharges. This variable has been shown to produce results most comparable to the "gold standard" provided by an internally linked inpatient statistics collection.[8] Thus, although the rates for people hospitalised as a result of injury reported here may include some multiple counting, overestimation of the injury burden due to non-traffic crashes is likely to be slight.

Our use of hospital separation data limits our ability to investigate the underlying causes for the observed trends. For example, changes in admission practice may result in observed hospitalisation rate changes, although observed rates for serious injuries are likely to be robust against this possibility, because of the high probability of admission for such injuries. The hospital data include extensive detail of injury diagnoses but lack details of pre-crash and during-crash factors, such as information about the use of protective equipment and exposure details (eg, how often a motorcyclist rides off-road). Thus, control for exposure could only be conducted in terms of population, and it is possible that the significantly increasing rate of hospitalisation for injury from non-traffic crashes reflects increasing popularity of these vehicles as a mode of travel or recreation off public roads. In the US, all-terrain vehicle-related injuries and mortality have increased in recent years with the increasing popularity of these vehicles.[16]

This study highlights a need to investigate the factors which contribute to non-traffic crashes, so that we can identify possible counter measures. Although non-traffic crashes can be expected to benefit from some initiatives that reduce traffic crashes (eg, improvements to vehicles and protective equipment), not much can be

2 Age-standardised hospitalisation rates/100 000 person-years, for patients injured in non-traffic accidents 1998–2007,* resident in New South Wales, and trends in rates by age, vehicle type and injury type

	n	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	% change in rate (95% CI)	*P*
All	37 480	53.7	55.1	60.3	56.2	53.0	55.6	59.3	58.5	58.4	57.1	0.7 (0.2, 1.2)	< 0.001
Sex†													
Male	30 351	83.4	88.0	97.9	91.6	86.7	89.9	94.6	95.0	94.6	93.3	1.3 (0.7, 1.9)	< 0.001
Female	7 128	23.3	21.5	22.2	20.1	18.8	20.5	23.1	21.5	21.2	20.3	−1.5 (−2.7, −0.4)	0.003
Age group (years)													
Young (0–14)	10 466	13.9	16.7	16.6	16.1	16.1	16.2	17.6	16.8	17.0	14.8	0.8 (−0.3, −1.8)	0.159
Adult (15–64)	24 324	36.0	34.8	39.9	36.6	33.4	35.8	37.7	37.8	37.6	38.4	0.8 (0.1, 1.4)	0.020
Old (≥ 65)	2 688	3.8	3.6	3.8	3.5	3.5	3.6	4.0	3.9	3.8	3.9	0.4 (−1.5, 2.4)	0.712
Travel mode													
Car	5 614	13.1	10.1	10.0	8.6	6.8	7.9	7.6	7.6	6.3	6.0	−8.3 (−9.5, −7.0)	< 0.001
Motorcycle	15 004	18.5	19.8	24.6	22.5	21.6	22.9	24.5	23.9	25.2	24.8	3.3 (2.4, 4.2)	< 0.001
Pedal cycle	10 100	11.3	15.0	14.9	14.9	15.3	14.9	16.9	17.5	17.9	15.7	3.7 (2.6, 4.9)	< 0.001
Pedestrian	2 277	4.0	3.5	3.8	3.5	3.3	3.1	3.9	2.8	2.7	3.3	−2.2 (−4.2, −0.2)	0.031
Off-road vehicle	1 253	1.0	1.4	1.3	2.1	1.9	2.0	2.0	2.0	2.1	3.0	13.1 (9.6, 16.9)	< 0.001
Heavy vehicle	1 524	2.3	2.0	2.4	2.2	2.2	2.2	2.4	2.0	2.4	2.3	−0.4 (−2.9, 2.2)	0.833
Specialised vehicle	1 088	2.0	2.1	1.9	1.4	1.3	2.0	1.4	1.5	1.2	1.4	−3.7 (−6.6, −0.8)	0.013
Other vehicle	620	1.4	1.1	1.3	1.1	0.7	0.6	0.6	1.1	0.5	0.7	−8.4 (−12.2, −4.6)	< 0.001
Severity													
Non-serious	31 909	46.0	46.7	51.5	48.1	45.9	48.6	50.5	49.2	49.9	47.8	0.4 (−0.1, 1.0)	0.134
Serious	5 571	7.7	8.4	8.8	8.1	7.1	7.0	8.8	9.3	8.4	9.4	2.2 (0.9, 3.6)	0.001

* Financial years. † Numbers do not total 37 480 due to missing values. ◆

done by way of investment in roads, or behaviour modification through enforcement. Nonetheless, improved off-road infrastructure and alternative behaviour modification techniques could be considered. One of the key challenges in this area will be to determine institutional responsibility for non-traffic crashes and the increasing burden of injury that they represent.

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COMPETING INTERESTS

None identified.

AUTHOR DETAILS

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