Assault-related admissions to hospital in Central Australia

Ged F Williams, Wendy P Chaboyer and Philip J Schluter

ABSTRACT

Objective: To determine the number of assault-related admissions to hospital in the Central Australia region of the Northern Territory over a six-year period.

Design and setting: Retrospective analysis of all patients admitted to Alice Springs Hospital (ASH) and Tennant Creek Hospital (TCH) from July 1995 to June 2001, where the primary cause of injury was "assault".

Main outcome measures: Frequency of assault-related admission to hospital; demographic characteristics of the victims.

Results: In the six years, there were 2449 assault-related admissions to ASH and 545 to TCH. Adults aged 25–34 years were most frequently hospitalised for assault, in a proportion greater than their proportion in the NT population. Females represented 59.7% of people admitted to ASH and 54.7% to TCH, greater than their proportion in the NT population. Aboriginals comprised 95.2% of ASH and 89.0% of TCH admissions, and were admitted in a significantly greater proportion than their proportion in the NT population ($P < 0.001$). The age-adjusted hospital admission rate resulting from assault has increased ($P = 0.002$) at an average rate of 1.6 (SE, 0.2) per 10 000 people per year. The proportion of assault-related admissions associated with alcohol has also increased significantly ($P < 0.001$).

Conclusion: The frequency of assault-related admissions to hospital, especially among the Aboriginal population, suggests that this major public health issue is escalating.

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A PERCEIVED INCREASE in serious assault and violence in Australia has received periodic intense media and public scrutiny. The focus is often on marginalised or minority groups, including Aboriginal people.[1-3] The personal, social and community effects of serious assault are well described and may be associated with substance misuse, poverty and cultural fragmentation.[4,5]

National surveys of assault in Australia demonstrate a range of demographic and social differences. Of the 618 300 people over the age of 15 assaulted in a 12-month period before 1998, 54% were male.[6] The Australian Capital Territory (6.9%) and the Northern Territory (6.3%) had the greatest proportions of their population assaulted, whereas the national rate was 4.3%.[6] Force or violence was associated with assaults in 245 000 (39.7%) cases, and 13 300 (2.2%) assaulted people were admitted to hospital.[6]

Data relating to the Indigenous population are generally of poorer quality and most reports are anecdotal.[7] In one study, the Indigenous age-adjusted rate of hospitalisation per 100 000 was 17 times the national rate.[8] Hospitalisation resulting from interpersonal violence was generally similar for male and female Aboriginals, but the rate of hospitalisation both for unarmed fights or brawls and for attack by cutting or piercing instruments was higher for men aged 15–49 years than for women of the same age.[8]

The purpose of our study was to describe the number of admissions to hospital that were directly related to assault (using a six-year retrospective analysis of computerised hospital data) and to examine factors associated with these admissions.

METHODS

Our data are from Alice Springs Hospital (ASH) and Tennant Creek Hospital (TCH), the only two hospitals in the Central Australia region of the NT. ASH is a 160-bed, general regional hospital, providing emergency, intensive care, and most other acute services. TCH is a 20-bed community hospital, 500 km north of Alice Springs. The catchment area for these hospitals is more than 1 million km^2 and has a residential population of 47 000, of whom about 40% are Aboriginal.[9]

Electronic records of all admissions to ASH and TCH between 1 July 1995 and 30 June 2001 were examined, and admission with the primary cause of injury as "assault" were extracted. Demographic data were collected using the Business Objects program, a hospital-based software system. Additional information from the electronic records identified alcohol use, repeated admissions and, for ASH, the cause of the assault. Data were de-identified and grouped to preserve the anonymity of subjects and communities, as required by the Institutional Ethics Committee, and Aboriginal subcommittee, who approved our study.

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In July 1998, the NT moved from ICD-9-CM to ICD-10-AM coding. The codes used for the two time periods are displayed in Box 1. Data entered into the ICD system are dependent on hospital coders examining individual patient records. The coders identify medical staff entries that refer to specific events (eg, alcohol present on admission, or blunt trauma). This information is translated into ICD codes and entered into an electronic database. At ASH, the same two hospital coders were responsible for all patient data entries for the six years of the study. These coders also monitored TCH data entry.

When patients were admitted to TCH and then transferred to ASH for a single assault-related admission, the episode was counted only once, and for TCH.

1: Coding classification of assault-related hospital admissions

	July 1995 to June 1998 (ICD-9-CM codes)	July 1998 to June 2001 (ICD-10-AM codes)
Assault		
Blunt object	E968.2	Y00
Sharp object	E966.	X99
Fire	E968.	X97
Force (excluding rape)	E960.	Y04
Rape	E960.1	Y05
Alcohol use		
Alcohol use disorder	305.00–305.02	F10.1
Acute drunkenness and alcoholism	303.00–303.02	F10.0†
Alcohol dependence	303.90–303.92	F10.2
Alcohol withdrawal	291.0-291.9	F10.3–F10.4

†Acute intoxication only.

2: Demographic characteristics of people admitted to Alice Springs Hospital (ASH) and Tennant Creek Hospital (TCH) for assault, July 1995 to June 2001

	ASH (*n*=2449)	TCH (*n*=545)	*P**	Total (*n*=2994)	ABS† (*n*=197590)	*P**
Age (years)						
⩽14	42 (1.7%)	24 (4.4%)		66 (2.2%)	51 103 (25.9%)	
15–24	372 (15.2%)	69 (12.7%)		441 (14.7%)	31 126 (15.7%)	
25–34	916 (37.4%)	227 (41.7%)	<0.001	1 143 (38.2%)	38 257 (19.4%)	<0.001
34–44	728 (29.7%)	152 (27.9%)		880 (29.4%)	32 472 (16.4%)	
⩾45	391 (16.0%)	73 (13.4%)		464 (15.5%)	44 632 (22.6%)	
Sex						
Male	986 (40.3%)	247 (45.3%)	0.03	1 233 (41.2%)	104 326 (52.8%)	<0.001
Female	1 463 (59.7%)	298 (54.7%)		1 761 (58.8%)	93 264 (47.2%)	
Ethnicity‡						
Aboriginal	2 210 (95.2%)	485 (89.0%)	<0.001	2 695 (94.0%)	56 364 (28.5%)	<0.001
Non-Aboriginal	112 (4.8%)	60 (11.0%)		172 (6.0%)	141 226 (71.5%)	

**P* value for test of association in distributions between ASH and TCH, and between total and ABS, respectively. †ABS: Data from Australian Bureau of Statistics for Northern Territory population in 2001. ‡Ethnicity was unknown for 127 individuals at ASH.

Statistical analysis

Frequencies (percentages) were used to report categorical variables, and associations between groups were assessed using Pearson's χ^2 test and Cochran–Armitage's trend test. Estimated resident population by age, sex and Indigenous status[9] was used to calculate admission rates. Age-adjusted rates were calculated using Australian Bureau of Statistics (ABS) census figures for the NT population in 2001 as the standard.[9] Assuming admission rates follow a Poisson distribution, 95% confidence intervals were calculated using computer simulation of size $n = 10\,000$. Linear regression was used to evaluate trends in the rates over time, and annual change estimates and standard errors are given. A significance level of $\alpha = 0.05$ was used for all comparisons.

RESULTS

There were 2994 assault-related admissions between July 1995 and June 2001: 2449 (81.8%) at ASH and 545 (18.2%) at TCH (Box 2). People aged 25–34 years, women, and Aboriginals accounted for significantly greater proportions of assault-related admissions than expected from their proportions in the NT population in 2001 (Box 2).

Box 3 displays crude assault-related admission rates per 10 000 people at ASH and TCH combined. While the non-Aboriginal rate was constant over the study period (test for non-zero linear slope, $P = 0.96$), the Aboriginal rate was much higher and significantly increased at an average rate of 2.4 (SE, 0.5) per 10 000 people per year ($P = 0.006$). The relative ratio for Aboriginal/non-Aboriginal crude rates was 31.6 in 1995–96, increasing to 43.8 in 2000–01.

The total number of admissions due to all causes (excluding day-only cases) at the two hospitals during the study period was only accessible from July 1997. The overall proportion of hospital admissions resulting from assault significantly increased from 4.2% in 1997–98 to 4.8% in 2000–01 ($P = 0.02$). This increase in proportions was evident in ASH admissions, increasing from 3.8% to 4.7% ($P = 0.003$), but not in TCH admissions, decreasing from 6.9% to 5.0% ($P = 0.05$).

Box 4 provides age-adjusted assault-related admission rates per 10 000 for the two hospitals combined over the study period. Each of these rates had a significant linear increase over time: females, 2.4 (SE, 0.3) per 10 000 people per year ($P = 0.001$); males, 0.9

(SE, 0.3) per 10 000 people per year ($P = 0.05$); and overall, 1.6 (SE, 0.2) per 10 000 people per year ($P = 0.002$).

The proportion of assault-related admissions involving alcohol increased from 29.9% in 1995–96 to 43.0% in 2000–01 ($P < 0.001$); however, the rates have remained steady since 1997–98 ($P = 0.92$) (Box 5).

The primary causes of assault-related admissions by year for ASH (TCH information was not accessible) appear in Box 6. Prior to 1999–00, blunt trauma was the most frequent cause of these admissions, although significantly decreasing over the study period ($P < 0.001$). A trend of increasing use of sharp objects was evident ($P < 0.001$), with physical force ($P = 0.25$), other ($P = 0.31$), and not recorded ($P = 0.14$) remaining stable. Fire was involved in 29 (1.2%) ASH assault-related admissions and rape in 19 (0.8%). Primary cause data were missing in less than 10% of observations.

DISCUSSION

We found that assault-related admissions to the only two hospitals in Central Australia significantly increased over the six years to 2001.

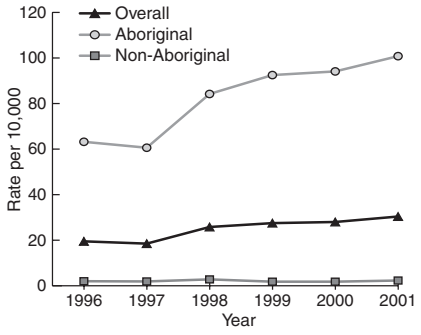
Adults aged between 25 and 44 years were most likely to be admitted to hospital for assault-related causes. A study in Victoria in 1997 found that 40% of people presenting to emergency departments because of assault were aged 25–44 years,[10] somewhat lower than the 68% in our study.

Women were admitted for assault-related injuries more frequently than expected from their population frequency, a finding contrary to previous reports.[4,6,8,10] In provincial Victoria, males were more likely to present to the emergency department because of assault.[10] In the NT, males comprised 53% of the population from 1979 to 1995, but made up 77% of the violence-related deaths, while a third of all injury-related deaths among Aboriginal women in the NT are due to homicide.[11] There are several possible reasons why women appeared to be more at risk of assault in our study than in previous ones. The Central Australian population, with 40% Aboriginals, is likely to be quite different to populations in other studies. Alcohol consumption is high in this population, and this might have an influence.[12,13] Finally, our data do not include individuals who were assaulted but not admitted to hospital, or those who died before hospitalisation.

It is striking that the proportion of hospital admissions due to assault fell at TCH while it rose at ASH. This warrants further consideration.

Aboriginals greatly outnumbered non-Aboriginals, comprising more than 90% of the admissions, significantly higher than the 40% they represent in the Central Australian population. Although the assault-related admissions

3: Crude assault-related admission rates at Alice Springs Hospital and Tennant Creek Hospital, July 1995 to June 2001



4: Age-adjusted annual assault-related admission rates per 10 000 people to Alice Springs Hospital and Tennant Creek Hospital, July 1995 to June 2001, standardised to the Northern Territory 2001 population

	Female		Male		Total	
Year	Rate	(95% CI)*	Rate	(95% CI)*	Rate	(95% CI)*
1995–96	26.5	(23.1–29.9)	19.2	(16.4–22.0)	22.7	(20.6–24.9)
1996–97	27.2	(23.8–30.7)	17.6	(15.0–20.2)	22.2	(20.1–24.3)
1997–98	31.9	(28.2–35.7)	20.7	(18.0–23.7)	26.0	(23.7–28.3)
1998–99	34.8	(31.0–38.6)	20.7	(18.0–23.7)	27.4	(25.1–29.7)
1999–00	36.5	(32.7–40.5)	20.3	(17.6–23.0)	27.9	(25.6–30.3)
2000–01	37.4	(33.5–41.3)	24.1	(21.3–27.1)	30.4	(28.1–32.8)

*95% confidence intervals were calculated using computer simulation of size N=10 000, assuming the rate of admissions follows a Poisson distribution.

5: Alcohol-associated assault admissions (*n*) as a proportion of the total assault admissions (*N*) for Alice Springs Hospital and Tennant Creek Hospital between July 1995 and June 2001

	Alice Springs Hospital				Tennant Creek Hospital					
	Female		Male		Female		Male		Overall	
Year	n/N	(%)	n/N	(%)	n/N	(%)	n/N	(%)	n/N	(%)
1995–96	47/179	(26.3%)	57/131	(43.5%)	11/47	(23.4%)	6/48	(12.5%)	121/405	(29.9%)
1996–97	50/183	(27.3%)	44/127	(34.6%)	18/60	(30.0%)	17/46	(37.0%)	129/416	(31.0%)
1997–98	98/229	(42.8%)	80/160	(50.0%)	13/58	(22.4%)	24/48	(50.0%)	215/494	(43.5%)
1998–99	106/271	(39.1%)	82/171	(48.0%)	20/48	(41.7%)	19/41	(46.3%)	227/531	(42.7%)
1999–00	99/280	(35.4%)	97/180	(53.9%)	28/57	(49.1%)	18/30	(60.0%)	242/547	(44.2%)
2000–01	136/321	(42.4%)	95/217	(43.8%)	12/28	(42.9%)	15/34	(44.1%)	258/600	(43.0%)
Total	536/1463	(36.6%)	455/986	(46.1%)	102/298	(34.2%)	99/247	(40.1%)	1192/2994	(39.8%)

6: Primary cause of assault related admissions to Alice Springs Hospital

Year	Total admissions	Blunt		Sharp		Physical force		Other*		Not recorded	
		n	(%)	*n*	(%)	*n*	(%)	*n*	(%)	*n*	(%)
1995–96	310	123	(39.7%)	90	(29.0%)	61	(19.7%)	9	(2.9%)	27	(8.7%)
1996–97	310	140	(45.2%)	82	(26.5%)	71	(22.9%)	4	(1.3%)	13	(4.2%)
1997–98	389	162	(41.6%)	116	(29.8%)	71	(18.3%)	6	(1.5%)	34	(8.7%)
1998–99	442	187	(42.3%)	113	(25.6%)	91	(20.6%)	14	(3.2%)	37	(8.4%)
1999–00	460	160	(34.8%)	164	(35.7%)	109	(23.7%)	11	(2.4%)	16	(3.5%)
2000–01	538	170	(31.6%)	209	(38.8%)	120	(22.3%)	5	(0.9%)	34	(6.3%)
Total	2449	942	(38.5%)	774	(31.6%)	523	(21.4%)	49	(2.0%)	161	(6.6%)

* Includes fire and rape.

per 10 000 people is only an estimate and is based on the predicted population at one point in time, it does support the proposition that Aboriginals make up a disproportionate number of hospital admissions for assault. Our study shows that serious assault resulting in admission to hospital is of real concern in the Aboriginal population, especially among women.

The association between alcohol use and violence is well known.[14,15] Importantly, our data demonstrate a significant increase over time in the proportion of assault admissions associated with alcohol. Alcohol is the overriding substance-misuse issue of concern for people in Central Australia. Consensus as to how to address this problem has been difficult to achieve, and the problem continues to escalate.[13] Many resources have been developed to assist healthcare workers, communities and individuals with alcohol and violence problems in the NT.[16-19] That the rate of alcohol-related assault admissions has stopped increasing since 1997–98 may reflect positive effects of these health interventions. However, this pattern could also be explained, in part, by the adoption of ICD-10-AM codes for alcohol use in July 1998. The reasons for the levelling since 1997–98 need to be clarified.

Most assaults involved blunt objects; however, a substantial rise in the use of sharp objects is evident since 1999–00.

Our study uses "admissions to hospital" data. These data are useful because:

- hospital admission data generally exclude more trivial assaults and injuries and are determined clinically by a qualified healthcare professional;
- presentations to the emergency department can be skewed by the availability of general practice services and other primary healthcare services, which can vary significantly over time;
- alternatives such as self-report surveys contain inherent biases and are not suited to a large proportion of the Central Australian community, who are itinerant, poorly literate and "non-compliant" with such approaches.

Limitations of secondary data are well known and apply to our data[20] — charting and coding may contain inaccuracies, be incomplete and be subject to coding bias,[21-23] although false-positive comorbidities in the Australian population have been shown to be low.[24]

Despite these limitations, the data reveal major potential problems, suggesting the need for more rigorous, prospective investigation. The trend of increasing assault-related admissions is likely to continue if new measures are not implemented to curtail it. Clearly, assault-related admissions to hospital in the proportions described here suggest a significant public health problem that requires attention.

COMPETING INTERESTS

None identified.

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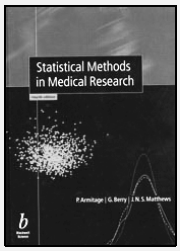
book reviews

Must-have statistics



Statistical methods in medical research. 4th edition. P Armitage, G Berry, J N S Mathews. Oxford: Blackwell Science, 2002 (xi + 817 pp, $193.60). ISBN 0 632 05257 0.

THE CHANCE OF REVIEWING the new edition of this classic text came just at the right time, as my first edition copy had finally started to disintegrate. My introduction to medical statistics, or indeed any statistics apart from a brief encounter with experimental error assessment, came with the opportunity to sit in on Peter Armitage's lectures at the London School of Hygiene and Tropical Medicine in 1971. These lectures formed the basis of his book, and since then each edition has improved and expanded considerably on the last, keeping pace with the ever-changing field of medical statistics and adding new co-authors on the way.

The book has been reorganised since the last edition, including, among other changes, new sections on permutation and Monte Carlo methods, non-linear regression and multilevel modelling, and also expanding the sections on Bayesian methods and clinical trials.

This book is about methods and their application and is aimed at the practitioner, but it is also suitable for anyone with an interest in statistics. It could be read as a unified text and could form the basis of a practice-oriented course, but it is most likely to be dipped into as required. The subject index appears extensive and exhaustive. There is also an excellent author index which helps to track down the context of any of the wide-ranging set of references. The authors do not present any mathematical theory; rather, they concentrate on commonsense explanation and justification for the techniques and methods that they describe, and these are accompanied by plenty of worked examples. They also direct readers to appropriate statistical software.

This book belongs on the shelf of anyone who uses or needs to understand anything about medical statistics, and will be constantly on loan from library shelves.

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Travel medicine — up to speed

International travel and health. Geneva: World Health Organisation, 2002 (viii + 193 pp, $43). ISBN 92 4 158027 5.

THE WORLD HEALTH ORGANIZATION has a measure of credibility when it comes to producing a book called *International travel and health*. Although this book is updated annually, in some years the most significant difference has seemed to be the change of colour to the stripe on the cover. The 2002 edition, though, is different!

The book has almost doubled in size, the cover has changed from the traditional yellow to a modern teal and, most significantly, there has been a change in the content. The claim on the cover of "abundant new material" is true. The list of acknowledgements reads like a "who's who" of travel medicine and their input has made the book up to date and value for money.

A diverse range of travel medicine topics are dealt with, from the traditional to the more unusual. Vaccinations, malaria, medical kits, altitude, deep vein thrombosis, jetlag, flight phobia, stings, worms, drownings, traffic accidents, muggings, travelling when pregnant, or with pre-existing medical conditions, and even risks from aircraft disinfection, ozone and cosmic radiation, are all dealt with. There is a particularly useful reference section summarising aspects of the infectious diseases that pose risks to travellers.

The book is organised logically with an extensive table of contents, index, excellent headings, and plenty of tables. The 12 maps in the centre give an excellent overview of the extent of various diseases in 2001 (eg, Japanese encephalitis, dengue, yellow fever, malaria, hepatitis A, B and C, rabies. The popular "Country List" remains — it outlines the current vaccination requirements and malaria situation for each country. This has limited value given the static nature of the publication, but takes up only 26 pages in a publication of 180 pages, so it does not detract too much from its general usefulness.

This 2002 edition is a great leap forward!

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