Hospitalized head injuries among older people in Australia, 1998/1999 to 2004/2005

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ORIGINAL ARTICLE

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Objective: To explore rates of hospitalized head injury among older Australians by a range of risk indicators.
Design: Head injury data for 60+-year-olds were obtained from the Australian Institute of Health and Welfare Hospital Morbidity Database from 1998/1999 to 2004/2005. Poisson regression modeling was used to examine head injury rates in relation to age, sex, Indigenous status, location, and injury type.
Results: Rates of hospitalized head injury among the older population increased 1.4-fold between 1998/1999 (582.8 per 100 000) and 2004/2005 (844.3 per 100 000) ($p<0.001$). Those aged 85+ years had 10.8 times the rate of their 60–64-year-old counterparts (95% CI 10.6 to 11.0) after adjustment for other covariates. Men had 1.1 times the rate of women (95% CI 1.1 to 1.2), and those living in rural/remote areas had 3.1 times the rate of their metropolitan-dwelling counterparts (95% CI 3.0 to 3.1). Those identifying themselves as Indigenous had 1.7 times the rate of non-Indigenous persons (95% CI 1.6 to 1.8). The most prevalent injuries were open wounds of the head (38.0%), followed by superficial injuries (24.7%) and intracranial trauma (18.3%). Falls accounted for 81.4% of all head injury admissions.
Conclusions: The oldest old were disproportionately represented among those sustaining hospitalized head injuries, along with men, those living in rural/remote areas, and Indigenous persons. Given the increasing proportion of older people in Western societies and the costs of treating hospitalized head injuries, the ability to reduce risk of such trauma in this age group is of critical public health importance.

People are living for longer in most Western societies.[1] They are healthier and have more active lifestyles.[2] As a consequence, they are increasingly exposed to risk of injury,[3] including injury to the head region.[4] The literature indicates that the prevalence of head injury among older populations in developed countries has increased over the last 30 years.[4 5] Given that the proportion of Australians aged 65+ years is projected to rise from 13% in 2002 to 27–30% in 2051,[6] head injuries in this age group are also likely to increase both in terms of case numbers and proportion of total injury.

Head injury poses a substantial threat to the health of older Australians, being the fifth leading cause of hospitalization for those aged 65+ years[7] and contributing to the global burden of death and disability across older age groups in general.[8] Estimating the magnitude of this problem is critical so that the relative burden of hospitalized head injuries compared with other preventable health problems in the older population can be assessed, and the appropriate level of national investment for specific head injury prevention activities among older people determined.[9] Risk factors for hospitalized head injury are generally more amenable to modification than those for disease, making prevention of hospitalized head injury among the older population a cost-effective public health strategy.

The aims of this study were: (1) to explore rates of hospitalized head injury among 60+-year-olds by age, sex, location, and Indigenous status at a national level in Australia in the last 7 years; (2) to examine differences by type of hospitalized head injury sustained in the same period; (3) to ascertain the primary causes of hospitalized head injury among the older population. The hypotheses in this simple descriptive study, based on the literature, were that: (1) rates of hospitalized head injury among the older population would be increasing at a annual rate of 5%;[4 5] (2) rates of hospitalized head injury would be 10% higher among the older old,[10] men,[9] those living in rural/remote locations,[11 12] and those identifying themselves as Indigenous[13]; (3) over 50% of diagnoses of hospitalized head injury would be open wounds to the head and superficial trauma[7 14]; (4) falls would be the external cause for two thirds of the hospitalized head injuries sustained.[15 16]

METHODS

Data on head injuries experienced by persons aged 60+ years who were admitted to public and private hospitals across all Australian states and territories were accessed from the Australian Institute of Health and Welfare National Hospital Morbidity Database from 1 July 1998 to 30 June 2005. Data were recorded in standardized ICD-10-AM (International Statistical Classification of Diseases and Related Health Problems, 10th Revision, Australian Modification) codes, which are patient record codes used throughout Australian hospitals. Because all data were de-identified and collected primarily for administrative purposes, the Human Research Ethics Committee of the University of Adelaide did not consider ethical approval to be necessary for the secondary analysis of such data.

The ICD-10-AM diagnosis codes pertaining to "injury to the head" were included. These are divided into 10 categories and include any injuries of the ear, eye, face, gum, jaw, oral cavity, palate, periocular area, scalp, temporomandibular joint area, tongue, and tooth. Records were selected according to whether the principal or additional diagnoses contained an ICD code of S00–S09 (table 1). It was possible for one head injury admission to have received more than one "injury to the head" diagnosis code—for example, a primary diagnosis code of S06.0 (concussion) might have been assigned an additional diagnosis code of S00.0 (superficial injury of scalp). The circumstances of injury events were coded according to the ICD Supplementary Classification of External Cause of Injury and Poisoning, referred to as E codes.

Demographic information was collected and included patients' age, sex, residential location, and Indigenous status. Residential location was measured using the Rural, Remote and

Table 1 Number of hospitalized head injuries among older Australians by diagnosis (ICD diagnosis code), 1998/1999 to 2004/2005

Code	Description	No of head injuries
S00	Superficial injury of head	49639 (24.7)
S01	Open wound of head	76336 (38.0)
S02	Fracture of skull and facial bones	17991 (9.0)
S03	Dislocation, sprain, and strain of joints and ligaments of the head	449 (0.2)
S04	Injury of cranial nerves	309 (0.2)
S05	Injury of eye and orbit	7361 (3.7)
S06	Intracranial injury	36776 (18.3)
S07	Crushing injury of head	16 (0.0)
S08	Traumatic amputation of part of head	134 (0.1)
S09	Other and unspecified injuries of head	11742 (5.8)
Total		200753 (100.0)

Values in parentheses are percentages.

Metropolitan Areas classification, which is an index based on Statistical Local Areas that allocates each of the latter in Australia to a category based on population numbers and an index of remoteness. ''Metropolitan'' is defined as any capital city or other metropolitan area with a population of >100 000, ''rural'' zones are those with a population ranging from 10 000 to 99 000, and ''remote'' areas those with a population of <10 000. For the purposes of this study, rural and remote zones were combined. ''Indigenous status'' was defined as a person who identified themselves as Aboriginal, Torres Strait Islander, or both. Separations with Indigenous status ''not stated'' were excluded from the analyses.

Estimated resident population (ERP) counts of all demographic stratifications (sex, age, Indigenous status, location) for the years 1998/1999 to 2004/2005 were provided by the Australian Bureau of Statistics. The ERP in Australia uses the census usual residence count as a basis, then makes certain assumptions on how the population is growing, and is likely to grow, since it was last officially estimated. To calculate the ERP, census counts are adjusted to exclude overseas visitors, include residents temporarily abroad, and to account for under-enumeration of the population in the last census. The ERP is calculated four times a year to provide official, up-to-date estimates of the population. It is thus the most reliable denominator for the purposes of our study.

Rates of hospitalized head injury incident (number of head injuries for a specified strata/diagnosis divided by the ERP of the same specified strata, multiplied by 100 000) and incident rate ratios were computed along with 95% CI using a generalized Poisson regression model.[17] Results from the Poisson regression models are presented as non-adjusted and adjusted incident rate ratios to estimate the independent effect of each covariate on the rate of hospitalized head injury. Confidence limit ratios are also presented.[18] Data were analysed using Intercooled Stata 8.0 (Stata Corp, College Station Texas, USA) .

RESULTS

There were a total of 164 233 hospital admissions for head injury, and 200 753 ''injury to the head'' diagnoses, for those aged 60+ years between 1998/1999 and 2004/2005 at a national level in Australia. Rates of hospitalized head injury increased from 582.8 per 100 000 in 1998/1999 to 844.3 per 100 000 in 2004/2005, a 1.4-fold increase ($p<0.001$). The most prevalent diagnoses were open wounds of the head (38.0%), followed by superficial injuries to the head (24.7%) and intracranial injury (18.3%) (table 1). Some 133 735 (81.4%) hospitalized admissions were due to falls.

The overall rate of hospitalized head injury was 719.0 per 100 000 (table 2). After adjustment for other covariates, people aged 85+ years had 10.8 times the rate of hospitalized head injury of those aged 60–64 years. Men had slightly higher rates than women, those living in rural/remote locations had 3.1 times the rate of their metropolitan-dwelling counterparts, and

Table 2 Rates of hospitalized head injury, unadjusted incidence rate ratios, and generalized adjusted incident rate ratios among older Australians; 1998/1999 to 2004/2005

Variable	No of head injury separations	Estimated resident population	Rate per 100000 (95% CI*)	Unadjusted rate ratio (95% CI*; CLR)	Adjusted rate ratio† (95% CI; CLR)
Total	164233	22839749	719.1 (719.0 to 719.2)		
Year					
1998/1999 (ref)	17693	3035689	582.8 (582.0 to 583.7)		
1999/2000	19848	3104659	639.3 (638.5 to 640.1)	1.10 (1.08 to 1.12; 1.04)	1.09 (1.07 to 1.11; 1.04)
2000/2001	21527	3176970	677.6 (676.8 to 678.3)	1.17 (1.14 to 1.19; 1.04)	1.14 (1.12 to 1.17; 1.04)
2001/2002	23515	3257558	721.9 (721.2 to 722.6)	1.24 (1.22 to 1.27; 1.04)	1.20 (1.18 to 1.23; 1.04)
2002/2003	25053	3338257	750.5 (749.8 to 751.2)	1.29 (1.27 to 1.32; 1.04)	1.24 (1.22 to 1.26; 1.03)
2003/2004	26964	3416823	789.2 (788.5 to 789.8)	1.36 (1.33 to 1.38; 1.04)	1.29 (1.27 to 1.32; 1.04)
2004/2005	29633	3509793	844.3 (843.7 to 844.9)	1.45 (1.42 to 1.48; 1.04)	1.38 (1.35 to 1.40; 1.04)
Age group					
60–64 years (ref)	15478	5755924	268.9 (268.2 to 269.6)		
65–69 years	15727	4891829	321.5 (320.8 to 322.2)	1.24 (1.21 to 1.26; 1.04)	1.24 (1.21 to 1.27; 1.05)
70–74 years	20789	4416936	470.7 (470.0 to 471.3)	1.75 (1.71 to 1.79; 1.05)	1.82 (1.78 to 1.86; 1.04)
75–79 years	29316	3606342	812.9 (812.3 to 813.5)	3.04 (2.98 to 3.10; 1.04)	3.22 (3.15 to 3.28; 1.04)
80–84 years	33864	2328021	1454.6 (1453.9 to 1455.3)	5.45 (5.35 to 5.56; 1.04)	5.82 (5.71 to 5.93; 1.04)
85+ years	49059	1840697	2665.2 (2664.6 to 2665.9)	10.00 (9.82 to 10.18; 1.04)	10.79 (10.60 to 10.90; 1.03)
Sex					
Male	72964	10455560	697.8 (697.6 to 698.1)	0.95 (0.94 to 0.95; 1.01)	1.14 (1.13 to 1.15; 1.02)
Female (ref)	91259	12384189	736.9 (736.7 to 737.1)		
Location					
Metropolitan (ref)	115880	20000299	579.4 (579.3 to 579.5)		
Rural/remote	47427	2839450	1670.3 (1669.8 to 1670.8)	2.88 (2.85 to 2.91; 1.02)	3.06 (3.03 to 3.09; 1.02)
Indigenous status					
Indigenous	1226	80799	1517.3 (1497.8 to 1536.9)	1.16 (1.10 to 1.23; 1.12)	1.67 (1.57 to 1.77; 1.13)
Non-Indigenous (ref)	163007	22758950	716.2 (716.1 to 716.3)		

CLR, confidence limit ratio (upper confidence limit divided by the lower confidence limit).[18]
*95% CI computed under standard large sample Poisson assumptions.[17]
†Generalized Poisson regression model rate ratio estimates are adjusted for all other covariates presented in the table.

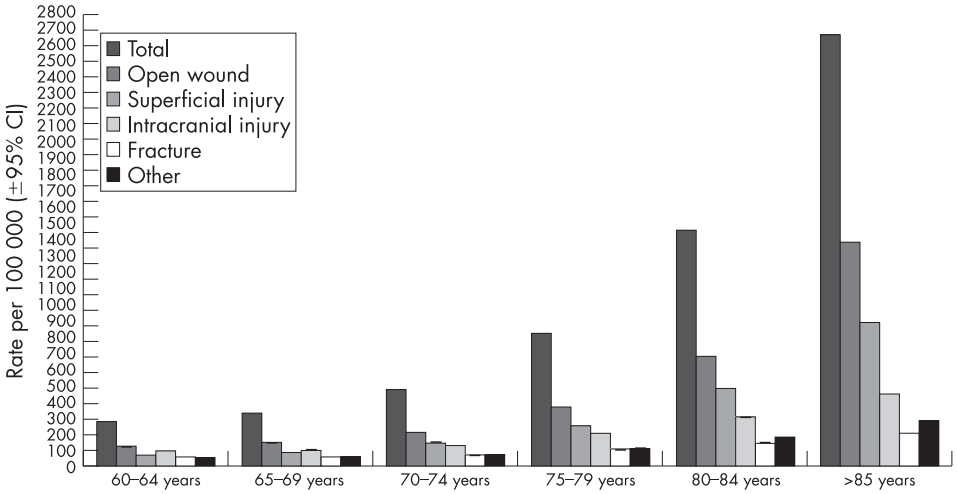

Figure 1 Rates of specific hospitalized head injuries by age group, 1998/1999 to 2004/2005.

those identifying themselves as Indigenous had 1.7 times the rate of their non-Indigenous counterparts.

When specific diagnoses of hospitalized head injury were considered in isolation, and after adjustment for potential confounders, people aged 85+ years had 13.7 times the rate of open wounds to the head, 14.6 times the rate of superficial injuries to the head, 5.9 times the rate of intracranial injury, 4.2 times the rate of fractures of the skull and facial bones, and 7.0 times the rate of "other" hospitalized head injury (ICD diagnosis categories S03, S04, S05, S07, S08, and S09 combined) of those aged 60–64 years. Men had 1.3 times the rate of open wounds to the head, 0.7 times the rate of superficial injuries to the head, 1.5 times the rate of intracranial injury, 1.2 times the rate of fracture of the skull and facial bones, and 1.1 times the rate of "other" diagnoses of their female counterparts. Rural/remote dwellers had 2.9 times the rate of open wounds to the head, 3.0 times the rate of superficial injuries to the head, 3.3 times the rate of intracranial injury, 2.9 times the rate of fracture of the skull and facial bones, and 3.6 times the rate of "other" diagnoses of those living in metropolitan areas. Those identifying themselves as Indigenous had 2.0 times the rate of open wounds to the head, 1.4 times the rate of superficial injuries to the head, 1.3 times the rate of intracranial injury, 1.8 times the rate of fracture of the skull and facial bones, and 2.0 times the rate of "other" diagnoses of their non-Indigenous counterparts.

Across all age groups, open wounds to the head were the most prevalent diagnoses (fig 1). Intracranial injuries were the next most common diagnosis for those aged 60–64 and 65–69 years, but for all other age groups, superficial injury was the next most common diagnosis. Across the age groups 60–79 years, rates for fracture of the skull and facial bones and "other" diagnoses were similar. However, in the 80–84 and 85+ year age groups, rates for the "other" diagnosis were higher than the rates of fracture of the skull and facial bone.

DISCUSSION

Our findings indicate that rates of hospitalized head injury among older people in Australia are increasing. Rates for people aged 85+ years were more than 10 times those of their 60–64 year old counterparts, ranging from 4.2 times greater for fracture of the facial bones to 14.7 times greater for superficial injuries of the head, in the period 1998/1999 to 2004/2005. Overall, rates of hospitalized head injury were higher in men than women, although the opposite was observed when various diagnoses were considered in isolation, for example, superficial injuries. Those living in rural/remote locations had over 3 times the hospitalized head injury rate of their metropolitan-dwelling counterparts, which increased to as much as 3.6 times when specific diagnoses were considered—for example, "other" diagnoses. Consistent with our hypothesis, rates of hospitalized head injury among older Indigenous people were higher than those of their non-Indigenous counterparts, except for the specific diagnosis of facial bone fracture. Across all age groups, the most prevalent diagnoses were open wounds to the head, followed by superficial injuries and intracranial injuries. Falls contributed to 81.4% of all injuries.

Before interpreting our findings, it is important to consider the weaknesses of the study approach. There is a greater likelihood of hospital admission by age alone in our sample, especially among those aged 85+ years. There is also a considerable role of comorbidities and age in the decision to admit. The study is based on national-level data pertaining to all hospitalized head injuries and, as such, includes a high proportion of minor injuries such as superficial trauma or conditions without intracranial pathology. Fatality data were not included, meaning that patients with severe head injuries who died before hospital admission are not represented. A future study that explores age gradients in serious head injuries, including mortality as a result of head injury, may be valuable. It is also important to note that hospital admission reflects only the tip of the head injury incidence iceberg. First there must be the injury event itself, with a multitude of factors relating to that, then a decision to seek care at an emergency department or trauma center, followed by a decision to admit to hospital. We have explored only the final step in this pathway.

Taking into account these caveats, our findings portray an interesting scenario given that by the year 2021, 17.8% of the Australian population are predicted to be aged 65+ years.[6] Older people already represent a substantial proportion of emergency department patients admitted because of head injury, and this is likely to rise as the proportion of the older old in Australia increases.[19]

Our findings suggest that rates of hospitalized head injury were higher among men than women. It is interesting to explore this by type of head injury sustained—for example, men had 1.3 times the rate of open wounds to the head, 1.5 times the rate of intracranial injury, and 1.2 times the rate of fracture of the skull and facial bone, but only 0.7 times the rate of superficial injury compared with their female counterparts. This is supported by the literature, which states that fall rates and rates of non-fatal injury are, in general, higher among women,[15 20] whereas rates of fatal falls, death being largely due to severe head injuries, are higher among men.[15 21] Injury rates

Key points

- Rates of hospitalized head injury among people aged 60+ in Australia are increasing.
- Rates are higher among those aged 85+ years, men, those living in rural/remote locations, and those identifying themselves as Indigenous.
- The most common diagnoses were open wounds of the head, followed by superficial injury and intracranial trauma.
- Over 80% of hospital admissions for head injury were due to falls.

in the older population are also, in general, higher among men,[9 13] so our findings may reflect an extension of this general theme. Strategies for head injury prevention that are specifically targeted towards older men have been shown to be difficult to implement for reasons that include the following: older men are more isolated, less trusting, more reluctant to admit that they need help, and have limited social networks compared with their female counterparts (particularly after the loss of a ''significant other'').[14 22]

It is concerning that rates of hospitalized head injury in our study were consistently higher among older rural/remote dwellers than their urban counterparts. Evidence suggests that those living in non-metropolitan areas in Australia are disadvantaged in terms of access to services,[23 24] and this is even more evident among the older rural population.[25] In much of rural/remote Australia, relatively small populations are spread through large areas, presenting practical challenges for injury prevention—for example, exercising programs for falls prevention that may be successful in large cities may not be successful in rural or remote areas. Distance and remoteness complicate rapid retrieval of injured people to acute care services, and may also complicate later stages of care and rehabilitation. Traditions of risk acceptance in some rural/remote-based occupations may also require special approaches. Clearly, prevention strategies to reduce head injury rates among rural/remote-dwelling older people need to become more of a priority for policy makers and government agencies working in this field, an important service provision issue in a country such as Australia because of the many expansive areas with minimal population.[11 12]

Our hypothesis that older Indigenous persons would have higher rates of hospitalized head injury than their non-Indigenous counterparts proved correct, but is perhaps an underestimation given that a substantial proportion of older Indigenous people who sustain head injury may prefer to not present to hospital for care.[26–28] A myriad of reasons have been suggested in the literature for this, including: fear of leaving home; fear of disempowerment associated with leaving the support of family networks; fears about hospital environments and ''high-tech'' treatments; fear of cultural alienation for familiar foods and ways of being; fear of travel; fear of loneliness; fear of language and communication barriers; financial fears; and, especially, fear of dying away from the homeland.[23 29 30] Rates of hospitalized injury are, in general, much higher among Indigenous people than for other Australians.[13 31] Remoteness may be one reason for these disparities—for example, of 1216 discrete Indigenous communities surveyed in 2001, 78% were situated more than 50 km from the nearest hospital.[32] However, in 2001, rates of injury in rural/remote-dwelling Indigenous people were higher than those in rural/remote-dwelling non-Indigenous people, indicating that remoteness was not in and of itself the reason for the higher injury rates among Indigenous groups.[32]

Given that falls contributed to more than 80% of hospitalized head injuries in our study, it is important to consider contemporary strategies for fall intervention at an international level that have been developed specifically for older populations.[33 34] In their review of interventions for the prevention of falls in older adults, Chang and colleagues[35] concluded that multifactorial fall risk assessment and management programs were the most effective in reducing the proportion of older people who fall. Although exercise was also reported as being effective in reducing falls among this population, there was no clear evidence for the independent effectiveness of environmental modification or education programs (except for individualized interventions using occupational therapists).

Australia's recently published National Injury Prevention and Safety Promotion Plan 2004–2014[15] supported the findings of Chang *et al*[35] and included the following priority areas of action to reduce the prevalence of hospitalized head injury among older people: (1) develop the capacity of health service providers to deal with head injury prevention, including raising awareness of the preventability of falls and fall-related injuries; (2) collaborate with key agencies responsible for services and planning in rural/remote areas, particularly among Indigenous groups, to ensure that head injury prevention is integral to planning and policy development; (3) raise awareness of the challenges of program implementation where populations are small and dispersed; (4) support safety promotion and injury prevention policies that address a range of social, environmental, and behavioral factors, and provide good examples of dealing with the underlying disadvantage of Indigenous persons; (5) improve surveillance systems to provide information for safety promotion and head injury prevention. However, injury prevention strategies also need to address severe head trauma that may result in the death of an older person before hospital admission, and take into account the role of anticoagulants in hospitalized head injury among older groups (the use of such medication has been reported to substantially increase the likelihood of mortality after head injury).[36 37]

SUMMARY

The oldest old were disproportionately represented among those sustaining hospitalized head injuries in our study, along with men, those living in rural/remote areas, and Indigenous persons. Open wounds of the head were the most prevalent injuries sustained, and falls were the most common cause of injury. Given the increasing proportion of older people in Western societies, and the direct and associated costs of treating hospitalized head injuries, the ability to reduce risk of such trauma in this age group is of critical public health importance.

Implications for prevention

This examination of rates of hospitalized head injury among the older population in Australia has confirmed the magnitude of the problem and identified a number of key areas in which improvements can be made. The role of gender, location, and Indigenous status need to be better understood so that interventions can be more effectively targeted. Given the high prevalence of hospitalized head injury resulting from falls in our study, policies that specifically target falls prevention, including multifactorial falls risk assessment and management programs, are likely to be beneficial. Proven fall interventions need to be implemented among older populations, as well as new ones designed for specific high-risk populations, such as those identified in our study.

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REFERENCES

1 **World Health Organisation**. *The world health report 2006: working together for health*, Geneva, The World Health Organisation, 2006.
2 **Acree LS**, Longfors J, Fjeldstad AS, *et al*. Physical activity is related to quality of life in older adults. *Health Qual Life Outcomes* 2006;**4**:37.
3 **Stone KL**, Ewing SK, Lui LY, *et al*. Self-reported sleep and nap habits and risk of falls and fractures in older women: the study of osteoporotic fractures. *J Am Geriatr Soc* 2006;**54**:1177–83.
4 **Sidal T**, Curtis DA. Fractures of the mandible in the aging population. *Spec Care Dentist* 2006;**26**:145–9.
5 **Thomson WM**, Stephenson S, Kieser JA, *et al*. Dental and maxillofacial injuries among older New Zealanders during the 1990s. *Int J Oral Maxillofac Surg* 2003;**32**:201–5.
6 **Australian Bureau of Statistics**. *Census of population and housing: ageing in Australia, 2001*. Canberra: Australian Bureau of Statistics, 2003.
7 **Australian Bureau of Statistics**. *Australian hospital statistics 2004–2005*. Canberra: Australian Bureau of Statistics, 2006.
8 Peden M, McGee K, Krug E, eds. *Injury:A leading cause of the burden of disease, 2000*. Geneva: The World Health Organisation, 2002.
9 **Corso P**, Finkelstein E, Miller T, *et al*. Incidence and lifetime costs of injuries in the United States. *Inj Prev* 2006;**12**:212–18.
10 **Young L**, Ahmad H. Trauma in the elderly: a new epidemic? *Aust N Z J Surg* 1999;**69**:584–6.
11 **Zeitz K**, Malone G, Arbon P, Fleming J. Australian issues in the provision of after-hours primary medical care services in rural communities. *Aust J Rural Health* 2006;**14**:99–104.
12 **Whitehead CH**, Harding S, Giles LC, Crotty M. Establishment of and first 20 months of operating an outreach geriatric clinic in a regional centre. *Rural Remote Health* 2006;**6**:444.
13 **Helps YLM**, Harrison JE. *Injury mortality of Aboriginal and Torres Strait Islander peoples in Australia 1997–2000*. Canberra: Australian Institute of Health and Welfare, 2004.
14 **Seematter-Bagnoud L**, Wietlisbach V, Yersin B, *et al*. Healthcare utilization of elderly persons hospitalized after a noninjurious fall in a Swiss academic medical center. *J Am Geriatr Soc* 2006;**54**:891–7.
15 **National Public Health Partnership**. *The national injury prevention and safety promotion plan 2004–2014*. Canberra: National Public Health Partnership, 2004.
16 **Berry JG**, Harrison JE. *Hospital separations due to injury and poisoning. Australia 2003–2004, Injury research and statistics series no.30*.AIHW cat.no.INJCAT 88. Adelaide: AIHW, 2007.
17 **Rothman K**, Greenland S. *Modern epidemiology*, 2nd edn., Philadelphia, PA: Lippincott Williams and Wilkins Publishers 1998.
18 **Poole C**. Low P-values or narrow confidence intervals: which are more durable? *Epidemiology* 2001;**12**:291–4.
19 **Moncrieff NJ**, Qureshi C, Deva AK. A comparative cost analysis of maxillofacial trauma in Australia. *J Craniofac Surg* 2004;**15**:686–91.
20 **Cripps R**, Carman J. *Falls by the elderly in Australia: trends and data for 1998*. Canberra: AIHW, 2001.
21 **Donohue JT**, Clark DE, DeLorenzo MA. Long-term survival of Medicare patients with head injury. *J Trauma* 2007;**62**:419–23.
22 **Wiens CA**, Koleba T, Jones CA, *et al*. The Falls Risk Awareness Questionnaire: development and validation for use with older adults. *J Gerontol Nurs* 2006;**32**:43–50.
23 **Gruen RL**, Bailie RS, Wang Z, *et al*. Specialist outreach to isolated and disadvantaged communities: a population-based study. *Lancet* 2006;**368**:130–8.
24 **Jones JA**, Meehan-Andrews TA, Smith KB, *et al*. ''There's no point in complaining, nothing changes'': rural disaffection with complaints as an improvement method. *Aust Health Rev* 2006;**30**:322–32.
25 **Neville C**, McCarthy A, Laurent K. Pain management skills of regional nurses caring for older people with dementia: a needs analysis. *Collegian* 2006;**13**:31–6.
26 **Clapham KF**, Stevenson MR, Lo SK. Injury profiles of Indigenous and non-Indigenous people in New South Wales. *Med J Aust* 2006;**184**:217–20.
27 **Kruger E**, Smith K, Tennant M. Jaw fractures in the indigenous and non-indigenous populations of Western Australia: 1999-2003. *Int J Oral Maxillofac Surg* 2006;**35**:658–62.
28 **McGrath P**. Exploring Aboriginal people's experience of relocation for treatment during end-of-life care. *Int J Palliat Nurs* 2006;**12**:102–8.
29 **Perkins JJ**, Sanson-Fisher RW, Girgis A, *et al*. The development of a new methodology to assess perceived needs among indigenous Australians. *Soc Sci Med* 1995;**41**:267–75.
30 **Gruen RL**, Weeramanthri TS, Bailie RS. Outreach and improved access to specialist services for indigenous people in remote Australia: the requirements for sustainability. *J Epidemiol Community Health* 2002;**56**:517–21.
31 **Lehoczky S**, Isaacs J, Grayson N, *et al*. Hospital statistics. Aboriginal and Torres Strait Islander Australians 1999–2000. Occasional paper. Canberra: ABS, 2002.
32 **Statistical Information Management Committee (SIMC)**. National summary of the 2001 and 2002 jurisdictional reports against the Aboriginal and Torres Strait Islander health performance indicators. Cat. no. IHW 12. Canberra: Statistical Information Management Committee, AIHW, 2004.
33 **Rubenstein LZ**, Powers CM, MacLean CH. Quality indicators for the management and prevention of falls and mobility problems in vulnerable elders. *Ann Intern Med* 2001;**135**:686–93.
34 **Shekelle P**, Rubenstein L, Maglione M, *et al*. *Falls prevention interventions in the Medicare population*, Evidence Report. Baltimore, MD: US Department of Health and Human Services, Health Care Financing Administration, 2003.
35 **Chang JT**, Morton SC, Rubenstein LZ, *et al*. Interventions for the prevention of falls in older adults: systematic review and meta-analysis of randomised clinical trials. *BMJ* 2004;**328**:680.
36 **Franko J**, Kish KJ, O'Connell BG, *et al*. Advanced age and preinjury warfarin anticoagulation increase the risk of mortality after head trauma. *J Trauma* 2006;**61**:107–10.
37 **Cohen DB**, Rinker C, Wilberger JE. Traumatic brain injury in anticoagulated patients. *J Trauma* 2006;**60**:553–7.