Original Article

Spinal cord and related injuries after attempted suicide: psychiatric diagnosis and long-term follow-up

RE Stanford^{*1}, R Soden², R Bartrop³, M Mikk⁴ and TKF Taylor^{5,6}

¹Department of Orthopaedics, Prince of Wales Hospital and University of New South Wales, Sydney NSW, Australia;

²Department of Medical Rehabilitation, Spinal Injuries Unit, Spinal Injuries Research Office, The Royal North Shore Hospital and University of Sydney, Sydney NSW, Australia; ³Department of Psychological Medicine, The Royal North Shore Hospital and University of Sydney, Sydney NSW, Australia; ⁴Department of Medical Rehabilitation, Spinal Cord Injury Unit, Prince Henry and Prince of Wales Hospitals, Sydney NSW, Australia; ⁵Department of Orthopaedics and Traumatic Surgery, The Royal North Shore Hospital and University of Sydney, Sydney NSW, Australia and ⁶SpineCare Foundation, Paramatta NSW, Australia

Study Design: Retrospective analysis of acute spinal cord injuries (ASCI).

Objectives: Determine incidence of ASCI due to suicide attempt from 1970 to 2000. Describe demographics, injuries, mental illness, functional outcomes and nature of subsequent deaths.

Setting: State spinal cord injury services, New South Wales, Australia.

Methods: Retrospective record review and follow-up interview.

Results: Of 2752 ASCI admissions, 56 were because of attempted suicide (55 falls, one gunshot wound). Thirty-six males and 20 females. Median age 30 years (15–74). Most common levels of vertebral injury were C5 and L1. Twenty-three had complete spinal cord injury. Thirty-two had an Injury Severity Score of >15. Forty had more than one major injury. There was a significant rise in the incidence of ASCI following self-harm over time (Poisson regression, $P=0.004$). There was a significant change in scene of injury away from hospitals over time (χ^2 test, $df=1$, $P=0.0001$). Psychiatric diagnoses were personality disorder 27; schizophrenia 16; depression 14; chronic alcohol abuse 10; mood disorder 10; chronic substance abuse 10; other four. Follow-up was available in 47 cases (84%) at an average of 8 years. Four subsequent deaths were by suicide. Domiciliary arrangements were: home 28; hospital five; nursing home three; group home/hostel four.

Conclusions: Community placement outcomes for survivors were good. Subsequent death by suicide was high. There was a significant rise in cases and a change in injury scene away from hospitals over time.

Spinal Cord (2007) 45, 437–443; doi:10.1038/sj.sc.3102043; published online 6 March 2007

Keywords: acute spinal cord injury; fall from height; suicide; mental-illness; long-term outcome; drug abuse

Introduction

During the 1990s there appeared to be an increasing number of mentally-ill individuals being admitted to the two spinal cord injury units in the state of New South Wales (NSW), Australia, after an episode of self-harm, usually involving a fall from a height. This prompted a retrospective study of the rate and circumstances of such episodes, the pattern of associated injuries and long-term outcomes.

Jumping from heights is an uncommon method of deliberate self-harm.^{1–4} Figures from the Australian

Bureau of Statistics indicate that jumping accounted for only 4% of suicides in Australia in 1998.⁵ However, during the 1980s there was an increase in suicide by jumping in Australia, the UK, Switzerland and Finland.^{2,3}

We speculated that the incidence of self-harm resulting in spinal cord injury (largely by jumping) might have been influenced by deinstitutionalisation of psychiatric care and the use of recreational drugs. Deinstitutionalization of Australian psychiatric facilities occurred from the 1960s to 1980s⁶ possibly leading to lower levels of supervision, poor treatment compliance and increased risk of deliberate self-harm.⁷ Rates of chronic substance abuse have increased in the last decade and a

*Correspondence: RE Stanford, Department of Orthopaedics, Prince of Wales Hospital and University of New South Wales, Sydney NSW, Australia

half⁸ and this has led to deterioration in mental health, homelessness and poor compliance with medication and professional advice. Collectively, these phenomena may lead to impulsive acts of deliberate self-harm, such as jumping from a height.

The purpose of the study was to review the incidence of acute spinal cord injury (ASCI) owing to self-harm as a result of a suicide attempt, over three decades (1970–2000) in NSW, Australia. Additional aims were to describe the demographic, physical injury and mental illness details of cases of self-harm resulting in ASCI. Long-term functional outcomes and the nature of subsequent deaths were also sought in each case.

Clinical material and methods

A retrospective review of patient records on those who had sustained spinal column injury with neurological deficit following an episode of self-harm in NSW between the beginning of 1970 and beginning of 2000 was performed. This study was conducted at the two ASCI units in NSW (the Royal North Shore and Prince Henry Hospitals). Identified cases were followed up by direct contact. We certify that all applicable institutional and governmental regulations concerning the ethical use of human volunteers were followed during the course of this research.

The criteria for inclusion in the study were admission to either unit between 1 January 1970 and 31 December 1999 with injury having occurred in NSW and documented evidence of self-harm on admission. There was no age restriction, but the spinal cord injury units accept the care of adolescents adults with an age cutoff at about 14 years. Cases of death occurring before acute hospital care were not included as were cases of spinal column injury without spinal cord impairment or where self-harm could not be demonstrated. An episode of self-harm was identified from written reports of several interviews between the patient and members of the health care team (acute care physician, consulting psychiatrist and social worker).

Demographic and physical data were collected from patient records in a consistent fashion by using standard

forms. The Injury Severity Score (ISS) is a system of stratifying trauma based on anatomical regions injured and severity of injuries to each of those regions.⁹ It is internationally accepted that the definition of severe trauma is an ISS of greater than 15.¹⁰ Spinal cord function was graded by the American Spinal Injury Association method (ASIA impairment scale).¹¹

Mental illness was recorded in diagnostic categories after the system laid down in the Diagnostic and Statistical Manual of Mental Disorders.¹² Medical records were reviewed by one of us (RB) and multi-axial assessment was made in each case: Axis I – clinical disorders and other conditions that may be a focus of clinical attention; Axis II – personality disorders; Axis III – general medical condition; Axis IV – psychosocial and environmental problems. It was not possible to derive a reliable functioning score (Axis V) either at time of injury or follow-up.

For the purposes of tracing individuals for long-term follow-up, demographic details on the patient group were collated with information in records held by the NSW State Government Office registering Births, Deaths and Marriages and Australian Federal Government electoral rolls for NSW. Occurrence and nature of deaths subsequent to the index admission were identified by contact with family or health carers or by searching the State Registry of Births, Deaths and Marriages. Those individuals alive at the time of review were invited to complete a questionnaire in person or by telephone interview (see Table 1). Their mental health care was discussed in more detail with them and their carers. The consent of the patient to do so was obtained before proceeding.

Change in incidence of cases over time was analysed using Poisson regression. Change in relative frequency of scene of jump was analysed using the χ^2 test.

Results

From 1970 to 2000 there were a total of 2752 ASCI admissions at Royal North Shore and Prince Henry Hospitals. Fifty-six cases of self-harm were identified (2.0% of total admissions). There were 20 females and

Table 1 Follow-up questionnaire. Summary of questions and range of answers

<i>Domicile status</i>	<i>Domestic status</i>	<i>Home care used</i>	<i>Income source</i>	<i>ASIA impairment</i>	<i>Episodes of hospital care</i>	<i>Current medications</i>
Home	Alone	No	Salary	A	For pressure ulcers	Freeform answer
Group home	Partner	Yes	Pension	B	Other physical reasons	
Hostel	Other family		Mixture salary/pension	C	Mental health reasons	
Nursing home	Group		Unemployment benefit	D		
Hospital ^a	Other		Other	E		

^aDefinition of hospital either a public or private facility for the care of patients with one or more acute or chronic medical and/or psychiatric conditions

36 males (1:1.8). The median age was 30 years, the youngest 15 years and the eldest 74 years. The mechanism of injury was jumping from a height in 55 (98%) cases and gun-shot in one (2%). Forty of 55 people (71%) jumped at a location where the postcode was the same as that of the place of residence.

The observed levels of vertebral and neurological injury were congruent and showed bimodal distributions, each with the most common levels of involvement at C5 and L1. The cervical spine accounted for 21% of spinal injuries and the thoracolumbar spine 68%. One case presented without a vertebral column injury, but suffered T12 complete paraplegia secondary to aortic rupture and presumed spinal cord infarction. Averaged across the group, there was improvement in spinal cord function by half of one ASIA impairment level after discharge from acute care to follow-up. Figure 1 shows the distribution of ASIA impairment scale at discharge and follow-up.

Of the 56 cases, 32 (57%) had an ISS greater than 15. Figure 2 shows the distribution of ISS with height for the 55 cases of injury by falling. There is a weak correlation between height of jump and ISS, with wide scatter. Table 2 shows the frequency, nature and number of injuries additional to the principal spinal injury. Four patients (7%) died during the acute post-injury hospital period.

Figure 1 ASIA impairment scale at discharge (56 cases) and follow-up (38 cases)

Figure 2 Correlation of estimated jump height with ISS. The circled cases died as a result of their injuries during acute hospital admission

Figure 3 shows the trend of incidence per million population in NSW over time. Trend analysis by Poisson regression shows that there has been a highly and statistically significant ($P=0.004$) increase in incidence from 1970 to 2000.

Table 3 shows the use of various scenes of injury. Figure 4 shows the change in scene of injury over time. There was a significant change from hospitals to other sites as a scene of jump after 1984. The definition of hospital as a scene of injury included acute and long-term care facilities for both physical and mental illness.

Table 4 shows the frequency of mental health diagnoses at the time of index injury. We observed that there were many individuals with co-morbid psychiatric diagnoses. Thirteen patients were noted to have attempted suicide at least once before the index event.

Table 5 shows the rates of follow-up. Of the eight late deaths in known circumstances, three were suicides (two by jumping, one by hanging), which represents 6% of those discharged after the index injury. Other diagnoses of subsequent death included sepsis and stroke. The average time to follow-up or death was 8 years (range 3–25 years).

Of the 35 who completed follow-up questionnaires, 25 (71%) had continued needs for mental health care, with maintenance of psychiatric medications and/or temporary or long-term admission to mental health institutions.

Table 2 Injuries in addition to the index spinal injury in 56 cases

	No. (%)
<i>Nature of additional injuries</i>	
Major limb fracture	27 (48)
Head injury	10 (18)
Chest	7 (13)
Visceral	3 (5)
Other vertebral fracture	6 (11)
<i>Number of additional injuries</i>	
0	16 (29)
1	23 (41)
2	11 (20)
3	6 (10)

Figure 3 Trend of incidence of ASCI due to self-harm over time

Table 3 Scene of injury in 56 cases

Scene	No. (%)
Hospital	15 (27)
Other public building	13 (23)
Bridge	11 (20)
Home	9 (15)
Railway	3 (5)
Cliff	4 (7)
Gaol	1 (2)

Figure 4 Change in scene of jump with time in 56 cases, consolidated data for hospital vs non-hospital**Table 4** Psychiatric diagnoses in 56 cases

Diagnosis	No. (%)
Personality disorder	27 (48)
Schizophrenia	16 (29)
Major depression	14 (25)
Long-term alcohol abuse	10 (18)
Mood disorder	10 (18)
Long-term substance abuse	10 (18)
Bipolar disorder	3 (5)
Schizoaffective disorder	1 (2)

Table 5 Follow-up rates

Outcome	No. (%)
Injury related death in hospital	4 (7)
Subsequent death, circumstances known	8 (14)
Subsequent death, circumstances unknown	1 (2)
Not traceable	5 (9)
Questionnaire answered	35 (63)
Refused to answer questionnaire, alive	3 (5)
Total cases	56 (100)
Follow-up available	47 (84)

The mental health care needs of these patients were largely stable, with good levels of compliance with treatment advice. The number admitted to hospital for pressure ulcer care was nine (26%). Table 6 shows the outcomes at follow-up for domiciliary arrangements and Table 7 that for income source.

Table 6 Outcome for domiciliary arrangements in 40 cases

Outcome	No. (%)
Home	28 (70)
Hospital	5 (13)
Nursing home	3 (7)
Group home	2 (5)
Hostel	2 (5)

Table 7 Outcome for income source in 34 cases

Outcome	No. (%)
Pension	21 (62)
Salary	6 (18)
Salary-pension mix	4 (11)
Other	3 (9)
Unemployment benefit	0 (0)

Discussion

As this study was carried out retrospectively, psychiatric diagnoses were made from descriptive reports rather than standardised criteria. Every effort was made to determine later mental health, but it was difficult to determine all subsequent episodes of self-harm without transgressing the privacy of individuals or their families when consent to obtain the information was not given.

There are two relevant published reports of spinal injury from self-harm, one from the UK¹³ and another from Denmark.¹⁴ Each is retrospective with long-term follow-up reporting subsequent deaths and psychosocial functioning, though the latter study did not specify psychiatric diagnoses. Comparative findings of these two studies and ours are shown in Table 8. The Danish study reported a significant rise in incidence over time from 1965 to 1987. Other principal findings were that the great majority of cases were from falls and schizophrenia formed a major proportion of the observed mental illness (at about 30%). Previous Australian studies have found that schizophrenia and personality disorder were prominent in self-harm by jumping from bridges.^{2,15} Two other studies of ASCI after self-harm report few characteristics of the study populations and have no long-term follow-up.^{16,17}

Schizophrenia is a low-prevalence disorder and the Australian point prevalence is reported as 4.7 per 1000 in urban populations between the ages of 18 and 64 years.¹⁸ The high frequency of schizophrenia found in cases of ASCI resulting from self-harm shown in our study compared with its low population prevalence shows the elevated risk of suicide in this condition, as is already established.¹⁹ Risk factors for suicide in schizophrenia have been described^{19,20} and include the possibility of hallucinatory phenomena,¹ but our study did not include an analysis of triggers for the suicide attempt.

Table 8 Comparison of similar published studies of ASCI after episodes of self-harm

	<i>Biering-Sorensen et al</i>	<i>Kennedy et al</i>	<i>Stanford et al</i>
Country of origin	Denmark	UK	Australia
Years of study	1965–1987	1951–1992	1970–2000
Number of cases	45	137	56
Proportion of follow-up	100%	52%	84%
Proportion of all ASCI treated	6.8%	1.6%	2.0%
M:F	0.6	1.0	1.8
Average age (years)	31	32	30
Age range (years)	17–59	14–65	15–74
Mechanism of injury			
Jump from height	42 (93%)	116 (85%)	55 (98%)
Gun shot wounds	1 (2%)	1 (1%)	1 (2%)
Other/unknown	2 (4%)	20 (14%)	0
Complete neurological deficit	15 (33%)	52 (38%)	23 (41%)
Subsequent suicide rate	3 (7%)	8 (6%)	3 (4%)
Psychiatric diagnoses	30 (67%)		
Schizophrenia	—	45 (33%)	16 (29%)
Depression	—	37 (27%)	14 (25%)
Personality disorder	—	7 (5%)	27 (48%)
Bipolar disorder	—	5 (4%)	3 (5%)
Drug and alcohol abuse	—	10 (7%)	20 (36%)

Although jumping from a height is a relatively uncommon means of suicide,⁵ a number of studies report the nature of physical injuries associated with such an event. The overall fatality rate from self-harm by jumping from a height is approximately 75%^{4,21} with most deaths occurring at the scene of injury. Falling from a height equivalent to six stories or more (~18 m) to hard ground carries a near-inevitable fatality rate.^{21,22} The in-hospital death rate is about 12%. Half of those that reach hospital have spinal column injuries, of which a third have neurological loss. Of all those that 'jump', 4% survive acute hospital admission with ASCI. The average rates of injuries to various body regions are limbs 73%, chest 40%, head 30%, pelvis 24% and abdominal 17%.^{1,3,21–25} The pattern of physical injury is the same in cases of intentional and accidental falls from a height.²³ Our study had a comparable in-hospital death rate (7%) to these studies, and we observed a similar pattern of injuries.

The severity of injury is greater with a higher fall and multiple injuries are common, though there is much variation.^{3,21–25} However, we found a weak relationship between height of fall and ISS; the four cases of in-hospital death had falls in the lower half of the range of heights recorded and were less than the historically fatal height of six stories. These apparent inconsistencies can be explained by our cases being a biased sample of all falls (survivors with spinal cord injury), as well as imprecise information on the height of the fall and the nature of the landing surface.

We found a significant increase in incidence of ASCI as a result of self-harm over time in NSW from 1970 to 2000. Two possible explanations for this are an increasing incidence of self-harm (particularly by jump-

ing) and increasingly effective means of retrieving injured people, leading to greater presentation to hospital. The effect of the latter is difficult to estimate, but it is known that the overall suicide rate for the age group 15–34 years has risen between 1964 and 1997 in Australia, particularly in males.²⁶ The cause of more people jumping with self-harm is likely to be multifactorial and may include de-institutionalisation of mental health care in NSW and rising recreational drug use. The rise in incidence of ASCI that we observed occurred in the mid-1990s, which is approximately 10 years after the completion of de-institutionalisation of the mentally ill in NSW.²⁷ Given this time lag it is difficult for us to find a direct relationship between de-institutionalisation and ASCI due to self-harm by jumping from heights.

Rates of substance abuse have increased in the last decade²⁸ and there is a high prevalence in those with psychosis in Australia.²⁹ In the mentally unwell, substance abuse leads to symptom worsening,³⁰ homelessness and poor compliance with medication.³¹ These conditions may be conducive to self-destructive acts. Specifically, cannabis use may precipitate psychosis in those at risk and worsen symptoms of established psychosis.³² A high proportion of people in our study have schizophrenia. It would appear that these individuals are vulnerable to self-harm by the nature of their illness and this may be compounded by substance abuse. Thus, there may be a link between rising rates of substance abuse in the community and a rise in spinal cord injury from self-harm. This has also been postulated by others.¹⁴

We found that there was a significant change in the scene of jumping away from hospitals from 1970 to 2000. This change occurred in the mid-1980s and may

reflect improvement in the housing of acute psychiatric patients on the ground floor. There may also be an increasing tendency for jumping to occur at non-hospital sites because jumping is an impulsive act. It thus can occur wherever the conditions are conducive to it (eg elevated situation) and if the individual is feeling sufficiently motivated or reckless.

The frequency of suicide following the index spinal injury appears to be high. We found that three patients died from self-harm after discharge and one died in unknown circumstances. Assuming the latter case died from self-harm, the late, fatal self-harm rate of those discharged from acute care after spinal injury was approximately 8%. By comparison, the population suicide rate in Australia in 1998 was 14.3/100 000⁵ and the suicide rate after ASCI from all traumatic causes in NSW is approximately 1% with a standardised mortality ratio of 4.4.^{33,34} The repeat suicide rate is higher than this in our study group and is comparable to the 10 year follow-up of unsuccessful first suicide attempts in New Zealand, where the subsequent suicide-associated death rate was 4.6%.³⁵ The high rate of subsequent suicide in our study can be attributed to a number of possible causes. It may reflect both the persistence of mental ill-health responsible for the index injury and the increased suicide risk of ASCI *per se*^{34,36} and major injury in general.³⁶ Eighteen percent of our study population suffered head injury as well as ASCI. Several studies have demonstrated increased suicide risk following head injury,^{37–39} which is independent of pre-injury mental state.⁴⁰ Although previous reports have highlighted the importance of intervention against suicide in the ASCI population as a whole,^{34,41,42} it appears from our study that there is a real and particular need for such action in the group of people with ASCI suffered after suicide attempt.

Prevention of injury and death from suicidal action is supported by much work and a key element is restriction of access to lethal means.^{43,44} Our study showed that jumping with suicide intent occurred preferentially from public buildings or structures (bridges and railway stations included) rather than natural places from which to jump (such as cliffs). First, this emphasises the need for easily accessed high structures to be rendered safe from suicide attempt. Secondly, substitution of jump site (such as cliff for building) by the subject is unlikely given the impulsiveness of the act and the effort involved to reach a natural site from which to jump, as shown in previous work,⁴³ making safety measures on buildings and structures worthwhile.

In conclusion, ASCI and associated injuries from attempted suicide are frequently severe. Our study group represents the survivors of these acute injuries and many were able to return home (often with modifications) (70%) and many others to group homes or hostels (10%). However, there was also a continuing need for mental health management in 71% of those followed up. The subsequent suicide rate is high and careful assessment and intervention is recommended in order to reduce this risk.

Acknowledgements

We thank the following colleagues for their assistance.

Professor Robert Cumming, Centre for Education and Research on Ageing, Concord Hospital, Concord, NSW, Australia. Professor Richard Jones, Spinal Cord Injury Unit, Prince Henry Hospital, Sydney, NSW, Australia. Dr Stella Engel, Spinal Cord Injury Unit, Prince of Wales Hospital, Sydney, NSW, Australia. Dr Susan Rutkowski, Spinal Cord Injury Unit, The Royal North Shore Hospital, NSW, Australia.

References

- 1 Sims A, O'Brien K. Autokabalesis: an account of mentally ill people who jump from buildings. *Med Sci Law* 1979; **19**: 195–198.
- 2 Cantor CH, Hill MA, McLachlan EK. Suicide and related behaviour from river bridges. A clinical perspective. *Br J Psychiatry* 1989; **155**: 829–835.
- 3 Bostman OM. Suicidal attempts by jumping from heights. A three-year prospective study of patients admitted to an urban university accident department. *Scand J Soc Med* 1987; **15**: 119–203.
- 4 Wyatt JP *et al*. Suicidal high falls. *J Clin Foren Med* 2000; **7**: 1–5.
- 5 McLennan W. *Suicides: Australia 1921–1998: Australian Bureau of Statistics* 2000.
- 6 Newton L *et al*. Deinstitutionalisation for long-term mental illness: an ethnographic study. *Aust NZ J Psychiatry* 2000; **34**: 484–490.
- 7 Babidge NC, Buhrich N, Butler T. Mortality among homeless people with schizophrenia in Sydney, Australia: a 10-year follow-up. *Acta Psychiatr Scand* 2001; **103**: 105–110.
- 8 Degenhardt L, Hall W. The association between psychosis and problematic drug use among Australian adults: findings from the National Survey of Mental Health and Well-Being. *Psychol Med* 2001; **31**: 659–668.
- 9 Baker SP *et al*. The injury severity score: a method for describing patients with multiple injuries and evaluating emergency care. *J Trauma-Injury Infect Critical Care* 1974; **14**: 187–196.
- 10 Boyd CR, Tolson MA, Copes WS. Evaluating trauma care: the TRISS method. trauma score and the injury severity score. *J Trauma-Injury Infect Critical Care* 1987; **27**: 370–378.
- 11 Marino RJ (ed). *International Standards for Neurological Classification of Spinal Cord Injury* 6th edn. American Spinal Injury Association: Chicago, IL 2000.
- 12 American-Psychiatric-Association. *Diagnostic and Statistical Manual of Mental Disorders (DSM-IV)* 4th edn. American Psychiatric Association Inc.: Washington, DC 1994.
- 13 Kennedy P *et al*. Spinal cord injuries and attempted suicide: a retrospective review. *Spinal Cord* 1999; **37**: 847–852.
- 14 Biering-Sorensen F, Pedersen W, Muller PG. Spinal cord injury due to suicide attempts. *Paraplegia* 1992; **30**: 139–144.
- 15 Cantor CH, Hill MA. Suicide from river bridges. *Aust NZ J Psychiatry* 1990; **24**: 377–380.
- 16 Girard R *et al*. Spinal cord injury by falls: comparison between suicidal and accidental cases. *Paraplegia* 1980; **18**: 381–385.

- 17 Hoff J, Chapman M. Vertebral fractures associated with suicide attempts. *Proc Veterans Adm Spinal Cord Injury Conf* 1971; **18**: 53–55.
- 18 Jablensky A et al. Psychotic disorders in urban areas: an overview of the study on low prevalence disorders. *Aust NZ J Psychiatry* 2000; **34**: 221–236.
- 19 Montross L, Zisook S, Kasckow J. Suicide among patients with schizophrenia: a consideration of risk and protective factors. *Ann Clin Psychiatry* 2005; **17**: 173–182.
- 20 Palmer DD, Henter ID, Wyatt RJ. Do antipsychotic medications decrease the risk of suicide in patients with schizophrenia? *J Clin Psychiatry* 1999; **60**: 100–103.
- 21 Isbister ES, Roberts JA. Autokabalesis: a study of intentional vertical deceleration injuries. *Injury* 1992; **23**: 119–122.
- 22 Scalea T et al. An analysis of 161 falls from a height: the 'jumper syndrome'. *J Trauma* 1986; **26**: 706–712.
- 23 Richter D et al. Vertical deceleration injuries: a comparative study of the injury patterns of 101 patients after accidental and intentional high falls. *Injury* 1996; **27**: 655–659.
- 24 Katz K et al. Injuries in attempted suicide by jumping from a height. *Injury* 1988; **19**: 371–374.
- 25 Wirbel RJ et al. Treatment of severe injuries caused by attempted suicide: pattern of injury and influence of the psychiatric disorder on the postoperative course. *Eur J Surg* 1998; **164**: 109–113.
- 26 Cantor CH, Neulinger K, De Leo D. Australian Suicide Trends 1964–1997: Youth and Beyond? *Med J Aus* 1999; **171**: 137–141.
- 27 Burdekin B. *Human rights and mental illness – report of the National Inquiry into the Human Rights of People with Mental Illness*. Australian Government Publishing Service: Canberra 1993.
- 28 Maxwell JC. Update: comparison of drug use in Australia and the United States as seen in the 2001 National Household Surveys. *Drug Alcohol Rev* 2003; **22**: 347–357.
- 29 Kavanagh DJ et al. Demographic and clinical correlates of comorbid substance use disorders in psychosis: multivariate analyses from an epidemiological sample. *Schizophr Res* 2004; **66**: 115–124.
- 30 Hunt GE, Bergen J, Bashir M. Medication compliance and comorbid substance abuse in schizophrenia: impact on community survival 4 years after a relapse. *Schizophr Res* 2002; **54**: 253–264.
- 31 Drake RE, Brunette MF. Complications of severe mental illness related to alcohol and other drug use disorders. In: Galanter M (ed). *Recent Developments in Alcoholism*. Plenum: New York 1998 pp 285–299.
- 32 Hall W, Degenhardt L, Teesson M. Cannabis use and psychotic disorders: an update. *Drug Alcohol Rev* 2004; **23**: 433–443.
- 33 Yeo J et al. Mortality following spinal cord injury. *Spinal Cord* 1998; **36**: 329–336.
- 34 Soden R et al. Causes of death after spinal cord injury. *Spinal Cord* 2000; **38**: 604–610.
- 35 Gibb SJ, Beautrais AL, Fergusson DM. Mortality and further suicidal behaviour after an index suicide attempt: a 10-year study. *Aust NZ J Psychiatry* 2005; **39**: 95–100.
- 36 Kishi Y, Robinson RG, Kosier JT. Suicidal ideation among patients with acute life-threatening physical illness: patients with stroke, traumatic brain injury, myocardial infarction and spinal cord injury. *Psychosomatics* 2001; **42**: 382–390.
- 37 Simpson G, Tate R. Clinical features of suicide attempts after traumatic brain injury. *J Nerv Ment Dis* 2005; **193**: 680–685.
- 38 Pentland B, Hutton LS, Jones PA. Late mortality after head injury. *J Neurol Neurosurg Psychiatry* 2005; **76**: 395–400.
- 39 Teasdale TW, Engberg AW. Suicide after traumatic brain injury: a population study. *J Neurol Neurosurg Psychiatry* 2001; **71**: 436–440.
- 40 Simpson G, Tate R. Suicidality after traumatic brain injury: demographic, injury and clinical correlates. *Psychol Med* 2002; **32**: 687–697.
- 41 Glass C. Applying functional analysis to psychological rehabilitation following spinal cord injury. *J Am Paraplegia Soc* 1992; **15**: 187–193.
- 42 Krause J. Spinal cord injury and its rehabilitation. *Curr Opinion Neurol Neurosurg* 1992; **5**: 669–672.
- 43 Daigle MS. Suicide prevention through means restriction: assessing the risk of substitution. A critical review and synthesis. *Accident Analysis Prevent* 2005; **37**: 625–632.
- 44 Mann JJ, Apter AB, J, Beautrais A et al. Suicide prevention strategies: A systematic review. *JAMA* 2005; **294**: 2064–2074.