

Mental disorders and risk of accidental death

Casey Crump, Kristina Sundquist, Marilyn A. Winkleby and Jan Sundquist

Background

Little is known about accidental death risks among psychiatric patients.

Aims

To examine this issue in the most comprehensive study to date.

Method

National cohort study of all Swedish adults ($n=6\,908\,922$) in 2001–2008.

Results

There were 22 419 (0.3%) accidental deaths in the total population, including 5933 (0.9%) accidental deaths v. 3731 (0.6%) suicides among psychiatric patients ($n=649\,051$). Of persons who died from accidents, 26.0% had any psychiatric diagnosis v. 9.4% in the general population. Accidental death

risk was four- to sevenfold among personality disorders, six- to sevenfold among dementia, and two- to fourfold among schizophrenia, bipolar disorder, depression or anxiety disorders, and was not fully explained by comorbid substance use. Strong associations were found irrespective of sociodemographic characteristics, and for different types of accidental death (especially poisoning or falls).

Conclusions

All mental disorders were strong independent risk factors for accidental death, which was substantially more common than suicide.

Declaration of interest

None.

Accidents kill about 4–5 million people annually and are a major cause of disability and mortality in all countries worldwide.^{1–3} Although mental disorders are well-known risk factors for suicide,⁴ little attention has been given to their associations with accidental death. People with mental disorders may be at increased risk of accidental death for multiple reasons, including comorbid substance use, medication side-effects, increased risk-taking behaviour, or common symptoms of psychiatric illness such as poor concentration and fatigue. High-risk behaviour associated with some mental disorders may occur on a continuum from subintentional to intentional.^{5,6} Indifference to death, in contrast with a desire to die, may result in subintentional harm and risk of accidental death, which cannot be adequately addressed through studies or interventions that focus exclusively on suicide.^{7,8} A more comprehensive understanding of the relationships between mental disorders and accidental death is needed to enable better risk management.

Previous studies of this issue have had important limitations, including the use of only hospitalised psychiatric cases,^{9,10} or small sample sizes in case-control¹¹ or other community-based^{12–16} studies. We conducted the largest study of this issue to date using data for the entire adult population of Sweden (~6.9 million). Mental disorders were ascertained using out-patient and in-patient diagnoses from all healthcare settings nationwide. We examined the association between sociodemographic factors or mental disorders and accidental death (overall and by specific types of accidents), while adjusting for confounders and exploring the potential mediating effect of comorbid substance use.

Method

Study population and accidental death ascertainment

The study population consisted of all adults aged 20 years or older who were living in Sweden on 1 January 2001 ($n=6\,908\,922$). The study outcome was death from accidents (ICD-10¹⁷ codes V01–X59) during 8 years of follow-up (1 January 2001 to 31 December 2008). These deaths were identified using

the Swedish Death Registry, which includes ~99.5% of all deaths nationwide.¹⁸ Sweden follows internationally accepted definitions of accidental death in the classification of deaths. An accidental death is defined as ‘any person killed immediately or dying within 30 days as a result of an injury accident’;¹⁹ and an injury accident is defined as unintentional damage to the body resulting from ‘acute exposure to energy (mechanical, thermal, electrical, chemical or radiant) in amounts that exceed the threshold of physiological tolerance [. . .] [or] an insufficiency of a vital element’ (such as heat or oxygen).^{20,21}

We examined accidental deaths overall (22 419 total deaths) and separately in the most common categories: falls (ICD-10 codes W00–W19; 5778 total deaths), transport accidents (ICD-10 codes V01–V99; 3362 total deaths) and accidental poisoning (ICD-10 codes X40–X49; 2177 total deaths, including 897 from alcohol, 458 from narcotics, 307 from neuropsychiatric medications, and 515 from other drugs, chemicals or gases). Deaths of undetermined intent (ICD-10 codes Y10–Y34; 2176 total deaths) were excluded from these outcomes. This study was approved by the regional ethics committee of Lund University in Sweden.

Mental disorder ascertainment

Mental disorders were identified by any primary or secondary diagnosis in the Swedish Out-patient Registry or the Swedish Hospital Registry during the follow-up period, 1 January 2001 to 31 December 2008. The Swedish Out-patient Registry contains all primary and secondary out-patient diagnoses nationwide starting in 2001 (including private and public out-patient departments as well as psychiatric clinics), and the Swedish Hospital Registry contains all primary and secondary hospital discharge diagnoses with nationwide coverage since 1987. These registries are estimated to be >99% complete.²² Mental disorders were classified according to ICD-10¹⁷ codes and examined in the following categories: any mental disorder (F00–F69), dementia (F00–F03), alcohol use disorder (F10), other substance use disorders (F11–F19), schizophrenia (F20), bipolar disorder (F31), depression (F32–F33), anxiety disorders (F40–F41) and personality disorders (F60–F61).

Other study variables

Sociodemographic characteristics that may be associated with mental disorders and accidental death were identified using national census data from 2000 to 2001, and were linked to the registry data using an anonymous personal identification number.²³ The following were examined as predictor and adjustment variables: gender (male or female); age (modelled both as a continuous variable by birth date and a categorical variable by age at study entry in 10-year categories to allow for a non-linear effect); marital status (married/cohabiting, never married, divorced, widowed, or unknown); country of birth (Sweden, other Nordic countries (Denmark, Finland, Iceland, Norway), non-Nordic countries, or unknown); education level (compulsory school or less (≤ 9 years), practical high school or some theoretical high school (10–11 years), theoretical high school and/or college (≥ 12 years), or unknown); employment status (employed or non-employed (non-employed includes students and home-makers)); income (categorical variable in quartiles, or unknown); and urban/rural status (large cities, medium-sized towns, small towns/rural, or unknown).

In a separate model, we examined the potential mediating effect of substance use in the associations between other mental disorders and accidental death, by further adjusting for any out-patient or in-patient diagnosis of alcohol use disorder (ICD-10 code F10) or other substance use disorders (ICD-10 codes F11–F19) during 2001–2008 (modelled as time-dependent variables).

Statistical analysis

We used Cox proportional hazards regression to compute hazard ratios (HRs) and 95% confidence intervals (CIs) for the associations between sociodemographic factors or mental disorders and accidental death during the follow-up period. Mental disorders were modelled as time-dependent variables in each model, so that persons contributed to 'non-exposed' person-years before and 'exposed' person-years after the earliest diagnosis of the respective mental disorder. Individuals were censored at the time of death from any cause other than accidents ($n = 709\,487$; 10.3%), or at the time of emigration as determined by the absence of a Swedish residential address in census data ($n = 199\,195$; 2.9%). A likelihood ratio test was used to assess for interaction between gender and mental disorders with respect to accidental death risk. Analyses were subsequently stratified by gender because of significant differences found in risk estimates. Three different adjusted models were used in the main analyses: the first was adjusted for age; the second for age and other sociodemographic factors (marital status, country of birth, education, employment status, income and urban/rural status); and the third for age, other sociodemographic factors, and alcohol and other substance use disorders (as time-dependent variables). We also examined the associations between mental disorders and the most commonly reported types of accidental death (poisoning, falls and transport accidents). The proportional hazards assumption was evaluated by graphical assessment of log-log plots²⁴ and was met in each of the models. All statistical tests were two-sided and used an α -level of 0.05. All analyses were conducted using Stata statistical software, version 11.0 for Windows.

Results

In this population of 6 908 922 Swedish adults, there were 22 419 (0.3%) accidental deaths in 51.6 million person-years of follow-up during 2001–2008. Among those diagnosed with mental disorders ($n = 649\,051$), there were 5933 (0.9%) accidental deaths

compared with 3731 (0.6%) suicides. Crude mortality rates due to accidents (per 100 000 person-years) were 43.4 in the entire population (125.4 among those with mental disorders *v.* 35.1 among those without mental disorders).

Sociodemographic factors and accidental death

Men had more than twice the risk of accidental death than women, after adjusting for all other sociodemographic factors (adjusted HR = 2.27, 95% CI 2.19–2.34). The risk of accidental death also increased strongly with increasing age (see online Table DS1). Other independent risk factors included unmarried status, low or unknown education level, non-employment and low income. Nordic immigrants had higher risk and other immigrants lower risk compared with native Swedes, and persons who lived in large cities had higher risk than those who lived in medium-sized or small towns (Table DS1).

Mental disorders and accidental death

In total, 26.0% of women and 26.8% of men who died from accidents were diagnosed with a mental disorder during the study period, compared with 10.1% of women and 8.7% of men in the general population (Table 1). The association between any mental disorder and accidental death varied significantly by gender ($P_{\text{interaction}} < 0.001$). After adjusting for age and other sociodemographic factors, hazard ratios for this association were 5.29 (95% CI 5.04–5.55) for women and 6.64 (95% CI 6.37–6.91) for men (Table 1). Among specific mental disorders, the strongest risk factors were alcohol use (14-fold risk for women and 9-fold for men) and other substance use disorders (8-fold risk for women and 10-fold for men). However, all other mental disorders also were strong risk factors for accidental death among both women and men. Personality disorders were associated with a 7-fold risk among women and a 4-fold risk among men, and dementia with a 6-fold risk among women and a 7-fold risk among men, whereas schizophrenia, bipolar disorder, depression and anxiety disorders had risk estimates in the 2- to 3.5-fold range (Table 1).

The potential mediating effect of alcohol and other substance use was examined by further adjusting for these disorders. This resulted in attenuation of all risk estimates, although they remained highly significant, including more than a fourfold risk of accidental death among women or men with any mental disorder (Table 1). We alternatively examined accidental death risks after excluding people with alcohol or other substance use disorders ($n = 150\,886$). This resulted in slightly higher risk estimates that were highly significant for all mental disorders (data not shown). These findings suggest that the associations between mental disorders and accidental death were not fully explained by comorbid substance use.

We assessed whether the association between any mental disorder and accidental death was modified by other sociodemographic factors (i.e. in addition to the gender difference shown above), by examining risk estimates after stratifying by these factors. After adjusting for sociodemographic factors as well as substance use disorders, all stratified hazard ratios were in the 1.6–6.0 range and highly significant (Table 2), suggesting that mental disorders are important risk factors for accidental death among all adults irrespective of age or other sociodemographic characteristics. Likelihood ratio tests for interactions showed that the association between any mental disorder and accidental death was stronger among adults who were older, married or non-employed; those who lived in large cities; and/or Swedes or Nordic immigrants compared with non-Nordic immigrants

Table 1 Mental disorders and risk of accidental death (2001–2008)

Mental disorders (ICD-10 codes)	No. (%) in total population	No. (%) among those who died from accidents	Adjusted for age Adjusted HR (95% CI)	Adjusted for age and other sociodemographics ^a Adjusted HR (95% CI)	Adjusted for age, other sociodemographics and substance use ^b Adjusted HR (95% CI)
Any mental disorder (F00–F69)					
Women	354 367 (10.1)	2420 (26.0)	5.71 (5.45–6.00)	5.29 (5.04–5.55)	4.63 (4.40–4.88)
Men	294 684 (8.7)	3513 (26.8)	8.12 (7.81–8.45)	6.64 (6.37–6.91)	4.46 (4.23–4.71)
Dementia (F00–F03)					
Women	67 729 (1.0)	1337 (6.0)	6.78 (6.38–7.20)	6.14 (5.78–6.53)	6.01 (5.65–6.38)
Men	45 728 (0.7)	1094 (4.9)	8.05 (7.54–8.59)	7.03 (6.58–7.51)	6.51 (6.10–6.95)
Alcohol use disorder (F10)					
Women	31 193 (0.9)	335 (3.6)	17.52 (15.67–19.59)	14.90 (13.29–16.72)	12.62 (11.17–14.25)
Men	77 353 (2.3)	1450 (11.1)	13.64 (12.90–14.43)	9.09 (8.56–9.65)	7.34 (6.89–7.83)
Other substance use disorders (F11–F19)					
Women	24 519 (0.7)	166 (1.8)	10.47 (9.02–12.16)	8.91 (7.66–10.36)	4.93 (4.19–5.80)
Men	36 038 (1.1)	713 (5.4)	16.99 (15.76–18.32)	10.58 (9.77–11.45)	6.16 (5.65–6.70)
Schizophrenia (F20)					
Women	10 825 (0.3)	51 (0.6)	4.58 (3.48–6.03)	3.15 (2.38–4.16)	2.90 (2.19–3.83)
Men	14 534 (0.4)	133 (1.0)	5.86 (4.94–6.94)	2.61 (2.20–3.11)	2.21 (1.86–2.63)
Bipolar disorder (F31)					
Women	17 661 (0.5)	61 (0.7)	3.87 (3.01–4.97)	3.46 (2.69–4.44)	2.77 (2.16–3.57)
Men	11 938 (0.4)	61 (0.5)	3.15 (2.46–4.05)	2.29 (1.78–2.94)	1.65 (1.29–2.12)
Depression (F32–F33)					
Women	124 256 (3.5)	492 (5.3)	3.08 (2.82–3.38)	2.92 (2.66–3.20)	2.47 (2.25–2.72)
Men	79 470 (2.4)	525 (4.0)	3.69 (3.38–4.02)	3.17 (2.90–3.45)	2.21 (2.02–2.42)
Anxiety disorders (F40–F41)					
Women	84 997 (2.4)	264 (2.8)	3.52 (3.12–3.97)	3.25 (2.88–3.67)	2.51 (2.21–2.84)
Men	52 679 (1.6)	281 (2.2)	4.05 (3.61–4.55)	3.07 (2.73–3.45)	1.86 (1.65–2.09)
Personality disorders (F60–F61)					
Women	16 413 (0.5)	66 (0.7)	9.77 (7.71–12.39)	7.41 (5.83–9.43)	4.02 (3.14–5.14)
Men	12 844 (0.4)	112 (0.9)	7.73 (6.43–9.29)	4.12 (3.42–4.96)	2.07 (1.71–2.49)

HR, hazard ratio.

a. Other sociodemographic variables included marital status, country of birth, education, employment status, income and urban/rural status.

b. Substance use included any out-patient or in-patient diagnosis of alcohol or other substance use disorders (modelled as time-dependent variables).

($P < 0.001$ for each of these interactions). Significant interactions also were found by education level or income, but the risk estimates did not have a consistent pattern across different strata (Table 2).

Mental disorders and specific types of accidental death

We also examined the associations between mental disorders and the most commonly reported types of accidental death: accidental poisoning, falls and transport accidents. After adjusting for age, other sociodemographic factors and substance use disorders, any mental disorder was associated with highly increased risks of death from accidental poisoning (5.5-fold among women and 3.2-fold among men) or falls (4.2-fold among women and 4.5-fold among men); and modestly increased risks of transport accident death (1.7-fold among women and 1.3-fold among men) (Table 3; for full data, see online Table DS2).

Among specific mental disorders, alcohol and/or other substance use disorders were the strongest risk factors for each type of accidental death, especially accidental poisoning (Table DS2). However, most other mental disorders also were significant risk factors. In the fully adjusted model, an increased risk of death from accidental poisoning was found for all mental disorders except dementia among women or men and schizophrenia among women (fully adjusted HRs ~1.6–3.9). An increased risk of death from falls was found for all mental disorders except bipolar disorder among men or personality disorders among women or men (fully adjusted HRs ~1.6–5.8). In addition, an increased risk

of transport accident death was found among women or men with depression, and women with anxiety or personality disorders (fully adjusted HRs ~1.7–3.7) (Table DS2). The proportion of automobile accident fatalities in which the deceased was the driver was similar comparing those with diagnosed mental disorders (122/170 = 71.8%) *v.* those without (1072/1567 = 68.4%) ($P = 0.36$).

Discussion

Main findings

In this large cohort study, people with mental disorders had a highly increased risk of accidental death, which was substantially more common than suicide. Mental disorders overall were associated with a 5.3-fold risk of accidental death among women and a 6.6-fold risk among men. Strong associations were found irrespective of age or socioeconomic status, and for different types of accidental death (especially poisoning and falls). Although alcohol and other substance use disorders were the strongest risk factors, all other mental disorders were major risk factors and did not appear fully explained by comorbid substance use. Sociodemographic risk factors included male gender, older age, unmarried status and low socioeconomic status. These findings are important for clinicians and can help inform better risk-management strategies.

To our knowledge, this is the largest study to date of the link between mental disorders and accidental death, and the first to examine mental disorders using nationwide out-patient and in-patient diagnoses. The use of out-patient as well as in-patient

Table 2 Association between any mental disorder and accidental death (2001–2008), stratified by sociodemographic factors or substance use disorders

	Adjusted hazard ratio (95% CI) ^a	P for interaction ^b
Age, years		<0.001
20–29	1.68 (1.26–2.24)	
30–39	2.49 (1.93–3.21)	
40–49	2.23 (1.78–2.79)	
50–59	2.93 (2.49–3.46)	
60–69	4.53 (3.91–5.25)	
70–79	5.40 (4.98–5.85)	
≥80	4.40 (4.19–4.62)	
Marital status		<0.001
Married/cohabiting	5.25 (4.93–5.60)	
Never married	2.85 (2.59–3.14)	
Divorced	3.42 (3.07–3.82)	
Widowed	3.89 (3.65–4.15)	
Country of birth		<0.001
Sweden	4.35 (4.18–4.52)	
Other Nordic countries	4.54 (3.79–5.45)	
Non-Nordic countries	3.86 (3.14–4.67)	
Education level (years)		<0.001
Compulsory high school or less (≤9)	3.74 (3.35–4.17)	
Practical or some theoretical high school (10–11)	2.69 (2.35–3.08)	
Theoretical high school and/or college (≥12)	3.45 (3.02–3.96)	
Unknown	4.80 (4.60–5.02)	
Employment status		<0.001
Employed	2.64 (2.26–3.07)	
Non-employed	4.59 (4.42–4.77)	
Income		0.01
Highest quartile	4.18 (3.73–4.69)	
2nd quartile	4.06 (3.70–4.45)	
3rd quartile	3.90 (3.66–4.16)	
Lowest quartile	4.03 (3.78–4.30)	
Urban/rural status		<0.001
Large cities	4.20 (3.95–4.48)	
Medium-sized towns	4.03 (3.77–4.31)	
Small towns/rural	3.79 (3.54–4.07)	
Any substance use disorder		Not estimable
No	4.41 (4.25–4.58)	
Yes	Not estimable	

a. Risk estimates were adjusted for gender and all other variables included in this table.

b. Likelihood ratio test for interaction between any mental disorder and the respective variable with respect to accidental death.

data is important because it allows the inclusion of individuals with milder mental disorders who do not require admission to hospital, enabling more reliable and generalisable risk estimates. Most previous studies of this issue were based on either hospital discharge data^{9,10} or smaller case-control¹¹ or community-based^{12–15} samples, and varied widely in adjustment for

confounding. Our overall risk estimates were higher than the two- to fivefold increased risks of accidental death among psychiatric patients reported in those studies, possibly due to better ascertainment and reduced misclassification of mental disorders. Our findings for accidental poisoning death were broadly consistent with those of a large US cohort study that

Table 3 Associations between any mental disorder (ICD-10 F00–F69) and specific type of accidental death (2001–2008)

Type of accidental death (ICD-10 code)	Accidental deaths, <i>n</i>	Adjusted for age and other sociodemographics ^a Adjusted hazard ratio (95% CI)	Adjusted for age, other sociodemographics and substance use ^b Adjusted hazard ratio (95% CI)
Accidental poisoning (X40–X49)			
Women	264	19.42 (15.95–23.64)	5.53 (4.10–7.46)
Men	927	20.26 (18.15–22.62)	3.17 (2.49–4.05)
Falls (W00–W19)			
Women	660	4.55 (4.15–4.99)	4.21 (3.82–4.64)
Men	870	6.20 (5.71–6.73)	4.53 (4.09–5.02)
Transport accidents (V01–V99)			
Women	74	2.03 (1.60–2.58)	1.74 (1.33–2.29)
Men	249	2.30 (2.01–2.63)	1.29 (1.04–1.60)

a. Adjusted for age, marital status, country of birth, education, employment status, income and urban/rural status.

b. Adjusted for the same variables as above, and any out-patient or in-patient diagnosis of alcohol or other substance use disorders (modelled as time-dependent variables).

consisted predominantly of men,⁸ except that we found that this cause-specific association was stronger among women.

Comorbid substance use accounted for part but not all of the observed associations between mental disorders and accidental death. We found that various mental disorders were strongly associated with death from poisoning or falls, and modestly associated with transport accident death, even after accounting for substance use. Several other mechanisms may contribute to these risks. Common symptoms of psychiatric illness, such as fatigue, poor concentration and sleep disturbance, may increase the risk of accidents through impaired judgement, coordination and reaction time.^{25–28} Psychiatric medications may also contribute to these risks through common side-effects, or unintentional overdose resulting from confusion or an effort to relieve symptoms of the underlying disorder.⁸ Some mental disorders are associated with risk-taking or self-destructive behaviour that may occur on a continuum from subintentional to intentional, increasing the risk of either accidental death or suicide.^{5,6} Studies with more detailed clinical information will be needed to elucidate the relative contributions of these factors for specific types of accidental death.

Although the risk of suicide among psychiatric patients has been studied extensively,⁴ less attention has been given to the risk and prevention of accidental death, which may be more common. We found that accidental death shares several risk factors in common with those previously reported for suicide,^{4,6} including male gender, unmarried status, unemployment, low socioeconomic status, as well as mental disorders. These findings have important implications for the prevention of premature death among people with mental illness. Previous studies have suggested that suicide prevention programmes that address a range of underlying risk factors, in contrast to more narrowly outcome-specific interventions, may effectively reduce mortality from accidental death and other adverse outcomes in addition to suicide.^{6,29} Our findings lend further support to this approach. Interventions targeting common underlying determinants of suicide and accidental death will likely have greater potential to reduce premature mortality than programmes focusing more narrowly on suicide.

Strengths and limitations

A major strength of this study was the ability to examine the link between mental disorders and accidental death in the largest cohort to date using registry data for an entire national population. Mental disorders were ascertained using out-patient as well as in-patient diagnoses from all healthcare settings nationwide, enabling more reliable risk estimates than studies limited to hospitalised cases or selected samples. The results were adjusted for broadly measured confounders, and we assessed the mediating effect of comorbid substance use.

Limitations included the inability to examine mental disorders that were undiagnosed, thus mental disorders in this study likely underestimated the true prevalence in the population. This has an uncertain effect on risk estimates but may cause attenuation towards the null hypothesis by making the two groups (those with and without mental disorders) spuriously more similar with respect to the outcome. Regardless, because we used nationwide out-patient and in-patient data in Sweden, which has universal healthcare access, ascertainment was much more complete than in previous studies. Substance use disorders also were ascertained using nationwide out-patient and in-patient diagnoses, which likely underestimated their true prevalence and influence as mediators. Some suicides may have been misclassified as accidental deaths,^{30,31} despite the exclusion of 'deaths of

undetermined intent' from the study outcomes. Suicide is a stigmatising and distressing verdict for families and there can be pressure to attribute deaths to accidents rather than suicides. However, the increasing accidental death risk by increasing age was in contrast to the absence of an age-effect for suicide risk that we previously noted in this population,²³ suggesting that misclassification was unlikely to be a major influence. Information on non-fatal accidents was unavailable and would be useful to examine in future studies when feasible. Finally, some analyses of specific types of accidents had limited precision because of small numbers of deaths. Additional large cohort studies will be needed to further elucidate the risks and mechanisms for different types of accidents.

Implications

This large national cohort study found that all mental disorders were strong risk factors for accidental death, which appeared to be substantially more common than suicide. Mental disorders were strongly associated with accidental death among adults of all ages and socioeconomic status, and this was not fully explained by comorbid substance use. These findings suggest that interventions to reduce premature mortality among people with mental disorders should address common underlying determinants of accidental death in addition to suicide. Improved awareness of accidental death risks is needed for more effective overall risk assessment and management.

Casey Crump, MD, PhD, Department of Medicine, Stanford University, Stanford, California, USA; **Kristina Sundquist**, MD, PhD, Center for Primary Health Care Research, Lund University, Malmö, Sweden, and Stanford Prevention Research Center, Stanford University, Stanford, California, USA; **Marilyn A. Winkleby**, PhD, Stanford Prevention Research Center, Stanford University, Stanford, California, USA; **Jan Sundquist**, MD, PhD, Center for Primary Health Care Research, Lund University, Malmö, Sweden, and Stanford Prevention Research Center, Stanford University, Stanford, California, USA

Correspondence: Casey Crump, MD, PhD, 211 Quarry Road, Suite 405, MC 5985, Palo Alto, CA 94304-1426, USA. Email: kccrump@stanford.edu

First received 20 Nov 2012, final revision 12 May 2013, accepted 5 Jun 2013

Funding

This work was supported by grants from the National Institute of Drug Abuse [R01DA030005], the Swedish Research Council, and ALF project grant, Lund, Sweden. The funding agencies had no role in the design and conduct of the study; in the collection, analysis and interpretation of the data; or in the preparation, review or approval of the manuscript.

References

- 1 Krug EG, Sharma GK, Lozano R. The global burden of injuries. *Am J Public Health* 2000; **90**: 523–6.
- 2 Mock C, Quansah R, Krishnan R, Arreola-Risa C, Rivara F. Strengthening the prevention and care of injuries worldwide. *Lancet* 2004; **363**: 2172–9.
- 3 Murray CJ, Lopez AD. Global mortality, disability, and the contribution of risk factors: Global Burden of Disease Study. *Lancet* 1997; **349**: 1436–42.
- 4 Harris EC, Barraclough B. Suicide as an outcome for mental disorders. A meta-analysis. *Br J Psychiatry* 1997; **170**: 205–28.
- 5 Neeleman J, Wessely S, Wadsworth M. Predictors of suicide, accidental death, and premature natural death in a general-population birth cohort. *Lancet* 1998; **351**: 93–7.
- 6 Neeleman J. A continuum of premature death. Meta-analysis of competing mortality in the psychosocially vulnerable. *Int J Epidemiol* 2001; **30**: 154–62.
- 7 Miller PG. Safe using messages may not be enough to promote behaviour change amongst injecting drug users who are ambivalent or indifferent towards death. *Harm Reduct J* 2009; **6**: 18.
- 8 Bohnert AS, Ilgen MA, Ignacio RV, McCarthy JF, Valenstein M, Blow FC. Risk of death from accidental overdose associated with psychiatric and substance use disorders. *Am J Psychiatry* 2012; **169**: 64–70.

- 9 Hiroeh U, Appleby L, Mortensen PB, Dunn G. Death by homicide, suicide, and other unnatural causes in people with mental illness: a population-based study. *Lancet* 2001; **358**: 2110–2.
- 10 Black DW, Warrack G, Winokur G. The Iowa record-linkage study. I. Suicides and accidental deaths among psychiatric patients. *Arch Gen Psychiatry* 1985; **42**: 71–5.
- 11 Gau SSF, Cheng ATA. Mental illness and accidental death. Case-control psychological autopsy study. *Br J Psychiatry* 2004; **185**: 422–8.
- 12 Hillard JR, Zung WW, Ramm D, Holland JM, Johnson M. Accidental and homicidal death in a psychiatric emergency room population. *Hosp Community Psychiatry* 1985; **36**: 640–3.
- 13 Holding TA, Barraclough BM. Psychiatric morbidity in a sample of accidents. *Br J Psychiatry* 1977; **130**: 244–52.
- 14 Martin RL, Cloninger CR, Guze SB, Clayton PJ. Mortality in a follow-up of 500 psychiatric outpatients. II. Cause-specific mortality. *Arch Gen Psychiatry* 1985; **42**: 58–66.
- 15 Rorsman B, Hagnell O, Lanke J. Violent death and mental disorders in the Lundby Study. Accidents and suicides in a total population during a 25-year period. *Neuropsychobiology* 1982; **8**: 233–40.
- 16 Ruschena D, Mullen PE, Burgess P, Cordner SM, Barry-Walsh J, Drummer OH, et al. Sudden death in psychiatric patients. *Br J Psychiatry* 1998; **172**: 331–6.
- 17 World Health Organization. *The ICD-10 Classification of Mental and Behavioural Disorders: Clinical Descriptions and Diagnostic Guidelines*. WHO, 1992.
- 18 National Board of Health and Welfare. *Causes of Death 2010*. National Board of Health and Welfare, 2011.
- 19 United Nations, Economic Commission for Europe. *Statistics of Road Traffic Accidents in Europe and North America*. United Nations, 2011.
- 20 Baker SP, O'Neill B, Karpf RS. *The Injury Fact Book*. Lexington Books, 1984.
- 21 Peden M, McGee K, Sharma G. *The Injury Chart Book: A Graphical Overview of the Global Burden of Injuries*. World Health Organization, 2002.
- 22 Ludvigsson JF, Andersson E, Ekblom A, Feychting M, Kim JL, Reuterwall C, et al. External review and validation of the Swedish national inpatient register. *BMC Public Health* 2011; **11**: 450.
- 23 Crump C, Sundquist K, Sundquist J, Winkleby MA. Sociodemographic, psychiatric and somatic risk factors for suicide: a Swedish national cohort study. *Psychol Med* 2013; 1–11. [Epub ahead of print]
- 24 Garrett JM. gr23: Graphical assessment of the Cox model proportional hazards assumption. *Stata Technical Bulletin* 1997; **35**: 9–14.
- 25 Kaufmann CN, Spira AP, Rae DS, West JC, Mojtabai R. Sleep problems, psychiatric hospitalization, and emergency department use among psychiatric patients with Medicaid. *Psychiatr Serv* 2011; **62**: 1101–5.
- 26 Leavitt VM, DeLuca J. Central fatigue: issues related to cognition, mood and behavior, and psychiatric diagnoses. *PM R* 2010; **2**: 332–7.
- 27 Skapinakis P, Lewis G, Meltzer H. Clarifying the relationship between unexplained chronic fatigue and psychiatric morbidity: results from a community survey in Great Britain. *Am J Psychiatry* 2000; **157**: 1492–8.
- 28 Krahn LE. Psychiatric disorders associated with disturbed sleep. *Semin Neurol* 2005; **25**: 90–6.
- 29 Knox KL, Litts DA, Talcott GW, Feig JC, Caine ED. Risk of suicide and related adverse outcomes after exposure to a suicide prevention programme in the US Air Force: cohort study. *BMJ* 2003; **327**: 1376.
- 30 Neeleman J, Wessely S. Changes in classification of suicide in England and Wales: time trends and associations with coroners' professional backgrounds. *Psychol Med* 1997; **27**: 467–72.
- 31 Cheng AT. Mental illness and suicide. A case-control study in east Taiwan. *Arch Gen Psychiatry* 1995; **52**: 594–603.

