# Suicide as an outcome for mental disorders. A meta-analysis.

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# Suicide as an outcome for mental disorders

## A meta-analysis

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**Background** Mental disorders have a strong association with suicide. This meta-analysis, or statistical overview, of the literature gives an estimate of the suicide risk of the common mental disorders.

**Method** We searched the medical literature to find reports on the mortality of mental disorders. English language reports were located on MEDLINE (1966–1993) with the search terms 'mental disorders', 'brain injury', 'eating disorders', 'epilepsy', 'suicide attempt', 'psychosurgery', with 'mortality' and 'follow-up studies', and from the reference lists of these reports. We abstracted 249 reports with two years or more follow-up and less than 10% loss of subjects, and compared observed numbers of suicides with those expected. A standardised mortality ratio (SMR) was calculated for each disorder.

**Results** Of 44 disorders considered, 36 have a significantly raised SMR for suicide, five have a raised SMR which fails to reach significance, one SMR is not raised and for two entries the SMR could not be calculated.

**Conclusions** If these results can be generalised then virtually all mental disorders have an increased risk of suicide excepting mental retardation and dementia. The suicide risk is highest for functional and lowest for organic disorders with substance misuse disorders lying between. However, within these broad groupings the suicide risk varies widely.

Suicide has a strong association with mental disorder and contributes to the excess mortality of the mentally ill. This association has been assessed by 'psychological autopsy' of consecutive series of suicides and by studying the suicide mortality of particular disorders. These approaches have shown some 90% of suicides to have one or more psychiatric disorders at the time they kill themselves and that certain mental illnesses have increased suicide risks.

The purpose of this paper is to organise the many follow-up mortality studies of mental disorders using the technique of meta-analysis, or statistical overview, to determine the best estimate of their combined suicide risk.

## METHOD

### Search procedure

We searched Index Medicus from 1966 to 1993 using MEDLINE with the search term " 'mental disorders' with 'mortality' and 'follow-up' ". We also searched similarly on 'brain injury', 'eating disorders', 'epilepsy', 'suicide attempt' and 'psychosurgery'. We also read up to mid-1995: *The Lancet*, *British Medical Journal*, *New England Journal of Medicine*, *British Journal of Psychiatry*, *Psychological Medicine*, *Archives of General Psychiatry* and *Acta Psychiatrica Scandinavica*.

Reference lists in the papers located provided further citations. We abstracted 249 papers which fulfilled the following criteria: described the mortality of a cohort with a defined disorder with a mean, or median, follow-up of two years or more, published in an English language peer reviewed journal; lost less than 10% of cases at follow-up; gave observed numbers of suicides; and gave expected numbers of suicides, or provided the facts to estimate expected numbers from World Health Organization (WHO) mortality statistics.

### Data abstraction

Observed values were confined to deaths stated as suicide. Expected values for suicide were given in 91 (37%) of the 249 papers, and provided by the authors in one (Amaddeo *et al*, 1995). We estimated expected values for the remaining 157 using WHO statistical reports (World Health Organization, 1961; 1962) for the relevant country and years, combined with the age/gender composition and mean observation period for each report. These values are marked * in the tables. The word 'expected', throughout the report, means values calculated in this way, or provided by authors. Male and female values are marked m and f.

The follow-up criteria were breached occasionally for papers of exceptional interest. Papers concerned with 'neurosis', no longer an approved term, require a special note. Neurosis is under that heading, anxiety neurosis is under anxiety disorders and depressive neurosis is in dysthymia. All populations were patients, predominantly psychiatric.

### Statistical methods

Standardised mortality ratios (SMRs) and 95% confidence intervals (CIs) were calculated for each disorder by comparing the sums of their observed and expected values. Statistical significance ($P<0.05$) was tested by the Poisson distribution, two-tailed. An increased SMR is statistically significant when the lower CI is greater than 100.

## RESULTS

### Presentation

Results are presented using the category order and terminology of DSM-III-R (American Psychiatric Association, 1987). Conditions not in DSM-III-R use the terminology of the ICD-9 (World Health Organization, 1977). Deviation from these manuals is explained where it occurs. The review concludes with populations of mixed diagnoses classified by care status.

The findings for each disorder are presented in the same way to make reading easier. The first paragraph summarises the papers in the accompanying table, the second gives the suicide risk, the third and subsequent paragraphs comment. A summary table in the Discussion gives an overview of the findings. The sample size, length of follow-up, total number of deaths and percentage of deaths due to suicide for

all cited studies are available from the corresponding author.

## Mental retardation (DSM-III-R 318.10, 319.00 and ICD-9 758.0) (Table 1)

Five reports from three countries reported on a population of over 3500 followed for up to 33 years. Many were children at cohort inception. In the only report giving gender 55% were male (Deaton, 1973). The USA provided 89% of the expected value, Sletten *et al* (1972) alone contributed 79%.

The suicide risk for the combined population was 0.9 times that expected. Of two reports from institutions and concerned with unspecified causes of mental retardation, one (Sletten *et al*, 1972) recorded three suicides (all adult) with 2.7 expected. The three reports about Down's syndrome, two of 'community care' and one institutional, found no suicides among over 400 deaths.

A serious degree of mental retardation is therefore not associated with an increased suicide risk. Since mental illness is more common in the mentally retarded than the general population, handicap may even be protective, probably because of impaired competence. The cheerful mood associated with Down's syndrome may also be protective.

## Child and adolescent psychiatric patients (Table 2)

Eleven papers from six countries reported on a population of 11 000 followed for 2–30 years. Fifty-two per cent of the population were male. Scandinavian studies contributed 96% of the expected value, Sweden alone 65%. de Château's child guidance study (1990) provided 48%. The papers principally, but not entirely, described the mortality of young adults, who as children or adolescents aged between 1 and 20 years, had required psychiatric treatment. In the longest follow-up (Larsen *et al*, 1990) some adults were in their early forties.

The overall suicide risk was almost five times that expected. The risk for females compared with males was the reverse of that in the general population, 2.8 times higher instead of three times lower (Rydelius, 1984; 1988; Kuperman *et al*, 1988; Stein & Tanzer, 1988; de Château, 1990; Kjelsberg *et al*, 1994). This remarkable difference is unexplained by the data.

The severity of the disorder, as assessed by type of treatment, was related to suicide risk. Child guidance clinic treatment (de Château, 1990) had a risk twice that expected, probationary school seven times (Rydelius, 1988), in-patient treatment eight times (King & Pittman, 1970; Rydelius, 1984; Kuperman *et al*, 1988; Larsen *et al*, 1990; Kjelsberg *et al*, 1994), and treatment for a suicide attempt eight times (Garfinkel *et al*, 1982; Goldacre & Hawton, 1985). Compulsory in-patient care for suicidal ideas or conduct had a risk 250 times the expected (Stein & Tanzer, 1988) but this was based on the mortality of only 25 cases. Assessing the true suicide risk for children

**Table 1** Mental retardation

| Report/disorder/SMR | Country | Suicides | |
|---|---|---|---|
| | | Observed | Expected |
| Down's syndrome (ICD-9 758.0) | | | |
| Baird & Sadovnick (1990) | Canada | 0 | 0.10* |
| Balarajan *et al* (1982) | England | 0 | 0.26* |
| Deaton (1973) | USA | 0 | 0.20* |
| | **Sub-total** | **0** | **0.56** |
| Severe (DSM-III-R 318.10) | | | |
| Blisard *et al* (1988) | USA | 0 | 0.14* |
| Unspecified (DSM-III-R 319.00) | | | |
| Sletten *et al* (1972) | USA | 3 | 2.70* |
| **SMR 88 (95% CI 18–258)** | **Total** | **3** | **3.40** |

*Expected value calculated by us; SMR, standardised mortality ratio.

**Table 2** Child and adolescent psychiatry patients

| Report/treatment/SMR | Country | Suicides | |
|---|---|---|---|
| | | Observed | Expected |
| Östman (1991) | Sweden | 1 | 0.70* |
| Child guidance clinic | | | |
| de Château (1990) | Sweden | 33 | 15.20* |
| Compulsory probationary school treatment for antisocial behaviour (DSM-III-R V71.02) | | | |
| Rydelius (1988) | Sweden | 28 | 4.10* |
| In-patient | | | |
| King & Pittman (1970) | USA | 1 | 0.02* |
| Kjelsberg *et al* (1994) | Norway | 35 | 4.24 |
| Kuperman *et al* (1988) | USA | 10 | 1.20 |
| Larsen *et al* (1990) | Denmark | 4 | 2.06* |
| Rydelius (1984) | Sweden | 15 | 0.80* |
| | **Sub-total** | **65** | **8.32** |
| Certified | | | |
| Stein & Tanzer (1988) | Canada | 5 | 0.02* |
| Suicide attempts | | | |
| Self-poisoning | | | |
| Goldacre & Hawton (1985) | England | 1 | 0.30* |
| Unspecified methods | | | |
| Garfinkel *et al* (1982) | Canada | 4 | 0.30* |
| | **Sub-total** | **5** | **0.60** |
| **SMR 473 (95% CI 397–560)** | **Total** | **137** | **28.94** |

*Expected value calculated by us; SMR, standardised mortality ratio.

may be affected by a reluctance to record self-inflicted death in the young as suicide. For example, Goldacre & Hawton (1985) stated six of 10 deaths were probable suicides with only one recorded as definite suicide.

Suicide in children during and subsequent to psychiatric treatment is probably unusual under the age of 17 as the following shows. Five reports gave ages at death (Rydelius, 1984; Goldacre & Hawton, 1985; Kuperman *et al*, 1988; Stein & Tanzer, 1988; de Château, 1990) and none of the 77 suicides was aged under 15 years. In the report giving suicide by age band, only five of the 28 suicides were aged 15–19 (Rydelius, 1984). In the other four reports giving data on age at death, all the suicides were 17 years or over. Six reports did not provide age at death. Most suicides among cohorts of children who required psychiatric treatment appeared to occur on entry to and within adult life. This suggests the continuation or recurrence of childhood disorders many years later.

An earlier report (Nylander, 1979) of the Swedish child guidance clinic cohort (de Château, 1990) was excluded.

## Eating disorders: Anorexia nervosa (DSM–III–R 307.10) and Bulimia nervosa (DSM–III–R 307.51) (Table 3)

Thirteen reports from seven countries gave the outcome for a population of some 1300 followed for up to 50 years. Nearly all were referrals to medical or psychiatric departments. Ninety-seven per cent were women. Britain and Scandinavia together contributed 92% of the expected value. The mean age at cohort inception was approximately 20 years. The mean period from disease onset to suicide could not be calculated, nor the mean age at suicide. The gender of the suicides was given in only one study (Tolstrup *et al*, 1985); all six were female. Since 97% of the total population was female probably all the suicides were also. The suicide risk was 23 times the expected for the combined group, ranging between zero and 100 times. The smaller studies had the more extreme values. The suicide risk for anorexia nervosa was also increased 23 times. For bulimia nervosa, only one suicide did not permit a statistically meaningful risk to be computed. Further long-term follow-up studies need to be completed before the risk for bulimia nervosa may be compared with that for anorexia nervosa.

## Psychoactive substance use disorders

This section considers dependence and abuse of alcohol, opioids and prescription drugs, use and misuse of cannabis, and nicotine use. Most reports consider mortality associated with one substance, but much substance abuse is multiple and some reports reflect this. The word 'drug' here includes alcohol and nicotine.

### *Alcohol dependence and abuse (DSM–III–R 303.90 and 305.00) (Table 4a)*

Thirty-two papers reported on a total population of over 45 000 from 11 countries followed, in some studies, for up to 30 years. Scandinavia accounted for 50% of the expected value and the USA 34%. Ninety per cent of the population were male. Combining the studies gave a suicide risk almost six times that expected but with variation between studies of 1–60 times. This variation is probably explained by differences in cohort composition by gender, clinical severity, comorbidity and alcohol consumed. A consideration of each may assist in identifying factors which modify suicide risk in alcohol abuse.

*Gender.* The suicide risk for females was very much greater than for males, about 20 times that expected compared with four for males. Women who break the convention opposing female heavy drinking may have a psychology which greatly increases their suicide risk. More abuse of other drugs in women may also be responsible (Dahlgren & Myrhed, 1977; Lindelius *et al*, 1974).

*Clinical severity.* Men who remained in full-time employment (Pell & D'Alonzo, 1973) had the lowest risk of any study, an SMR of 180 derived from two suicides with 1.13 expected.

*Comorbidity.* Medical illness (Gillis, 1969) including peptic ulcer (Harris & Barraclough, 1994), psychiatric illness in general (Nicholls *et al*, 1974; Dahlgren & Myred, 1977) and affective disorder in particular (Thorarinsson, 1979; Smith *et al*, 1983), other drug abuse (Lindelius *et al*, 1974; Dahlgren & Myrhed, 1977; Thorarinsson, 1979), previous suicide attempt (Medhus, 1975) and personality disturbance (Zielinski, 1974; Thorarinsson, 1979) were thought to increase suicide risk.

Peptic ulcer was three times more common in suicidal alcoholics than non-

**Table 3** Eating disorders, not differentiated

| Report/disorder/SMR | Country | Suicides | |
|---|---|---|---|
| | | Observed | Expected |
| Norring & Sohlberg (1993) | Sweden | 2 | 0.02* |
| Anorexia nervosa (DSM–III–R 307.10) | | | |
| Crisp *et al* (1992) | England | 0 | 0.07* |
| | Scotland | 4 | 0.07* |
| Eckert *et al* (1995) | USA | 0 | 0.05* |
| Garfinkel *et al* (1977) | Canada | 1 | 0.01* |
| Hall *et al* (1984) | New Zealand | 0 | 0.02* |
| Nemiah (1950) | USA | 0 | 0.001* |
| Patton (1988) | England | 6 | 0.13* |
| Ratnasuriya *et al* (1991) | England | 3 | 0.04* |
| Theander (1985) | Sweden | 5 | 0.31* |
| Tolstrup *et al* (1985) | Denmark | 6 | 0.41* |
| | **Sub-total** | **25** | **1.11** |
| Bulimia nervosa (DSM–III–R 307.51) | | | |
| Collings & King (1994) | England | 0 | 0.01* |
| Fairburn *et al* (1995) | England | 0 | 0.02* |
| Mitchell *et al* (1988) | USA | 1 | 0.02* |
| Patton (1988) | England | 0 | 0.03* |
| | **Sub-total** | **1** | **0.08** |
| **SMR 2314 (95% CI 1538–3344)** | **Total** | **28** | **1.21** |

*Expected value calculated by us; SMR, standardised mortality ratio.

suicidal (Berglund, 1984). This corroborates the finding that peptic ulcer has a suicide risk twice that expected, probably because of a link with alcohol excess (Harris & Barraclough, 1994).

***Consumption.*** In a further study which examined the suicide risk by alcohol intake of 49 000 Swedish conscripts followed for 15 years (Andréasson *et al*, 1988), the heaviest drinkers had a suicide risk about five times that of the non-drinkers, and moderate drinkers only a slightly raised risk. 'Probable' suicides followed the same trend. This result is tabulated apart from the other studies because the expected was calculated from the non-drinkers, not the general population. A 20-year follow-up of the same conscripts observed a similar association, but with definite and 'probable' suicides combined (Andréasson *et al*, 1991).

**Table 4a** Psychoactive substance use disorders: Alcohol (DSM–III–R 303.90)

| Report/SMR | Country | Suicides | |
|---|---|---|---|
| | | Observed | Expected |
| Adelstein & White (1976) | England | 75 | 3.42 |
| Berglund (1984) | Sweden | 88 | 8.40* |
| Brenner (1967) | USA | 9 | 2.55 |
| Costello *et al* (1978) | USA | 4 | 0.65* |
| Dahlgren (1951) | Sweden (m) | 63 | 19.71 |
| Dahlgren & Myrhed (1977) | Sweden (m) | 2 | 0.30 |
| | (f) | 2 | 0.10 |
| Davies *et al* (1956) | England | 1 | 0.01* |
| de Lint & Levinson (1975) | Canada | 3 | 0.20* |
| Dubourg (1969) | England (m) | 1 | 0.02* |
| Gillis (1969) | S. Africa | 11 | 0.17 |
| Higuchi (1987) | Japan (m) | 4 | 0.43 |
| | (f) | 7 | 0.20 |
| Kessel & Grossman (1961) | England | 7 | 0.16 |
| Lindberg & Ågren (1988) | Sweden (m) | 98 | 12.40 |
| | (f) | 21 | 1.40 |
| Lindelius *et al* (1974) | Sweden | 10 | 1.00 |
| Medhus (1975) | Sweden (f) | 4 | 0.13 |
| Ohara *et al* (1989) | Japan | 14 | 1.93 |
| Öjesjö (1981) | Sweden (m) | 2 | 0.66* |
| Pell & D'Alonzo (1973) | USA | 2 | 1.13* |
| Pieninkeroinen *et al* (1992) | Finland | 3 | 0.36* |
| Pokorny (1964) | USA | 9 | 1.54 |
| Pokorny (1983) | USA | 15 | 1.85 |
| Poser *et al* (1992) | W. Germany | 13 | 1.23* |
| Rathod *et al* (1966) | England (m) | 2 | 0.03* |
| Robinette *et al* (1979) | USA (m) | 48 | 24.90 |
| Schmidt & De Lint (1972) | Canada | 51 | 8.26 |
| Schuckit & Gunderson (1974) | USA (m) | 16 | 3.66 |
| Sletten *et al* (1972) | USA | 4 | 1.03* |
| Smith *et al* (1983) | USA (f) | 2 | 0.12* |
| Thorarinsson (1979) | Iceland (m) | 45 | 10.20 |
| van Dijk & van Dijk-Koffeman (1973) | Netherlands (m) | 1 | 0.09* |
| Wells & Walker (1990) | New Zealand | 3 | 1.10* |
| Westermeyer & Peake (1983) | USA | 1 | 0.10* |
| **SMR 586 (95% CI 541–633)** | **Total** | **641** | **109.44** |
| Heavy drinkers compared with abstainers | | | |
| Andréasson *et al* (1988) | Sweden | 15 | 2.93 |

*Expected value calculated by us; SMR, standardised mortality ratio; m, males; f, females.

***Opioid dependence and abuse (DSM–III–R 304.00 and 305.50) (Table 4b)***

Nine papers reported on a combined population of over 7500 intravenous opiate users from five countries, followed, in some studies, for up to 12 years. Italy accounted for 38% of the expected value, Scandinavia 25%, the USA 25% and Britain 12%. Perucci *et al* (1991) contributed 38%. Over 75% of the population were male.

Combining the studies gave a suicide risk 14 times that expected but with variation between studies of 3–36 times. The cause of this variation is unexplained. Possible explanations are uncertainties over suicide ascertainment and HIV.

Self-inflicted deaths from drugs are difficult to classify because suicidal intent may be impossible to infer from the mode of death, particularly when combined with an isolated life. Accidental or undetermined death may be recorded instead of suicide. The higher suicide rate found for opiate users receiving methadone treatment compared with those who were not may be explained by more being known about the methadone group (Grönbladh *et al*, 1990).

HIV might be expected to increase the suicide risk of drug addiction (Harris & Barraclough, 1994). This appeared not to be so. Three studies (Segest *et al*, 1990; Skidmore *et al*, 1990; Perucci *et al*, 1991) included the 1980s. Their combined SMR of 940 is considerably less than that of the pre-HIV studies with an SMR of 1830. HIV was implicated directly in suicide in only one study, which reported the suicide of a 16-year-old the day after an HIV test (Skidmore *et al*, 1990).

Bucknall & Robertson (1986) and James (1967) were included in Skidmore *et al* (1990) and Bewley *et al* (1968) and so were omitted.

***Sedative, hypnotic or anxiolytic (i.e. prescription drugs) dependence and abuse (DSM–III–R 304.10 and 305.40) (Table 4c)***

Two papers from Sweden and one from West Germany reported on the mortality of a combined population of 1500. Fifty per cent were male. Abuse confined to prescription drugs was predominantly female (68%), and when combined with other drugs mostly male (63%).

For prescription drug abuse alone the suicide risk was 20 times the expected, when combined with alcohol abuse 16 times and when combined with illicit drug abuse 44 times the expected. Multi-drug abuse has one of the highest suicide risks

**Table 4b** Substance use: Opioids (DSM–III–R 304.00)

| Report/SMR | Country | Suicides | |
|---|---|---|---|
| | | Observed | Expected |
| Bewley *et al* (1968) | UK | 9 | 0.24* |
| Grönbladh *et al* (1990) | Sweden | 12 | 0.50* |
| Haastrup & Jepsen (1984) | Denmark | 12 | 0.40* |
| Perucci *et al* (1991) | Italy (m) | 11 | 1.61 |
| | (f) | 0 | 0.13 |
| Pokorny (1983) | USA | 7 | 0.83 |
| Segest *et al* (1990) | Denmark | 9 | 0.25* |
| Skidmore *et al* (1990) | Scotland | 1 | 0.24* |
| Stimson *et al* (1978) | England | 2 | 0.07* |
| Vaillant (1966) | USA | 1 | 0.30* |
| **SMR 1400 (95% CI 1079–1788)** | **Total** | **64** | **4.57** |

*Expected value calculated by us; SMR, standardised mortality ratio; m, male; f, female.

**Table 4c** Substance use: Sedatives, hypnotics, or anxiolytics (DSM–III–R 304.10)

| Report/SMR | Country | Suicides | |
|---|---|---|---|
| | | Observed | Expected |
| Allgulander *et al* (1984) | Sweden | 4 | 0.06* |
| Allgulander *et al* (1987) | Sweden | 20 | 1.11* |
| Poser *et al* (1992) | W. Germany | 12 | 0.60* |
| **SMR 2034 (95% CI 1425–2816)** | **Total** | **36** | **1.77** |
| With alcohol | | | |
| Allgulander *et al* (1987) | Sweden | 10 | 1.16* |
| Poser *et al* (1992) | W. Germany | 23 | 0.95* |
| **SMR 1564 (95% CI 1077–2196)** | **Total** | **33** | **2.11** |
| With other drugs | | | |
| Allgulander *et al* (1987) | Sweden | 5 | 0.24* |
| Poser *et al* (1992) | W. Germany | 18 | 0.28* |
| **SMR 4423 (95% CI 2804–6637)** | **Total** | **23** | **0.52** |

*Expected value calculated by us; SMR, standardised mortality ratio.

associated with psychiatric disorder. Allgulander's 1941–54 material (1987) when compared with his 1973–5 material (1984) suggests the suicide risk for prescription drug abuse may have increased over time.

Piesiur-Strehlow *et al* (1986) was included in Poser *et al* (1992) and so omitted.

### *Mixed drug dependence and abuse (Table 4d)*

Four reports on cohorts comprising single and multi-drug abusers did not provide the data to allocate their findings under the other headings. We have included them here because the results provide further evidence of the high suicide risk attached to substance abuse.

The reports gave the mortality for a combined population of more than 3500 followed for up to 14 years. Sixty per cent were men. The three Scandinavian reports provided 95% of the expected value, Engström *et al* (1991) alone contributed 70%.

The combined suicide risk was 20 times that expected. Opiate and cocaine use had the highest risk according to the authors (Ekeberg *et al*, 1991; Engström *et al*, 1991). A past history of attempted suicide increased the suicide risk further for female drug users to 87 times that expected (Ekeberg *et al*, 1991). Many self-inflicted deaths were recorded as accidents (Tunving, 1988; Ekeberg *et al*, 1991; Engström *et al*, 1991).

### *Cannabis use (Table 4e)*

We found one report relating cannabis use to mortality, a 15-year follow-up of 45 000 Swedish conscripts (Andréasson & Allebeck, 1990) whose use of cannabis was assessed at military intake by self-report. The relative risk for subsequent suicide of heavy users was four times that of non-users. Lesser use was not associated with increased risk.

A causal relation between cannabis use and suicide seems unlikely. The association probably arises from comorbidity with other substance abuse and mental disorder, conditions where heavy cannabis use might be expected.

### *Nicotine dependence (DSM–III–R 305.10) (Table 4f)*

Tobacco is not an obvious cause of suicide yet there is an unmistakable association. The suicide rate for 34 000 male British doctors who responded to a postal questionnaire in 1951 and were followed for 40 years (Doll *et al*, 1994) correlated with cigarettes smoked (Table 4*f*). Compared with those who had never smoked, even ex-smokers had a raised rate, although considerably less than for heavy smokers.

**Table 4d** Substance use: Mixed drugs

| Report/SMR | Country | Suicides | |
|---|---|---|---|
| | | Observed | Expected |
| Black *et al* (1985*a*) | USA | 6 | 0.32 |
| Ekeberg *et al* (1991) | Norway | 34 | 0.80 |
| Engström *et al* (1991) | Sweden | 79 | 4.90* |
| Tunving (1988) | Sweden | 16 | 1.00* |
| **SMR 1923 (95% CI 1612–2276)** | **Total** | **135** | **7.02** |

*Expected value calculated by us; SMR, standardised mortality ratio.

**Table 4e** Cannabis use: (heavy users compared to non-users)

| Report/SMR | Country | Suicides | |
|---|---|---|---|
| | | Observed | Expected |
| Andréasson & Allebeck (1990) | Sweden | 10 | 2.60 |
| **SMR 385 (95% CI 184–707)** | | | |

*SMR, standardised mortality ratio.

**Table 4f** Suicide rate per 100 000 by cigarettes smoked per day

| | | | | | |
|---|---|---|---|---|---|
| | Never | 1–14 | 15–24 | >24 | Former |
| Doll *et al* (1994) (m) | 23 | 26 | 33 | 57 | 29 |
| Doll *et al* (1980) (f) | 19 | 9 | 37 | 55 | 19 |
| | Never | 1–19 | 20–39 | 40–59 | 60+ |
| Davey Smith *et al* (1992) (m) | 11 | 15 | 20 | 25 | 38 |
| | Never | 1–9 | 10–19 | >20 | Former |
| Tverdal *et al* (1993) (m) | 18 | 27 | 30 | 44 | 23 |

m, males; f, females.

The rate for current cigar and pipe smokers was raised at 34 per 100 000.

Six thousand female British doctors, similarly studied and followed for 22 years from 1951 to 1973 (Doll *et al*, 1980), showed the same trend, except for former smokers. The suicide rate among an unselected sample of 360 000 American males aged 35–57, from the Multiple Risk Factor Intervention Trial, followed for 12 years (Davey Smith *et al*, 1992), also showed an association with cigarettes smoked, as did a similar study of an unselected sample of 44 000 Norwegian males followed for 13 years (Tverdal *et al*, 1993). The 24 500 females in the Norwegian study (Tverdal *et al*, 1993; not in table) showed that current smokers had a suicide rate of 14 per 100 000, 7 per 100 000 for 1–9 cigarettes per day and 21 per 100 000 for 10 or more per day. This compared with 9 per 100 000 for females who had never smoked.

These four cohorts totalling nearly 500 000 and followed for lengthy periods provide a convincing result. However, smoking cigarettes is thought unlikely to be a direct cause of suicide (Doll *et al*, 1980; Davey Smith *et al*, 1992; Tverdal *et al*, 1993; Doll *et al*, 1994). Doll attributed the association to heavy cigarette use occurring with alcohol abuse and personality disorder, conditions with high suicide rates. If this were the entire explanation, should suicide rates for former smokers have fallen as much as they did? Nicotine is highly addictive and its relation to suicide similar to other addictive substances. The cancers to which cigarette smokers are prone probably also had an effect (Harris & Barraclough, 1994).

The expected figure for the summary table (Table 15) was calculated by comparing the rate for non-smokers with that for heavy smokers. Observed numbers of suicides were those recorded in heavy smokers.

## Schizophrenia (DSM-III-R 295.10–295.95) (Table 5a)

Thirty-eight papers from 13 countries reported on a population of over 30 000 followed in some studies for up to 60 years. Sixty per cent of the population was male. Scandinavia accounted for 56% of the expected value, North America 19% and Great Britain 18%. Sixty-five per cent came from three reports, Mortensen & Juel 48% (1990; 1993) and Copas & Robin 17% (1982).

Combining the studies gave a mean risk of suicide 8.5 times that expected, with variation between studies of 0.8–115 times. Five risk values were over 50, of which three were over 100.

Studies with expected values less than 1.0 tended to have higher suicide risk values, which suggests selective publication. This, if true, has had only a small effect on the mean risk, which is derived largely from studies with expected values over four.

### *Diagnosis*

Schizophrenia, without further elaboration, was the diagnosis in 32 of the 38 reports. Six papers were more specific. The suicide risk for paranoid psychosis was increased 17 times (Achté, 1967; Niskanen & Pihkanen, 1971), catatonic schizophrenia 13 times (Guggenheim & Babigian, 1974), schizoaffective disorder 25 times (Müller-Oerlinghausen *et al*, 1992) and 'psychotic disorders' five times (Buda *et al*, 1988; Friis *et al*, 1991). 'Psychotic disorder' included schizoaffective disorder, schizophreniform disorder, atypical psychotic disorder, reactive psychoses and paranoid psychoses.

### *Chronicity*

The influence of chronicity on cohort suicide risk is shown in Mortensen & Juel's two enquiries (1990; 1993). The 1990 report examined the mortality of a residual population of long-stay in-patients from 1957 who had survived the initial phases of illness when the suicide risk was highest, with some possibly recovered. Their suicide risk was only 1.3 times the expected. In contrast the suicide risk for their acutely ill cohort from 1970 to 1987 was 20.7 (Mortensen & Juel, 1993). Suicide was most common in those aged under 30 years and in the first follow-up year. Copas & Robin found the same (1982).

### *Attempted suicide*

The combination of schizophrenia and first ever suicide attempt had a very high risk, 80 times the expected (Wilkinson & Bacon, 1984). Ten of the 11 deaths were suicide, the eleventh undetermined.

### *Non-western cultures*

A study from Singapore looked at Chinese patients with schizophrenia and found a suicide risk increased 60 times over that expected (Tsoi & Wong, 1991). Thirty-four of the 48 deaths recorded were suicide.

To extend the range of cultures further we have noted a 10-year follow-up of 90 patients with schizophrenia from India in which the four suicides recorded among nine deaths was almost certainly an excess (Thara *et al*, 1994). The statistics are not in Table 5a because expected values were not given, nor computable.

Black *et al* (1985*b*) is included in Black & Fisher (1992) and Munk-Jörgensen & Mortensen (1989) in Mortensen & Juel (1993).

**Table 5a** Schizophrenia (DSM–III–R 295.10–295.95)

| Report/SMR | Country | Suicides | |
|---|---|---|---|
| | | Observed | Expected |
| Achté (1967) | Finland | 3 | 0.23* |
| Allebeck (1989) | Sweden | 33 | 2.70 |
| Anderson *et al* (1991) | England | 7 | 0.42 |
| Black & Fisher (1992) | USA | 16 | 0.69 |
| Bland & Parker (1976) | Canada | 2 | 0.16* |
| Bland & Orn (1978) | Canada | 1 | 0.12* |
| Buda *et al* (1988) | USA | 13 | 4.31 |
| Carone *et al* (1991) | USA | 8 | 0.07* |
| Christensen (1974) | Denmark | 6 | 1.50* |
| Cohen *et al* (1990) | USA | 8 | 0.18* |
| Conway *et al* (1994) | England | 4 | 0.04* |
| Copas & Robin (1982) | England | 116 | 24.10 |
| Friis *et al* (1991) | Norway | 4 | 0.13* |
| Guggenheim & Babigian (1974) | USA | 6 | 0.46* |
| Helgason (1990) | Iceland | 10 | 0.50 |
| Huber *et al* (1980) | Germany | 7 | 2.85* |
| Johanson (1958) | Sweden | 3 | 0.37 |
| Kendler (1986) | USA | 21 | 3.59 |
| Lesage *et al* (1990) | Italy | 2 | 0.05* |
| Leyberg (1965) | England | 1 | 0.03* |
| Lindelius (1970) | Sweden | 1 | 1.21* |
| Lindelius & Kay (1973) | Sweden | 18 | 2.10 |
| Mortensen & Juel (1990) | Denmark | 56 | 42.36 |
| Mortensen & Juel (1993) | Denmark | 508 | 24.58 |
| Müller-Oerlinghausen *et al* (1992) | Germany | 2 | 0.08* |
| Newman & Bland (1991*b*) | Canada | 97 | 4.95 |
| Niskanen & Pihkanen (1971) | Finland | 4 | 0.18* |
| Noreik (1975) | Norway | 21 | 0.68* |
| Nyman & Jonsson (1986) | Sweden | 10 | 0.40 |
| Ogawa *et al* (1987) | Japan | 14 | 0.90* |
| Pokorny (1964) | USA | 31 | 4.21 |
| Pokorny (1983) | USA | 19 | 0.96 |
| Röder (1970) | Denmark | 13 | 0.55* |
| Sletten *et al* (1972) | USA | 49 | 8.03* |
| Tsoi & Wong (1991) | Singapore | 34 | 0.57 |
| Wilkinson (1982) | England | 3 | 0.06 |
| Wilkinson & Bacon (1984) | Scotland | 10 | 0.12* |
| Zilber *et al* (1989) | Israel | 15 | 4.69 |
| **SMR 845 (95% CI 798–895)** | **Total** | **1176** | **139.13** |

*Expected value calculated by us; SMR, standardised mortality ratio.

### Brief reactive psychosis (DSM–III–R 298.80) (Table 5b)

Two papers reported on a Scandinavian population of more than 22 500, some followed for up to 18 years. Gender was not given. Jorgensen & Mortensen's (1992) Danish study provided 99% of the expected value. Combining the studies gave a suicide risk 15 times the expected. Jorgensen & Mortensen (1992) stated that brief reactive psychosis as a diagnosis tended to be changed at later admissions to schizophrenia or manic–depression. Astrup *et al* (1959) was omitted, assumed to be in Noreik (1975).

## Mood disorders

This section considers major depression, bipolar disorder, dysthymia and mood disorder not otherwise specified.

#### *Major depression (DSM–III–R 296.2x and 296.3x) (Table 6a)*

Twenty-three papers from nine countries reported on a population of more than 8000, followed, in some studies, for up to 48 years. In the 75% of the population for which the gender was given 50% were male. The USA and Canada accounted for 49% of the expected value, Scandinavian countries 44% and Switzerland 6%. Berglund & Nilsson (1987) provided 31% of the expected, Tsuang (1978) 13%. Combining the studies gave a suicide risk 20 times that expected, but with variation between studies of 0–200 times. Extreme values occurred in studies with a small expected value. Risk was highest in the first few weeks following discharge from in-patient treatment, declining thereafter (Perris & d'Elia, 1966; Buchholtz-Hansen *et al*, 1993).

Baldwin & Jolley (1986) and Post's (1972) population of 192 elderly depressed subjects followed for three to eight years recorded a combined suicide risk 35 times the expected, showing an excess risk persists into old age.

The suicide risk for cohorts treated before 1970 was increased by 17 times and after 1970 by 36 times. The reason for this doubling of risk cannot be inferred from this material but may be related to secular changes in care arrangements.

#### *Bipolar disorder (DSM–III–R 296.4–296.6) (Table 6b)*

Fourteen papers from seven countries reported on a population of 3700 followed, in some studies, for 60–70 years. The population was treated between 1900 and 1985. In the 58% of the population for which gender was given 50% were female.

Scandinavian countries provided 33% of the expected value, Canada 22%, Switzerland 22%, and the USA 20%. Angst (1986) contributed 22%, Newman & Bland (1991*a*) 22% and Lundquist (1945) 16% of the expected. Combining the studies gave a suicide risk 15 times the expected, but with variation between studies of 0–133 times. Extreme values occurred in studies with a small expected value. Increased risk was related to time since discharge, both recent (Perris & d'Elia, 1966) and up to five years before (Newman & Bland, 1991*a*),

**Table 5b** Brief reactive psychosis (DSM–III–R 298.80)

| Report/SMR | Country | Suicides | |
|---|---|---|---|
| | | Observed | Expected |
| Jorgensen & Mortensen (1992) | Denmark | 1060 | 69.74 |
| Noreik (1975) | Norway | 21 | 0.59* |
| **SMR 1537 (95% CI 1447–1631)** | **Total** | **1081** | **70.33** |

*Expected value calculated by us; SMR, standardised mortality ratio.

**Table 6a** Major depression (DSM–III–R 296.2x and 296.3x)

| Report/SMR | Country | Suicides | |
|---|---|---|---|
| | | Observed | Expected |
| Angst (1986) | Switzerland | 17 | 0.96* |
| Avery & Winokur (1976) | USA | 8 | 0.28* |
| Baldwin & Jolley (1986) | England | 2 | 0.08* |
| Berglund & Nilsson (1987) | Sweden | 103 | 5.40 |
| Black *et al* (1987) | USA | 34 | 0.79 |
| Buchholtz-Hansen *et al* (1993) | Denmark | 16 | 0.47 |
| Copeland (1983) | England | 1 | 0.02* |
| Coryell (1981) | USA | 5 | 0.30* |
| Coryell *et al* (1982) | USA | 6 | 0.75* |
| Dunner *et al* (1976) | USA | 2 | 0.05* |
| Evans & Whitlock (1983) | England | 6 | 0.06 |
| Friis *et al* (1991) | Norway | 2 | 0.01* |
| Lee & Murray (1988) | England | 4 | 0.17* |
| Müller-Oerlinghausen *et al* (1992) | Germany | 1 | 0.01* |
| Newman & Bland (1991*a*) | Canada | 55 | 1.56 |
| Nyström (1979) | Sweden | 0 | 0.26* |
| Pederson *et al* (1972) | USA | 13 | 0.54* |
| Perris & d'Elia (1966) | Sweden | 20 | 1.30 |
| Pokorny (1964) | USA | 31 | 1.24 |
| Post (1972) | England | 3 | 0.05* |
| Sletten *et al* (1972) | USA | 7 | 0.66* |
| Tsuang (1978) | USA | 13 | 2.22 |
| Whitlock & Siskind (1979) | Australia | 2 | 0.07* |
| **SMR 2035 (95% CI 1827–2259)** | **Total** | **351** | **17.25** |

*Expected value calculated by us; SMR, standardised mortality ratio.

past suicide attempt, and alcohol abuse (Noreik, 1975).

Lithium prophylaxis (Müller-Oerlinghausen *et al*, 1992) possibly affects risk. The lower relative mortality of lithium-treated patients from the 1960s when compared with those of earlier this century suggested to Kay & Petterson (1977) that lithium prophylaxis prevented suicide in the manic–depressive; see (a) and (b) in Table 6*b*. The higher suicide risk found in those who stopped their lithium compared with those who continued led Müller-Oerlinghausen *et al* (1992) to the same conclusion. Four suicides occurred among the 13 non-compliant and two among the 55 compliant, in a group of unipolar, bipolar and schizo-affective patients. Neither study is conclusive proof that lithium prevents suicide in mood disorder.

### *Dysthymia (DSM–III–R 300.40) (Table 6c)*

Included here are neurotic depression, depressive neurosis, reactio-neurotico-depressiva, psychoneurosis and neurocirculatory asthenia.

Nine papers from four countries reported on a population of 50 000, followed, in some studies, for up to 24 years. Fifty-three per cent were female. Sweden provided 79% of the expected value, the USA 21%. Allgulander (1994) contributed 79% of the expected value, Keehn *et al* (1974) 20% and the seven other studies 1%.

Combining the studies gave a suicide risk 12 times the expected, but with variation between studies of 3–100 times. Extreme values occurred in studies with a small expected number. Allgulander's Swedish national study (1994) of 'depressive neurosis', in 40 000 subjects, found the suicide risk to be increased 14-fold. The greatest risk was in the first three months following hospital discharge. The risk for the elderly was increased seven times (Allgulander & Lavori, 1993). This was an unselected sample, which may explain why the suicide risk is so much higher than Keehn *et al*'s (1974) threefold increase based on a military sample of fit young men.

### *Mood disorders NOS (Table 6d)*

Included here are papers dealing with cohorts of uncertainly defined or mixed diagnoses linked by being disorders of mood. All contain subjects treated after 1970 excepting Kerr *et al* (1969).

Twelve papers from seven countries reported on a total population of over 10 000, followed, in some studies, for up to 12 years. In the seven papers giving gender 55% were female. Britain provided 58% of the expected value, Denmark 20% and the USA 12%. Copas & Robin (1982) contributed 56% of the expected value and Weeke & Vaeth (1986) 19%.

Combining the studies gave a suicide risk 16 times the expected with variation between studies of 4–38 times. Studies with small expected numbers tended to have the extreme values. Copas & Robin (1982) and Weeke & Vaeth (1986), the two large studies, described similar risk values of 14 and 17 times the expected value.

## Anxiety disorders (Table 7)

This section considers anxiety neurosis, agoraphobia, obsessive–compulsive disorder and panic disorder.

**Table 6b** Bipolar disorder (DSM–III–R 296.4–296.6)

| Report/SMR | Country | Suicides | |
|---|---|---|---|
| | | Observed | Expected |
| Angst (1986) | Switzerland | 13 | 1.36* |
| Black *et al* (1987) | USA | 7 | 0.48 |
| Bratfos & Haug (1968) | Norway | 4 | 0.09 |
| Carlson *et al* (1974) | USA | 2 | 0.03* |
| Coppen *et al* (1991) | England | 0 | 0.12 |
| Dunner *et al* (1976) | USA | 8 | 0.06* |
| Friis *et al* (1991) | Norway | 2 | 0.02* |
| Kay & Petterson (1977) | Sweden (a) | 3 | 0.41* |
| | (b) | 0 | 0.15* |
| Lundquist (1945) | Sweden | 18 | 1.00* |
| Müller-Oerlinghausen *et al* (1992) | Germany | 3 | 0.05* |
| Newman & Bland (1991*a*) | Canada | 19 | 1.38 |
| Noreik (1975) | Norway | 6 | 0.14* |
| Perris & d'Elia (1966) | Sweden | 3 | 0.23 |
| Tsuang (1978) | USA | 5 | 0.66 |
| **SMR 1505 (95% CI 1225–1844)** | **Total** | **93** | **6.18** |

*Expected value calculated by us; SMR, standardised mortality ratio.
(a) pre- and (b) post-lithium.

**Table 6c** Dysthymia (DSM–III–R 300.40)

| Report/SMR | Country | Suicides | |
|---|---|---|---|
| | | Observed | Expected |
| Akiskal *et al* (1978) | USA | 3 | 0.05* |
| Allgulander (1994) | Sweden | 1330 | 93.70* |
| Black *et al* (1985*a*) | USA | 5 | 0.16 |
| Bronisch *et al* (1985) | W. Germany | 6 | 0.07* |
| Copeland (1983) | England | 1 | 0.01* |
| d'Elia *et al* (1974) | Sweden | 3 | 0.20* |
| Keehn *et al* (1974) | USA | 74 | 23.50 |
| Sletten *et al* (1972) | USA | 13 | 0.28* |
| Wheeler *et al* (1950) | USA | 1 | 0.48* |
| **SMR 1212 (95% CI 1150–1277)** | **Total** | **1436** | **118.45** |

*Expected value calculated by us; SMR, standardised mortality ratio.

*Anxiety neurosis*

One paper (Allgulander, 1994) reported on a population of nearly 10 000 followed for up to 17 years. All subjects were part of a Swedish national study. Sixty-six per cent were female.

The suicide risk was six times the expected, the risk being highest in the first three months after hospital discharge. The risk assessment was based on our own expected value because the author calculated hers using a statistic combining suicide with undetermined death. Undetermined death contributed significantly to the mortality accounting for 35 (3%) of the 1356 deaths. Sub-samples of this enquiry, not cited in Table 7, found increased risk persisted into old age. Risk under 70 years was increased 2.5 times, and over 70, 3.5 times (Allgulander & Lavori, 1991; 1993).

*Agoraphobia (DSM–III–R 300.22)*

One paper (Cohen *et al*, 1984) reported on a group of 45 followed for two years. Eighty-four per cent were female. The single death was from natural causes.

*Obsessive–compulsive disorder (DSM–III–R 300.30)*

Two papers reported on a population of 117 followed for up to 20 years. Forty-seven per cent were male. Norway provided 77% of the expected value, Australia 23%.

Combining the studies gave a suicide risk over 10 times that expected. However, this risk is probably much greater than that for an unselected sample of the disorder because Kringlen's (1965) group had been treated as in-patients, and Hay *et al*'s (1993) by neurosurgery.

*Panic disorder (DSM–III–R 300.01 and 300.21)*

Three papers reported on a population of 276, followed for up to 49 years. Sixty-six per cent were male. The USA provided 98% of the expected value, Italy 2%. Coryell *et al* (1982) contributed 89%. Combining the studies gave a suicide risk of 10 times that expected. The risk varied from zero for Fava *et al* (1995), who were panic-free after treatment, to 37.5 for Noyes *et al* (1991), whose group contained 60% with a previous history of major depression.

## Somatisation disorder (DSM–III–R 300.81) (Table 8)

Briquet's syndrome and hysteria are placed here. Two papers (Ziegler & Paul, 1954; Coryell, 1981) reported on a population of 142 followed for between 20 and 57 years. Briquet's syndrome accounted for 76 subjects, hysteria 66. The hysteria group, diagnosed in the inter-war years, explains the lengthy follow-up. All subjects were USA females.

Combining the studies gave a suicide risk of five times the expected value. Based on two deaths with 0.38 expected the result is not statistically significant.

Slater & Glithero (1965) lost 14% to follow-up in their famous study of 99 subjects with hysteria, which is therefore not listed in Table 8. However, the four suicides he recorded among 12 deaths were probably excessive.

## Adjustment disorder (DSM–III–R 309.90 and 309.00) (Table 9)

Two papers (Black *et al*, 1985*a*; Bronisch, 1991) reported on a population of over 400

**Table 6d** Mood disorders NOS

| Report/SMR | Country | Suicides | |
|---|---|---|---|
| | | Observed | Expected |
| Black *et al* (1985*a*) | USA | 22 | 0.78 |
| Copas & Robin (1982) | England | 180 | 13.20 |
| Fawcett *et al* (1990) | USA | 32 | 1.54* |
| Kerr *et al* (1969) | England | 3 | 0.10 |
| Müller-Oerlinghausen *et al* (1994) | Den & Ger | 2 | 0.55 |
| Newman & Bland (1991*a*) | Canada | 22 | 0.72 |
| Norton & Whalley (1984) | Scotland | 6 | 0.17 |
| Pokorny (1983) | USA | 18 | 0.60 |
| Surtees & Barkley (1994) | Scotland | 5 | 0.13* |
| Vestergaard & Aagaard (1991) | Denmark | 5 | 0.24 |
| Weeke & Vaeth (1986) | Denmark | 76 | 4.40 |
| Zilber *et al* (1989) | Israel | 6 | 0.98 |
| **SMR 1610 (95% CI 1452–1781)** | **Total** | **377** | **23.41** |

*Expected value calculated by us; SMR, standardised mortality ratio.

**Table 7** Anxiety disorders

| Report/disorder/SMR | Country | Suicides | |
|---|---|---|---|
| | | Observed | Expected |
| Anxiety neurosis | | | |
| Allgulander (1994) | Sweden | 151 | 24.00* |
| **SMR 629 (95% CI 533–738)** | | | |
| Agoraphobia (DSM-III-R 300.22) | | | |
| Cohen *et al* (1984) | England | 0 | 0.01* |
| Obsessive-compulsive disorder (DSM-III-R 300.30) | | | |
| Hay *et al* (1993) | Australia | 2 | 0.06* |
| Kringlen (1965) | Norway | 1 | 0.20* |
| **SMR 1154 (95% CI 238–3372)** | **Total** | **3** | **0.26** |
| Panic disorder (DSM-III-R 300.01 and 300.21) | | | |
| Coryell *et al* (1982) | USA | 6 | 0.80* |
| Fava *et al* (1995) | Italy | 0 | 0.02* |
| Noyes *et al* (1991) | USA | 3 | 0.08* |
| **SMR 1000 (95% CI 457–1898)** | **Total** | **9** | **0.90** |

*Expected value calculated by us; SMR, standardised mortality ratio.

**Table 8** Somatisation disorders (DSM-III-R 300.81)

| Report/SMR | Country | Suicides | |
|---|---|---|---|
| | | Observed | Expected |
| Coryell (1981) | USA | 1 | 0.30* |
| Zeigler & Paul (1954) | USA | 1 | 0.08* |
| **SMR 526 (95% CI 64–1901)** | **Total** | **2** | **0.38** |

*Expected value calculated by us; SMR, standardised mortality ratio.

followed for up to 10 years. Fifty-eight per cent were female. The USA provided 72% of the expected value, Germany 28%. Bronisch (1991) reported on adjustment disorder with depression. Combining the studies gave a suicide risk 14 times the expected value.

## Neurosis (ICD-9 300) (Table 10)

Included here are studies of 'neurosis', so defined by their authors. Neurosis is not a DSM-III-R term. Eight papers from five countries reported on a population of over 9000, some followed for up to 35 years. The USA provided 89% of the expected value, Great Britain 9%. In the cohorts giving gender over 80% were male. This reflected the Veterans Administration (VA) source of Pokorny (1964; 1983) and Kendler (1986).

Combining the studies gave a suicide risk nearly four times the expected value. Risk varied between zero for the Norwegian study (Noreik, 1970) and 40 times for the Scottish one (Giel *et al*, 1964). Extreme values were associated with small expected values. Kendler (1986) studied twins, which may explain why his value is so much lower than that of Pokorny (1964; 1983) when both populations are VA derived. Sims (1973) was included in Sims & Prior (1978) and is therefore omitted from Table 10.

## Personality disorder (ICD-9 301) (Table 11)

Five papers reported on a population of over 3000, some followed for up to 14 years. In the cohorts giving gender 80% were male, reflecting the VA source used by Pokorny (1964; 1983). The USA provided 99% of the expected, Norway 1%. Pokorny contributed 56%. The diagnosis of personality disorder was not sub-classified.

Combining the studies gave a suicide risk seven times the expected value. The US studies, all of in-patients at inception and therefore likely to be more severe, showed little variation in suicide risk. The Norwegian study gave a much higher risk, although based on only one death.

## Neuropsychiatric disorders

This section considers conditions which are part of the subject matter of psychiatry and neurology but are either not in the DSM-III-R classification, or are uncertainly defined. These are Huntington's disease, epilepsy, psychosurgery, brain injuries, dementia, unspecified organic mental disorder, stupor, transient global amnesia and encephalitis lethargica.

**Table 9** Adjustment disorder not otherwise specified (DSM–III–R 309.90)

| Report/disorder/SMR | Country | Suicides | |
|---|---|---|---|
| | | Observed | Expected |
| Black *et al* (1985*a*) | USA | 3 | 0.21 |
| With depressed mood (DSM–III–R 309.00) | | | |
| Bronisch (1991) | Germany | 1 | 0.08* |
| **SMR 1379 (95% CI 376–3532)** | **Total** | **4** | **0.29** |

*Expected value calculated by us; SMR, standardised mortality ratio.

**Table 10** Neurosis (ICD–9 300)

| Report/SMR | Country | Suicides | |
|---|---|---|---|
| | | Observed | Expected |
| Black *et al* (1985*a*) | USA | 10 | 0.33 |
| Giel *et al* (1964) | Scotland | 2 | 0.05* |
| Kendler (1986) | USA | 24 | 14.16 |
| Noreik (1970) | Norway | 0 | 0.03* |
| Pokorny (1964) | USA | 28 | 5.34 |
| Pokorny (1983) | USA | 3 | 0.46 |
| Sims & Prior (1978) | England | 14 | 2.07 |
| Zilber *et al* (1989) | Israel | 4 | 0.43 |
| **SMR 372 (95% CI 297–460)** | **Total** | **85** | **22.87** |

*Expected value calculated by us; SMR, standardised mortality ratio.

**Table 11** Personality disorder (ICD–9 301)

| Report/SMR | Country | Suicides | |
|---|---|---|---|
| | | Observed | Expected |
| Black *et al* (1985*a*) | USA | 7 | 0.54 |
| Mehlum *et al* (1991) | Norway | 1 | 0.04* |
| Pokorny (1964) | USA | 13 | 2.27 |
| Pokorny (1983) | USA | 4 | 0.49 |
| Sletten *et al* (1972) | USA | 5 | 0.90* |
| **SMR 708 (95% CI 477–1010)** | **Total** | **30** | **4.24** |

*Expected value calculated by us; SMR, standardised mortality ratio.

**Table 12*a*** Huntington's disease (ICD–9 333.4, 294.1)

| Report/SMR | Country | Suicides | |
|---|---|---|---|
| | | Observed | Expected |
| Farrer (1986) | USA | 25 | 7.00 |
| Pflanz *et al (1991)* | Scotland | 0 | 0.13* |
| Schoenfeld *et al* (1984) | USA | 20 | 5.00 |
| Sorensen & Fenger (1992) | Denmark | 22 | 11.00 |
| **SMR 290 (95% CI 224–368)** | **Total** | **67** | **23.13** |

*Expected value calculated by us; SMR, standardised mortality ratio.

### *Huntington's disease (ICD–9 333.4, 294.1) (Table 12a)*

Four papers reported on a population of 6200 followed in some studies from before diagnosis to death. The USA accounted for 52% of the expected value, Denmark 47%. About 50% of the population were male.

Combining the studies gave a suicide risk three times that expected. A history of attempted suicide in 20% of each of the four cohorts strengthens the association with suicide. Five other studies, which did not provide the statistics needed for inclusion in Table 12*a*, described high suicide risks for the affected (Reed & Chandler, 1958; Hayden *et al*, 1980) or for relatives (Bolt, 1970; Dewhurst *et al*, 1970; Di Maio *et al*, 1993), particularly near the average age of disease onset. Possibly, self-diagnosis triggered suicide.

### *Epilepsy (ICD–9 345.0–345.9) (Table 12b)*

Twelve papers reported on a population of over 6500 followed in some studies for up to 30 years. The UK provided 48% of the expected value, Poland 27% and Scandinavia 17%. Fifty-one per cent were female in the third of the population for which the gender was given.

Combining the reports gave a suicide risk five times that expected. The risk was highest in temporal lobe epilepsy at eight times the expected, but 80 times after surgical treatment. Petit mal epilepsy, treatment in institutions, in out-patients and in primary medical care had risks of between three and five times the expected. Authors commented that higher risk was associated with previous suicide attempts (Stepien *et al*, 1969), abuse of alcohol (Currie *et al*, 1972; Lip & Brodie, 1992) and of drugs (White *et al*, 1979), poor morale and stigma (Dalby, 1969); and lower risk with institutional living (Klenerman *et al*, 1993).

### *Brain injuries (Table 12c)*

*War.* The 6500 brain-injured Finnish soldiers from the Russian war of 1941 had, in the 25 years post-injury, a suicide risk three times that expected in the male Finnish population. This may be too high. WHO suicide rates for Finnish males aged 25–54 year (1968) gave a risk 1.5 times that expected. Hillbom's (1960) study of these soldiers was included in Achté *et al* (1970) and so omitted. Suicide in brain-injured Vietnam war veterans was not excessive according to a report that did not provide the statistics necessary for

**Table 12b** Epilepsy (ICD–9 345.0–345.9)

| Report/disorder/SMR | Country | Suicides | |
|---|---|---|---|
| | | Observed | Expected |
| Temporal lobe | | | |
| Currie *et al* (1972) | England | 3 | 0.36* |
| Lindsay *et al* (1979) | England | 1 | 0.14* |
| **SMR 800 (95% CI 218–2048)** | **Sub-total** | **4** | **0.50** |
| Surgically treated | | | |
| Stepien *et al* (1969) | Poland | 2 | 0.03* |
| Taylor & Falconer (1968) | England | 5 | 0.05* |
| **SMR 8750 (95% CI 3518–18028)** | **Sub-total** | **7** | **0.08** |
| Institutionalised | | | |
| Klenerman *et al* (1993) | England | 0 | 0.40* |
| White *et al* (1979) | England | 21 | 3.90 |
| **SMR 488 (95% CI 302–747)** | **Sub-total** | **21** | **4.30** |
| Petit mal | | | |
| Dalby (1969) | Denmark | 2 | 0.48* |
| **SMR 417 (95% CI 50–1505)** | | | |
| Out-patient | | | |
| Hauser *et al* (1980) | USA | 3 | 0.95* |
| Lip & Brodie (1992) | Scotland | 3 | 0.25* |
| Sillanpaa (1983) | Finland | 1 | 1.40* |
| Zielinski (1974) | Poland | 16 | 3.00* |
| **SMR 411 (95% CI 266–607)** | **Sub-total** | **25** | **6.08** |
| General practice | | | |
| Cockerell *et al* (1994) | UK | 1 | 0.30* |
| **SMR 333 (95% CI 8–1857)** | | | |
| **SMR 511 (95% CI 390–658)** | **Total** | **60** | **11.74** |

*Expected value calculated by us; SMR, standardised mortality ratio.

**Table 12c** Brain injuries

| Remote/disorder/SMR | Country | Suicides | |
|---|---|---|---|
| | | Observed | Expected |
| War | | | |
| Achté *et al* (1970) | Finland | 107 | 32.50 |
| **SMR 329 (95% CI 270–398)** | | | |
| Civil | | | |
| Fahy *et al* (1967) | England | 0 | 0.02* |
| Heiskanen & Sipponen (1970) | Finland | 2 | 0.24* |
| Lewin *et al* (1979) | England | 3 | 1.0 |
| Miller & Stern (1965) | England | 0 | 0.16* |
| Wilkinson (1969) | England | 0 | 0.01* |
| **SMR 350 (95% CI 114–816)** | **Total** | **5** | **1.43** |

*Expected value calculated by us; SMR, standardised mortality ratio.

inclusion in Table 12c (Rish *et al*, 1983). Possibly the combination of brain injury and post-war conditions caused the increased suicide risk in Finnish soldiers. Amputees from this war had a suicide risk 1.5 times that expected (Harris & Barraclough, 1994).

*Civil.* Five papers reported on a population of 650 followed for up to 40 years. England provided 83% of the expected, Finland 17%. Eighty-three per cent were male in the three papers that gave gender. Combining the studies gave five suicides with 1.43 expected, a significant excess.

### *Psychosurgery (Table 12d)*

Six papers reported on a group of over a 1000 followed postoperatively for up to 20 years. A mixture of diagnoses and surgical techniques are represented. England accounted for 90% of the expected value, Sykes & Treadgold (1964) alone contributing 40%. Seventy per cent of the population were female in the 77% in which gender was given.

Combining the studies gave a suicide risk 20 times that expected. The suicides accounted for 12% of the 98 deaths. All three of Pippard's suicides (1955) followed unsuccessful open operations for 'tension states'. Whether surgery altered the suicide risk for the disorders treated cannot be inferred from these data, nor if stereotactic techniques differed in outcome from earlier surgical methods.

### *Dementia not otherwise specified (DSM–III–R 290.00 and 290.10) (Table 12e)*

Two papers reported on a population of 277 followed for up to four years. Seventy-six per cent were female. Alzheimer's disease was the probable diagnosis but post-mortem examination showed other dementing disorders in some. England and the USA contributed equal proportions of the expected value.

No suicides occurred among the 104 deaths. Textbooks suggest that early dementia with insight predisposes to suicide. This would not be detected in these two studies of established dementia, which suggest no increase of risk. The result is similar to that for mental handicap. Impaired competence may protect.

### *Unspecified organic mental disorders (Table 12f)*

Four papers reported on a population of over 4000 in-patients followed for up to 10 years. All four studies came from the USA,

**Table 12d** Psychosurgery

| Report/SMR | Country | Suicides | |
|---|---|---|---|
| | | Observed | Expected |
| Göktepe *et al* (1975) | England | 3 | 0.08* |
| Hay *et al* (1993) | Australia | 1 | 0.06* |
| Hussain *et al* (1988) | England | 0 | 0.05* |
| Pippard (1955) | England | 3 | 0.08* |
| Ström-Olsen & Carlisle (1971) | England | 2 | 0.08* |
| Sykes & Tregold (1964) | England | 3 | 0.23* |
| **SMR 2069 (95% CI 1069–3614)** | **Total** | **12** | **0.58** |

*Expected value calculated by us; SMR, standardised mortality ratio.

**Table 12e** Dementia not otherwise specified (DSM–III–R 290.00 and 290.10)

| Report/SMR | Country | Suicides | |
|---|---|---|---|
| | | Observed | Expected |
| Burns *et al* (1990) | England | 0 | 0.05* |
| Knopman *et al* (1988) | USA | 0 | 0.05* |
| | **Total** | **0** | **0.10** |

*Expected value calculated by us; SMR, standardised mortality ratio.

**Table 12f** Unspecified organic mental disorders

| Report/SMR | Country | Suicides | |
|---|---|---|---|
| | | Observed | Expected |
| Black *et al* (1985c) | USA | 1 | 0.42 |
| Pokorny (1964) | USA | 4 | 1.16 |
| Pokorny (1983) | USA | 1 | 0.32 |
| Sletten *et al* (1972) | USA | 11 | 4.95* |
| **SMR 248 (95% CI 145–397)** | **Total** | **17** | **6.85** |

*Expected value calculated by us; SMR, standardised mortality ratio.

**Table 12g** Stupor

| Report/SMR | Country | Suicides | |
|---|---|---|---|
| | | Observed | Expected |
| Joyston-Bechal (1966) | England | 4 | 0.07* |
| **SMR 5714 (95% CI 1557–14631)** | | | |

*Expected value calculated by us; SMR, standardised mortality ratio.

**Table 12h** Transient global amnesia (ICD–9 780.9)

| Report/SMR | Country | Suicides | |
|---|---|---|---|
| | | Observed | Expected |
| Gandolfo *et al* (1992) | Italy | 1 | 0.10* |
| **SMR 1000 (95% CI 25–5572)** | | | |

*Expected value calculated by us; SMR, standardised mortality ratio.

and 72% of the expected from Missouri (Sletten *et al*, 1972). Pokorny's (1964; 1983) VA cohorts were predominantly male, and 52% of the cohort described by Black *et al* (1985c) were also. Gender was not given for Sletten *et al* (1972). The diagnoses were 'organic mental disorder' (Black *et al* (1985c) and 'organic brain syndrome' (Pokorny, 1964; 1983; Sletten *et al*, 1972). Pokorny (1964; 1983) and Sletten *et al* (1972) studied large in-patient cohorts, whereas Black *et al* (1985c) studied a mixed group.

Combining the studies gave a suicide risk 2.5 times that expected, with little variation between the studies. Although significantly increased, this risk is much less than that of the functional mental disorders.

### *Stupor (Table 12g)*

One paper (Joyston-Bechal, 1966) reported on an English cohort of 100 admitted with stupor of unknown cause and followed for between two and 13 years. Sixty per cent were female. The outcome diagnoses showed predominantly functional mental disorder in which stupor was a cardinal sign of serious illness. The diagnoses were schizophrenia (34), depression (25), neurological disorders (23), neuroses (10) and unknown (8).

The suicide risk was increased more than 50 times, with four suicides in 19 deaths. Three suicides had depression and one had schizophrenia.

### *Transient global amnesia (ICD–9 780.9) (Table 12h)*

One paper described an Italian cohort of 102 followed for up to 20 years. The definition excluded subjects with histories of recent head injury, epilepsy, neurological dysfunction and psychiatric illness. Fifty-six per cent were female. The single suicide recorded among 13 deaths does not permit a conclusion about the suicide risk; however, an increase seems unlikely. The category is included because of the possibility of functional mental disorder presenting in this way as in stupor. However, the outcome suggests a neurological basis. Amnesia recurred in 19, a stroke affected four and intellectual impairment developed in three.

### *Encephalitis lethargica (ICD–9 323.4) (Table 12i)*

A paper describing an English cohort of 170 from the inter-war period, followed for up

to 12 years, is included because of its historical interest. The gender ratio was unstated. The suicide risk was 20 times that expected. All four suicides were in the early stages of the disease and not seriously disabled. Attempts at suicide in a quarter of the cohort and threats in a third strengthen the association. The increased risk of suicide was probably an outcome of the mood disturbance characteristic of the early stages of this unpleasant disease, which has now virtually disappeared.

**Table 12*l*** **Encephalitis lethargica (ICD–9 323.4)**

| Report/SMR | Country | Suicides | |
|---|---|---|---|
| | | Observed | Expected |
| Harris & Cooper (1937) | England | 4 | 0.20* |
| **SMR 2000 (95% CI 545–5121)** | | | |

*Expected value calculated by us; SMR, standardised mortality ratio.

**Table 13*a*** **Suicide attempts – by self-poisoning (ICD–9 950–951)**

| Report/SMR | Country | Suicides | |
|---|---|---|---|
| | | Observed | Expected |
| Bratfos (1971) | Norway | 8 | 0.20 |
| Buglass & McCulloch (1970) | Scotland | 17 | 0.14* |
| Lönnqvist *et al* (1975) | Finland | 4 | 0.17* |
| Nordentoft *et al* (1993) | Denmark | 103 | 3.48 |
| Paerregaard (1975) | Denmark | 53 | 1.46* |
| Pierce (1981) | Wales | 7 | 0.25* |
| Rosen (1976) | Scotland | 34 | 0.49* |
| Rosenman (1983) | Australia | 7 | 0.17* |
| Ström *et al* (1986) | Denmark | 110 | 1.63* |
| Sundqvist-Stensman (1988) | Sweden | 68 | 1.27* |
| Suokas & Lönnqvist (1991) | Finland | 33 | 1.65 |
| **SMR 4070 (95% CI 3700–4467)** | **Total** | **444** | **10.91** |

*Expected value calculated by us; SMR, standardised mortality ratio.

**Table 13*b*** **Suicide attempt by any method (ICD–9 950–959)**

| Report/SMR | Country | Suicides | |
|---|---|---|---|
| | | Observed | Expected |
| Beck & Steer (1989) | USA | 22 | 0.40* |
| Cullberg *et al* (1988) | Sweden | 6 | 0.32* |
| Ettlinger (1964) | Sweden | 30 | 0.62* |
| Ettlinger (1975) | Sweden | 150 | 3.40 |
| Greer & Lee (1967) | England | 1 | 0.02* |
| Mehlum (1994) | USA | 0 | 0.20 |
| Nielsen *et al* (1990) | Denmark | 24 | 0.31* |
| Pederson *et al* (1975) | USA | 52 | 2.10* |
| Van Aalst *et al* (1992) | USA | 0 | 0.06* |
| **SMR 3836 (95% CI 3403–4308)** | **Total** | **285** | **7.43** |

*Expected value calculated by us; SMR, standardised mortality ratio.

## Attempted suicide (ICD–9 950–959)

This material is grouped into attempted suicide by self-poisoning, attempted suicide by any method and past histories of attempted suicide or suicidal ideation.

### *Attempted suicide by self-poisoning (ICD–9 950–951) (Table 13a)*

Eleven papers from seven countries reported on a population of 8000 treated for self-poisoning, many in intensive care, followed for up to 10 years. Fifty-eight per cent were female. Four Scandinavian countries accounted for 90% of the expected value, Scotland and Wales 8%. Denmark alone provided 60%. Nordentoft *et al* (1993) contributed 32%.

Combining the studies gave a suicide risk 40 times the expected value but with variation between studies of 20–120 times. Increased risk was related to recency of previous attempt (Paerregaard, 1975; Rosen, 1976; Sundqvist-Stensman, 1988; Suokas & Lönnqvist, 1991; Nordentoft *et al*, 1993), more than one previous attempt (Nordentoft *et al*, 1993), a history of previous or current psychiatric treatment, particularly for depression or schizophrenia (Lönnqvist *et al* 1975; Paerregaard, 1975; Rosen, 1976; Sundqvist-Stensman, 1988), and to measures of social cohesion such as loneliness, loss of a partner, being orphaned at a young age, being an immigrant, having a poor work record and having many changes of dwelling place (Buglass & McCulloch, 1970; Lönnqvist *et al*, 1975; Rosenman, 1983; Nordentoft *et al*, 1993).

### *Attempted suicide by any method (ICD–9 950–959) (Table 13b)*

Nine papers from four countries reported on a population of 2700 followed in some studies for up to 20 years. Fifty-five per cent were female. Sweden and Denmark accounted for 62% of the expected value, the USA 37%. Ettlinger (1975) alone provided 46%. The suicide methods used are not given and are assumed to be mixed. Some studies are of all admissions from an area (Ettlinger, 1964; Pederson *et al*, 1975; Cullberg *et al*, 1988; Beck & Steer, 1989) others are restricted to the seriously ill (Greer & Lee, 1967; Ettlinger, 1975; van Aalst *et al*, 1992).

Combining the studies gave a suicide risk 38 times the expected but with variation between studies of 0–77 times. Risk was highest in the two years following the index

attempt (Ettlinger, 1964). Increased risk was also related to alcohol abuse (Cullberg *et al*, 1988; Beck & Steer, 1989; Nielsen *et al*, 1990), depression (Cullberg *et al*, 1988; Nielsen *et al*, 1990) and long-standing medical illness (Nielsen *et al*, 1990). The similarity of the suicide risk of this mixed method group and that for self-poisoning suggests they are from the same suicide-prone populations. Wang *et al* (1985) was included in Nielsen *et al* (1990) and is therefore omitted from Table 13*b*.

### *Suicidal ideation/attempts – mixed group (Table 13c)*

Three papers reported on a US population of 1600 followed for up to 14 years. The population had in-patient psychiatric treatment for suicidal threats or ideation, or a previous suicide attempt. Ninety-five per cent also had a mental illness. Eighty-eight per cent were men, reflecting the VA source of Eisenthal *et al* (1966) and Pokorny (1966).

Combining the studies gave a suicide risk 47 times the expected. Increased risk was found for the single or divorced (Eisenthal *et al*, 1966), being White (Beck *et al*, 1985) and for organic mental disorder, personality disorder, schizophrenia (Pokorny, 1966) or affective disorder (Beck *et al*, 1985). A history of a previous attempt had a higher risk than suicidal threats or ideation (Eisenthal *et al*, 1966; Pokorny, 1966). The highest risk was in the first three months after consultation (Pokorny, 1966). The exceptionally high risk for this unusual population probably results from the combination of mental illness and the proven strong desire to commit suicide.

**Table 13c** Suicidal ideation/attempts

| Report/SMR | Country | Suicides | |
|---|---|---|---|
| | | Observed | Expected |
| Beck *et al* (1985) | USA | 14 | 0.22* |
| Eisenthal *et al* (1966) | USA | 46 | 0.89* |
| Pokorny (1966) | USA | 21 | 0.60 |
| **SMR 4737 (95% CI 3762–5887)** | **Total** | **81** | **1.71** |

*Expected value calculated by us; SMR, standardised mortality ratio.

## All diagnoses of psychiatric illness by treatment setting

This section considers populations defined by each study author by care status at study inception: forensic psychiatric unit, involuntary commitment, in-patient, long-stay in-patient, previous in-patient, out-patient, community care and all treatment settings combined. Cohorts therefore vary by diagnostic mix, duration of treatment under index type of care and demographic composition. Reports which gave suicide mortality by diagnoses are also included in the relevant sections of this paper (Pokorny, 1964; 1983; Sletten *et al*, 1972; Copas & Robin, 1982; Black *et al*, 1985*a*; Zilber *et al*, 1989). Treatment in a psychiatric setting is, in these studies, consistently associated with high risks of suicide. The recently discharged and the recently admitted are at especially high risk.

### *Forensic psychiatric unit (Table 14a)*

Two papers reported on a population of nearly 2000 from two separate US maximum-security hospitals followed for up to 25 years. Haynes & Marques (1984) contributed 97% of the expected value, Batten & Kamara (1992) 3%. The former population was male, the latter of unstated gender.

Combining the studies gave a suicide risk six times that expected, a mean derived from markedly different risks: 4.5 for Haynes & Marques (1984) 43 for Batten & Kamara (1992). A charge of murder or attempted murder carried an especially high risk in Haynes & Marques (1984), in which 50% of the suicides were on such a charge compared with 10% of the total hospital population. Schizophrenia carried a high risk in Batten & Kamara's (1992) group: eight of the 10 suicides had schizophrenia compared with 38% of the total hospital population.

**Table 14a** Forensic psychiatric unit – all psychiatric diagnoses

| Report/SMR | Country | Suicides | |
|---|---|---|---|
| | | Observed | Expected |
| Batten & Kamara (1992) | USA | 10 | 0.23 |
| Haynes & Marques (1984) | USA | 29 | 6.44 |
| **SMR 585 (95% CI 416–799)** | **Total** | **39** | **6.67** |

SMR, standardised mortality ratio.

**Table 14b** Involuntary commitment – all psychiatric diagnoses

| Report/SMR | Country | Suicides | |
|---|---|---|---|
| | | Observed | Expected |
| Engberg (1994) 1970s | Denmark | 116 | 2.60 |
| 1980s | Denmark | 72 | 2.30 |
| McKechnie *et al* (1986) | Scotland | 3 | 0.10* |
| Shore *et al* (1981) | USA | 2 | 0.01* |
| **SMR 3852 (95% CI 3328–4436)** | **Total** | **193** | **5.01** |

*Expected value calculated by us; SMR, standardised mortality ratio.

### *Involuntary commitment (Table 14b)*

Three papers reported on a total population of 14 000 of which 98% were followed for one year following commitment and 2% for 2.5–8.5 years. This breech of the inclusion criteria of two years' minimum for follow-up time is justified by the absence of other

**Table 14c** In-patients – all psychiatric diagnoses

| Report/SMR | Country | Suicides | |
|---|---|---|---|
| | | Observed | Expected |
| Copas & Robin (1982) | England | 375 | 81.50 |
| Gale *et al* (1980) | USA | 60 | 2.26* |
| Lim *et al* (1993) | Singapore | 91 | 2.36* |
| Pokorny (1964) | USA | 117 | 16.10 |
| Pokorny (1983) | USA | 67 | 5.52 |
| Shinozaki (1976) | Japan | 49 | 4.03 |
| Sletten *et al* (1972) | USA | 97 | 20.00* |
| Temoche *et al* (1964) | USA | 30 | 17.90 |
| Varsamis *et al* (1972) | Canada | 2 | 0.12* |
| Zilber *et al* (1989) | Israel | 35 | 8.79 |
| **SMR 582 (95% CI 545–621)** | **Total** | **923** | **158.58** |

*Expected value calculated by us; SMR, standardised mortality ratio.

**Table 14d** Long-stay in-patients – all psychiatric diagnoses

| Report/SMR | Country | Suicides | |
|---|---|---|---|
| | | Observed | Expected |
| Brook (1985) | Netherlands | 26 | 13.93 |
| [Brook (1985) | Netherlands | 26 | 3.80*] |
| Giel *et al* (1978) | Netherlands | 23 | 5.45 |
| Licht *et al* (1993) | Denmark | 2 | 0.63 |
| **SMR 255 (95% CI 190–335)** | **Total** | **51** | **20.01** |
| **[SMR 516 (95% CI 384– 679)** | **Total** | **51** | **9.88]** |

*Expected value calculated by us; SMR, standardised mortality ratio.

**Table 14e** Previously hospitalised patients – all psychiatric diagnoses

| Report/SMR | Country | Suicides | |
|---|---|---|---|
| | | Observed | Expected |
| Allgulander *et al* (1992) | Sweden | 1115 | 152.90* |
| Black *et al* (1985*a*) | USA | 68 | 3.21 |
| James & Levin (1964) | Australia | 75 | 14.21 |
| Temoche *et al* (1964) | USA | 147 | 32.40 |
| **SMR 693 (95% CI 657–73)** | **Total** | **1405** | **202.72** |

*Expected value calculated by us; SMR, standardised mortality ratio.

**Table 14f** Out-patients – all psychiatric diagnoses

| Report/SMR | Country | Suicides | |
|---|---|---|---|
| | | Observed | Expected |
| Beck *et al* (1990) | USA | 17 | 1.12* |
| Koranyi (1977) | Canada | 11 | 0.35 |
| Martin *et al* (1985) | USA | 6 | 0.41 |
| **SMR 1809 (95% CI 1252–2527)** | **Total** | **34** | **1.88** |

*Expected value calculated by us; SMR, standardised mortality ratio.

large studies on involuntary commitment. Fifty-five per cent were male. Engberg's (1994) Danish population accounted for 98% of the expected value, 52% from admissions in the 1970s and 46% from the 1980s.

Combining the studies gave a suicide risk 39 times that expected. The highest risks were for 'non-psychosis' and following short first admissions. Only 7% of Engberg's (1994) suicides occurred while committed to hospital, which suggests that compulsory in-patient care is protective. There was no significant difference between the suicide risk for the 1970s compared with that for the 1980s, after age standardisation (Engberg, 1994).

### *In-patients (Table 14c)*

Ten papers from six countries reported on a total population of more than 100 000 followed for up to 10 years. At the start of each study all subjects were in-patients but at the end some had left in-patient care. Approximately 60% were male. England accounted for 51% of the expected value, the USA 39%. Copas & Robin (1982) provided 51% of the expected value.

Combining the studies gave a suicide risk nearly six times that expected but with a range of 2–39 times. This is explained in part by variation in cohort composition, by time since admission, diagnosis, duration of stay, discharge policy, demography and duration of follow-up. Higher suicide risk was related to the first month of admission (Sletten *et al*, 1972), recent discharge, with (Pokorny, 1964, 1983; Lim *et al*, 1993) and without leave (Pokorny, 1964; Sletten *et al*, 1972), being White (Pokorny, 1983) and being unmarried (Pokorny, 1983). Risk declined with stay and was lowest for those remaining in-patients.

### *Long-stay in-patients (Table 14d)*

Three papers reported on a population of over 28 000, 99% followed for two years and 1% for a mean of 5.5 years. For the 40% of the combined population for which gender was given 52% were female. The Netherlands contributed 97% of the expected value, Denmark 3%. Brook (1985) accounted for 70% of the expected value, Giel *et al* (1978) 27%.

Combining the studies gave a suicide risk 2.5 times the expected value with little variation between studies. However, our estimate of Brook's (1985) expected value, 3.8 compared with his of 13.93, changes

these values (figures in parentheses, Table 14*d*). Brook's contribution to the expected value is reduced to 38% and Giel's increased to 55%. The new suicide risk for the combined group becomes five times that expected. We consider our estimate to be nearer the correct value.

Levy & Southcombe (1953) reported on all suicides occurring in a USA mental hospital from 1891 to 1949. Almost half occurred in the three months following admission, with 17% in the first week and few after five years. We included this resumé of old material because of the similarity to contemporary results of the findings on the relation between suicide risk and time since admission. The study is not in Table 14*d* because the expected values could not be calculated.

### *Previously hospitalised patients (Table 14e)*

Four papers from three countries reported on a population of nearly 16 000 followed for up to 15 years after discharge from in-patient treatment. Fifty-one per cent were male. Sweden provided 75% of the expected value with the large study by Allgulander *et al* (1992), while the USA provided 18% and Australia 7%.

Combining the studies gave a suicide risk seven times that expected, with little variation between studies except for Black *et al* (1985*a*) in which the risk was 21 times for unexplained reasons. Highest risks were for the young, the recently discharged, and diagnoses of affective disorder, schizophrenia and neurosis (Black *et al*, 1985*a*; Allgulander *et al*, 1992).

### *Out-patients (Table 14f)*

Three papers from two countries reported on a population of 4500 followed for up to 12 years after receiving out-patient psychiatric treatment. Fifty-nine per cent were female. The USA provided 81% of the expected value, Canada 19%. Beck *et al* (1990) accounted for 59%, Martin *et al* (1985) 22%.

Combining the studies gave a suicide risk 18 times that expected with Beck *et al* (1990) and Martin *et al* (1985) both 15 times but Koranyi (1977) much higher at 31 times that expected. Highest risks were for the young of both genders, females of all ages (Koranyi, 1977) and a diagnosis of affective disorder (Beck *et al*, 1990).

### *Community care patients (Table 14g)*

Five papers from five countries reported on a population of over 10 000 followed for up to 12 years during and after care in the community. Care was based in 'community psychiatric services' (Sturt, 1983; Cantor *et al*, 1992; Amaddeo *et al*, 1995), a 'community mental health centre' (Corten *et al*, 1991) and 'sheltered care' (Segal & Kotler, 1991). Australia contributed 52% of the expected value (with Cantor *et al*'s (1992) large study based on death certificate data) and Italy 30%.

Combining the studies gave a suicide risk almost 13 times that expected. Highest risks were for the young and diagnoses of affective disorder and schizophrenia.

### *All treatment settings (Table 14h)*

Six papers from four countries reported on a population of over 45 000 followed for up to 15 years. The populations received many kinds of treatment not distinguished in the reports. The USA provided 58% of the expected value, Britain 22% and Sweden 20%. Babigian & Odoroff (1969) provided 58%, Rorsman (1974) 20% and King & Barraclough (1990) 16% of the expected value.

Combining the studies gave a suicide risk 11 times that expected, with variation between studies of 6–27 times. Highest risks were seen for men under 44 years (Innes & Millar, 1970; King & Barraclough, 1990), the year following consultation (King & Barraclough, 1990), and for those with a history of suicide attempt (Rorsman, 1974). Lowest risk was seen for those aged over 75 years (Innes & Millar, 1970). Robinson's (1989) study of patients aged over 65 years found no excess suicide in men or women.

**Table 14g** Community care patients – all psychiatric diagnoses

| Report/SMR | Country | Suicides | |
|---|---|---|---|
| | | Observed | Expected |
| Amaddeo *et al* (1995) | Italy | 30 | 1.72 |
| Cantor *et al* (1992) | Australia | 34 | 3.00* |
| Corton *et al* (1991) | Belgium | 6 | 0.23 |
| Segal & Kotler (1991) | USA | 3 | 0.79* |
| Sturt (1983) | England | 1 | 0.04* |
| **SMR 1280 (95% CI 1111–1608)** | **Total** | **74** | **5.78** |

*Expected value calculated by us; SMR, standardised mortality ratio.

**Table 14h** All treatment settings – all psychiatric diagnoses

| | Country | Suicides | |
|---|---|---|---|
| | | Observed | Expected |
| Babigian & Odoroff (1969) | USA | 133 | 14.73 |
| Hoenig & Hamilton (1966) | England | 3 | 0.13* |
| Innes & Millar (1970) | Scotland | 30 | 1.10 |
| King & Barraclough (1990) | England | 77 | 4.10 |
| Rorsman (1974) | Sweden | 49 | 5.20 |
| Old age | | | |
| Robinson (1989) | England | 1 | 0.17* |
| **SMR 1152 (95% CI 1024–1292)** | **Total** | **293** | **25.43** |

*Expected value calculated by us; SMR, standardised mortality ratio.

## DISCUSSION

### Sources of error

A meta-analysis based on papers may show a greater difference in the predicted direction, here of an increased suicide risk, than one based on patient data (Stewart & Parmar, 1993). Subject exclusion, short follow-up, form of analysis, publication bias and multiple publication of the same material can overestimate the effect studied. We used an analysis of papers

because access to individual patient data was impossible.

We have commented on error from subject exclusion and method of analysis where it was evident, but could not do so for all papers cited in the tables. The error in calculating the expected number of suicides from WHO data overestimates the expected value and therefore acts against finding an increased suicide risk, as explained in the statistical method and shown by us elsewhere (Harris & Barraclough, 1994).

We decided on a minimum two-year follow-up as the inclusion criterion unless a study was of exceptional interest. Papers reporting more than 10% loss of subjects at follow-up were excluded because of the error introduced by ignorance of outcome of a substantial proportion of a cohort (Sims, 1973). Bias favouring the publication of papers reporting increased suicide risk seems to have happened in studies on alcohol, schizophrenia, mood disorders, attempted suicide and possibly others. The evidence for this bias is that papers with small expected numbers had higher suicide risks than studies with large expected numbers. However, the effect of this on increasing the mean values for suicide risk is small because the effect is outweighed by the larger studies. This consideration is described in the relevant sections.

Double counting of data in a meta-analysis results from: the deliberate re-publication of the same data; data from early papers becoming incorporated into later ones to provide a longer follow-up; and data from part of a country appearing again in a national or larger area study. Double counting was avoided by including the most appropriate paper. This is referred to in the sections where we detected it.

These precautions largely avoid over-estimating the increases in suicide risk found.

### Literature search

Because MEDLINE covers disease associated mortality we did not search other computerised databases. We restricted the MEDLINE search to 'mental disorders', 'brain injury', 'eating disorders', 'epilepsy', 'psychosurgery' and 'suicide attempts'. Papers may have been missed because of coding error, publication before January 1966 or since July 1993, or appearance in a language other than English. Papers published between July 1993 and June 1995 would, however, be included if published in, or cited within papers published in, *The Lancet*, *British Medical Journal*, *New England Journal of Medicine*, *British Journal of Psychiatry*, *Psychological Medicine*, *Archives of General Psychiatry* or *Acta Psychiatrica Scandinavica*. MEDLINE is believed to identify only 50% of material on a given topic (Chalmers *et al*, 1992). To compensate, we read the references cited in papers found by MEDLINE, and so on. The reappearance of familiar references and failure to find new ones provided the search end-point.

The MEDLINE search identified 37% (40) of the 109 papers presented in the tables that were published between 1983 and 1992. A percentage higher than 50% would suggest we had missed many useful papers. Few of the papers included were published before 1966 because our inclusion criteria tended to exclude earlier papers rather than because 1966 is the earliest year indexed on MEDLINE.

We omitted 'suicide' from the search term to avoid a bias towards finding papers reporting high suicide risks. This bias was shown in Stenager & Stenager's (1992) study of suicide as an outcome for neurological disorders. Their search term included 'suicide' and resulted in a higher proportion of papers reporting increased suicide risk than our search on neurological disorders did (Harris & Barraclough, 1994).

Because over three-quarters of the psychiatric literature included in MEDLINE is published in English (Barraclough & Noyes, 1989) it seems unlikely that restricting the search to papers in English has missed material which would alter the main findings.

### Statistical error

Some error must arise from our calculation of expected values from WHO data. However, in a previous paper (Harris & Barraclough, 1994), we took those studies in which the author(s) provided an expected value and compared it with an expected value calculated by us from WHO data. The author's expected value was on average 26% lower. This probably resulted from our overestimating the mean of the follow-up period by using the average of the maximum and minimum values of the follow-up intervals. The true mean, which can only be calculated using patient data, will probably be smaller because larger numbers of subjects tend to be followed for a shorter time. Our estimates, being too high, will tend to reduce the observed-minus-expected value where the true suicide risk is raised, and increase it where the true suicide risk is reduced. This may understate raised and overstate lowered risk.

We could not include some studies because 'suicide' was included with accident and homicide in a category called 'violent death'. Other studies not included had combined 'suicide' with 'undetermined death' making it impossible to analyse data for suicide alone.

Many authors commented on how deaths classified to accident or undetermined death, which common sense would classify to suicide, underestimate the magnitude of suicide as a cause of death in mental disorders. This tendency to underestimate probably affects child death more than adult death because of sentiment; substance abuse death more than violent death because intent is harder to deduce from poisoning than, say, hanging; and non-psychosis death, in which poisoning is common, more than psychosis death in which violence is preferred (Dahlgren, 1951; Tashiro & Lipscomb, 1963; Gillis, 1969; Medhus, 1975; Robinette *et al*, 1979; Thorarinsson, 1979; Smith *et al*, 1983; Berglund, 1984; Martin *et al*, 1985; Beck *et al*, 1990).

The country of origin of studies probably limits the application of these findings to the developed world, and possibly not all of that. Of the 306 entries in the tables, North America, Scandinavia and the UK combined contributed 85%, the USA alone 30%, Scandinavia 28%, the UK 22% and Canada 5%. The rest of Europe contributed 8%, Australia and New Zealand 3%. Eleven entries came from the rest of the world; Israel and Singapore four each, Japan two and South Africa one. There were no entries from Eastern Europe, mainland Asia, Africa (apart from South Africa), Central or South America.

## CONCLUSIONS

Of the 44 disorders in the summary table (Table 15), 36 have a significantly raised SMR for suicide, five have a raised SMR which fails to reach significance, one SMR is not raised and for two entries the SMR could not be calculated as no suicides were recorded. If these results can be generalised, then virtually all mental disorders have an increased risk of suicide excepting mental retardation and possibly dementia and agoraphobia.

**Table 15** Summary

| | Observed | Expected | SMR | 95% CI |
|---|---|---|---|---|
| Organic disorders | | | | |
| Surgically treated TLE | 7 | 0.08 | 8750 | 3518–18028 |
| Encephalitis lethargica | 4 | 0.20 | 2000 | 545–5121 |
| Transient global amnesia | 1 | 0.10 | 1000 | 25–5572 |
| Temporal lobe epilepsy | 4 | 0.50 | 800 | 218–2048 |
| Institutionalised epilepsy | 21 | 4.30 | 488 | 302–747 |
| Petit mal epilepsy | 2 | 0.48 | 417 | 50–1505 |
| Out-patient epilepsy | 25 | 6.08 | 411 | 266–607 |
| Civil brain injuries | 5 | 1.43 | 350 | 114–816 |
| GP epilepsy | 1 | 0.30 | 333 | 8–1857 |
| War brain injuries | 107 | 32.50 | 329 | 270–398 |
| Huntington's disease | 67 | 23.13 | 290 | 224–368 |
| Unspecified organic | 17 | 6.85 | 248 | 145–397 |
| Mental retardation | 3 | 3.40 | 88 | 18–258 |
| Dementia not otherwise specified | 0 | 0.10 | | |
| **Total** | **264** | **79.45** | **332** | **293–375** |
| Substance use disorders | | | | |
| Sedatives, with other drugs | 23 | 0.52 | 4423 | 2804–6637 |
| Sedatives | 36 | 1.77 | 2034 | 1425–2816 |
| Mixed drugs | 135 | 7.02 | 1923 | 1612–2276 |
| Sedatives, with alcohol | 33 | 2.11 | 1564 | 1077–2196 |
| Opioids | 64 | 4.57 | 1400 | 1079–1788 |
| Alcohol | 641 | 109.44 | 586 | 541–633 |
| Cannabis | 10 | 2.60 | 385 | 184–707 |
| Nicotine | 153 | 62.60 | 244 | 207–286 |
| **Total** | **1095** | **190.63** | **574** | **541–609** |
| Functional disorders | | | | |
| Stupor | 4 | 0.07 | 5714 | 1557–14631 |
| Suicidal ideation/attempts | 81 | 1.71 | 4737 | 3762–5887 |
| Suicide attempts | | | | |
| By self poisoning | 444 | 10.91 | 4070 | 3700–4467 |
| By any method | 285 | 7.43 | 3836 | 3403–4308 |
| Anorexia nervosa | 25 | 1.11 | 2252 | 1458–3325 |
| Psychosurgery | 12 | 0.58 | 2069 | 1069–3614 |
| Major depression | 351 | 17.25 | 2035 | 1827–2259 |
| Mood disorders not otherwise specified | 377 | 23.41 | 1610 | 1452–1781 |
| Brief reactive psychosis | 1081 | 70.33 | 1537 | 1447–1631 |
| Bipolar disorder | 93 | 6.18 | 1505 | 1225–1844 |
| Adjustment disorder | 4 | 0.29 | 1379 | 376–3532 |
| Bulimia nervosa | 1 | 0.08 | 1250 | 32–4465 |
| Dysthymia | 1436 | 118.45 | 1212 | 1150–1277 |
| Obsessive–compulsive disorder | 3 | 0.26 | 1154 | 238–3372 |
| Panic disorder | 9 | 0.90 | 1000 | 457–1898 |
| Schizophrenia | 1176 | 139.13 | 845 | 798–895 |
| Personality disorder | 30 | 4.24 | 708 | 477–1010 |
| Anxiety neurosis | 151 | 24.00 | 629 | 533–738 |
| Somatisation disorder | 2 | 0.38 | 526 | 64–1901 |
| Child and adolescent | 137 | 28.94 | 473 | 397–560 |
| Neurosis | 85 | 22.87 | 372 | 297–460 |
| Agoraphobia | 0 | 0.01 | | |
| **Total** | **5787** | **478.53** | **1209** | **1178–1241** |
| Medical disorders[1] | | | | |
| Renal haemodialysis | 20 | 1.38 | 1449 | 885–2238 |
| Head and neck neoplasms | 9 | 0.79 | 1139 | 521–2163 |
| AIDS/HIV | 207 | 31.48 | 658 | 577–763 |
| SLE | 18 | 4.14 | 435 | 258–687 |
| Renal transplantation | 11 | 2.87 | 383 | 191–686 |
| Spinal cord injury | 183 | 47.89 | 382 | 329–442 |
| Multiple sclerosis | 87 | 36.91 | 236 | 189–291 |
| Peptic ulcer | 245 | 116.57 | 210 | 185–238 |
| Malignant neoplasms | 1625 | 903.02 | 180 | 171–189 |

SMR, standardised mortality ratio.
1. From Harris & Barraclough (1994).

Suicide risk seems highest at the beginning of treatment and diminishes thereafter. Many papers make this point. The rate of decline is probably determined by illness chronicity and recurrence of episodes. This suggests the lifetime risk assessed on small cohorts with relatively short follow-up should be re-determined (Guze & Robins, 1970; Miles, 1977). A paper on this subject is in preparation.

Populations in this review comprised treated patients, mainly in a hospital setting, and therefore are of the more severely ill, or those vulnerable in other ways. Populations with the same disorders treated in general practice, or not at all, may have a lower suicide risk. This probably applies to eating disorders, substance misuse, some mood disorders, attempted suicide and epilepsy. The SMRs in the epilepsy section illustrate the point.

The product of the suicide rate of a disorder and its prevalence should give the number of suicides from that disorder in a population. In theory, the total number of suicides resulting from mental disorders for a nation is calculable. Since psychological autopsy studies claim some 90% of suicides have one or more mental disorders, this total should approximate to the number of suicides that occur. Miles (1977) attempted such a calculation for the US population, producing two similar numbers. We have not attempted a replication because knowledge of prevalence and risk is not yet, in our opinion, sufficiently accurate.

When disorders are grouped by their supposed aetiology, 'organic' has the lowest SMR, 'substance abuse' is next and 'functional' highest. The SMRs are in the approximate ratio 1:2:4. This emphasises the peculiarly high risk attached to functional disorders.

We also include here the nine medical disorders (out of 63 examined) found to have a significantly raised suicide risk (Harris & Barraclough, 1994). The summary table gives an overview of suicide as an outcome for both 'mental' and 'medical' disease states.

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### CLINICAL IMPLICATIONS

- Suicide risk is raised for virtually all mental disorders and also some medical disorders related to mental disorder or substance abuse; suicidal thoughts and actions, both past and present, increase risk further.
- Functional mental disorders have, overall, the highest risk, with substance abuse and organic disorders lesser degrees of risk.
- Suicide risk is particularly high at the inception of treatment and at its end, declining thereafter.

### LIMITATIONS

- The results apply to those countries and subject groups studied. Most of the world is excluded.
- The subject groups may not be representative.
- This is, by its design, an overview with limited interpretation of the results.


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