Risk factors for suicide in patients with schizophrenia: nested case–control study

C. D. ROSSAU and P. B. MORTENSEN

Background Of 9156 patients admitted to psychiatric hospitals in Denmark between 1970 and 1987 and diagnosed for the first time as having schizophrenia, 508 committed suicide. The purpose of the study was to identify risk factors for suicide among patients with schizophrenia, particularly factors relating to hospitalisation.

Method From the cohort of all 9156 patients, the 508 who had committed suicide were individually matched to 10 controls from the same cohort, and data were analysed using conditional logistic regression.

Results Suicide risk was particularly high during the first 5 days after discharge, and increased risk was also associated with multiple admissions during the previous year, previous suicide attempts, previous diagnosis of depression, male gender, and previous admissions to general hospitals for physical disorders. After adjusting for these factors, no effect was found for age. There was some evidence of an excess of suicides during temporary leave from the psychiatric department.

Conclusions The findings suggest that preventive measures could be focused on the first period after discharge, when closer monitoring and better social support may be needed. This may also apply to patients on temporary leave during a period of admission.

It is well known that patients with schizophrenia are at greater risk of committing suicide than the population in general (Simpson, 1988). A lifetime risk of up to 10% has been suggested by Miles (1977), but even this figure may be under-estimated (Mortensen, 1995). It has been a recurring concern that the suicide risk among patients with schizophrenia seems to be rising (Pokorny, 1960; Saugstad & Odegard, 1979; Mortensen & Juel, 1993). Many studies have aimed at identifying risk factors for suicide in patients with schizophrenia, as reviewed by Allebeck (1989) and Caldwell & Gottesman (1990). However, up till now, the risk factors identified for suicide in schizophrenia do not have sufficient sensitivity and specificity to enable us to identify high-risk groups of individuals so that they could be targeted with preventive intervention.

Another strategy might be to identify particularly vulnerable periods during the course of schizophrenia, during which intervention strategies could be aimed at most patients. Appleby (1992) stated that a priority for suicide research is to study in detail the relationship between suicide and the provision of psychiatric and other services, but also found that this necessitates the use of a substantial sample of psychiatric suicides and a case–control design.

The aim of this study was to identify risk factors for suicide in patients with schizophrenia, with particular emphasis on factors related to the hospitalisation course, to enable us to identify such particularly vulnerable periods.

METHOD

The study was based on the nationwide Danish Psychiatric Case Register which has been computerised since 1969, and includes all Danish psychiatric in-patient facilities. The study population consisted of all 9156 persons (5658 males and 3498 females) who were admitted for the first time to any psychiatric hospital or department during the period 1 April 1970 to 31 December 1987, and diagnosed at least once within this period as having schizophrenia. Diagnoses were according to ICD–8 (World Health Organization, 1967) and the cohort was thus identical to the one used in the mortality study by Mortensen & Juel (1993).

A nested case–control study (Clayton & Hills, 1993) was conducted on this cohort. The application of this design of study to psychiatric research has been described by Mortensen (1988). The cases were all the 508 patients from the cohort (370 males, 138 females) who had committed suicide in the period between their first schizophrenia admission, and 25 March 1988. The cause of death was taken from the Register of Death Certificates at the Danish Institute of Clinical Epidemiology, as described by Mortensen & Juel (1993). From the same cohort, 10 individually-matched controls were identified for each suicide case. The sampling strategy was that of time-matched incidence density sampling (Greenland & Thomas, 1982). The matching criteria were: (a) diagnosed as having schizophrenia before the date of death of the suicide case; and (b) alive at the time of death of the case.

Analysis was performed using conditional logistic regression (Hosmer & Lemeshow, 1989) using the computer package Epilog (Epicenter Software, 1993). The odds ratio estimates resulting from this sampling and analysis can be interpreted as estimates of the incidence rate ratio (IRR) between the exposed category or categories and the reference level of exposure (Flanders & Louv, 1986). In other words, in all variables the reference category by definition has an IRR of 1.

Data on admissions to general hospitals were obtained from the Danish National In-patient Register (Sundhedsstyrelsen, 1993). This register came into operation on a nationwide basis in 1977; consequently, data on suicide attempts and admissions to general hospitals were only available for cases and the corresponding controls if the suicide occurred on 1 January 1977 or later.

Data were analysed initially including one explanatory variable at a time, adjusting separately for gender and age; and after that, including all variables which were either relevant on the basis of expectations based on the literature, or marginally significant ($P<0.15$). In the final model, only variables (such as age and gender, which were consistently found to be important in other studies), or variables which

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were statistically significant at a 5% level, were included. The only exception was the year of first admission, which we wanted to include in order to see whether the increase in suicide risk which we had previously reported in the same population (Mortensen & Juel, 1993) could be explained by other risk factors. Where continuous variables were relevant but the exact form of the dose–response relationship was unknown (e.g. duration of admission), the variable was included as a combination of categorical variables with the lowest level of exposure (e.g. a short duration of admission) as reference category. These variables were included when the removal of all of the variables indicating the separate levels of exposure significantly reduced the fit of the model, even if every single variable indicating a specific level of the exposure was not statistically significant. The different levels of the exposure were retained, however, in order to make the results easier to interpret.

RESULTS

Both the univariate results and the final model are summarised in Table 1. The effect of gender was as expected, with males being at greater risk than females, whereas the effect of age (i.e. higher risk among the younger patients) disappeared when other variables (in particular, duration of illness) were included.

Suicide risk was highest during the first six months after the first admission with schizophrenia, declining after this period. This remained true after adjusting for the time of diagnosis of schizophrenia, where those diagnosed as having schizophrenia on their first admission had a lower suicide risk than those diagnosed later.

The number of psychiatric admissions during the last year before the suicide was found to have considerable effect. When the patients who had not been admitted to hospital during the last year before the suicide were taken as a reference, the risk was higher: a relative risk of approximately 3.5 in patients with 1–2 admissions during the last year rose to a relative risk of almost 11 for those with more than eight admissions, implying that the so-called revolving-door pattern of admission increases the suicide risk considerably.

The current admission/discharge status and the duration of this status also had a strong effect. When the risk during the first 5 days after admission was taken as reference (that is, the risk during what will often be an acute psychotic episode), the risk declined during the period of admission, even though the risk was not significantly different from that of the first 5 days. More surprising, however, was that during the first 5 days after discharge the risk of suicide was more than twice (IRR=2.14) that in the first 5 days of admission, and even during the first 28 days after discharge, the risk was still the same as during the initial phase after admission. After the first 28 days of discharge, the risk declined to the same level as the risk more than 28 days after being admitted. It should be noted that the only period in which the suicide risk was significantly different from that in the period just after admission was the first 5 days after discharge, but the whole set of categorical variables characterising risk during the hospitalisation/discharge course was highly significant.

Table 1 Effects of various factors on suicide risk in in-patients with schizophrenia

Variable		Univariate results[1]		Final model	
		IRR	95% CI	IRR	95% CI
Gender	Female *v.* male	0.65	(0.53–0.8)	0.63	(0.50–0.79)
Present age	>45 years *v.* <45 years	0.48	(0.36–0.65)	1.00	(0.71–1.4)
Time of schizophrenic diagnosis	Later admissions *v.* first admission	2.17	(1.79–2.63)	1.39	(1.1–1.75)
Duration of illness	0.5 years	1 (reference)		1 (reference)	
	1 year	0.62	(0.55–0.83)	0.66	(0.45–0.98)
	2 years	0.39	(0.28–0.55)	0.67	(0.46–0.99)
	3 years	0.35	(0.28–0.55)	0.63	(0.42–0.95)
	4 years	0.31	(0.21–0.50)	0.6	(0.39–0.92)
	5 years	0.26	(0.17–0.39)	0.6	(0.38–0.97)
	7 years	0.22	(0.15–0.32)	0.5	(0.32–0.77)
	>7 years	0.14	(0.10–0.19)	0.39	(0.24–0.64)
Admitted to general hospital	Ever *v.* never	3.00	(2.40–3.74)	1.61	(1.22–2.13)
No. of previous suicide attempts	0	1 (reference)		1 (reference)	
	1	2.48	(1.93–3.19)	1.48	(1.09–2.0)
	2	3.86	(2.74–5.47)	2.13	(1.41–3.22)
	>2	4.54	(3.19–6.47)	2.14	(1.40–4.28)
No. of psychiatric admissions during the preceding year	0	1 (reference)		1 (reference)	
	2	5.37	(4.14–6.97)	3.46	(2.57–4.64)
	6	10.15	(7.62–13.54)	5.34	(3.80–7.52)
	8	18.38	(10.34–32.59)	7.89	(4.12–15.11)
	>8	21.72	(11.94–39.53)	10.93	(5.63–21.21)
Time after admission	<5 days	1 (reference)		1 (reference)	
	5–28 days	0.62	(0.34–1.12)	0.73	(0.39–1.37)
	>28 days	0.38	(0.23–0.65)	0.62	(0.35–1.09)
Time after discharge	<5 days	1.77	(0.92–3.39)	2.14	(1.07–4.31)
	5–28 days	0.88	(0.50–1.55)	1.06	(0.58–1.94)
	>28 days	0.17	(0.10–0.28)	0.61	(0.35–1.06)
Depression diagnosis	Ever *v.* never	1.88	(1.46–2.42)	1.46	(1.10–1.94)
Year of first psychiatric admission	1970–74	1 (reference)		1 (reference)	
	1975–80	1.25	(1.0–1.57)	0.87	(0.66–1.16)
	1981–87	2.51	(1.88–3.35)	1.25	(0.80–1.96)

Fit of the model $\chi^2=590.83$, d.f.=26, $P<10^{-5}$.
1. All univariate results are adjusted for gender and age using conditional logistic regression. Univariate results for gender and age are adjusted for age or gender, respectively.

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The only data available describing psychopathology were psychiatric diagnoses according to ICD–8. Patients who had at some stage been diagnosed with manic–depressive disorder were at increased risk, which would appear to confirm previous findings that the risk of suicide in schizophrenia is increased in the presence of depressive symptoms. This was also reflected by a non-significant increase in suicide risk in the schizoaffective subtype (ICD–8: 295.79). No other effect of schizophrenia subtypes was found, and this variable was not included in the final model.

A surprising finding was that patients who had been admitted to a general hospital for physical disorders were at increased risk of later suicide. No particular pattern of specific physical disorders could be identified among those who committed suicide. Our previous finding (Mortensen & Juel, 1993) of an increasing suicide risk in patients with schizophrenia was replicated in the univariate analysis, but disappeared after adjusting for the other risk factors in the final model.

This might suggest that the increase is associated with changes in the hospitalisation course, reflected by the other risk factors in the final model.

Marital status, and whether living in the town or the country, yielded IRR estimates close to 1 (i.e. no effect) and large P values in the univariate analysis and were not considered in the multivariate analyses.

A diagnosis of drug or alcohol abuse appeared to increase risk in the univariate analysis (IRR=1.3, P=0.01), but this was reversed in the multivariate analysis, where the risk just failed to reach statistical significance (IRR=0.8, P=0.07). Patients admitted compulsorily were at approximately half the risk of patients admitted voluntarily in the univariate analysis, but this effect disappeared in the multivariate analysis.

Because of the relatively strong effects of the various factors related to the course of hospitalisation, we also tried to compare the risk during admission and the risk during temporary leave from hospital with the risk after discharge from hospital. Unfortunately, it was not possible to get exact dates for the beginning and end of temporary leaves, but only for admissions and discharges, and therefore the exact time at risk during temporary leave could not be calculated and the risks could not be directly compared. However, cases of suicide could be distributed according to admission status: 340 (67%) of the suicides occurred during discharge, and 54 (10.6%) occurred during admission to a psychiatric hospital, whereas 114 suicides (22.4%) occurred during temporary leave. Since we would expect periods of temporary leave to be considerably shorter than the admission periods, and since we know that, after their first admission, patients with schizophrenia spend approximately 10% of their time as in-patients (Munk-Jørgensen & Mortensen, 1992), this would indicate that the risk of suicide is greatly increased during temporary leave from psychiatric departments, even though an exact IRR cannot be calculated.

Table 2 Methods of suicide

Method	Males, % (n=370)	Females, % (n=138)
Drowning	10	11
Poisoning	26	35
Violent	24	23
Hanging	28	17
Others	11	14

The distribution of methods of suicide is shown in Table 2. As in the general Danish population, there were among the patients relatively more self-poisonings and relatively fewer deaths by hanging among women than among men, but generally there was a higher proportion of suicides by violent means (which includes jumping from high places, and self-inflicted injuries from shooting, or from cutting and piercing instruments) among women with schizophrenia than in the general population, where the difference between men and women in this respect is much greater.

The differences in method, related to admission status at the time of suicide, are shown in Table 3. Hanging, drowning, and other violent methods of suicide were more frequent during admission, violent and 'other' methods dominated during temporary leave, and poisoning and hanging were more frequent methods after discharge. Unfortunately, it is not possible to specify the group 'other' in any more detail from the information to hand, but a number of such cases will have jumped in front of trains.

Table 3 Method of suicide and admission status at the time of the suicide

Suicide method	Discharged, % n=340	Admitted, % n=54	On temporary leave, % n=114
Poisoning	37.1	5.6	14.0
Hanging	24.1	44.4	19.3
Drowning	8.5	18.5	10.5
Violent	22.1	22.2	30.7
Other	8.2	9.3	25.4
Total	100	100	100

χ^2=65.25, d.f.=8, $P<10^{-7}$.

DISCUSSION

Hospitalisation course and suicide

The main finding of this study was the close relationship between factors related to the course of hospitalisation and the duration of illness, and the risk of suicide. To our knowledge this has not previously been demonstrated specifically for schizophrenia while taking other relevant risk factors such as age and gender into account. Neither have other studies used the exact number of person–years at risk in the calculations, comparing suicide risk at different times during follow-up. This means that in most other studies – for example, comparing risk during admission and discharge – the fact that patients spend more time outside than inside a psychiatric hospital will not have been taken into account. Also, the fact that follow-up to death was almost complete in our study would presumably lead to higher and more accurate risk estimates for suicide during discharge than in other studies.

However, irrespective of these methodological differences, our findings are in accordance with a number of other studies. Temoche *et al* (1964) found an increased risk of suicide in both current and former patients of mental institutions, and also found the risk to be highest during the first six months after discharge. Copas & Robin (1982), studying only suicides during in-patient episodes, found that the suicide risk was considerably increased during the first week of admission, and declined steadily thereafter. In a study of patients with schizophrenia, Roy (1982) found that 30% of suicides among discharged patients occurred within the first month after discharge, and Appleby (1992), in his review of suicide risk in psychiatric patients, concludes that maximum risk occurs at two points: (a) at the beginning of the acute phase; and (b) after discharge from in-patient stay, especially during the first three months.

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The decrease in suicide risk with increasing duration of illness is in accordance with the results of a number of studies, including Virkkunen (1974), and replicates our own previous findings (Mortensen & Juel, 1993), even after adjusting for the other risk factors in the final model. A number of other studies, including Sletten *et al* (1972) and Yarden (1974), have also found that the number of psychiatric admissions during the last year before the suicide has a considerable effect, but it is interesting that we found this effect too, since our study was based on a population of first-admission patients and thus was not selected with respect to chronicity, and also, the duration of the current admission or discharge period was taken into account, as well as the total duration of illness. In combination, the above-mentioned findings suggest that a change from longer, less frequent stays in hospital, to shorter periods in hospital with more frequent readmissions, may have a significantly negative effect, that is it increases the suicide risk in patients with schizophrenia. In Denmark during the 1970s and 1980s there has been a reduction in the number of available psychiatric beds, as well as a change towards shorter and more frequent admissions (Munk-Jørgensen & Mortensen, 1992; Mortensen & Eaton, 1994). Our study suggests that these changes, at least in part, may explain our previous finding of an increasing suicide risk in patients with schizophrenia during the first year after discharge (Mortensen & Juel, 1993).

A relatively large proportion of suicides occurred during temporary leave of absence from the hospital department. Since the exact duration of these periods could not be determined, it was not possible to calculate exact relative risks, but the finding is in accordance with other reports of a relatively large number of suicides during temporary leave (e.g. Niskanen *et al*, 1974). Together with the fact that there is an increased risk just after discharge, this suggests that the period of transition from the hospital environment to another setting (most often the patient's own home) is a particularly vulnerable one, and that perhaps particular attention should be paid to preventive measures during this time.

Age and gender

Age was not found to be of significant importance, after the inclusion of other risk factors. This should not, however, be interpreted as a failure to replicate previous studies. When included alone in the present study, it did show a significant effect, the younger patients being at greater risk. The effect of age disappeared, however, after including in the model the duration of the illness, hospitalisation status and the number of previous admissions. This is not surprising since young patients have a young age at onset, and this is also closely related to an increased risk of readmission (Mortensen & Eaton, 1994). The finding that the risk is higher in male patients is consistent with the literature on suicide in schizophrenia (Caldwell & Gottesman, 1990).

Other risk factors

The findings regarding the influence of previous suicide attempts are in accordance with those of most other studies (Caldwell & Gottesman, 1990); and the influence of a previous diagnosis of manic–depressive illness confirms the findings of Roy (1982) (among others) that depressive symptoms and hopelessness are important risk factors for suicide in schizophrenia.

An unexpected finding was the influence of previous hospital admissions for physical disorders. No specific pattern could be found in the diagnoses. Stensman & Sundqvist-Stensman (1988) have previously suggested that "suicide among persons with a chronic physical disease might be the final deciding factor in a person with severe psychiatric illness", and Bolin *et al* (1968), in their survey of suicide among patients on home leave from mental hospitals, suggest that poor physical health may be an important risk factor for suicide. However, further studies are needed to confirm the importance of poor physical health in assessing suicide risk in schizophrenia.

CONCLUSIONS

The increased risk of suicide immediately after admission and discharge, together with the high proportion of suicide cases during temporary leave of absence from the hospital, suggest that these may be periods when preventive intervention might be particularly appropriate. However, our study only gives information as to where and when suicide

CLINICAL IMPLICATIONS

- Patients are at higher suicide risk immediately after discharge and during temporary leave from the psychiatric department.
- Suicide prevention could be targeted at these vulnerable periods.
- 'Revolving door' admission patterns are associated with increased suicide risk.

LIMITATIONS

- A limited number of variables available, in particular lack of information on treatment, social conditions and psychopathology.
- The study is observational, not a controlled intervention study, so that the evidence as to possible effects of intervention is, at best, circumstantial.
- The study does not include patients who have exclusively been treated as out-patients, and inclusion is based on clinical diagnoses, rather than research diagnostic criteria for schizophrenia.

CHARLOTTE DAHL ROSSAU MD; PREBEN BO MORTENSEN, DrMedSc, Institute for Basic Psychiatric Research, Aarhus, Denmark

Correspondence: Dr Rossau, Institute for Basic Psychiatric Research, Department of Psychiatric Demography, Psychiatric Hospital in Aarhus, University of Aarhus, Denmark

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risk is highest: it does not give any information as to *why* the patients commit suicide, or about the psychopathology, current treatment, relation to relatives, or social support in general, of the suicidal patients. Much research is needed to specify this in detail, and even given this information, the evaluation of preventive intervention may be difficult, because of the low baseline rate of suicides among patients with schizophrenia (Mortensen, 1995). However, we find that since most risk factors identified in this study, together with other risk factors in the literature (such as depressive symptoms, real or perceived loss or rejection, limited external support, social isolation, etc.), are very common among psychiatric patients, and improvements in this respect would be desirable irrespective of the possible effects on suicide risk, the most promising avenue for future research and intervention would probably be to focus on these general factors during the specific high-risk periods confirmed in this study. Also, we suggest that any intervention should probably be focused on measures which can be applied to most or all psychiatric patients, thus reducing the prevalence of risk factors for suicide among psychiatric patients in general, rather than focusing on small high-risk groups of suicidal psychiatric patients.

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