

# Papers

## Change in suicide rates for patients with schizophrenia in Denmark, 1981-97: nested case-control study

Merete Nordentoft, Thomas Munk Laursen, Esben Agerbo, Ping Qin, Eyd Hansen Høyer, Preben Bo Mortensen

### Abstract

**Objective** To study the change in risk of suicide among patients with schizophrenia and related disorders.

**Design** Nested case-control design with linked data.

**Setting** 4 longitudinal Danish registers.

**Participants** 18 744 people aged up to 75 years who committed suicide in 1981-97 individually matched with 20 controls.

**Results** Over the time studied the reduction in suicide rate among patients with schizophrenia and schizophrenia spectrum disorder was similar to that seen in the general population (incidence rate ratio 1.00, 95% confidence interval 0.98 to 1.03). The reduction among patients with other psychosis in the schizophrenia spectrum was faster than the reduction seen in the general population. Among people admitted to hospital with schizophrenia the risk of suicide was highest in the first year after first admission, and the excess risk was largest in the younger age groups—that is, the risk decreased per year for every additional year of age.

**Conclusion** The suicide rate among patients with a diagnosis of schizophrenia and related disorders has fallen. This may be due to better psychiatric treatment, reduced access to means of suicide, or improvements in treatment after suicide attempts.

### Introduction

In 1980, the suicide rate in Denmark peaked and reached a level that was among the highest in the world, with 34 suicides per 100 000 inhabitants. After 1980 the number of suicides decreased each year, and in 1997 the rate was 15 per 100 000 inhabitants, a 56% reduction.

In Denmark, about half of the people who commit suicide have previously been admitted to psychiatric departments and more than a quarter have been admitted during the past year.<sup>1 2</sup> It is consistently reported from several countries that the standardised mortality (standardised for age and sex) for suicide in people with schizophrenia is high,<sup>3 4</sup> and in a meta-analysis Palmer et al found that the lifetime risk of suicide among patients after a first admission for schizophrenia was 5.6%.<sup>5</sup> Danish and Swedish analyses have shown an increasing rate of suicide among women with a diagnosis of schizophrenia, while the suicide rate has declined in the general population.<sup>6-8</sup> The increasing standardised mortality rates for suicide among the most severely mentally ill people have played an important part in the debate about the organisation of psychiatric treatment and prevention of suicide in Denmark and other countries.<sup>9</sup>

We investigated the suicide rates among patients with schizophrenia and related disorders to see if there was a similar reduc-

tion to that seen in the general suicide rate in Denmark from 1981 to 1997. We hypothesised that the ratio between suicide rates in people with a diagnosis of schizophrenia and related disorders compared with suicide rates in the general population would increase.

### Methods

#### Data sources

Data for this study were extracted from four Danish longitudinal registers, including the Danish civil registration system, the cause of death register, the Danish psychiatric central register, and the IDA database.

The Danish civil registration system has been functioning since 1968 and contains a personal identifier for all individuals living in Denmark and their birth information as well as links to parents.<sup>10</sup> The personal identifier (the CPR number) is used as a key to retrieve and merge individual data from different databases. The Danish civil registration system also contains information about the vital status of each person; it is therefore possible to exclude people who have disappeared or emigrated. The cause of death register contains computerised information about all deaths in Denmark, including date, way, and cause of death.<sup>11</sup> The Danish psychiatric central register covers all psychiatric inpatient facilities in Denmark and has been computerised since 1969.<sup>12</sup> The IDA database, a Danish acronym for integrated database for labour market research, contains longitudinal information on labour market conditions, automatically extracted from official records for everyone in the population and their sociodemographic data.<sup>13</sup>

#### Study population

From the cause of death register we extracted a list of all people aged less than 76 years who committed suicide in Denmark from 1981 to 1997. Suicide was determined as way of death when the causes of death were coded as E950-959 (ICD-8, international classification of diseases, eighth revision) for the period 1969-93 and as X60-84 (ICD-10, international classification of diseases, 10th revision) from 1994 and onwards. By using a nested case-control design matching for birth year, sex, and calendar time, we randomly selected 20 controls per case from a 5% random sample of the total population in the IDA database. We included 18 744 people who committed suicide and 374 880 population controls in the study.

#### Diagnostic groups and psychiatric treatment

We extracted information about psychiatric inpatient treatment from the Danish psychiatric case register. Patients were subdivided into mutually exclusive diagnostic groups on the

basis of the diagnosis at the latest admission. The “schizophrenia” group included patients with the diagnostic codes 295 (ICD-8) and F20 and F25 (ICD-10), the group of “other psychoses in schizophrenia spectrum” included patients with diagnoses 297 and 298.29, 298.39, 298.89, 298.99, 299.05, and 299.09 (ICD-8) and F22, F23, F24, F28, and F29 (ICD-10), and “schizophrenia spectrum disorders” included 301.09, 301.29, and 301.83 (ICD-8) and F21, F60.0, and F60.1. Data for all other diagnoses are not shown. The psychiatric admissions were divided into categories of time since latest admission and time since first admission. We chose the variables used for the purpose of adjustment because they are highly associated with suicide in Denmark.<sup>1 2 14 15</sup>

**Data analyses**

We analysed data using conditional logistic regression with Stata 8.0 clogit procedure. Because of the method of sampling controls from people at risk at the time, odds ratio can be interpreted as incidence rate ratios.<sup>16</sup> Of particular interest was the change in the suicide rate over the calendar period. Exposure to inpatient treatment for schizophrenia and related disorders were considered as explanatory variables. Calendar time was first included as annual indicators, and, using a Wald test, we investigated whether the rate of change with the calendar year could be described as a linear trend. We adjusted the incidence rate ratios for suicide for social and demographic risk factors of suicide in the general population—that is, education, place of residence, income, cohabitation, employment, place of birth, number of children, and death and suicide of a child.

We modelled the age-diagnosis interaction as a linear trend so that age was included as a continuous variable for all people who were admitted. As the data were matched for age, the continuous age variable expresses the annual change in risk for patients compared with the suicide-age pattern in the general population. The suicide risk associated with the main effect of admission should therefore be interpreted as an estimation of the risk for a patient aged 30 years.

**Results**

The crude suicide rates in the general population fell from 1981 to 1997 (fig 1). Among those who had been admitted to psychiatric hospitals or departments in the same period, there were 756 suicides among patients with schizophrenia, 633 suicides among patients with other psychosis within the schizophrenia spectrum, and 276 suicides among patients with non-psychotic schizophrenia spectrum disorder. Figure 2 shows the incidence rate ratios for suicide, adjusted for age and sex, for patients with these diagnoses. During the period from 1981 to 1997, the incidence rate ratio for suicide among patients with schizophrenia was about 20 times higher than in the general population. We fitted a regression line expressing the change from 1981 to 1997 relative to the general population for each diagnostic group. The lines had slopes of 0.99 (95% confidence interval 0.97 to 1.01, P=0.3) for schizophrenia, 0.95 (0.93 to 0.97, P<0.0001) for other psychosis, and 0.99 (0.96 to 1.04, P=0.9) for schizophrenia spectrum disorders, indicating that for patients with schizophrenia and non-psychotic schizophrenia spectrum disorder, the decrease was similar to the decrease in the general population, while the suicide rate among patients with other psychosis in the schizophrenia spectrum fell faster than in the general population.

We adjusted the incidence rate ratio for suicide for social and demographic risk factors and for time since admission and included age as an interaction term. We then fitted a regression

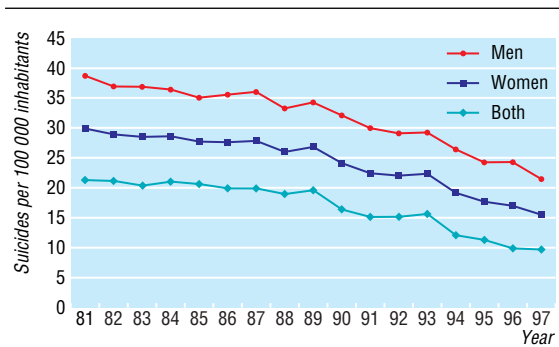


Fig 1 Number of suicides per 100 000 inhabitants in Denmark, 1981-97

line expressing the change from 1981 to 1997 relative to the general population, adjusted for confounding factors, and for all diagnostic groups there was a linear trend ( $\chi^2$  76.24, df=64, P=0.14). The table shows the results of the analyses for both sexes and for men and women separately. We mutually adjusted the incident rate ratios for different variables. As in the non-adjusted analyses we found that for patients with schizophrenia and non-psychotic schizophrenia spectrum disorder, the decrease was similar to the decrease in the general population, while the decrease for patients with other psychosis in schizophrenia spectrum was faster; this change was explained by a faster reduction in suicide rate among male patients with these diagnoses compared with the general population (see the results by sex).

The risk of suicide was high in all diagnostic groups during an inpatient stay and during the first month after discharge, and the longer the time a patient had been discharged, the lower the risk of suicide. Patients who were admitted for the first time during the previous year had a 59% higher risk of suicide compared with other patients.

For patients with schizophrenia, the excess suicide mortality (relative to the general population) decreased with increasing age. We chose patients aged 30 years as reference category and incidence rate ratio was 0.97 (95% confidence interval 0.96 to 0.98) per year. This means that for patients with schizophrenia, the excess suicide mortality is reduced by 3% on average for each year added to the patient’s age until 75 years. Thus, the incidence rate ratio of suicide compared with the risk in the general population for two patients aged 30 years and 40 years, respectively, both diagnosed with schizophrenia, currently admitted, and

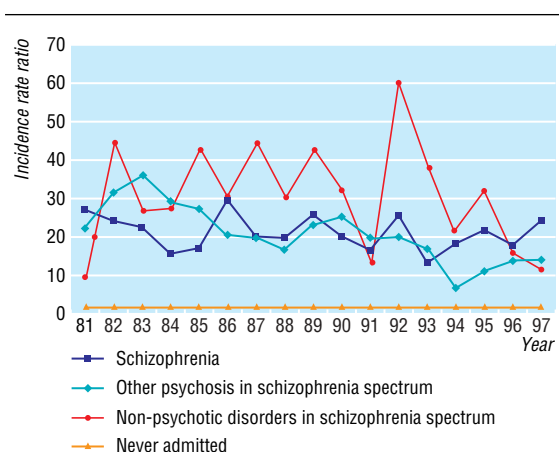


Fig 2 Incidence rate ratio for suicide in patients with schizophrenia and related disorders, relative to general population. Adjusted for age and sex

Incidence rate ratio for suicide among patients with schizophrenia and related disorders, adjusted for social and demographic risk factors\* and for interaction with age by diagnosis, compared with the general population. Figures are incidence rate ratios (95% confidence intervals)

	Schizophrenia	Other psychosis in schizophrenia spectrum	Schizophrenia spectrum disorder
<b>Both sexes</b>			
Development relative to general population 1981-97 (years)	1.00 (0.98 to 1.03)	0.97 (0.94 to 0.99)	1.03 (0.98 to 1.08)
Currently admitted	18.00 (13.87 to 23.36)	63.41 (41.95 to 95.86)	78.26 (39.95 to 153.29)
Length of stay before discharge (months):			
<1	80.39 (51.83 to 124.69)	194.51 (102.20 to 370.19)	67.59 (29.35 to 155.64)
1-6	38.26 (27.29 to 53.64)	51.01 (34.42 to 75.60)	31.91 (17.12 to 59.49)
7-12	18.70 (12.59 to 27.78)	40.85 (26.40 to 63.19)	21.90 (10.62 to 45.17)
>12	5.39 (4.10 to 7.08)	10.47 (7.60 to 14.43)	4.98 (2.97 to 8.35)
First admission within past year (for all three diagnostic groups)	—	1.59 (1.41 to 1.79)	—
<b>Men</b>			
Development relative to general population 1981-97 (years)	1.00 (0.97 to 1.02)	0.95 (0.91 to 0.98)	1.00 (0.94 to 1.06)
Currently admitted	13.32 (9.71 to 18.27)	39.03 (22.72 to 67.07)	50.76 (22.75 to 113.28)
Length of stay before discharge (months):			
<1	62.78 (36.39 to 108.31)	275.97 (90.47 to 841.88)	37.70 (14.07 to 101.01)
1-6	31.13 (20.78 to 46.65)	46.76 (27.46 to 79.60)	39.03 (17.78 to 85.69)
7-12	14.84 (9.19 to 23.96)	40.38 (22.60 to 72.14)	19.45 (7.79 to 48.58)
>12	4.46 (3.18 to 6.25)	8.80 (5.78 to 13.41)	3.41 (1.78 to 6.54)
First admission within past year	—	1.97 (1.69 to 2.30)	—
<b>Women</b>			
Development relative to general population 1981-97 (per year)	1.03 (0.99 to 1.08)	1.01 (0.97 to 1.05)	1.08 (0.99 to 1.17)
Currently admitted	36.57 (22.65339 to 59.04)	113.52 (58.34 to 220.87)	290.96 (71.44 to 1185.08)
Length of stay before discharge (months):			
<1	133.44 (62.75 to 283.81)	188.13 (80.53 to 439.50)	544.55 (60.59 to 4893.88)
1-6	53.75 (28.60 to 101.03)	75.89 (40.90 to 140.81)	27.42 (8.97 to 83.87)
7-12	31.84 (15.45 to 65.60)	52.97 (26.33 to 106.56)	32.14 (8.83 to 117.03)
>12	7.66 (4.75 to 12.34)	16.49 (9.75 to 27.87)	12.49 (4.87 to 32.04)
First admission within past year	—	1.25 (1.02 to 1.52)	—

\*Marital status, being parent of young child, employment status, annual income, place of residence, and absence from work due to sickness as well as age, sex, and calendar time through matching.

sharing all other characteristics, is 18.00 for the one aged 30 years and 13.27 (18.00×0.97<sup>10</sup>) for the one aged 40 years.

We adjusted the analysis for confounding with risk, social, and demographic factors known to be of importance in the general population. Adjustment for social and demographic risk factors reduced the incidence rate ratio for suicide among patients with schizophrenia from 21.37 to 12.26. Thus, social and demographic factors explain some of the increased suicide risk for schizophrenia, but even after we controlled for social and demographic factors, suicide was 12 times more common among patients with schizophrenia than in a matched group in the general population.

The table also shows the results of the study for each sex separately. In the general population the suicide rate among men is about twice as high as in women. The incidence rate ratio of suicide for women with schizophrenia and related disorders is higher than for men for all diagnostic groups and for all phases of treatment. This does not mean that the suicide rate for female patients is higher than for male patients, but it indicates a weaker effect of schizophrenia and related disorders among men. For both sexes, the decrease is similar to the decrease in the general population, except that men with other psychoses in the schizophrenia spectrum had a faster decrease in suicide rate than men in the general population.

## Discussion

Although the risk of suicide among patients with schizophrenia and related disorders is almost constantly 20 times higher than in the general population, in Denmark it fell by more than 50% from 1981 to 1997. The change in the suicide rate among these patients was no different from the change seen in the general

population, except that in patients with non-schizophrenic psychoses in schizophrenia spectrum the suicide rate fell faster.

Previous reports from Denmark and Sweden<sup>6-8, 17</sup> showed that compared with the general population suicide rates among patients with schizophrenia were increasing. We could not replicate these findings, which covered a later time period and was adjusted for possible confounding factors and interactions with age. The difference in findings between our study and previous Danish studies might reflect a positive development in risk of suicide among patients with schizophrenia and related disorders or it might indicate that the previous studies were insufficiently adjusted for social and demographic risk factors, different suicide rates in different follow up periods, and interaction with age.

### Explanations for findings

We cannot draw any firm conclusions regarding our observations of a decreasing risk of suicide over time. One hypothesis is that the patients were exposed to the same positive factors as the general population, such as reduced availability of means to commit suicide, better somatic and psychiatric treatment after attempted suicide, increased social and cultural stability in society, more general focus on prevention, and increased access to telephone counselling and psychiatric emergency services.<sup>17</sup>

Another hypothesis is that the suicide rates among the patients were reduced at the same rate but through different mechanisms. The results must be compared with the transition in the organisation of psychiatric treatment, with a marked reduction in the number of psychiatric beds and more focus on outpatient treatment and social support. In 1980, the number of psychiatric beds in Denmark was 2.0 per 100 000 inhabitants, and during the years until 1997 the number was reduced to 0.79

per 100 000,<sup>18</sup> a reduction of 6000 beds (Denmark had a population of 5.2 million inhabitants in 1997). During the same period the number of supported housing places (previously psychiatric nursing homes) increased from none in 1980 (at that time defined as psychiatric beds) to 3533 in 1997.<sup>18</sup> In addition, before 1997, 1728 places were established in psychiatric group's homes with staff support. Thus, the net reduction in the number of psychiatric beds and supported housing in the community between 1980 and 1997 was less than 1000 (a reduction of 0.19 beds per 100 000 inhabitants). During the same period, there was an increase in the number of people employed in psychiatry. The number of staff members employed in community mental health centres doubled between 1993 and 1997. In psychiatric wards, the number of staff members increased by 30%. Furthermore, staff members were employed with the task of supporting people with severe mental illness in their own home.<sup>18</sup> Thus the treatment and social support available for patients with schizophrenia and related disorders has increased, providing more possibilities for closer follow up during outpatient periods and closer observation and support during inpatient stay.

The decrease in mortality from suicide in the general population from 1981 to 1997 was relatively more marked among women than men, and the incidence rate ratio was stable throughout the period for both male and female patients with schizophrenia. Therefore, as in the general population, the decline in suicide rate was more marked for female patients with schizophrenia than for male patients. This suggests that the decline in suicide risk for patients was due to some of the same mechanisms as in the general population, such as less availability of suicidal means. If the decline in suicide rate among the patients was mainly due to better treatment of schizophrenia and related disorders, it would probably be equally effective in male and female patients.

We confirmed the finding that suicide was more common during inpatient stays and during the first month after recent discharge.<sup>1 2 8</sup> As in several other studies<sup>6 8 19-21</sup> we found that the period shortly after first psychiatric admission was associated with the highest risk of suicide.

## Conclusion

Throughout the period 1981-97, the risk of suicide among patients with schizophrenia was much higher than in the general population. The suicide rate among patients with schizophrenia and related disorders declined from 1981 to 1997, as did the suicide rate in the general population. It is unclear whether the reason for the reduction in suicide risk among patients with schizophrenia and related disorders is due to factors affecting the general population—such as decreased availability of means to commit suicide—or to factors that affect only patients with schizophrenia and related disorders—such as changes in psychiatric services—or both. Priority must continuously be given to preventive efforts directed towards the general population as well as towards psychiatric patients. The finding that the risk of suicide is especially high during the first month after discharge should lead to systematic evaluation of risk among inpatients before discharge and increased treatment and support immediately after discharge. Younger patients experiencing a first episode of schizophrenia are at high risk for suicide, and more intensive treatment and support should be offered to them.

Contributors: MN, TML, EA, PQ, EHH, and PBM accept full responsibility for the design and conduct of the study, have had access to the data, and controlled the decision to publish. TML analysed the data and all authors participated in critical discussion of the data analyses. MN wrote and revised the manuscript.

## What is already known on this topic

The suicide rates in the general population in Denmark fell by 56% during the period from 1980 to 1997

Previous studies have raised concern about whether the reduction in number of psychiatric beds was associated with an increased risk of suicide among patients with schizophrenia

The risk of suicide is highest the first year after first admission for schizophrenia, and the excess risk is highest in the younger age groups

## What this study adds

The reduction in suicide rates among patients with schizophrenia was similar to the reduction among the general population

This may have been facilitated by better psychiatric treatment or by factors that such patients share with the general population, such as less access to means to commit suicide and better treatment after attempted suicide

The risk of suicide among patients with schizophrenia is almost constantly 20 times higher than seen in the general population

Funding: Stanley Medical Research Institute and the Danish Medical Research Council ref. No. 22-02-0402. The National Centre for Register-based Research was supported by the Danish National Research Foundation.

Competing interests: None declared.

Ethical approval: This study was approved by Danish Data Protection Agency (2000-41-0307).

- Mortensen PB, Agerbo E, Eriksson T, Qin P, Westergaard-Nielsen N. Psychiatric illness and risk factors for suicide in Denmark. *Lancet* 2000;355:9-12.
- Qin P, Agerbo E, Mortensen PB. Suicide risk in relation to socioeconomic, demographic, psychiatric, and familial factors: a national register-based study of all suicides in Denmark, 1981-1997. *Am J Psychiatry* 2003;160:765-72.
- De Hert M, Peuskens J. Psychiatric aspects of suicidal behaviour. In: Hawton K, Van Heeringen K, eds. *The international handbook of suicide and attempted suicide*. Chichester: Wiley, 2000:121-34.
- Black DW, Warrack G, Winokur G. The Iowa record-linkage study. *Arch Gen Psychiatry* 1985;42:71-5.
- Palmer BA, Pankratz VS, Bostwicz JM. The lifetime risk of suicide in schizophrenia: a reexamination. *Am J Psychiatry* (in press).
- Mortensen PB, Juel K. Mortality and causes of death in first admitted schizophrenic patients. *Br J Psychiatry* 1993;163:183-9.
- Osby U, Correia N, Brandt L, Ekblom A, Sørensen P. Time trends in schizophrenia mortality in Stockholm county, Sweden: cohort study. *BMJ* 2000;321:483-4.
- Rossau CD, Mortensen PB. Risk factors for suicide in patients with schizophrenia: nested case-control study. *Br J Psychiatry* 1997;171:355-9.
- Munk-Jørgensen P. Has deinstitutionalization gone too far? *Eur Arch Psychiatry Clin Neurosci* 1999;249:136-43.
- Malig C. *The civil registration system in Denmark: technical papers of the international institute for vital registration and statistics*. Bethesda, MA: IIVRS, 1996.
- Sundhedsstyrelsen (Danish National Board of Health). *Causes of death in Denmark 1980*. 1st ed. Copenhagen: Danish National Board of Health, 1982.
- Munk-Jørgensen P, Mortensen PB. The Danish psychiatric central register. *Dan Med Bull* 1997;44:82-4.
- Danmarks Statistik (Danish National Bureau of Statistics). *IDA en integreret database for arbejdsmarkedsforskning*. [IDA an integrated database of labour market research.] Copenhagen: Denmark's Statistics Press, 1991.
- Agerbo E, Mortensen PB, Eriksson T, Qin P, Westergaard-Nielsen N. Risk of suicide in relation to income level in people admitted to hospital with mental illness: nested case-control study. *BMJ* 2001;322:334-5.
- Qin P, Agerbo E, Westergaard-Nielsen N, Eriksson T, Mortensen PB. Gender differences in risk factors for suicide in Denmark. *Br J Psychiatry* 2000;177:546-50.
- Clayton D, Hills M. *Statistical models in epidemiology*. Oxford: Oxford University Press, 1993.

- 17 Sundhedsstyrelsen (Danish National Board of Health). *Forslag til national handlingsplan for forebyggelse af selvmord og selvmordsforsøg i Danmark*. [National Programme for Prevention of Suicide and Suicide attempt.] 1st ed. Copenhagen: Sundhedsstyrelsen, 1998.
- 18 Ministry of Social Affairs MotIaH. *Government status report on services for the mentally ill 2000*. Copenhagen: Statens Information, 2002.
- 19 Appleby L, Dennehy JA, Thomas CS, Faragher EB, Lewis G. Aftercare and clinical characteristics of people with mental illness who commit suicide: a case-control study. *Lancet* 1999;353:1397-400.
- 20 Copas JB, Robin A. Suicide in psychiatric in-patients. *Br J Psychiatry* 1982;141:503-11.
- 21 Roy A. Suicide in chronic schizophrenia. *Br J Psychiatry* 1982;141:171-7.

(Accepted 6 May 2004)

doi 10.1136/bmj.38133.622488.63

Bispebjerg Hospital, Department of Psychiatry, Bispebjerg Bakke 23, 2400  
Copenhagen NV, Denmark  
Merete Nordentoft *associate professor*

National Centre for Register-based Research, University of Aarhus, Taasingegade  
1, DK-8200 Aarhus N, Denmark  
Thomas Munk Laursen *graduate research scholar*

Esben Agerbo *associate professor*

Ping Qin *assistant professor*

Eyd Hansen Høyer *senior registrar*

Preben Bo Mortensen *professor*

Correspondence to: M Nordentoft merete.nordentoft@dadlnet.dk