

## RESEARCH REPORT

# Psychiatric illness, socioeconomic status, and marital status in people committing suicide: a matched case-sibling-control study

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**Study objective:** Suicides cluster in both families and persons with psychiatric disorders and socioeconomic disadvantages. This study compares these factors between suicide cases, their siblings, and population based controls in an attempt to evaluate both the familial and the individual element of these factors.

**Design:** Nested case-control study. Information on causes of death, psychiatric admission, marital status, children, and socioeconomic factors was obtained from routine registers.

**Setting:** Denmark.

**Participants:** 985 suicide cases, 1104 sex-age ( $\pm 3$  years) matched siblings, and 16 619 controls.

**Main results:** The suicide rate ratios obtained from the case-sibling and the case-control analysis, respectively, were of similar magnitude. For example, in the case-sibling analysis the adjusted suicide rate ratios associated with discharge from a psychiatric hospital within the previous 365 days, being unemployed the previous year, having a postgraduate degree and being single were 42.13 (95% CI 17.75 to 100.02), 1.78 (1.35 to 2.36), 0.51 (0.21 to 1.26), and 2.69 (1.91 to 3.79), respectively. The corresponding rate ratios obtained from the case-control analysis were 47.91 (35.41 to 64.83), 1.76 (1.49 to 2.08), 0.45 (0.26 to 0.76), and 2.39 (1.87 to 3.07). Moreover, the analogous ratios when comparing siblings and controls were 1.98 (1.08 to 3.63), 1.22 (1.06 to 1.41), 0.65 (0.44 to 0.95), and 0.89 (0.75 to 1.06).

**Conclusions:** People who commit suicide deviate similarly from siblings and controls in exposure to hospitalised psychiatric disorders and socioeconomic disadvantages, although these factors contribute to the familial aggregation of suicides.

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It is well recognised that suicides cluster in families.<sup>1–5</sup> Genetic and environmental factors related to psychiatric illness, poor socioeconomic conditions, and adverse circumstances during childhood are suggested to play an important part in this aggregation of suicides.<sup>6–12</sup> Similarly, individual factors during adolescence or adulthood, such as psychiatric disorders, educational underachievement, singlehood, and socioeconomic status are associated with the risk of suicide,<sup>13–21</sup> but this might well be attributable to an intergenerational transmission of these risk factors.<sup>22–28</sup> Yet, the impact and confounding effect of these individual and familial factors are inseparable in most studies.

The purpose of this paper is to study the association between the risk of suicide and the influences of psychiatric admission, socioeconomic position, and marital status while attempting to separate the familial clustering of these risk factors from a direct effect on the individual level. By comparing cases with population based controls and to sibling-controls, respectively, and sibling-controls to population based controls, this study will try to evaluate the familial element of these risk factors and the confounding effect of unobserved shared familial factors.

## METHODS

### Source of data and population based registers

Data were obtained by linking Danish population based registers using the unique personal identification number, which is assigned to all persons living in Denmark since April 1968 and used across all registration systems.<sup>29</sup> The study was approved by the Danish Data Protection Agency.

The Danish Medical Register on Vital Statistics contains dates and causes of all deaths in Denmark recorded from the cause of death certificates since 1976 and for suicide since 1970.<sup>30</sup> Suicide was defined as ICD8<sup>31</sup> codes E950–959 and ICD10<sup>32</sup> codes X60–X84.

The Danish Psychiatric Central Register includes all admission and discharge dates and diagnoses according to the World Health Organisation ICD8 and ICD10 classification of all psychiatric inpatient facilities in Denmark since 1969.<sup>33</sup> There are no private psychiatric hospitals in Denmark, and all treatment is free of charge.

The Statistical Register for Fertility Research contains information on children with reference to a biological mother at their birth, which was 69.4% of all born after 1945, and almost all who were born later than 1960 (for example, 98.6% and 99.99% in 1960 and 1997, respectively).<sup>34</sup> A few references to fathers were missing throughout the period, as they were not known at birth (for example, 4.37% and 0.91% in 1960 and 1997, respectively). People living in Denmark and born after 1960, who had no reference to a mother, were primarily immigrants. Siblings were identified through this register as those people who had a reference to the same biological mother but not necessarily to the same father because of the uncertainty regarding father's identity and because the mother more probably represents shared conditions.

The Integrated Database for Longitudinal Labour Market Research<sup>35</sup> covers the entire population and contains annual information for the period 1980 and onwards with information from administrative registers.

### Study population and sampling designs

All subjects ( $n = 21\,249$ ) who had committed suicide in the period from 1981 to 1997 were identified from the Danish Medical Register on Vital Statistics.<sup>21</sup> Using a matched case-sibling design,<sup>36</sup> subjects were excluded, if they were not resident in Denmark the previous year (80 cases excluded, fig 1), if they had no reference to a biological mother (17 314 excluded), if they had no registered sibling born less than three years apart ( $\pm 3 \times 365$  days) of the same sex (2833 excluded), if they had no sibling who was alive on the particular matching date or resident in the country the previous year (37 excluded and 985 cases left). Of note, the excessive loss of cases with no reference to a mother is not attributable to poor linkages but rather to the fact that the registration system was started in 1968 and the restriction is therefore an age restriction. However, only 4.6% of all suicides are included in the study, which reflects an increasing suicide risk with age.

Using a nested case-control design,<sup>37</sup> each suicide case in the study was matched to a random sample of exactly 20 persons ( $n = 19700$ ) of the same sex, who were born the same year, who were alive on the particular matching date (that is, date of suicide) and age (in days); that is, the sex-birth year stratified controls were at risk at the same age and calendar date.<sup>37</sup> To make the selection feasible and to minimise the computational burden, a random 5% longitudinal sample was selected from the entire population within which controls were randomly selected. The study comprised only controls who were living in the country the previous year and who had a reference to a biological mother. To make cases and controls more comparable, the 3081 controls without siblings were excluded and the remaining 16 619 controls were kept in the analyses.

Using the identity of the suicide case, siblings were matched to the controls who were originally selected to the particular case—that is, a particular case-person's siblings were matched to controls of the same sex and year of birth  $\pm 3$  years.

### Covariates

Variables showing whether the person had been admitted to a psychiatric hospital and duration of current discharge period were added. Socioeconomic factors ascertained the year before the matching date from the Integrated Database for Longitudinal Labour Market Research were labour market affiliation, gross income, educational attainment, and marital status. Labour market affiliation during the previous year was categorised as fully employed or self employed, unemployed more than 1% of the year and receiving

unemployment benefits, recipient of social benefits including sickness benefits, disability pensioner, student or others (a residual category comprising homemakers, pupils, and people otherwise outside the labour market). Unemployment benefits were only paid to the unemployed who were actively seeking work or who had unemployment insurance. The status of being disability pensioners, recipients of social benefits, students and others is registered in November, and therefore, persons who within the same year had been unemployed and, for example, disability pensioner were grouped as being unemployed. Annual gross income was grouped into age-sex-year specific quartiles calculated using a five year age band for each sex-calendar combination from the 5% longitudinal sample, and cases, siblings and controls were placed in the appropriate quartile afterwards. Information on education was reported from all educational establishments since 1973 and earlier information stems from a national census in 1970. Educational attainment was defined categorically: primary school, high school only, vocational training, bachelor and high school plus three to four years' education (for example, primary school teacher, nurse, social worker, police officer, etc), postgraduate degree, and a category of persons without any information, which could be persons who had not finished an education or who had immigrated. To avoid a possible overadjustment, gross income was not considered in the joint model.<sup>38</sup> Marital status on 31 December the previous year (or 1 January the present year) was defined categorically: married and living with their spouse, cohabitant—that is, living with a person of the opposite sex who was not a first degree relative and being older than 18, living single and being older than 18 years, younger than 18 and not being married.

### Statistical analyses

The case-control and the case-sibling data were analysed using conditional logistic regression<sup>37 39</sup> with each case forming a separate stratum. As the controls were selected randomly within the appropriate risk sets, estimated rates will be called rate ratios.<sup>40</sup> Although the rate ratios were similarly obtained in the case-sibling and the case-control design, they have different interpretations as the rates from the case-siblings design were implicitly adjusted for shared observed and unobserved familial factors so that the baseline rate could be rather different.

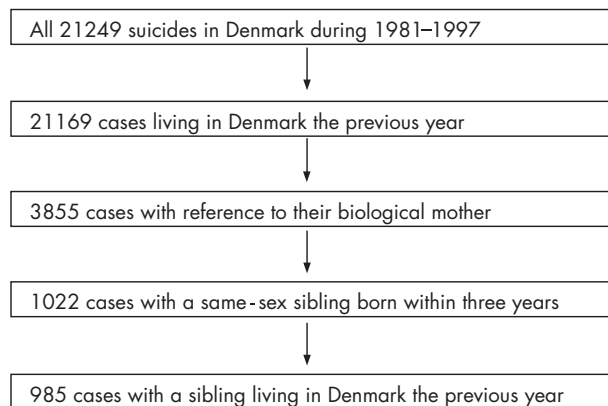
Siblings were compared with controls as follows. Stratifying on the particular suicide case, and thereby stratifying by sex, age ( $\pm 3$  years), and year, a conditional logistic regression was used to calculate odds ratios of observing an exposure to that of a reference exposure between siblings and controls. Alternatively, these odds ratios can be interpreted as rate ratios for experience one's sibling dying by suicide. As the siblings represent the families of the suicide cases, these rates suggest whether the particular factor is more common in families with suicide regardless of whether the factor is a risk factor within siblings. To assess the possibility of survival bias,<sup>36</sup> the final analysis was re-run restricted to older siblings exclusively.

Data were analysed using the PhReg procedures in SAS (version 8.1), 95% asymptotic confidence intervals were computed.

### RESULTS

Overall, 985 cases, 1104 siblings and 16 619 controls were enrolled into the study.

Table 1 shows sample characteristics of the study population. Men were about four times more likely to commit suicide than women. The age of suicide ranged from 10 to 52 years with a mean of 28 years.



**Figure 1** Identification process of the suicide cases included in the study.

**Table 1** Characteristics of cases, siblings and controls. Values are number of persons (%)

Characteristics	Cases n = 985	Siblings n = 1104	Controls n = 16619
<b>Sex</b>			
Female	190 (19)	202 (18)	3288 (20)
Male	795 (81)	902 (82)	13331 (80)
<b>Age (years)</b>			
<20	120 (12)	129 (12)	2249 (14)
20–30	515 (52)	579 (52)	8977 (54)
30–40	316 (32)	361 (33)	4964 (30)
≥40	34 (3)	35 (3)	429 (3)
<b>Psychiatric history</b>			
Currently admitted	98 (10)	10 (1)	32 (0)
Discharged ≤365 days before the suicide/matching date	187 (19)	13 (1)	85 (1)
Discharged >365 days after the suicide/matching date	114 (12)	52 (5)	375 (2)
Never admitted	586 (59)	1029 (93)	16127 (97)
<b>Labour market affiliation the previous year</b>			
Unemployed	412 (42)	367 (33)	4742 (29)
Social benefits recipient	57 (6)	21 (2)	168 (1)
Disability pensioner	79 (8)	27 (2)	204 (1)
Student	46 (5)	44 (4)	965 (6)
Otherwise not fully employed	28 (3)	29 (3)	420 (3)
Fully employed	363 (37)	616 (56)	10120 (61)
<b>Gross income the previous year</b>			
Lowest quartile	445 (45)	260 (24)	3465 (21)
Second	229 (23)	280 (25)	4004 (24)
Third	162 (16)	240 (22)	4109 (25)
Highest quartile	149 (15)	324 (29)	5041 (30)
<b>Educational attainment</b>			
No information	41 (4)	58 (5)	469 (3)
Primary school (9/10 years)	505 (51)	461 (42)	6382 (38)
High school only	96 (10)	86 (8)	1527 (9)
Vocational training	280 (28)	366 (33)	6104 (37)
Bachelor, high school + 3 to 4 years education	44 (4)	102 (9)	1613 (10)
Postgraduate degree	19 (2)	31 (3)	624 (4)
<b>Marital status 1 January</b>			
Living single, age ≥18 years	689 (70)	510 (46)	7876 (47)
Cohabitant, age ≥18 years	143 (15)	266 (24)	3974 (24)
Married and living with the spouse	103 (10)	256 (23)	3814 (23)
Unmarried, age <18 years; that is, child	50 (5)	72 (7)	955 (6)

**Table 2** Suicide in relation to individual psychiatric history, labour market affiliation, gross income, educational achievement, and marital status for 985 people who committed suicide, siblings (n = 1104) and controls (n = 16619)

	Case-sibling rate ratio*	Case-control rate ratio*
<b>Psychiatric history</b>		
Currently admitted	70.52 (22.03 to 225.76)	82.65 (53.46 to 127.78)
Discharged ≤365 days earlier	52.99 (22.72 to 123.58)	61.74 (45.86 to 83.10)
Discharged >365 days earlier	5.70 (3.59 to 9.05)	8.19 (6.46 to 10.39)
Never admitted	1	1
<b>Labour market affiliation the previous year</b>		
Unemployed	2.26 (1.80 to 2.84)	2.51 (2.16 to 2.91)
Social benefits recipient	7.89 (4.20 to 14.80)	9.62 (6.99 to 13.25)
Disability pensioner	6.71 (3.90 to 11.56)	10.38 (7.77 to 13.86)
Student	1.71 (1.05 to 2.80)	1.27 (0.90 to 1.79)
Otherwise not fully employed	1.79 (0.94 to 3.43)	1.96 (1.24 to 3.09)
Fully employed	1	1
<b>Gross income the previous year</b>		
Lowest quartile	5.14 (3.81 to 6.93)	5.50 (4.43 to 6.83)
Second	2.00 (1.50 to 2.67)	2.40 (1.91 to 3.03)
Third	1.55 (1.15 to 2.08)	1.60 (1.26 to 2.04)
Highest quartile	1	1
<b>Educational attainment</b>		
No information	0.71 (0.43 to 1.18)	1.27 (0.87 to 1.86)
Primary school (9/10 years)	1	1
High school only	0.78 (0.54 to 1.15)	0.75 (0.60 to 0.95)
Vocational training	0.59 (0.46 to 0.74)	0.49 (0.41 to 0.57)
Bachelor, high school + 3 to 4 years	0.25 (0.16 to 0.40)	0.27 (0.19 to 0.37)
Postgraduate degree	0.35 (0.18 to 0.69)	0.29 (0.18 to 0.47)
<b>Marital status 1 January</b>		
Living single, age ≥18 years	3.97 (2.98 to 5.28)	4.51 (3.61 to 5.63)
Cohabitant, age ≥18 years	1.35 (0.97 to 1.89)	1.63 (1.25 to 2.12)
Married and living with the spouse	1	1

\*Adjusted for age, sex, and year by stratification.

Compared with siblings and population based controls, the risk of suicide was increased among people with a history of admission for a psychiatric illness, who had been unemployed, or a recipient of social benefits, disability pensioner, student, who had a lower income (dose-response association), or a shorter educational attainment, or had been living single (table 2). The rate ratios in table 2 are adjusted for age, sex, and year by stratification. Although suicide risk was strongly associated with all measures shown in table 2 when cases were compared with siblings and with controls, rate ratios tended to be higher when comparing cases with controls than with siblings (though confidence intervals are overlapping). An important element of table 2, however, is the similarity between the rates rather than the dissimilarity.

Table 3 shows rate ratios associated with psychiatric history, labour market affiliation, gross income, educational achievement, and marital status between siblings and controls. It was more probable that siblings had been admitted with a psychiatric illness and with recent discharge being particularly probable, or that siblings were unemployed, recipients of social benefits or disability pension, while the association with marital status seemed similar to status of controls, while no difference with respect to educational attainment was seen.

When all factors were considered simultaneously (table 4), the suicide risk associated with admission for a psychiatric illness, job, and marital status remained significant in the case-sibling and in the case-control design, while the suicide risk associated with educational attainment was only statistically significant in the case-control design whereas the rate ratios were of similar size. For example, in the case-sibling analysis the adjusted suicide rate ratios associated with discharge from a psychiatric hospital within the previous 365 days, being unemployed the previous year, having a postgraduate degree and being single were 42.13 (95% CI 17.75 to 100.02), 1.78 (1.35 to 2.36), 0.51 (0.21 to

1.26), and 2.69 (1.91 to 3.79), respectively. The corresponding rate ratios obtained from the case-control analysis were 47.91 (35.41 to 64.83), 1.76 (1.49 to 2.08), 0.45 (0.26 to 0.76), and 2.39 (1.87 to 3.07). Although the impact of the risk factors in the case-sibling and the case-control analysis seemed broadly similar, siblings had higher rates of having been admitted with a psychiatric illness and having been unemployed or not fully employed than controls, and in contrast with all siblings, educational attainment of older siblings was not different from controls. The analogous ratios when comparing siblings and controls were 1.98 (1.08 to 3.63), 1.22 (1.06 to 1.41), 0.65 (0.44 to 0.95), and 0.89 (0.75 to 1.06).

## DISCUSSION

An increased risk of suicide in relation to discharge from psychiatric hospital, unemployment and other labour market marginalisation, lower income, educational underachievement, and singleness has been reported earlier.<sup>1 8 13 15-17 19 20 41-44</sup> In our study, the suicide risk related to these factors is of similar magnitude whether obtained from the case-sibling or the case-control analysis, which suggests that people who commit suicide deviate from their siblings and from controls in a similar manner. Moreover, a familial aggregation of these factors is identified, as siblings to people who commit suicide have more often been hospitalised with a psychiatric disorder and been unemployed than have controls, which is in keeping with the findings from the case-sibling and case-control analysis as the baseline rate might differ between the two analyses. The results suggest that individual risk factors are more important than measured and unmeasured factors shared by siblings. Although methods to decompose risk factors into "between" and "within" family components have been proposed in case-sibling designs,<sup>45</sup> as far as the authors are aware, no study has hitherto applied the present case-sibling-control design in evaluating individual and familial risk factors.

The uniformity of the rate ratios associated with psychiatric admission obtained from the sibling based design and the population based design is noteworthy. As siblings are more likely to share genetic and environmental factors preceding psychiatric disorders,<sup>11 12 41 44</sup> an immediate conjecture could be that rate ratios based on a case-sibling comparison should be smaller than the analogous population based rate ratios. This conjecture is supported by the results from the sibling-control design, where siblings have higher rate ratio associated with previous psychiatric admission than controls. However, the direct case-sibling and case-control comparisons only partly supported this conjecture, but showed that own psychiatric illness, as a risk factor for suicide, seemed comparatively little confounded by factors shared by siblings. In keeping with a previous study,<sup>4</sup> an explanation could be that siblings with psychiatric illness from families without a previous history of psychiatric illness are particularly at risk, or in principle but possibly less likely, that siblings without psychiatric illness from families with a history of psychiatric illness are at particularly low risk.

The rate ratio estimates based upon comparing cases and siblings may be biased, and the direction of this bias is not easily predicted. An ascertainment bias could be operating so that a diagnosed psychiatric disorder of one sibling could increase the likelihood of other siblings being ascertained and hospitalised, and thereby spuriously decreasing the risk. On the other hand, a study has empirically found a non-genetic association between one family member suffering from a psychiatric disorder and the suicide of another family member,<sup>46</sup> which implies that behavioural traits associated with some psychiatric disorders, or that the admission/discharge itself, might increase the suicide risk in the other sibling. The rate ratios from the sibling-control comparison are in keeping herewith, as the dose-response relation with

**Table 3** Rate ratios associated with psychiatric history, labour market affiliation, gross income, educational achievement, and marital status comparing siblings (n = 1104) and controls (n = 16619)

	Sibling-control rate ratio*
<b>Psychiatric history</b>	
Currently admitted	4.58 (2.22 to 9.45)
Discharged ≤365 days earlier	2.31 (1.28 to 4.17)
Discharged >365 days earlier	2.14 (1.58 to 2.89)
Never admitted	1
<b>Labour market affiliation the previous year</b>	
Unemployed	1.30 (1.13 to 1.49)
Social benefits recipient	2.08 (1.31 to 3.30)
Disability pensioner	2.04 (1.34 to 3.09)
Student	0.77 (0.55 to 1.08)
Otherwise not fully employed	1.15 (0.72 to 1.82)
Fully employed	1
<b>Gross income the previous year</b>	
Lowest quartile	1.15 (0.96 to 1.37)
Second	1.08 (0.91 to 1.29)
Third	0.90 (0.76 to 1.08)
Highest quartile	1
<b>Educational attainment</b>	
No information	2.07 (1.48 to 2.89)
Primary school (9/10 years)	1
High school only	0.77 (0.60 to 0.98)
Vocational training	0.75 (0.64 to 0.87)
Bachelor, high school + 3 to 4 years	0.76 (0.60 to 0.96)
Postgraduate degree	0.58 (0.40 to 0.86)
<b>Marital status 1 January</b>	
Living single, age ≥18 years	1.01 (0.85 to 1.20)
Cohabitant, age ≥18 years	1.03 (0.85 to 1.23)
Married and living with the spouse	1

\*Adjusted for age, sex, and year by stratification.



**Table 4** Suicide in relation to psychiatric history, labour market affiliation, educational achievement, and marital status for 985 people who committed suicide, siblings (n = 1104) and controls (n = 16619)

	Cases and siblings rate ratio*	Cases and controls rate ratio*	Siblings and controls rate ratio*	Older siblings and controls rate ratio *
<b>Psychiatric history</b>				
Currently admitted	63.57 (18.42 to 219.37)	68.16 (44.31 to 104.85)	4.27 (2.05 to 8.86)	3.53 (1.17 to 10.65)
Discharged <365 days earlier	42.13 (17.75 to 100.02)	47.91 (35.41 to 64.83)	1.98 (1.08 to 3.63)	2.40 (1.09 to 5.28)
Discharged >365 days earlier	5.05 (3.05 to 8.36)	5.46 (4.26 to 7.00)	1.73 (1.27 to 2.36)	2.20 (1.44 to 3.37)
Never admitted	1	1	1	1
<b>Labour market affiliation the previous year</b>				
Unemployed	1.78 (1.35 to 2.36)	1.76 (1.49 to 2.08)	1.22 (1.06 to 1.41)	1.29 (1.07 to 1.57)
Social benefits recipient	3.37 (1.49 to 7.64)	2.20 (1.45 to 3.34)	1.46 (0.91 to 2.35)	1.40 (0.68 to 2.85)
Disability pensioner	1.37 (0.63 to 2.98)	0.98 (0.67 to 1.44)	1.24 (0.79 to 1.95)	1.78 (1.00 to 3.19)
Student	1.24 (0.66 to 2.30)	0.94 (0.65 to 1.38)	0.76 (0.54 to 1.07)	0.49 (0.30 to 0.82)
Otherwise not fully employed	0.59 (0.26 to 1.36)	0.77 (0.45 to 1.34)	0.96 (0.60 to 1.53)	0.53 (0.23 to 1.22)
Fully employed	1	1	1	1
<b>Educational attainment</b>				
No information	1.04 (0.55 to 1.96)	1.09 (0.70 to 1.71)	1.94 (1.39 to 2.71)	1.09 (0.59 to 2.05)
Primary school (9/10 years)	1	1	1	1
High school only	0.78 (0.45 to 1.34)	0.79 (0.60 to 1.04)	0.84 (0.66 to 1.07)	1.30 (0.94 to 1.80)
Vocational training	0.78 (0.58 to 1.05)	0.75 (0.62 to 0.90)	0.79 (0.67 to 0.92)	1.10 (0.88 to 1.37)
Bachelor, high school + 3 to 4 years	0.43 (0.23 to 0.79)	0.45 (0.31 to 0.65)	0.84 (0.66 to 1.06)	1.29 (0.94 to 1.78)
Postgraduate degree	0.51 (0.21 to 1.26)	0.45 (0.26 to 0.76)	0.65 (0.44 to 0.95)	1.01 (0.60 to 1.70)
<b>Marital status 1 January</b>				
Living single, age ≥18 years	2.69 (1.91 to 3.79)	2.39 (1.87 to 3.07)	0.89 (0.75 to 1.06)	0.84 (0.66 to 1.08)
Cohabitant, age ≥18 years	1.35 (0.90 to 2.02)	1.38 (1.04 to 1.82)	0.99 (0.82 to 1.19)	0.98 (0.76 to 1.26)
Married and living with the spouse	1	1	1	1

\*Mutually adjusted and adjusted for age, sex, and year by stratification.

time since discharge from a psychiatric hospital suggests an adverse environmental influence. However, as most psychiatric disorders have a family component,<sup>24</sup> suicide cases without a diagnosed psychiatric illness might be more prone to suffer from an undiagnosed psychiatric disorder, when there is a family history of psychiatric illness.

Fully employed people are less likely to commit suicide, and although confounded by psychiatric illness, the suicide mortality is increased in people who are unemployed or recipients of social benefits.<sup>15 19 47</sup> In keeping with general mortality studies,<sup>28</sup> this increase showed little difference between the case-sibling analysis and the case-control analysis, showing that the suicide risk is stronger associated with individual unemployment than with familial aggregation of unemployed and socioeconomic hardship. Economic studies have verified that family background exerts an important influence on adult economic status,<sup>22 27</sup> which is in keeping with the present sibling-control comparison, which shows that siblings are more often unemployed than controls. A possible explanation pointing to the role of relative poverty could be that the unemployed or socioeconomically disadvantaged people from families without unemployment and socioeconomic adversity are particularly at risk.<sup>48</sup> Furthermore, the importance of unemployment and socioeconomic disadvantage might be different in families with a history of psychiatric illness.<sup>13</sup> Similarly, the association between the risk of suicide and educational attainment

or marital status differed little between the case-sibling and the case-control comparison. The mean age of the study subjects is 28 years, and therefore, a fraction of the subjects might not have gained a foothold on the labour market, or might not have reached the age of onset of psychiatric disorders. Nevertheless, the differences between the comparisons with older and younger siblings, respectively, suggest that especially the effect of educational attainment is subject to a survival or secular bias,<sup>49</sup> as younger siblings might not have finished their education. In principle, confounding by secular trends or birth order effects in environmental exposures could be remedied or recognised by the use of younger siblings.<sup>36</sup>

This study should be viewed in the context of its limitations. The results are solely based on psychiatric illnesses that lead to hospital admission, which is a subgroup of all people suffering from psychiatric illnesses.<sup>30</sup> It is only a surmise whether the general effect of psychiatric illness is underestimated or overestimated. This depends on whether the most severely ill and suicidal patients are more likely to be hospitalised, and on the likelihood of cases and controls being admitted.<sup>1</sup> Moreover it is unclear, if this selection is particularly pronounced in certain families. An advantage, however, is that hospitalised patients are more readily accessible for preventive efforts. Another limitation is that the effect of sudden changes in socioeconomic factors could not be considered, as data lacked for quantifying the effect of very recent divorce or unemployment. Lastly, the results only apply to people with siblings of the same sex and preclude extrapolation to only children. On the other hand, as far as

### What this paper adds

- Suicide risks obtained from case-sibling and case-control comparisons are of similar magnitude—that is, people who commit suicide deviate similarly from sibling as from controls when common risk factors are considered.
- Comparing sibling with controls showed that psychiatric illnesses and socioeconomic disadvantages are more common in families with suicides.

### Policy implications

While exposure to familial adverse socioeconomic circumstances and familial psychiatric health problems have an effect on suicide, the suicide risk associated with own psychiatric illness, socioeconomic disadvantage, educational deficit, and singleness seem little confounded by familial factors shared by siblings

the authors are aware, they are the first to apply the present case-sib-control design in evaluating individual and familial risk factors.

While exposure to familial adverse socioeconomic circumstances, parental psychiatric health problems during childhood, and exposure to specific genetic factors might have a causal effect on adult suicide,<sup>8 23 41 51</sup> the suicide risk associated with own psychiatric illness, socioeconomic disadvantage, educational deficit, and singleness seem little confounded by familial factors shared by siblings. Furthermore, these findings are in keeping with the hypothesis that both social causation and social selection contribute to the suicide mortality,<sup>52</sup> and they point to a life course approach as a future priority.<sup>53</sup>

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Conflicts of interest: none.

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