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Ellenor Mittendorfer-Rutz · Finn Rasmussen · Danuta Wasserman

Familial clustering of suicidal behaviour and psychopathology in young suicide attempters

A register-based nested case control study

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Abstract *Introduction* Familial clustering of suicidal behaviour and psychopathology has been reported in young suicide attempters. Most of these studies were predominantly carried out in clinical treatment settings and lacked statistical power to assess the independent and modifying influences of own and familial psychopathology and suicidal behaviour. *Methods* We carried out a population-based record-linkage study with a nested case control design. The 14,440 individuals hospitalised due to suicide attempt (cases) and 144,400 matched controls were born in Sweden between 1968 and 1980 and followed up till December 31, 1999. *Results* Among the strongest independent familial risk factors for youth suicide attempt were siblings' (OR 3.4; 2.8–4.1), maternal (OR 2.7; 2.5–3.1) and paternal (OR 1.9; 1.7–2.1) suicide attempt. Other important risk factors were familial personality and substance abuse disorders, maternal schizophrenia, non-affective psychoses and organic disorders and parental neurotic, stress-related and somatoform disorders (1.9–3.2 fold increase), and paternal (OR 1.9; 1.6–2.3) and maternal (OR 1.8; 1.3–2.4) suicide completion. Mental illnesses in index subjects, particularly substance abuse, affective and personality disorders, were the dominant determinants of suicide attempt. Strong interactions were observed between psychopathology in index subjects and familial suicidality. Familial suicide completion

had a stronger effect on suicide attempt of earlier onset and on boys. Nearly half (47%) of all suicide attempts could be attributed to familial psychopathology (13%), family suicide attempt (7%) and suicide completion (1%) and own psychopathology (25%). *Conclusion* Early recognition and adequate treatment of individual mental illness contribute to prevent youth suicide attempts. Children of parents with psychopathology and suicidal behaviour should receive early support and attention. Evaluation of familial suicidal behaviour seems to be vital for suicide risk assessment in young psychiatric inpatients. There appears to be an independent effect of familial suicidal behaviour as well as familial psychopathology on youth suicide attempt beyond the transmission of mental illness.

Key words family – suicide – attempt – psychopathology – epidemiology

Introduction

Familial clustering of suicidal behaviour has been reported for adolescent suicide attempters, primarily in clinical settings [20, 23]. Results from studies of adopted children and twins have suggested that suicidal behaviour might be partly genetically determined [15, 31]. The genetic component of risk for suicide attempt has been reported to be around 17% [13]. This hereditary component includes both vulnerability to mental disorders as well as to other risk factors of suicidality like genetically determined personality traits characterised by impulsivity and aggression. Besides these hereditary factors, familial clustering of suicidal behaviour may be due to transmission through environmental conditions, like poor and inappropriate parenthood, family disruption, child abuse and neglect as well as imitation.

E. Mittendorfer-Rutz (✉) · D. Wasserman
National Centre for Suicide Prevention and Prevention of Mental Ill-Health (NASP)
Dept. of Public Health Sciences
Karolinska Institutet
17177 Stockholm, Sweden
E-Mail: ellenor.mittendorfer-rutz@ipm.ki.se

F. Rasmussen
Child and Adolescent Public Health Epidemiology Group
Division of Social Medicine
Dept. of Public Health Sciences
Karolinska Institutet
Stockholm, Sweden

The occurrence of attempted suicide was found to be elevated in the relatives of completers [5] and the occurrence of completed suicide was increased in the relatives of attempters [20]. Therefore, it can be assumed that familial transmission of suicidal behaviour involves a common vulnerability for both attempted and completed suicides.

Adolescent suicide attempters have higher rates of own and familial psychopathology than community and clinical controls, mainly affective, substance abuse and personality disorders [3, 12, 20]. Familial transmission of suicidal behaviour seems, however, not to be explained by transmission of mental disorders alone, since increased risk for suicide attempt persists after controlling for mental disorder [9, 17, 20].

Family studies of attempted suicide in adolescents and young adults have mainly been carried out within psychiatric clinical settings. These studies often lack statistical power and have a tendency to be subject to recall and selection bias. National registers have also been used to investigate the importance of familial risk factors for suicide completion in youth and adults [1, 24, 25, 28]. However, we could not identify any nation-wide population based study that analysed whether and to what extent suicide attempt in adolescents and young adults was influenced by familial suicidal history and own and familial psychopathology, including detailed information on diagnostic groups.

Therefore our overall aim was to address the following questions in a large record-linkage database enabling us to overcome some of the limitations in previous research:

- To what extent are suicide attempt and completion among mothers, fathers and siblings associated with subsequent suicide attempt in young adults?
- To what extent are specific psychiatric and personality disorders in index subjects and their mothers, fathers and siblings associated with suicide attempt in young adults?
- To what extent are the associations of suicidal attempt or completion in mothers, fathers and siblings with index suicide attempt mediated by psychiatric and personality disorders?
- Are familial and individual risk factors interacting and are they mediated by gender and age of onset?

Material and methods

The study was carried out as a nested case-control study through linkage of various Swedish registers: The Multi-Generation Register (MGR) for the identification of parents and siblings; the Inpatient Care Register (ICR) providing information on date and diagnosis of individual hospital admissions; the Cause of Death Register (CDR) with data on all deceased persons registered in Sweden; the 1990 Population and Housing Census (PHC) for identification of the area of residence (county), and the Register of the Total Population, including information on emigration and immigration.

Case/control characteristics

The 14,440 cases and 144,400 controls comprise singletons born in Sweden between 1968 and 1980 (drawn from the MGR), for whom also both parents could be identified. Cases are all individuals who have been registered for inpatient hospital care due to attempted suicide from their tenth birthday to the end of follow up (December 31, 1999) in Sweden. It was deemed that suicidal acts before age of ten may be misclassified. Diagnoses according to the Swedish 7th, 8th, 9th and 10th version of the International Classification of Diseases (ICD) were extracted from the ICR. Cases received diagnoses of certain attempted suicide (E950–E959 in ICD-8 and ICD-9, X60–X84 in ICD-10) and uncertain attempted suicide (E980–E989 in ICD-8 and ICD-9, Y10–Y34 in ICD-10), respectively. The two diagnoses were combined and defined as outcome variable in all analyses to limit underreporting and temporal and regional variation in ascertainment routines. We selected ten controls for each case randomly and matched them for gender, month of birth and county. If a case had died before 1990, information on the county was taken from the ICR instead of from the 1990 PHC. Only individuals who were still alive at the end of 1999 and who never had emigrated according to Statistics Sweden emigration files during the study period were sampled as controls. Controls could only be matched to one case.

Risk factors

All events in index subjects (cases and controls) and their mothers, fathers and siblings were only included in the analyses if they occurred before the date when the index case attempted suicide in order to limit reverse causality. The following risk factors were studied for cases and controls:

Parental factors: psychiatric and personality disorders, suicide attempts (ICR; 1964–1999), suicides and deaths due to other reasons (CDR; 1967–1999).

Sibling's factors: psychiatric and personality disorders, suicide attempts (ICR; 1964–1999), suicides and deaths due to other reasons (CDR; 1967–1999).

Index subjects' characteristics: psychiatric and personality disorders (ICR; 1978–1999).

Statistical analysis

We used SPSS 13.0 for Windows for data processing. We applied conditional logistic regression to determine odds ratios with 95% confidence intervals, for the variables associated with suicide attempt. As the likelihood to have an affected sibling increases with the number of siblings, the analyses were adjusted for the number of siblings (0, 1, 2, 3, 4+, introduced as a categorical variable). The likelihood ratio test was used to identify interaction, by comparing the likelihood of the full model including the interaction term and all other relevant variables with the likelihood of the same model without the interaction term. Attributable proportions (AP) were derived from the fully adjusted model.

Coding of variables

For each subject, psychiatric and personality disorders (main and side diagnoses) at all admissions during the observation period were available. In order to have mutually exclusive groups and limit collinearity, we used the main diagnosis at the latest available hospital admission within the inclusion period (up until date of index attempt), for two reasons: first, the main diagnosis reflects the primary condition causing the hospital admission and second using the last admission takes the course of mental ill health into consideration.

Familial and individual main diagnoses at latest available hospital admission were categorised in diagnostic groups as shown in

Table 1. Each diagnostic group was compared to the reference group of “no history of hospital admission”, comprising the vast majority of parents and index subjects. Within the inclusion period, 409 familial suicide attempts were followed by completed suicide and therefore were only considered as completed suicide in the analysis. Likewise with inclusion criteria for suicide attempters, familial suicidal behaviour was only considered if it occurred after the tenth birthday.

Results

■ Familial and individual history of psychopathology and suicidal behaviour

We analysed 14,440 suicide attempters—index cases (4,773 males and 9,667 females)—and 144,400 matched controls. Among all suicide attempts, 78% were certain attempts and 86% used poisoning. The mean age of suicide attempters was 19.1 (SD 3.6) years. Of the cases (suicide attempters), 23% had a history of familial hospital admission due to mental illness, while 12% and 2% had a history of suicide attempt and suicide in the family, respectively (Table 2). Odds ratios for familial risk factors ranged from 2.7 for paternal psychopathology to 4.5 for sibling’s suicide attempt. Having two or more family members, who have been admitted to a hospital with psychiatric or personality disorders or have attempted or completed suicide, raised the risk for suicide attempt more than twofold compared with having only one family member with a history of admission or suicidal behaviour. Only 26% of suicide attempters had been admitted to a hospital due to psychopathology before their attempt. The odds ratio for previous hospital admission due to own psychopathology was 33.5 times higher among cases than among controls (Table 1).

We observed a significant interaction with gender for familial suicide completion ($\chi^2 = 6.3$; $df = 1$; $P = 0.012$). The odds ratio for attempting suicide with paternal or sibling’s suicide completion was higher for boys than for girls (Table 2).

■ Interaction between familial and individual risk factors

The interactions between hospital admission due to psychopathology in index subjects and familial hospital admission due to psychopathology and between psychopathology among index subjects and familial suicidal history (attempt and completion combined) were prominent and all strongly significant ($\chi^2 = 86.1$ and 27.8, respectively; $df = 1$; $P < 0.001$). Table 3 shows these combined risks by stratified analysis. For example, the odds ratio of being both admitted to a hospital with a psychiatric or personality disorder and having a family member with suicidal behaviour (OR 64) clearly exceeds the additive risk of both factors separately (OR 37 and OR 3.5). This interaction of

Table 1 Psychopathological diagnostic groups and corresponding ICD-7 to ICD-10 codes in family and index subjects

| Diagnostic groups | ICD-7 | ICD-8 | ICD-9 | ICD-10 |
|----------------------------------------------------|------------------------------------|---------------------------------------|----------------------------------|------------------------------------|
| Schizophrenia and non-affective psychoses | 300, 303 | 295, 297, 298.2–298.9 | 295, 297, 298C–298X | F20–F29 |
| Affective disorders | 301.0–301.2, 302 | 296, 298.0, 298.1 | 296, 298A, 298B, 311 | F30–F39 |
| Substance abuse disorders | 307, 322, 323 | 291, 303, 304 | 291, 292, 303, 304, 305 | F10–F19 |
| (abuse/dependence and psychoses) | | | | |
| Neurotic, stress-related and somatoform disorders | 310–318 | 300, 305 | 300, 306, 308, 309 | F40–F49 |
| Organic disorders (including mental retardation) | 304–306, 308, 309, 325 | 290, 292, 293, 294, 299, 309, 310–315 | 290, 293, 294, 299, 310, 317–319 | F00–F09, F70–F79 |
| Behavioural, emotional and developmental disorders | 320.6, 324, 326 | 302, 306–308 | 302, 307, 312–315 | F50–F59, F61–F69, F80–F89, F90–F99 |
| Personality disorders | 320 (with exception of 320.6), 321 | 301 | 301 | F60 |

Table 2 Risk of suicide attempt (odds ratios) among index subjects according to family history of psychopathology, suicide attempt and completion, 14,440 index subjects and 144,400 controls

| Familial history | N, frequency (%) | | OR (95% CI) ^a | | |
|--------------------|------------------|--------------|--------------------------|---------------|---------------|
| | Cases | Controls | All | Males | Females |
| Psychopathology | | | | | |
| Mother | 1,738 (12) | 6,219 (4.3) | 3.0 (2.8–3.2) | 2.9 (2.6–3.2) | 3.1 (2.9–3.3) |
| Father | 1,859 (13) | 7,369 (5.1) | 2.7 (2.6–2.9) | 3.0 (2.8–3.3) | 2.6 (2.4–2.8) |
| Siblings | 368 (2.5) | 1,407 (1.0) | 2.8 (2.5–3.1) | 2.8 (2.3–3.4) | 2.8 (2.5–3.2) |
| 1 family member | 2,886 (20) | 12,892 (8.9) | 2.5 (2.5–2.7) | 2.7 (2.5–2.8) | 2.5 (2.4–2.7) |
| ≥2 family members | 527 (3.6) | 1,038 (0.7) | 5.8 (5.2–6.4) | 6.1 (5.1–7.4) | 5.6 (4.9–6.4) |
| Index subjects | 3,761 (26) | 1,610 (1.1) | 33.5 (31–36) | 33.5 (29–37) | 33.5 (30–36) |
| Suicide attempt | | | | | |
| Mother | 950 (6.8) | 2,373 (1.6) | 4.2 (3.9–4.5) | 4.2 (3.7–4.8) | 4.2 (3.8–4.6) |
| Father | 632 (4.8) | 1,956 (1.4) | 3.3 (3.0–3.6) | 3.6 (3.1–4.2) | 3.2 (2.8–3.6) |
| Siblings | 251 (1.7) | 535 (0.4) | 4.5 (3.8–5.2) | 4.2 (3.2–5.5) | 4.7 (3.9–5.6) |
| 1 family member | 1,654 (12) | 4,766 (3.3) | 3.7 (3.5–3.9) | 3.9 (3.6–4.4) | 3.5 (3.3–3.8) |
| ≥2 family members | 139 (1.0) | 201 (0.1) | 7.3 (5.8–9.1) | 7.0 (4.7–10) | 7.4 (5.7–9.6) |
| Suicide completion | | | | | |
| Mother | 88 (0.6) | 284 (0.2) | 3.1 (2.5–3.9) | 3.3 (2.2–4.8) | 3.0 (2.2–4.1) |
| Father | 240 (1.6) | 858 (0.6) | 2.9 (2.5–3.3) | 3.5 (2.7–4.4) | 2.6 (2.1–3.1) |
| Siblings | 26 (0.2) | 104 (0.07) | 2.7 (1.8–4.2) | 3.3 (1.5–6.8) | 2.6 (1.5–4.3) |
| 1 family member | 346 (2.4) | 1,240 (0.9) | 2.7 (2.4–3.0) | 3.2 (2.6–3.9) | 2.5 (2.1–2.9) |
| ≥2 family members | 5 (0.03) | 5 (0.003) | 9.8 (2.8–34) | 9.8 (1–156) | 9.8 (2.4–39) |

^aAdjusted for number of siblings where appropriate

index subjects' psychopathology and familial suicidal behaviour was seen in all diagnostic groups (data not shown). There was also a significant interaction of age with familial suicide completion ($\chi^2 = 5.5$; $df = 1$; $P = 0.019$). The risk increased with decreasing age of onset.

Independent effects of familial and individual risk factors

Table 4 shows independent contributions to risk of suicide attempt among index subjects of the various diagnostic groups as well as of suicide attempt, suicide completion and death due to other reasons, separately for father, mother and siblings. Model 1 presents results from the crude analysis with matching for gender, age and county. Model 2 analyses the independent effect of the various diagnostic groups (psychopathology) from the suicidal history and vice versa, separately for father, mother, siblings and in-

dex subjects. Model 3 additionally assesses mutually adjusted effects on risk of suicide attempt in index subjects of family history of psychopathology and suicidal behaviour from psychopathology in index subjects.

Model 1

Psychopathology

In the first model, odds ratios ranged between 1.8 and 5.9 for the various diagnostic groups in fathers, mothers and siblings. We found highest odds ratios for familial personality and substance abuse disorders and lowest for the group of "behavioural, emotional and developmental disorders" (Table 4). The majority of diagnostic groups were associated with higher odds ratios in the mother compared to the father, particularly organic disorders, schizophrenia and non-

Table 3 Effect modification between individual hospital admission due to psychopathology, familial suicidal behaviour and familial history of hospital admission due to psychopathology in relation to the risk of suicide attempt in index subjects

| Admission of index subjects due to psychopathology | Familial suicidal behaviour | Admission of family members due to psychopathology | Cases N (%) | OR (95% CI) ^a |
|----------------------------------------------------|-----------------------------|----------------------------------------------------|--------------|--------------------------|
| Yes | Yes | Yes | 439 (3.0) | 82.9 (65–104) |
| Yes | Yes | No | 164 (1.1) | 64.1 (45–90) |
| Yes | No | Yes | 659 (4.6) | 39.4 (33–45) |
| Yes | No | No | 2,499 (17.3) | 37.4 (34–40) |
| No | Yes | Yes | 891 (6.2) | 4.5 (4.1–4.8) |
| No | Yes | No | 513 (3.6) | 3.5 (3.1–3.8) |
| No | No | Yes | 1,424 (9.9) | 2.3 (2.1–2.4) |
| No | No | No | 7,851 (54.3) | 1 |

^aAdjusted for number of siblings

affective psychoses and substance abuse disorders. The effect of paternal personality disorder was stronger for male than female suicide attempts (OR 5.4 vs. 3.2). Maternal affective disorders influenced female suicide attempt more strongly than male attempts (OR 2.7 vs. 1.9). These interactions with gender were, however, not statistically significant.

Hospital admissions due to psychopathology in the index subjects themselves were by far the most important risk factors, particularly substance abuse, affective and personality disorders. We found strong and statistically significant gender differences for individual psychopathology. With the exception of substance abuse disorders and organic disorders all other diagnostic groups were associated with higher odds ratios in females compared to males.

Suicidal behaviour

Suicide attempt in siblings (OR 4.5), mothers (OR 4.2) and fathers (OR 3.3) were strongly associated with suicide attempt in index subjects (Table 4). Familial suicide completion increased the risk for suicide attempt in the index cases compared to controls from 2.7 times in siblings to 3.1 times in the mothers. Familial suicide attempt generally increased the risk of suicide attempt in young adults to a greater extent than familial suicide completion. Maternal and paternal death other than suicide raised suicide attempt risk by 50%.

■ Model 2: independent effects of psychopathology and suicidal behaviour

Adjustments in the second model decreased the odds ratios related to familial suicidal history to a greater extent than familial psychopathology, while the effect of index subjects' own psychopathology was barely altered (Table 4). Familial suicide attempts showed the strongest attenuation of risk estimates (ORs). Among all familial psychopathological risk factors, the effects of maternal and sibling's substance abuse and personality disorders, were especially decreased.

■ Model 3: fully adjusted effects of familial risk factors and individual psychopathology

Further adjustments in model 3 decreased the effect of familial psychopathology to some degree, with a marginal effect on familial suicidal history and on the various diagnostic groups in index subjects. Familial personality and substance abuse disorders, parental neurotic, stress-related and somatoform disorders and maternal schizophrenia, non-affective psychoses and organic disorders among all diagnostic groups remained the strongest risk factors for suicide attempt in index subjects in the final model. Maternal suicide

attempt seems to be considerably more important than paternal attempt. Suicide attempt in the siblings turned out to be the strongest familial risk factor for attempted suicide in young adults. Parental suicide completion was significant as a risk factor for subjects' suicide attempt. Parental death other than suicide remained marginally important and significant. Nearly half (47%) of all suicide attempts could be attributed to familial (13% to psychopathology, 7% to suicide attempt and 1% to suicide completion) and individual (25%) risk factors. Out of the 13% attributed to familial psychopathology, the vast majority (10%) was due to substance abuse disorders and neurotic, stress-related and somatoform disorders.

Discussion

■ Strengths and limitations

The strengths of this register-based study are due to its population-based nature and the large sample yielding high statistical power giving us the opportunity to analyse the independent and modifying effects of a variety of familial and individual risk factors. This study avoided some difficulties like recall and selection bias often encountered in studies based on medical care provided in clinical settings, where recruitment of family members are based on previous enrolment of an index subject.

The data in various registers in Sweden has been assessed previously and considered to be of good quality [2, 10, 11]. Some limitations of the study should be mentioned. First, using data on attempted suicide from ICRs excludes individuals who were not hospitalised following their suicide attempt. The same is true when using hospital admission of mental illness from the ICR, which is further affected by differences in access to mental health care and in help seeking behaviour by time, region and gender. Furthermore, national coverage of family data on hospital admission was not complete until 1987. We believe we have overcome most of these limitations in our case control study matching for gender, age and county. Third, the study was restricted to subjects attempting suicide between the ages of 10 and 31 years, and our results may not apply to older subjects with suicidal behaviour.

■ Familial psychopathology

Our findings are comparable to results from clinical and population-based studies showing that the risk of suicide attempt in adolescents and young adults tends to be associated with familial psychopathology, particularly substance abuse, affective, neurotic and personality disorders [14, 20, 23]. A history of hospital admission due to psychopathology in a first-

Table 4 Risk of suicide attempt in index cases and controls according to family history of hospital admission due to psychopathology and suicidal behaviour and index subjects' hospital admission due to psychopathology

| Characteristics | Cases N (%) | Controls N (%) | Model 1 matched for gender, age and county OR (95% CI) | Model 2 independent effects of psychopathology and suicidal behaviour OR (95% CI) | Model 3 independent effects of familial and individual factors OR (95% CI) | AP (%) |
|------------------------------------------------------------|----------------|-------------------|--------------------------------------------------------------------|-----------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------|-----------|
| <i>Paternal psychopathology</i> | | | | <i>Paternal history</i> | | |
| Schizophrenia and non-affective psychoses | 77 (0.5) | 409 (0.3) | 2.05 (1.6–2.6) | 1.81 (1.4–2.3) | 1.44 (1.1–1.9) | 0.1 |
| Affective disorders | 115 (0.8) | 632 (0.4) | 1.99 (1.6–2.4) | 1.64 (1.3–2.0) | 1.40 (1.1–1.8) | 0.2 |
| Substance abuse disorders | 1,130 (7.8) | 4,163 (2.9) | 2.97 (2.7–3.1) | 2.41 (2.2–2.5) | 2.31 (2.1–2.5) | 4.1 |
| Neurotic, stress-related and somatoform disorders | 385 (2.7) | 1,622 (1.1) | 2.58 (2.3–2.8) | 2.15 (1.9–2.4) | 1.87 (1.6–2.2) | 1.2 |
| Organic disorders | 33 (0.2) | 169 (0.1) | 2.14 (1.5–3.1) | 1.85 (1.3–2.7) | 1.28 (0.8–2.1) | 0.04 |
| Behavioural, emotional and developmental disorders | 18 (0.1) | 103 (0.1) | 1.92 (1.2–3.2) | 1.68 (1.0–2.7) | 1.34 (0.7–2.5) | 0.02 |
| Personality disorders | 101 (0.7) | 271 (0.2) | 4.06 (3.2–5.1) | 3.28 (2.6–4.2) | 2.94 (2.2–3.8) | 0.5 |
| No admission ^a | 12,581 (87.1) | 137,030 (94.9) | 1 | 1 | 1 | |
| <i>Paternal suicidal history/vital status</i> | | | | | | |
| Suicide vs. alive | 240 (1.7) | 858 (0.6) | 2.88 (2.5–3.3) | 1.97 (1.7–2.3) | 1.91 (1.6–2.3) | 0.8 |
| Death vs. alive | 652 (4.5) | 4,231 (2.9) | 1.59 (1.5–1.7) | 1.34 (1.2–1.5) | 1.27 (1.1–1.4) | 0.9 |
| Suicide attempt | 632 (4.4) | 1,956 (1.4) | 3.33 (3.0–3.6) | 1.90 (1.7–2.1) | 1.88 (1.7–2.1) | 2.0 |
| <i>Maternal psychopathology</i> | | | | <i>Maternal history</i> | | |
| Schizophrenia and non-affective psychoses | 131 (0.9) | 548 (0.4) | 2.61 (2.1–3.1) | 2.23 (1.8–2.7) | 1.98 (1.6–2.5) | 0.4 |
| Affective disorders | 186 (1.3) | 825 (0.6) | 2.45 (2.1–2.9) | 1.89 (1.6–2.2) | 1.43 (1.2–1.7) | 0.4 |
| Substance abuse disorders | 385 (2.7) | 1,121 (0.8) | 3.73 (3.3–4.2) | 2.51 (2.2–2.8) | 2.21 (1.9–2.5) | 1.5 |
| Neurotic, stress-related and somatoform disorders | 825 (5.7) | 2,988 (2.1) | 2.99 (2.7–3.2) | 2.28 (2.1–2.5) | 1.87 (1.7–2.1) | 2.6 |
| Organic disorders | 77 (0.5) | 276 (0.2) | 3.04 (2.3–3.9) | 2.52 (1.9–3.3) | 2.16 (1.6–2.9) | 0.3 |
| Behavioural, emotional and developmental disorders | 36 (0.2) | 211 (0.1) | 1.85 (1.3–2.6) | 1.31 (0.9–1.9) | 1.34 (0.9–2.0) | 0.05 |
| Personality disorders | 98 (0.7) | 250 (0.2) | 4.25 (3.3–5.3) | 2.84 (2.2–3.6) | 2.14 (1.6–2.8) | 0.4 |
| No admission ^a | 12,702 (88) | 138,180 (95.7) | 1 | 1 | 1 | |
| <i>Maternal suicidal history/vital status</i> | | | | | | |
| Suicide vs. alive | 88 (0.6) | 284 (0.2) | 3.13 (2.5–3.9) | 2.15 (1.7–2.8) | 1.79 (1.3–2.4) | 0.3 |
| Death vs. alive | 286 (2.0) | 1,891 (1.3) | 1.53 (1.3–1.7) | 1.37 (1.2–1.6) | 1.21 (1.0–1.4) | 0.3 |
| Suicide attempt | 950 (6.6) | 2,373 (1.6) | 4.23 (3.9–4.5) | 2.61 (2.4–2.8) | 2.75 (2.5–3.1) | 4.2 |
| <i>Siblings' psychopathology^b</i> | | | | <i>Siblings' history</i> | | |
| ≥1 schizophrenia and non-affective psychoses | 27 (0.2) | 98 (0.1) | 2.96 (1.9–4.5) | 2.24 (1.4–3.5) | 1.81 (1.0–3.1) | 0.1 |
| ≥1 affective disorders | 19 (0.1) | 64 (0.04) | 3.18 (1.9–5.3) | 2.08 (1.2–3.6) | 1.17 (0.5–2.6) | 0.01 |
| ≥1 substance abuse disorders | 71 (0.5) | 141 (0.1) | 5.20 (3.9–6.9) | 3.18 (2.3–4.3) | 2.33 (1.5–3.6) | 0.3 |
| ≥1 neurotic, stress-related and somatoform disorders | 61 (0.4) | 200 (0.1) | 3.31 (2.5–4.4) | 2.48 (1.8–3.3) | 1.47 (1.0–2.0) | 0.1 |
| ≥1 organic disorders | 50 (0.3) | 303 (0.2) | 1.81 (1.3–2.4) | 1.73 (1.2–2.3) | 1.43 (1.0–2.0) | 0.1 |
| ≥1 behavioural, emotional and developmental disorders | 93 (0.6) | 517 (0.4) | 1.96 (1.6–2.4) | 1.78 (1.4–2.2) | 1.57 (1.2–2.0) | 0.2 |
| ≥1 personality disorders | 47 (0.3) | 84 (0.1) | 5.95 (4.1–8.5) | 3.88 (2.6–5.7) | 3.16 (2.0–4.9) | 0.2 |
| No admission ^a | 14,072 (97.5) | 142,992 (99) | 1 | 1 | 1 | |
| <i>Siblings' suicidal history/vital status^b</i> | | | | | | |
| Suicide vs. alive | 26 (0.2) | 104 (0.1) | 2.76 (1.7–4.2) | 2.24 (1.4–3.5) | 1.85 (1.1–3.2) | 0.1 |
| Death vs. alive | 200 (1.4) | 1,864 (1.3) | 1.15 (0.9–1.3) | 1.13 (0.9–1.3) | 1.13 (0.9–1.3) | 0.2 |
| Suicide attempt | 251 (1.7) | 535 (0.4) | 4.53 (3.8–5.2) | 3.22 (2.7–3.8) | 3.42 (2.8–4.1) | 1.2 |
| <i>Index subjects' psychopathology</i> | | | | <i>Subjects' history</i> | | |
| Schizophrenia and non-affective psychoses | 265 (1.8) | 105 (0.1) | 44.7 (34–57) | 44.5 (34–57) | 42.2 (32–54) | 1.7 |
| Affective disorders | 562 (3.9) | 62 (0.04) | 135.8 (102–179) | 139.7 (105–185) | 135.6 (102–180) | 3.8 |
| Substance abuse disorders | 1,123 (7.8) | 130 (0.1) | 144.4 (116–178) | 142.2 (114–176) | 138.0 (111–171) | 7.7 |
| Neurotic, stress-related and somatoform disorders | 875 (6.1) | 274 (0.2) | 48.5 (41–56) | 45.5 (38–53) | 44.0 (37–51) | 5.9 |
| Organic disorders | 67 (0.5) | 337 (0.2) | 2.6 (2.0–3.5) | 2.5 (1.9–3.3) | 2.4 (1.8–3.1) | 0.3 |
| Behavioural, emotional and developmental disorders | 450 (3.1) | 621 (0.4) | 9.9 (8.7–11.3) | 9.5 (8.3–10.9) | 9.2 (8.1–10.5) | 2.7 |
| Personality disorders | 416 (2.9) | 81 (0.1) | 78.9 (60–102) | 77.4 (59–101) | 73.8 (56–96) | 2.8 |
| No admission ^a | 10,682 (74) | 142,789 (98.9) | 1 | 1 | 1 | |

^aReference group^bAdjusted for number of siblings

Model 1: crude; Model 2: familial suicidal behaviour and hospital admission due to psychopathology mutually adjusted; individual psychopathology adjusted for familial suicidal history; Model 3: as Model 2 and additionally familial factors adjusted for subjects' hospital admission due to psychopathology; subjects' psychopathology additionally adjusted for familial psychopathology

degree relative (sibling or parent) was 2.3–3.7 times more common in youth suicide attempters than community controls [9, 23]. This is in keeping with our finding of a 2.9 times increased risk of suicide attempt if a parent or sibling has been admitted to a hospital due to psychopathology.

All parental diagnoses were significantly associated with an increased risk of suicide attempt in the final model with the exception of the group of emotional, behavioural and developmental disorders and paternal organic disorders. The main difference between maternal and paternal diagnoses was the elevated odds ratio for maternal schizophrenia, non-affective psychoses and organic disorders. The latter were often preceded by earlier admissions for affective and non-affective psychoses. The fact that maternal organic psychoses, schizophrenia and non-affective psychoses were associated with higher odds ratios for attempted suicide compared to paternal, suggests a greater vulnerability to maternal psychoses in the index subjects. Studies analysing the effect of parental psychoses on offspring's suicidal behaviour are sparse. Pfeffer et al. did not report a significantly increased risk of psychotic disorders in first-degree relatives of young suicide attempters, most likely due to small sample sizes [23]. The influence of maternal psychotic disorders on offspring's suicidal behaviour warrants further investigation.

■ Psychopathology in index subjects

Our finding that hospital admission was 33 times more common in cases (young suicide attempters) than in controls is in line with a Danish register study, which reported an odds ratio of 30 for individual hospital admission [9]. The hospitalisation of 26% in young cases prior to index attempt is higher than in a Danish study for young suicide completers (15%) and is in contrast to clinical studies where 80–90% of young suicide attempters meet criteria for any psychiatric disorder [1, 3]. This suggests that a majority of young suicide attempters in Sweden do not obtain treatment for their mental health problems before they receive clinical attention for their suicide attempt. The predominance of substance abuse, affective and personality disorders in suicide attempters is in accordance with previously published work [3, 12, 18]. All diagnostic groups were associated with a significantly and most of them with a greatly increased suicide attempt risk in our study. This calls for active approaches in early detection and treatment of children and young adults at risk for mental ill health.

■ Familial and individual psychopathology

In our study, familial psychiatric disorders and personality disorders remained significant predictors of subjects' suicide attempts after adjustment for indi-

vidual mental illness. Similar results have been reported in clinical [5] and register studies [9, 25]. This suggests that parental mental ill health, in addition to increasing the risk for mental ill health in the offspring, might contribute to risk for offspring's suicide attempt partly through hereditary and partly through environmental factors [8, 16]. The importance of environmental factors seems to be stressed by our findings of a particularly increased risk of suicide attempt in case of parental substance abuse and personality disorders. Part of the explanation can also be unobserved and under-diagnosed mental illness among index subjects.

■ Familial suicidal history

In this study, 13% of the cases had a parent or sibling who had completed or attempted suicide. The occurrence of suicidal behaviour in first-degree relatives of young people who have attempted suicide ranged from 6.3 to 16.8% in earlier studies [9, 20]. It is likely that this variation is primarily explained by differences in study population and methods.

Our findings are consistent with clinical and community surveys showing that the risk of suicide attempt tends to be associated with familial suicidal behaviour, primarily familial suicide attempt [14, 17, 20, 23, 30]. In these studies odds ratios for index suicide attempt range from 2.3 to 5.8 if a first-degree relative attempted suicide. This is in accordance with our findings of an odds ratio of 4.0 for familial suicide attempt. Similar results as in our study of stronger importance in case of maternal compared to paternal suicide attempt have been reported previously [19, 23, 30]. Our findings of sibling's suicide attempt as a stronger risk factor than maternal attempt is in contrast to earlier findings and might be explained by differences in methods of assessment and age of the study population [23, 30].

We could further show that a familial history of suicide completion had a stronger effect for boys than girls, and stronger in case of father's than mother's suicide. Sex differences in the effect of familial suicidal history in suicide completers and attempters could be found in one [23], but not in other studies [21, 24]. Further studies are needed to investigate possible gender differences in the transmission of suicidal behaviour.

■ Suicidal behaviour and psychopathology

In accordance with clinical studies, population-based studies and register-based studies, our findings suggest that familial suicidal behaviour remains important for subject's suicide attempt even after controlling for familial and individual mental disorder [6, 9, 17, 20, 25]. Furthermore, psychopathology in index subjects strongly interacted with familial

suicidal behaviour, which increased the odds ratios for all diagnostic psychopathological groups. These observations provide further evidence for the additional effect of familial suicidal behaviour over and above the diagnosed familial and individual mental illness. When interpreting these findings a potential effect of under-diagnosed mental illness has to be taken into account.

■ Modes of transmission

Genetic and environmental factors

Familial aggregation of suicidal behaviour appears to be due to genetic factors such as transmission of a vulnerability to psychiatric disorders and personality traits (characterised by impulsivity and aggression) as well as environmental factors such as imitation, bereavement of a parent, shortcomings in care and attachment and exposure to family violence and discord [4, 29]. Our results showing that a family history of suicide completion has a stronger effect on early onset suicide attempt, suggest that a history of familial suicidal behaviour may be an indicator of a genetic predisposition to suicidal behaviour. However, younger people might also be less capable of coping with adverse familial environmental influences associated with familial suicidal behaviour. Similar findings have been reported earlier, but the results of other studies are inconsistent [7, 21, 24, 27, 28].

Public health and clinical implications

Early recognition and adequate treatment of mental illness contribute to prevent youth suicide attempts. Children of parents with suicidal behaviour and psychopathology, particularly parental substance abuse, neurotic, stress-related, somatoform and personality disorders as well as maternal psychotic disorders, should receive early attention. Collaboration between adult and child psychiatry as well as social services is crucial. Support for parents with psychopathology may start as early as during ante- and post-natal care, suggested by recent evidence of long-term adverse consequences of early life experiences of parental psychosocial and psychiatric problems [22, 26]. It is also vital to consider the history of suicidal behaviour in the whole family when assessing the suicide risk in adolescents and young adults with mental ill health.

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