

## Gender differences in risk factors for suicide in Denmark<sup>†</sup>

PING QIN, ESBEN AGERBO, NIELS WESTERGÅRD-NIELSEN, TOR ERIKSSON and PREBEN BO MORTENSEN

**Background** Gender is one of the most frequently replicated predictors for suicide.

**Aims** To identify risk factors for suicide among males and females and to investigate whether risk factors for suicide differ by gender.

**Method** A time-matched nested case–control design was performed using Danish longitudinal register databases to obtain 811 suicide cases and 79 871 controls. Data were analysed using conditional logistic regression.

**Results** A history of hospitalised mental illness was the most marked risk factor for suicide for both genders. Unemployment, retirement, being single and sickness absence were significant risk factors for men, whereas having a child <2 years old was significantly protective for women. The relative risks for suicide differed significantly between genders according to psychiatric admission status and being the parent of a child <2 years. However, adjustment for these factors did not eliminate the gender difference in suicide risk.

**Conclusions** Risk factors for suicide differed by gender and gender differences could not be explained by differential exposure to known risk factors.

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A number of studies have analysed the health and socio-economic indicators for suicidal ideation and behaviour, in which gender is one of the most frequently replicated predictors (Goldacre *et al*, 1993; Moscicki, 1994; Canetto & Sakinofsky, 1998). Identifying variables that indicate greater risk of suicide in different genders, as well as investigating whether risk factors associated with suicide differ by gender, are important tasks. Also, very few studies have examined interactions by gender for each of the risk factors while adjusting for other confounders. A previous study by Mortensen *et al* (2000) found that a history of hospitalised mental disorders, unemployment and being single were all associated with an elevated suicide risk in Denmark. The purposes of this study are to identify further the significant risk factors for suicide among males and females separately, and to examine whether psychiatric or socio-economic factors can explain gender differences in suicide risk and whether risk factors for suicide differ between genders in a large representative population-based sample.

### METHOD

The data for this study were based on three Danish longitudinal registers that were merged by using a unique personal identification number known as the CPR-number. The CPR-number is the equivalent of a person's social security number and is used across all registration systems in Denmark and can be logically checked for errors.

The first and basic register in our study is the Longitudinal Labour Market Register (Westergård-Nielsen, 1984), which includes a 5% random sample of about 240 000 individuals from the Danish population aged 16–78 years and contains year-by-year information on individual income, wealth, employment, education, marriage and other demographics for a 15-year span from 1980 to 1994. The second register is

the Danish Medical Register on Vital Statistics (Sundhedsstyrelsen, 1992), which contains the Cause-of-Death Register recording the causes and dates of all deaths in Denmark. During the study period, suicides were identified from the Cause-of-Death Certification according to the WHO ICD-8 (World Health Organization, 1967) codes E950–E959 and ICD-10 (World Health Organization, 1992) codes X60–84. The third register is the Danish Psychiatric Central Register (Munk-Jorgensen & Mortensen, 1997), which covers all psychiatric in-patient facilities in Denmark and cumulatively records all admission and discharge information such as dates and diagnoses.

Most socio-economic data included in our study were extracted from the Labour Market Register (Westergård-Nielsen, 1984), i.e. degree of unemployment, measured as the fraction of the year for which unemployment benefits were paid, and split into being in work, <20% degree of unemployment and 20–100% degree of unemployment; age pension, indicating retirement after age 60; disability pension, indicating retirement due to permanent disability before age 60; the seven mutual independent categories for labour-market participation status, including the three levels of employment, accepting an age pension, a disability pension and other social benefits and being a student; annual income and wealth (property or debt) divided into quartiles; educational level, grouped into three categories referring to primary school, high school and university level; marital status, classified into married or cohabiting and being single; being the parent of a young child, indicating having a child less than 2 years old; sickness absence, indicating an absence from work due to illness for more than 3 weeks; living in the capital area (referring to the Copenhagen and Frederiksberg municipality). All these data were cited according to information obtained 2 years prior to the matching time because some of them, such as annual income and unemployment degree, are finally constructed by authorities in the subsequent year, which means that information for the year preceding the year of death could be incomplete.

Further explanatory variables derived from the Psychiatric Central Register (Munk-Jorgensen & Mortensen, 1997) included psychiatric admission history, duration of current discharge period, diagnosis, etc. and were updated to the

<sup>†</sup>See editorial, pp. 484–485, this issue.

matching time. The psychiatric diagnoses contained in this data-set were based on the main diagnosis at the latest discharge. However, alcoholism and drug misuse were considered as separate variables irrespective of whether they occurred alone or in combination with other mental disorders in previous diagnoses. It should be noted also that information about the person was available only if he or she had been admitted to a psychiatric hospital or ward.

A time-matched nested case-control design (Clayton & Hills, 1993) was performed to select representative controls, where each person committing suicide was matched to a random subsample of all available controls, that is, all individuals who were alive and recorded in the Longitudinal Labour Market Register at the time of the suicide. Individuals selected as controls for each case were replaced after each specific selection. This procedure was followed for each suicide, resulting in a sample consisting of 811 suicide cases and 79 871 controls for the years 1982–1994.

The data were analysed in a conditional logistic regression model using the PhReg procedure in SAS version 6.12 for UNIX (SAS Institute, 1997). Odds ratios and 95% confidence limits were estimated. The Wald test was used to examine whether the risks in various categories were significantly different from the references. *P*-values of gender interaction were based on the likelihood ratio test, that is, interaction between a specified variable and gender was tested by comparing the likelihood value of the full model, including all variables and gender as main effects as well as gender interactions with each category of all variables, with the likelihood value of the same model excluding only the gender interactions with each category of the specified variable.

## RESULTS

The main results of this study are shown in Table 1. The 3rd and 4th columns display the percentage distributions of cases and controls in different variable categories. The female:male ratios were 270:541 among suicides and 39 981:39 890 among controls in our study population.

The next two columns present the age-adjusted relative risks for individual variables. Some variables had the same impact on suicide risk for both men and women, e.g. being single, living in the capital area, ever having been an alcohol or drug misuser

and ever having been a patient in a psychiatric hospital, and the relative risks increased or decreased in the expected direction. Some other factors, such as unemployment, income, wealth, having a young child and sickness absence from a job, had different effects on suicide for men and women. The influence of educational level on suicide risk was weak for both genders.

However, when all these variables as well as age were included in one model and adjusted for each other, the effects of most socio-economic indicators were either reduced, eliminated or even reversed. This is due to a strong association between a history of hospitalised psychiatric disease and these variables. As is shown in the 7th and 8th columns in Table 1, a history of hospitalised mental illness was the strongest risk factor for suicide for both genders. The highest risks for committing suicide were among those who had been discharged from psychiatric hospitals within the preceding month and those currently admitted. Compared with those never admitted, the relative risks for these two subgroups were 127.47 and 51.96 for men and 152.33 and 146.00 for women respectively. Moreover, in this multivariate analysis, being single, unemployment, retirement and sickness absence remained significant risk factors for suicide for men even after controlling for psychiatric history. For women, besides the history of psychiatric hospitalisation, there were no statistically significant risk factors except that having a child less than 2 years old significantly reduced the suicide risk.

In this study population, the relative risk of committing suicide among males *v.* females was 2.05 (95% CI 1.77–2.38) after controlling for age only, and 2.17 (95% CI 1.83–2.56) after further controlling for all other variables. This means that taking psychiatric history and socio-economic and demographic factors into account did not explain gender differences in suicide rates in Denmark.

The last column in the table displays the *P*-values of the results of the analyses as to whether the impacts of these variables differ for suicide between the genders. There were no significant interactions between gender and marital status, education level, annual income, wealth status, region, sickness absence from job and alcohol and drug misuse, respectively. However, the interaction between gender and having a history of psychiatric hospitalisation was obviously

significant, with  $P < 0.01$  which, in connection with the odds ratios displayed in the 7th and 8th columns, means that a history of psychiatric admission had a stronger impact on increasing suicide risk among females than males. Also, the gender interaction of having a child <2 years old was also significant, which suggests that being a parent of a young child was more protective against suicide behaviour for females than for males.

## DISCUSSION

This study was based on individual data from three Danish longitudinal registers, which made it possible to analyse suicide in relation to a relatively wide range of health and socio-economic indicators in a large representative population.

The main finding of the present study was that hospitalised mental illness, in particular recent discharge from a psychiatric hospital or ward, appeared to be the most prominent risk factor for suicide for both men and women. Moreover, a history of psychiatric hospitalisation made the increased suicide risk higher in females than in males. However, this does not mean that suicide rates are higher among female than male psychiatric patients, because the suicide rate in the general population is lower in females than in males.

Another important finding in our study was that socio-economic risk factors for suicide differed among males and females. Unemployment, retirement, being single and sickness absence were still significant risk factors for men, even after controlling for psychiatric admission. For women, no significant risk factor other than mental illness was classified, whereas having a child <2 years old reduced the suicide risk.

However, the third finding was that there was no prominent gender interaction for most socio-economic indicators on suicide, except having a history of psychiatric hospitalisation and being the parent of a child <2 years old.

Many studies have found that the highest suicide mortality rates were for individuals diagnosed with a mental disorder (Moscicki, 1994; Dennehy *et al.*, 1996; Harris & Barraclough, 1997; Heikkinen *et al.*, 1997). In our study, 42.7% of male and 59.6% of female suicides had ever been admitted for psychiatric illness. Although our finding of a highly elevated risk after discharge was consistent with the findings,

**Table 1** The percentage distribution of 811 cases of suicide and 79 871 controls and the main results of the conditional logistic regression analysis

Variable	Category	Distribution (%)		Odds ratio (95% CI) adjusted by age only		Odds ratio (95% CI) adjusted by all variables		P-value for interaction with gender
		Cases n=811	Controls n=79 871	Male n=541	Female n=270	Male	Female	
Marital status	Married/cohabiting <sup>1</sup>	55.86	72.82	1.00	1.00	1.00	1.00	0.2829
	Being single	44.14	27.18	2.59 (2.18–3.09)**	2.16 (1.69–2.76)**	1.39 (1.13–1.71)**	1.15 (0.86–1.52)**	0.2093
Education level	> 13 years <sup>1</sup>	12.58	12.20	1.00	1.00	1.00	1.00	
	11–13 years	27.50	33.36	0.79 (0.60–1.03)	1.14 (0.72–1.80)	0.74 (0.55–1.00)	1.15 (0.70–1.91)	
Labour market participation status	< 11 years	59.93	54.44	1.03 (0.79–1.34)	1.27 (0.84–1.93)	0.81 (0.60–1.09)	0.95 (0.58–1.55)	0.5254
	Working <sup>1</sup>	41.06	54.13	1.00	1.00	1.00	1.00	
Wealth status	< 20% unemployed	5.18	6.85	1.29 (0.90–1.84)	0.74 (0.34–1.60)	1.01 (0.69–1.49)	0.80 (0.36–1.78)	0.4304
	20–100% unemployed	11.84	9.58	2.21 (1.69–2.88)**	1.37 (0.86–2.19)	1.36 (1.00–1.89)*	1.21 (0.72–2.04)	
Annual income level	Student	2.22	6.10	1.41 (0.75–2.66)	0.67 (0.23–1.89)	1.11 (0.56–2.44)	0.41 (0.12–1.45)	0.6241
	Age pension	19.85	11.53	1.74 (1.26–2.41)**	2.25 (1.57–3.33)**	1.69 (1.05–2.71)*	1.62 (0.80–3.27)	
Having a child < 2 years old	Disability pension	9.49	2.93	4.12 (2.93–5.75)**	4.91 (3.26–7.42)**	0.78 (0.50–1.21)	1.24 (0.72–2.13)	0.0307
	Other social benefits	10.36	8.88	1.93 (1.38–2.70)**	1.63 (1.11–2.39)**	1.23 (0.81–1.87)	1.29 (0.76–2.21)	
Region	Upper quartile <sup>1</sup>	30.33	25.48	1.00	1.00	1.00	1.00	0.1022
	2nd quartile	18.87	22.21	1.34 (1.04–1.72)*	0.71 (0.49–1.03)	0.96 (0.73–1.27)	0.69 (0.46–1.05)	
Sickness absence	Lower half	50.80	52.31	1.87 (1.53–2.29)**	0.77 (0.56–1.05)	1.03 (0.81–1.31)	0.85 (0.58–1.24)	0.2191
	Upper quartile <sup>1</sup>	24.41	25.41	1.00	1.00	1.00	1.00	
Alcohol misuse	2nd quartile	22.69	25.27	1.37 (1.10–1.73)**	0.93 (0.58–1.48)	0.94 (0.72–1.23)	0.85 (0.51–1.43)	0.9333
	3rd quartile	25.40	24.89	2.01 (1.58–2.57)**	1.02 (0.65–1.60)	1.05 (0.76–1.43)	0.76 (0.45–1.29)	0.7555
Drug misuse	Lower quartile	27.50	24.43	2.34 (1.81–3.03)**	1.44 (0.93–2.23)	0.84 (0.57–1.25)	0.78 (0.42–1.44)	0.0149
	No <sup>1</sup>	96.67	92.04	1.00	1.00	1.00	1.00	
Psychiatric admission status	Yes	3.33	7.96	0.68 (0.45–1.05)	0.16 (0.05–0.51)**	0.90 (0.57–1.41)	0.26 (0.08–0.85)*	
	The other areas <sup>1</sup>	69.79	76.16	1.00	1.00	1.00	1.00	
Never admitted <sup>1</sup>	The capital area	30.21	23.84	1.28 (1.06–1.54)**	1.61 (1.25–2.07)**	0.97 (0.79–1.19)	1.29 (0.98–1.71)	0.7555
	No <sup>1</sup>	89.03	93.43	1.00	1.00	1.00	1.00	0.2191
Admitted	Yes	10.97	6.57	2.73 (2.10–3.55)**	1.37 (0.88–2.16)	1.60 (1.17–2.10)**	1.09 (0.65–1.85)	0.9333
	No <sup>1</sup>	93.71	99.50	1.00	1.00	1.00	1.00	0.7555
Discharged < 1 month	Yes	6.29	0.50	11.81 (7.89–17.68)**	15.57 (9.84–24.65)**	1.05 (0.66–1.67)	1.08 (0.63–1.85)	0.0149
	No <sup>1</sup>	84.46	98.95	1.00	1.00	1.00	1.00	
Discharged 1–6 months	Yes	15.54	1.05	13.33 (10.49–16.94)**	18.95 (12.74–28.20)**	1.22 (0.89–1.67)	1.11 (0.69–1.79)	0.2829
	No <sup>1</sup>	51.66	95.51	1.00	1.00	1.00	1.00	
Discharged 7–12 months	Never admitted <sup>1</sup>	8.51	0.18	62.19 (41.32–93.59)**	167.08 (102.75–271.69)**	51.96 (33.62–80.31)**	146.00 (87.63–243.25)**	0.2093
	Admitted	6.04	0.08	154.21 (89.55–265.55)**	167.77 (90.77–310.08)**	127.47 (72.22–224.99)**	152.33 (81.52–284.64)**	0.5254
Discharged > 1 year	Discharged < 1 month	8.01	0.25	43.32 (28.98–64.47)**	100.71 (62.89–161.28)**	34.00 (21.97–52.64)**	86.06 (52.02–142.38)**	0.2093
	Discharged 1–6 months	5.18	0.23	27.10 (16.40–44.79)**	90.06 (53.94–150.36)**	20.83 (12.12–35.79)**	77.80 (45.23–133.83)**	0.2093
	Discharged 7–12 months	20.60	3.75	8.77 (6.96–11.05)**	12.41 (9.05–17.03)**	7.14 (5.42–9.40)**	11.31 (8.02–15.95)**	0.2093

I. Reference category. \*P < 0.05; \*\*P < 0.01.

for example, of Goldacre *et al* (1993) in a national sample in England, the effect of psychiatric illness on suicide might still be underestimated since we only took in-patients into account and were unable to get information for those not meeting admission criteria. Similar underestimation could also be presented for both alcohol and drug misuse. Our findings that alcoholism and drug misuse increased risk in the age-adjusted analyses were concordant with the literature (Adams & Overholser, 1992; Heikkinen *et al*, 1995; Rossow & Amundsen, 1995; Taylor *et al*, 1999). However, with psychiatric admission in the multivariate analysis, there was no additional risk from alcohol or drug misuse. This is because information on alcohol and drugs was available only for those people who had ever been admitted to a psychiatric hospital or ward, and that substance misuse often is not reported as an auxiliary diagnosis.

Our results from the analysis only controlling for age confirmed previous reports that some health and socio-demographic factors, such as sickness absence, being single and living in large urban areas, were associated with an increased suicide risk (Johansson *et al*, 1997). On the other hand, our results that economic stressors such as employment status, income and wealth played a more important role in suicide for males than for females supported the hypothesis that men respond more strongly to changing social and economic conditions than women (Crombie, 1990; Taylor *et al*, 1998). Some earlier studies (Johansson & Sundquist, 1997; Lewis & Sloggett, 1998) had found an increased risk among the unemployed, and our study identified that this effect was prominent only for males both when controlling for age and when further controlling for all variables.

Our finding that people, especially women, who had a young child were less likely to commit suicide was consistent with previous reports (Hoyer & Lund, 1993; Heikkinen *et al*, 1995; Moscicki, 1997). Our result also supported the hypothesis first suggested by Durkheim, (1966) that the protective effect of marriage on suicide rates in women was largely an effect of having children.

The finding of high suicide risk for those living in the capital area was comparable with reports from most Western countries. Different effects of urban living between genders might be because women

#### CLINICAL IMPLICATIONS

- The risk factors of suicide differed according to gender. Unemployment played a more important role in predicting suicide for men. But a history of hospitalised mental illness was the most marked risk factor for suicide for both men and women.
- Psychiatric history and socio-economic factors did not explain the higher suicide rate in men.
- Gender interactions were significant in relation to psychiatric admission history and to being the parent of a child <2 years old.

#### LIMITATIONS

- The impact of psychiatric history as well as alcohol and drug misuse might be underestimated.
- Most socio-economic data were cited according to information gained 2 years prior to the matching time.
- Data regarding genetic factors, personal characteristics and life events were not available.

PING QIN, MD, PREBEN BO MORTENSEN, MD, ESBEN AGERBO, MSc, Department of Psychiatric Demography, Institute for Basic Psychiatric Research, Psychiatric Hospital in Aarhus, University Hospital in Aarhus, Risskov, Denmark; NIELS WESTERGÅRD-NIELSEN, PhD, TOR ERIKSSON, DPolSci, Center for Labour Market and Social Research, University of Aarhus, Aarhus, Denmark

Correspondence: Dr Ping Qin, Department of Psychiatric Demography, Institute for Basic Psychiatric Research, Psychiatric Hospital in Aarhus, University Hospital in Aarhus, 8240 Risskov, Denmark. e-mail: qpi@psykiatri.aaa.dk

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living in cities feel more alienated and socially isolated (Murphy, 1998).

Our study also found that an absence from work due to illness was significantly associated with a higher suicide risk only for males in the analyses both controlling for age and further controlling for all other variables. This indicates that physical weakness might more easily lead to a lack of self-esteem and confidence for men.

Since the psychiatric history, socio-economic factors and demographics did not explain the higher suicide rate in males than in females, there may be some other aspects, such as genetic factors, personality characteristics and stressful life events, that increase suicide risk. Unfortunately, such variables were not available in our study. Another limitation of our study was that information regarding most socio-economic factors was based on records from 2 years prior to the matching time, whereas

psychiatric information was updated to the matching time. This would weaken the demonstration of the importance of socio-economic factors in comparison, even though they might have had their effect during the 2 years prior to suicide.

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