

Risk Factors for Suicide in Denmark

— A Register-based Linkage Study

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Research Background

- **Social and demographic factors:** age, gender, marital status, parenthood, region of living, ethnicity
- **Economical factors:** income and wealth status, labour market status
- **Health-related factors:** psychiatric illness, substance abuse, physical illness
- **Family history:** psychiatric disorders, suicidal behaviour
- **Other factors:** previous suicide attempt, stressful life events, availability of methods

Study aims of the project

- What is the joint impact of factors regarding family structure, socio-economic status, mental illness as well as family history of suicide and psychiatric disorders on the risk of suicide for the general population in Denmark?
- Are there gender differences in risk factors for suicide?
- How strongly do completed suicide and hospitalised mental illness among parents and siblings act as risk factors for suicide, and do these risk factors interact?
- What is the impact of parental status on the risk of completed suicide in the context of other risk factors?

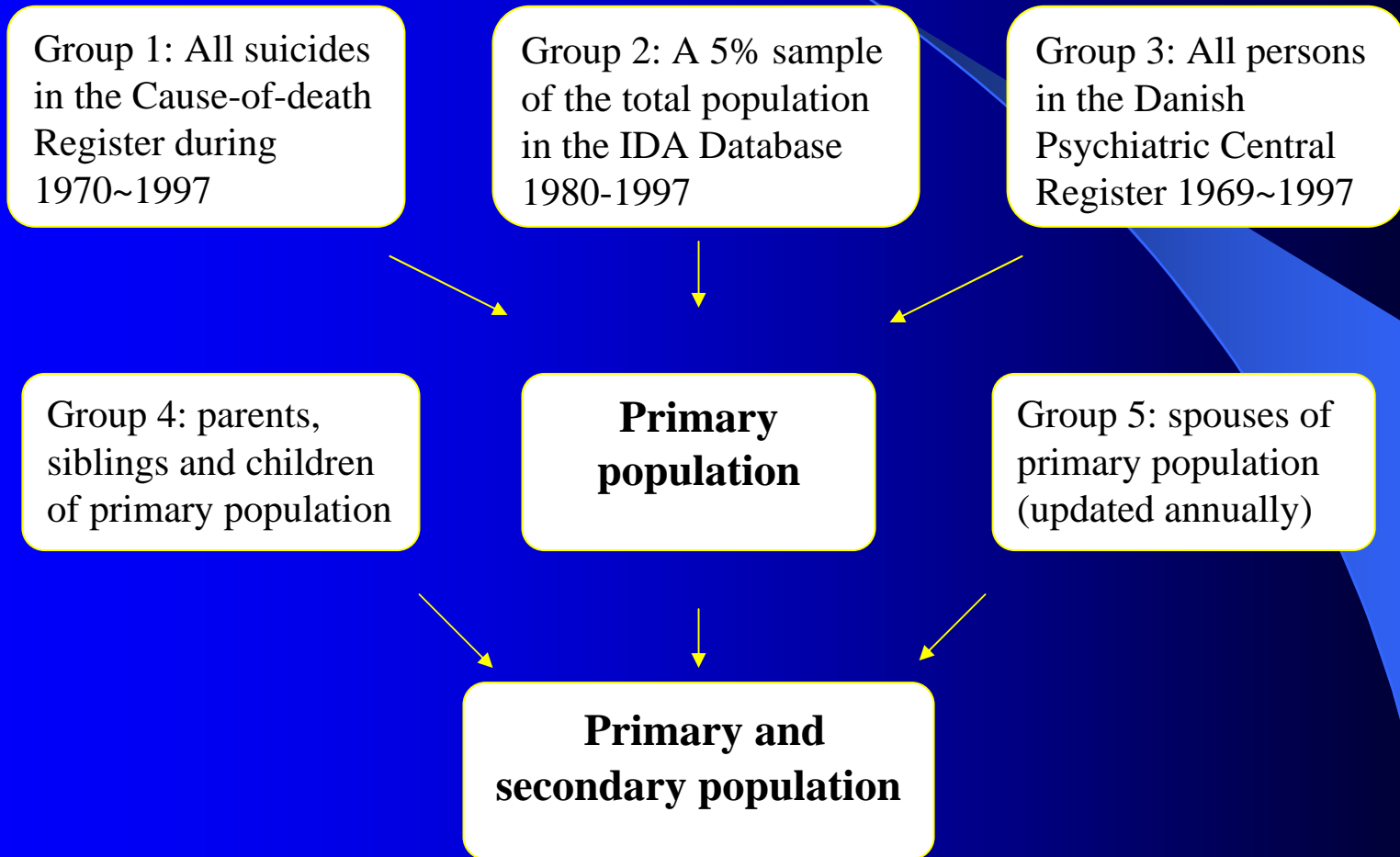
Material and Methods (1)

Data sources

- **The Danish Civil Registration System:** CPR-number to all individuals, links to parents and children;
- **The Cause-of-Death Register:** causes and dates of all deaths, suicide coded as E950-959 (ICD8) or X60-84 (ICD10);
- **The Danish Psychiatric Central Register:** dates and diagnoses of all psychiatric admission and discharge, outpatients since 1994;
- **The IDA Database:** labour market conditions and general information for all people, (t-1);
- **The Longitudinal Labour Market Register Database:** labour market condition and general information, (t-2) .

Material and Methods (2)

Data extraction



Material and Methods (3)

Study variables

- Marital status
- Links to children
- Links to parents or siblings
- Education level
- Labour market status
- Annual gross income
- Wealth
- Ethnicity
- Place of residence
- Sickness absence from work
- Psychiatric admission status
- Alcohol and substance misuse
- Family history of suicide
- Non-suicidal deaths in the first-degree relatives
- Family history of psychiatric disorders

Material and Methods (4)

Study subjects

➤ **Suicide cases**

All suicides during 1981-1997 were obtained from the Cause-of-Death Register with a restriction that the suicide was residing in Denmark in the year before the year of suicide. 21,169 suicides aged 9-103 years were finally included.

➤ **Controls**

A nested case-control design was used to select representative controls. Up to 20 controls per case were matched for gender, age and calendar time resulting in 423,128 matched controls. For only a few cases older than 93 years old it was not possible to find 20 controls.

Material and Methods (5)

Statistical methods

- **The effects of** risk factors were estimated by conditional logistic regression analysis yielding odds ratios, 95% confidence limits and corresponding p-values.
- **Test of trends** was carried out from the full model of the conditional logistic regression analysis to estimate analogous odds ratio for the trend of effects of some variables.
- **Interactions** between variables were examined using the likelihood ratio test.
- **Population attributable risk** for important risk factors was calculated on the basis of adjusted relative risks from the full analysis and the distribution of exposure in the cases.

This project has resulted in the following papers:

- Qin P, Mortensen PB, Agerbo E, Westergaard-Nielsen N, Eriksson T. Gender differences in risk factors for suicide in Denmark. *British Journal of Psychiatry*. 2000 Dec;177(6): 546-550.
- Qin P, Agerbo E, Mortensen PB. Suicide risk in relation to socioeconomic, demographic, psychiatric and familial factors — A register-based study of all suicides in Denmark 1981-1997. *American Journal of Psychiatry*. In press, 2002 October.
- Qin P, Agerbo E, Mortensen PB. Suicide risk in relation to family history of completed suicide and hospitalized psychiatric disorders — A nested case-control study based on longitudinal registers. *Lancet*. 2002 Oct; 360:1126-1130.
- Qin P, Mortensen PB. The impact of parental status on the risk of completed suicide. *Archives of General Psychiatry*. In press, 2002 November.

Results (1)

Risk factors for suicide in the general population

All 21,169 suicides and 423,128 matched controls

Table 1. Odds ratio (95% CIs) of risk factors for the total subjects

Variables	Crude odds Ratio	Adjusted odds ratio
No psychiatric admission	1	1
Currently admitted	*57.1 (52.2-62.4)	*43.1 (39.2-47.3)
Discharged <8 days	*278.3 (217.6-365.0)	*226.0 (175.7-290.7)
Discharged 8-30 days	*132.8 (112.5-156.8)	*107.2 (90.3-127.3)
Discharged 1-6 months	*61.5 (56.4-67.0)	*44.1 (40.3-48.2)
Discharged 7-12 months	*33.6 (30.4-37.0)	*22.9 (20.7-25.4)
Discharged >1 year	*8.5 (8.2-8.9)	*6.0 (5.8-6.3)
No sickness absence	1	1
Sickness absence	*2.5 (2.4-2.6)	*2.0 (1.9-2.1)
Married	1	1
Cohabiting	*1.5 (1.4-1.6)	*1.3 (1.2-1.4)
Being single	*3.2 (3.1-3.3)	*1.9 (1.8-1.9)
No young child	1	1
Child <2 years old	*0.5 (0.4-0.6)	*0.6 (0.6-0.7)
Child 2-3 years old	*0.6 (0.6-0.7)	0.9 (0.8-1.0)
Child 4-6 years old	*0.7 (0.6-0.8)	1.0 (0.9-1.0)
No link to relatives	1	1
With link to relatives	*0.6 (0.6-0.7)	1.0 (0.9-1.0)
No family suicide history	1	1
With family suicide history	*3.5 (3.0-4.0)	*2.1 (1.8-2.6)
No family psychiatric history	1	1
Family psychiatric history	*2.2 (2.1-2.3)	*1.3 (1.2-1.4)

*: P<0.01;

#: P<0.05.



Table 1 Continued

Fully employed	1	1
<20% unemployed	*1.6 (1.4-1.6)	*1.1 (1.1-1.2)
20-80% unemployed	*2.1 (2.0-2.3)	*1.2 (1.1-1.3)
81-100% unemployed	*2.1 (1.9-2.3)	*1.2 (1.1-1.4)
Age pensioners	*2.2 (2.0-2.3)	*1.6 (1.5-1.7)
Disability pensioners	*5.9 (5.6-6.2)	*1.4 (1.3-1.5)
Full-time students	*1.6 (1.4-1.8)	*0.8 (0.7-0.9)
Receipt of other benefits	*6.0 (5.5-6.6)	0.9 (0.8-1.1)
Out of labour market	*2.1 (2.0-2.3)	*0.7 (0.6-0.8)
Income in the upper quartile	1	1
Income in the 2 nd quartile	*1.7 (1.6-1.7)	1.0 (0.9-1.0)
Income in the 3 rd quartile	*2.4 (2.3-2.5)	#0.9 (0.9-1.0)
Income in the lowest quartile	*5.5 (5.2-5.8)	*2.7 (2.5-2.9)
Wealth in the upper quartile	1	1
Wealth in the 2 nd quartile	*1.2 (1.1-1.2)	*0.8 (0.8-0.9)
Wealth in the 3 rd quartile	*2.1 (2.0-2.2)	*1.1 (1.1-1.2)
Wealth in the lowest quartile	#1.1 (1.0-1.1)	*0.9 (0.8-0.9)
Danes born in Denmark	1	1
Danes born in Greenland	*3.7 (3.0-4.6)	*2.7 (2.0-3.5)
Danes born abroad	*1.2 (1.1-1.3)	*1.2 (1.0-1.3)
Non-Danish citizens	*0.9 (0.8-0.9)	*0.9 (0.8-1.0)
Living in other areas	1	1
Living in the provincial cities	*1.1 (1.0-1.3)	1.0 (0.9-1.0)
Living in the capital	*1.3 (1.3-1.4)	1.0 (1.0-1.1)

*: P<0.01;

#: P<0.05.

Results (2)

Gender differences in risk factors for suicide

All 13,681 male suicides and 273,371 matched controls

All 7488 female suicides and 149,757 matched controls

Table 2. Adjusted odds ratio (95% CIs) of risk factors for men and women

Variables	Males	Females	P-value of sex interaction
No psychiatric admission	1	1	P<0.01
Currently admitted	*28.2 (25.0-31.9)	*77.8 (66.9-90.4)	
Discharged <8 days	*137.5 (101.1-186.9)	*493.5 (313.6-776.4)	
Discharged 8-30 days	*78.3 (62.9-97.5)	*172.4 (130.1-228.5)	
Discharged 1-6 months	*33.2 (29.6-37.3)	*66.3 (57.4-76.7)	
Discharged 7-12 months	*16.8 (14.7-19.3)	*34.8 (29.6-40.8)	
Discharged >1 year	*4.9 (4.7-5.2)	*8.3 (7.7-8.9)	
No sickness absence	1	1	P>0.05
Sickness absence	*1.9 (1.8-2.0)	*2.2 (2.0-2.5)	
Married	1	1	P<0.01
Cohabiting	*1.3 (1.2-1.4)	*1.2 (1.1-1.4)	
Being single	*1.9 (1.8-2.0)	*1.6 (1.5-1.7)	
No young child	1	1	P<0.01
Child <2 years old	*0.7 (0.6-0.8)	*0.4 (0.3-0.5)	
Child 2-3 years old	1.0 (0.9-1.2)	*0.5 (0.4-0.7)	
Child 4-6 years old	1.0 (0.9-1.1)	*0.8 (0.7-0.9)	
No link to relatives	1	1	P>0.05
With link to relatives	1.0 (1.0-1.1)	0.9 (0.9-1.0)	
No family suicide history	1	1	P<0.05
With family suicide history	*1.9 (1.5-2.4)	*3.0 (2.1-4.1)	
No family psychiatric history	1	1	P>0.05
Family psychiatric history	*1.3 (1.2-1.4)	*1.2 (1.1-1.4)	

*: P<0.01;
#: P<0.05.



Table 2. continued

Fully employed	1	1	
<20% unemployed	*1.1 (1.0-1.2)	*1.2 (1.1-1.4)	P<0.01
20-80% unemployed	*1.2 (1.1-1.3)	1.1 (1.0-1.3)	
81-100% unemployed	*1.2 (1.1-1.4)	1.2 (1.0-1.5)	
Age pensioners	*1.4 (1.3-1.6)	*2.2 (1.9-2.6)	
Disability pensioners	*1.2 (1.1-1.4)	*1.9 (1.6-2.1)	
Full-time students	*0.7 (0.6-0.9)	0.9 (0.7-1.2)	
Receipt of other benefits	0.8 (0.7-1.0)	1.2 (1.0-1.6)	
Out of labour market	0.9 (0.8-1.0)	*0.7 (0.6-0.8)	
Income in the upper quartile	1	1	
Income in the 2 nd quartile	1.1 (1.0-1.1)	*0.8 (0.7-0.9)	
Income in the 3 rd quartile	1.0 (1.0-1.1)	*0.8 (0.7-0.8)	
Income in the lowest quartile	*3.3 (3.0-3.6)	*1.9 (1.6-2.2)	
Wealth in the upper quartile	1	1	P<0.01
Wealth in the 2 nd quartile	*0.8 (0.8-0.9)	*0.8 (0.7-0.9)	
Wealth in the 3 rd quartile	*1.2 (1.2-1.3)	1.0 (0.9-1.1)	
Wealth in the lowest quartile	*0.9 (0.9-1.0)	*0.8 (0.7-0.9)	
Danes born in Denmark	1	1	P<0.05
Danes born in Greenland	*2.7 (1.9-3.8)	*2.7 (1.7-4.3)	
Danes born abroad	1.1 (0.9-1.2)	*1.3 (1.1-1.5)	
Non-Danish citizens	*0.7 (0.6-0.9)	1.1 (0.9-1.3)	
Living in other areas	1	1	P<0.01
Living in the provincial cities	*0.9 (0.8-0.9)	*1.2 (1.1-1.3)	
Living in the capital	*0.9 (0.9-1.0)	*1.2 (1.1-1.3)	

*: P<0.01;

#: P<0.05.

Table 3 The attributable risk* of important risk factors for suicide (%)

Risk factors	Total	Male	Female
Cohabiting	1.8	1.9	1.0
Single	25.8	26.2	20.6
Unemployment	2.8	3.0	2.1
Retirement	10.2	7.0	18.8
Disability	3.2	1.7	6.7
The lowest quartile income	8.8	9.3	7.2
Sickness absence from job	6.4	6.6	6.2
Psych. Adm. within 1 year	24.7	20.1	32.9
Psychiatric admission ever	40.3	33.0	53.6

*: Attributable risks were derived from multiple logistic regression, and are not additive.

Results (3)

Suicide risk in relation to family history of completed suicide and psychiatric illness

**4262 suicides who were born in Denmark in 1952 or later
and 80,238 matched controls**

Table 4. The number of relatives identified for 4262 cases and 80238 controls and the information of suicide and psychiatric admission among these relatives

	Total Number		Suicide (%)		Psychiatric admission (%)	
	Cases	Controls	Cases	Controls	Cases	Controls
Mother	3617	68211	52 (1.4)	279 (0.4)	551 (15.2)	4733 (6.9)
Father	3360	65438	78 (2.3)	528 (0.8)	323 (9.6)	3387 (5.2)
Siblings	5920	107133	31 (0.5)	160 (0.2)	361 (6.1)	3067 (2.9)
All relatives	12897	240782	161 (1.3)	967 (0.4)	1235 (9.6)	11187 (4.7)

Table 5. Odds ratios (95% CIs) derived from the full analysis ‡ for the total subjects, people with and without a history of psychiatric admission, respectively.

Variables	Total subjects	People never admitted	People ever admitted
Mother			
Never admitted and not suicide	1	1	1
Never admitted but suicide	1.8 (0.9-3.8)	2.1 (0.9-5.0)	1.2 (0.4-4.3)
Ever admitted but not suicide	*1.5 (1.3-1.7)	*1.7 (1.4-1.9)	1.2 (1.0-1.5)
Ever admitted and suicide	*3.4 (2.2-5.2)	*3.2 (1.9-5.5)	*3.1 (1.5-6.7)
No reference to mother	1.0 (0.8-1.1)	0.9 (0.7-1.1)	1.0 (0.8-1.3)
Father			
Never admitted and not suicide	1	1	1
Never admitted but suicide	*2.1 (1.4-3.0)	*2.5 (1.6-3.8)	1.4 (0.6-3.0)
Ever admitted but not suicide	1.1 (1.0-1.3)	*1.3 (1.1-1.6)	0.9 (0.7-1.1)
Ever admitted and suicide	*2.0 (1.3-3.2)	*2.3 (1.3-4.0)	1.7 (0.9-3.5)
No reference to father	1.1 (1.0-1.3)	*1.3 (1.1-1.6)	0.9 (0.7-1.1)
Siblings			
None admitted or suicide	1	1	1
None admitted but ≥ 1 suicide	*2.6 (1.3-5.0)	*3.6 (1.8-7.2)	0.9 (0.2-3.4)
≥ 1 admitted but none suicide	1.1 (1.0-1.3)	*1.5 (1.2-1.8)	#0.8 (0.6-1.0)
≥ 1 admitted and ≥ 1 suicide	*2.5 (1.3-5.0)	2.3 (0.9-5.9)	2.5 (0.9-7.2)
No reference to siblings	*1.1 (1.0-1.3)	#1.1 (1.0-1.3)	1.1 (1.0-1.4)

*: $P < 0.01$; #: $P < 0.05$. ‡: Adjusted for marital status, being a parent of a young child, labour market status, annual income, place of residence and sickness absence from work as well as age, gender and calendar time through matching.

Table 6. Odds ratios (95% CIs) derived from the full analysis[‡] using the combined data in table 5

Variables	Total subjects	People never admitted	People ever admitted
All relatives[§]			
None admitted or suicide	1	1	1
None admitted but ≥ 1 suicide	*2.6 (1.8-3.6)	*2.7 (1.8-3.9)	#2.4 (1.1-5.1)
1 admitted but none suicide	*1.3 (1.2-1.5)	*1.6 (1.4-1.8)	0.9 (0.8-1.1)
1 admitted and ≥ 1 suicide	*2.7 (2.0-3.7)	*2.9 (2.0-4.2)	*2.1 (1.2-3.7)
≥ 2 admitted but none suicide	*1.5 (1.2-1.8)	*2.0 (1.5-2.6)	1.0 (0.7-1.3)
≥ 2 admitted and ≥ 1 suicide	*2.6 (1.6-4.1)	*4.7 (2.5-8.9)	1.5 (0.8-2.8)

*: P<0.01; #: P<0.05.

[‡]: Adjusted for marital status, being a parent of a young child, labour market status, annual income, place of residence and sickness absence from work as well as age, gender and calendar time through matching.

[§]: Using the combined data of relatives listed in the table 5. The results were adjusted for the number of available relatives also.

Results (4)

The impact of parental status on the risk of completed suicide

18,611 suicides aged 18-75 years and 372,220 matched controls

Table 7. Odds ratios (95% CIs) derived from the joint analysis[‡] for the males and the females separately

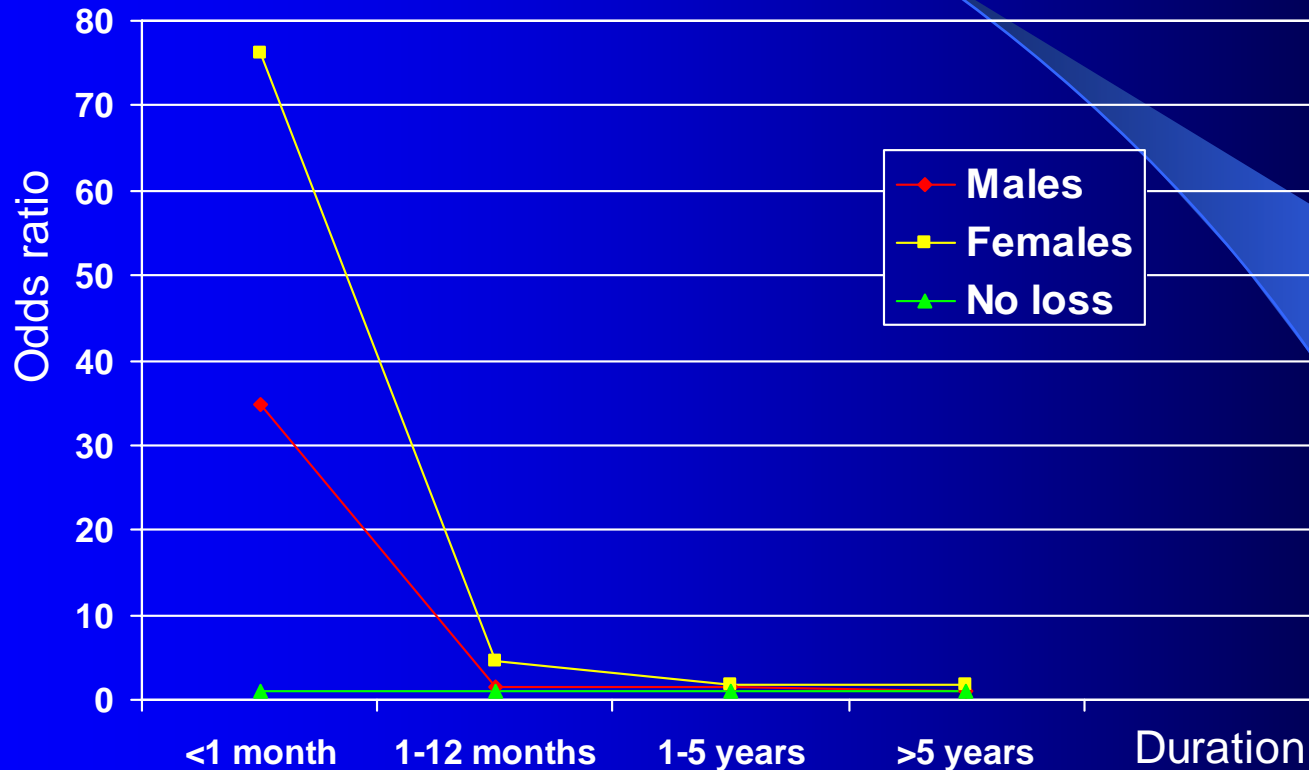
Variables	Males	Females
Number of children		
No child [§]	1	1
1 child	1.06 (1.0-1.1)	1.02 (0.9-1.1)
2 children	1.03 (0.9-1.1)	0.97 (0.9-1.1)
3-4 children	0.98 (0.9-1.1)	*0.84 (0.7-1.0)
5 or more children	0.86 (0.7-1.1)	*0.62 (0.4-0.9)
Age of the youngest child		
>18 years old	1	1
7-18 years old	*1.12 (1.0-1.2)	*0.76 (0.7-0.9)
4-6 years old	1.05 (0.9-1.2)	*0.66 (0.5-0.8)
2-3 years old	1.06 (0.9-1.2)	*0.42 (0.3-0.6)
< 2 years old	*0.74 (0.6-0.8)	*0.32 (0.2-0.4)
Psychiatric illness in children		
No child admitted	1	1
1 child ever admitted	*1.22 (1.1-1.4)	1.08 (0.9-1.3)
2+ children admitted	#1.54 (1.0-2.4)	1.40 (0.8-2.6)
Deaths in children		
No child dead	1	1
Death of a child < 1 year old	1.15 (0.7-1.8)	*2.64 (1.4-5.0)
Death of a child aged 1-6 years	*5.18 (3.2-8.4)	*4.70 (2.1-10.4)
Death of a child aged 7-17 years	*2.17 (1.3-3.5)	*3.85 (2.0-7.4)
Non-suicidal death of a child aged 18+	#1.40 (1.0-1.9)	1.35 (0.8-2.2)
Suicidal death of a child aged 18+	#1.90 (1.1-3.2)	*3.47 (2.1-5.8)

[‡]: Adjusted for marital status, labour market status, annual income, place of residence, ethnicity, sickness absence from work and psychiatric status as well as age, gender and calendar time through matching.

*: P<0.01;

#: P<0.05.

Fig.: Odds ratio of suicide in relation to the time since losing a child



Adjusted for the number of children as well as all other variables in the full model.

Discussion (1)

The use of registers

- **Main advantages:**
 - Strong statistical power
 - Low risk of differential misclassification bias
 - Precise data

- **Shortcomings:**
 - Information in the registers is limited
 - Poor records on some variables

Discussion (2)

The nested case-control design

- To avoid the computational burden associated with a large sample and time-dependent explanatory variables;
- To estimate the precise influence of time-dependent variables;
- To reduce confounding from time-dependent background factors.

Discussion (5)

Implications

- It is important to assess the impacts of a number of factors as socioeconomic status, health condition and family history while assessing individuals at the risk of suicide;
- Mental illness should be a focus for preventive interventions and assessment of these interventions;
- The improvement of health-service care for the general population and maintaining care beyond the point of clinical recovery would be important in protecting high-risk individuals;
- Familial and social support is necessary and very important for people, e.g., recently bereaved from losing a child;
- Strategies of improving social cohesion to make suicide less likely might well have some impact on reducing suicide rates;
- Both population-based and high-risk prevention strategies should take gender differences in risk factors into account, and the effects of interventions may differ, e.g., by gender.

Discussion (6)

Limitations in the author's studies

- Some desirable variables were absent in these studies, e.g., previous suicide attempt, physical illness, etc.;
- Failure to get data updated to the exact date of suicide might weaken the demonstration of the importance on relevant factors;
- The data concerning psychiatric history and family history were only available for a relatively long period but not a lifetime;
- Some variables as substance misuse, links to the first-degree relatives, might be poorly recorded in the source registers.

Discussion (7)

Suggestions for future research

- Large-scale investigations from other countries are needed to draw a global picture of the joint impact of risk factors for suicide;
- The similarities and differences of risk factors for suicide in people at different age groups, or in patients with different psychiatric diagnoses have not been investigated;
- Interactions between a number of risk factors, such as marital status, labour market status, physical illness, psychiatric illness, are still poorly understood;
- Denmark has experienced a marked decrease of suicide mortality since 1980s, hence, further research is required to address explanations for this decrease as well as changes of risk factors contributing to suicide during this period.

Thank you

