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# **Socio-economic differences in suicide risk vary by sex : A population-based case-control study of 18-65 year olds in Denmark\***

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## **Abstract**

The objective of this paper was to investigate variations in the risk of suicide by socioeconomic status/position (SES) for men and women. Data on 15,648 suicide deaths between 18-65 year old men and women over the period 1981-1997 were linked to data on SES indicators, using a nested case control design. Cox's proportional hazard regression models were fitted separately for men and women. The results showed that suicide, in both men and women aged 18 to 65 years, is strongly associated with a range of commonly measured indicators of SES, and that the association does vary by sex even after adjusting for these SES measures simultaneously and controlling for the effect of health status. Low economic status, measured as low income, unskilled blue-collar work, unspecific wage work and unemployment, tends to increase suicide risk more prominently in men than in women; marital status seems to have a comparable influence on suicide risk in the both sexes and the risk is significantly higher among the singlers; parenthood is protective against suicide and the protective effect is statistically stronger for women; living in a big city tends to raise suicide risk for women but reduce the risk for men; Foreign citizens living in Denmark have a lower risk for suicide compared with Danish dwellers but the reduced risk is mainly confined to male immigrants. Our findings reflect the reality of the SES distribution of suicide risk, and underscore the importance and necessity of taking sex, various SES proxies and health factors into consideration mutually and simultaneously for a better understanding of this association.

**Keywords:** Suicide risk; Socioeconomic status; Sex differences; Population study.

**JEL classification:** I00.

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## **1. Introduction**

Since Durkheim (1951) noted the association between social relationships and suicide in the 1800s, the effects of socioeconomic factors on health and well being have attracted scholarly interest. An extensive body of literature has consistently documented an inverse relationship between mortality and socioeconomic status/position (SES) indicating a lower mortality among those of higher SES, regardless of the socioeconomic indicator employed and the specific cause of death studied (Mackenbach, Kunst, Cavelaars, Groenhouf, & Geurts, 1997; Houweling, Kunst, & Mackenbach, 2001; Gregorio, Walsh, & Paturzo, 1997; Fuhrer et al., 2002; Cubbin, LeClere, & Smith, 2000). Suicide, as a leading cause of death among young and middle age adults, is not only a personal tragedy but also results in a serious loss of human capital and productive assets to society. Previous research has demonstrated that suicide is highly associated with a number of individual social and economic factors such as income (Agerbo, Qin, & Mortensen, 2006; Qin, Agerbo, & Mortensen, 2003), unemployment (Agerbo, 2003; Blakely, Collings, & Atkinson, 2003; Lewis & Sloggett, 1998; Platt & Hawton, 2000; Qin et al., 2003), ethnicity (Johansson, Sundquist, Johansson, Qvist, & Bergman, 1997b; Qin et al., 2003; Sundaram, Qin, & Zollner, 2006), marital status (Heikkinen, Isometsa, Marttunen, Aro, & Lonnqvist, 1995; Johansson et al., 1997b) and (Qin et al., 2003)childbearing (Hoyer & Lund, 1993; Qin & Mortensen, 2003) as well as place of residence (Johansson et al., 1997b; Qin et al., 2003; Middleton, Gunnell, Frankel, Whitley, & Dorling, 2003; Qin, 2005).

It is likely that the link between socioeconomic factors and suicide is multi-factorial and therefore complex. At the individual level, SES implies a differential exposure to physical, psychological, environmental, and occupational factors; differences in access to health care, quality of life; and different lifestyles, all of which have a potential impact on suicide risk

(Smith, Hart, Blane, Gillis, & Hawthorne, 1997). Proxies for SES often considered in suicide research include variables like income, education, marriage, employment and occupational status (Agerbo et al., 2006; Qin et al., 2003; Lewis et al., 1998; Johansson et al., 1997b; Platt et al., 2000; Sundaram et al., 2006; Blakely et al., 2003). These proxies all represent different elements of the broad domain of social status and access to resources; however, few studies have estimated the relative importance of these elements by accounting for them simultaneously.

Furthermore, men and women have different roles in family and society, and the elements of SES are differentially distributed by gender. A number of studies have investigated the impact of sex on the association of SES with suicide, using both individual and population data (Johansson et al., 1997b; Platt et al., 2000; Qin et al., 2003). However, the results are mixed, probably due to differences in sample size, the nature of controls, and the SES measures used. More research using empirical data from a large scale population is therefore needed to stress the sex differences in the association between SES and suicide.

In the present study we use the rich data of the Danish population longitudinal registers to investigate the impact of a range of SES elements on risk of suicide among 18-65 year old men and women, a group of persons who are mostly active in labor market, and moreover to explore their influence differences by sex.

## **2. Methods**

### ***Setting, design and subjects***

This study uses a nested case control design (Clayton & Hills, 1993) based upon the entire national population of Denmark. Data were derived from four Danish longitudinal registers that

cover the whole Danish population. The Danish Cause-of-Death Registry (Juel & Helweg-Larsen, 1999) contains dates and causes of all deaths in Denmark recorded from the Cause of Death Certificates for suicide since 1970. The *Integrated Database for Labour Market Research* (IDA Database) (Danmarks Statistik, 1991) contains detailed information on labour market conditions and socio-demographic data for all individuals living in Denmark and is updated annually with information from administrative registers since 1980. The *Danish Psychiatric Central Register* (Munk-Jorgensen & Mortensen, 1997) covers all psychiatric facilities in Denmark and cumulatively records all personal contacts with psychiatric hospitals with computerized data since 1969. Finally, the Danish Civil Registration System (Pedersen, Gotzsche, Moller, & Mortensen, 2006) contains the unique personal identification number known as the CPR-number for all people living in Denmark, their birth information, and links to parents. The personal identification (CPR-number) is used in all national registers and can be automatically checked for errors, making linkage of personal data across registers almost 100% correct (Pedersen et al., 2006). In the present study, we used the personal identification of each study subject as a key to retrieve and link personal information from various register databases.

We obtained all completed suicides during the years 1981 through 1997 from the Danish Cause-of-Death Registry, collected from the death certificates and coded according to the International Classification of Diseases (ICD), using E950-959 in ICD-8 (World Health Organization, 1967) before 1994, and using X60-X84 in ICD-10 (World Health Organization, 1992) thereafter. We restricted study cases to those who died from suicide while aged between 18 to 65 years and who were living in Denmark on the 31 December in the year before the year of suicide. People in this group represent the socio-economically active part of the population, and had complete information on SES in the IDA database for that previous year. The final sample of cases

comprised 10,438 men and 5,210 women, accounting for almost all (99.8%) suicides in this age band during the study period.

Population controls were drawn from a 5% random sub-sample of the total population in the IDA database. Each index suicide case was matched with 20 individuals who were alive at the time of the index suicide and who were of the same age and sex as the index suicide case. Using this procedure, 208,760 male and 104,200 female population controls were included in the study.

### *Variables*

In order to capture the multiple elements of SES, we used six variables as proxies. These were: occupation and labour market status, gross annual income, citizenship status, place of residence, marital status and parenthood status. Individual information on all these variables was drawn from the IDA Database based upon the records in the last week of November in the year before the year of suicide.

We used the Statistics Denmark classification of occupation and labour market status (Danmarks Statistik, 1991). It was grouped into 11 mutually exclusive categories: (1) top or high-level manager (manager, superior salaried employee), (2) low level manager (head of salaried staff), (3) ordinary salaried employee, (4) skilled blue-collar worker, (5) unskilled blue-collar worker, (6) unspecified wage worker, (7) self-employed, (8) unemployed (receiving unemployment benefits and active in job searching), (9) Full-time student, (10) out of labour force (e.g., housewives) and (11) disability or early age pensioner. We chose the ordinary salaried employee group as the reference category.

Gross annual income includes wages, pensions, unemployment benefit, social security benefits and bank interest during the calendar year. It was categorized into four equal size groups in quartiles according to its yearly 5-year age-sex distribution in the population in Denmark.

Marital status was categorized as married, cohabiting (defined as living in the same address with a partner of opposite sex with an age difference less than 15 years), and single.

Parenthood status is intended to capture family structure according to the age of the youngest children. Dummy variables were generated for parent of a child < 2 years, 2-3 years old, and 4-6 years old according to the age of the youngest children, or having no young children.

Citizenship is measured as a dummy variable indicating if a person is a Danish citizen or not.

The variable of residence place was constructed by splitting the country into three main areas: the capital area (the Copenhagen and Frederiksberg municipalities and its suburbs); large cities (those with more than 100,000 inhabitants); and other areas (the rest of areas).

To control for confounding effect of health status, we also constructed two additional variables. These were a dichotomous variable indicating if a person had a sickness-related absence from work (i.e. absence for more than three consecutive weeks due to illness), and a variable demonstrating history of psychiatric hospitalization (never admitted, admitted within last one year, or admitted more than one year ago). Data on sickness absence from job was obtained from the IDA Database upon the record of last year as for the SES variables; while data on psychiatric

history was derived from the Danish Psychiatric Central Register and updated to the time of suicide or matching.

### ***Statistical Analysis***

We used a conditional logistic regression model to estimate the associations between SES and suicide mortality for men and women separately (Clayton et al., 1993). We reported all coefficients in the form of odds ratios (OR) together with their 95% confidence intervals (CI). Because of the rarity of suicide and the method of sampling sex-age-matched controls from individuals at risk for suicide at the time, the estimated odds ratios can be interpreted equivalently to incidence risk ratios. Conditional logistic regression analyses were carried out by using the *PHREG* procedure available within SAS statistical package version 8 (SAS Institute Inc., 1999). Crude odds ratios were derived from univariate analyses only controlling for age and calendar time through matching. Adjusted odds ratios were derived from the full model including all study variables and the two health-related variables. To verify that sex differences in the association between SES and suicide were not due to chance, a likelihood ratio test was additionally performed to examine the interaction between sex and study variables based on the full model.

### **3. Results**

During the study period of 1981 through 1997, 10,438 men and 5,210 women aged between 18 to 65 years inclusive died by suicide in Denmark. Table 1 shows the raw distribution of their social and economic status. Compared with population controls, a higher proportion of both men and women who died by suicide had jobs with low skill requirements, or were unemployed, not in the labor force, or recipients of age or disability pensions, and to have a low income. They



were more commonly single and with no young children and residing in the capital or big cities. Table 1 also shows the risk for suicide associated with these factors derived from conditional logistic regression analyses for men and women separately.

The association between occupation and labour market affiliation and suicide varied by sex ( $p < 0.001$ ). Compared with salaried employees, the reference group, suicide risk was significantly higher for both men and women who were unemployed, self-employed, full-time students, out of the labor market or pensioners due to early retirement or disability. In all labour market groups, the risk of suicide tended to decrease after further adjustment for other socioeconomic variables and health status, but for both sexes it remained significantly higher for those unemployed, or on an age or disability pension. Among women, it remained higher for the self-employed. Both male and female unspecified wage workers were at a significantly elevated risk for suicide, with this risk almost unchanged after controlling for other socioeconomic factors and health status. In the unskilled blue-collar category only males showed a significantly higher risk of suicide compared with their salaried counterparts. Men in managerial roles had significantly reduced risk for suicide; while among women a tendency to increased risk was rendered statistically non-significant after adjustment for additional factors.

Table 1. Distribution of study variables among suicide cases and population live controls as well as risk of suicide associated with social and economic status (SES) for men and women aged 18-65 years in Denmark

SES Variables	Number (%)				Risk for suicide				Test of sex interaction <sup>§</sup>
	Men		Women		Crude odds ratio (95% CI) <sup>†</sup>		Adjusted odds ratio (95% CI) <sup>‡</sup>		
	Cases (n=10 438)	Controls (n=208 760)	Cases (n=5 210)	Controls (n=104 200)	Men	Women	Men	Women	
<b>Occupation and labor market status</b>									
Salaried employee	91 (7.5)	3 166 (11.0)	32 (14.0)	4 609 (23.5)	1 reference	1 reference	1 reference	1 reference	X <sup>2</sup> =115.4, P<0.001
Top or high level manager	48 (5.2)	4 136 (11.5)	09 (2.1)	042 (2.9)	0.6 (0.6-0.7)*	1.2 (1.0-1.5) <sup>#</sup>	0.7 (0.6-0.8)*	1.1 (0.8-1.4)	
Low-level manager	90 (5.6)	3 061 (11.0)	67 (7.0)	0 412 (9.9)	0.7 (0.6-0.8)*	1.2 (1.1-1.4)*	0.8 (0.7-0.9)*	1.1 (0.9-1.2)	
Skilled blue-collar worker	053 (10.0)	3 321 (15.8)	8 (1.1)	853 (1.8)	0.9 (0.8-1.0) <sup>#</sup>	1.1 (0.8-1.4)	0.9 (0.8-1.0) <sup>#</sup>	1.1 (0.8-1.5)	
Unskilled blue-collar worker	488 (14.1)	3 279 (15.8)	78 (9.1)	7 533 (16.7)	1.3 (1.2-1.4)*	1.0 (0.8-1.1)	1.2 (1.1-1.3)*	0.9 (0.8-1.0)	
Unspecified wage worker	49 (7.1)	293 (3.5)	53 (6.7)	074 (8.7)	3.5 (3.1-3.9)*	1.5 (1.3-1.7)*	2.7 (2.4-3.1)*	1.6 (1.3-1.8)*	
Self-employed	059 (10.1)	5 002 (11.9)	40 (2.7)	518 (3.4)	1.3 (1.1-1.4)*	1.5 (1.2-1.8)*	1.1 (0.9-1.2)	1.2 (1.0-1.5)*	
Unemployed	126 (10.7)	3 806 (6.6)	72 (7.1)	614 (6.3)	2.4 (2.2-2.6)*	1.9 (1.7-2.2)*	1.3 (1.2-1.5)*	1.2 (1.0-1.4) <sup>#</sup>	
Full-time student	10 (2.0)	796 (1.8)	8 (1.9)	583 (1.5)	2.1 (1.8-2.5)*	2.0 (1.5-2.6)*	1.0 (0.8-1.3)	1.1 (0.8-1.5)	
Out of labor force	118 (10.6)	154 (3.9)	66 (18.4)	3 458 (12.8)	4.4 (4.0-4.9)*	3.0 (2.7-3.3)*	1.0 (0.8-1.1)	1.0 (0.8-1.2)	
Age and disability pensioner	793 (17.0)	5 486 (7.4)	569 (29.9)	3 144 (12.5)	4.4 (4.1-4.9)*	6.7 (6.0-7.4)*	1.4 (1.2-1.5)*	1.9 (1.6-2.2)*	
<b>Gross income</b>									
Highest income quartile	616 (15.5)	586 (3.2)	30 (17.8)	1 561 (11.1)	1 reference	1 reference	1 reference	1 reference	X <sup>2</sup> =67.7, P<0.001
Second highest income quartile	961 (37.9)	25 233 (60.0)	18 (15.7)	1 517 (20.6)	1.9 (1.8-2.0)*	1.0 (0.9-1.1)	1.0 (0.9-1.0)	0.8 (0.7-0.9)*	
Second lowest income quartile	867 (27.5)	1 658 (24.7)	661 (31.9)	4 641 (42.8)	3.0 (2.8-3.2)*	1.9 (1.8-2.1)*	0.8 (0.8-0.9)*	0.7 (0.6-0.8)*	
Lowest income quartile	994 (19.1)	5 283 (12.1)	801 (34.6)	6 481 (25.4)	9.6 (8.9-10.2)*	2.3 (2.1-2.6)*	3.8 (3.4-4.2)*	1.7 (1.5-2.1)*	

<b>Marital status</b>									
Married	702 (35.5)	22 634 (58.7)	135 (41.0)	7 910 (65.2)	1 reference	1 reference	1 reference	1 reference	X <sup>2</sup> =4.3, P=0.118
Cohabiting	90 (9.5)	4 089 (11.5)	26 (8.2)	937 (8.6)	1.6 (1.5-1.8)*	1.7 (1.5-1.9)*	1.3 (1.2-1.4)*	1.2 (1.1-1.4)*	
Single	746 (55.0)	2 037 (29.7)	649 (50.8)	7 353 (26.2)	3.7 (3.6-3.9)*	3.3 (3.1-3.5)*	1.8 (1.7-1.9)*	1.7 (1.5-1.8)*	
<b>Parenthood</b>									
No young child	150 (87.7)	72 785 (82.8)	868 (93.4)	1 678 (88.0)	1 reference	1 reference	1 reference	1 reference	X <sup>2</sup> =44.5, P<0.001
Child less than 2 years old	33 (3.3)	22 227 (5.9)	3 (1.6)	875 (3.7)	0.5 (0.5-0.6)*	0.4 (0.3-0.5)*	0.7 (0.6-0.8)*	0.4 (0.3-0.6)*	
Child 2-3 years old	05 (3.9)	0 404 (5.0)	5 (1.4)	617 (3.5)	0.7 (0.7-0.8)*	0.4 (0.3-0.5)*	1.1 (0.9-1.2)	0.5 (0.4-0.7)*	
Child 4-6 years old	50 (5.3)	3 344 (6.4)	84 (3.5)	030 (4.8)	0.7 (0.7-0.8)*	0.6 (0.5-0.7)*	1.0 (0.9-1.1)	0.8 (0.7-0.9) <sup>#</sup>	
<b>Place of residence</b>									
Other than large city or capital area	523 (62.5)	37 373 (65.8)	919 (56.0)	7 712 (65.0)	1 reference	1 reference	1 reference	1 reference	X <sup>2</sup> =30.6, P<0.001
Large city	122 (10.7)	3 894 (11.4)	52 (12.5)	1 831 (11.3)	1.0 (0.9-1.1)	1.3 (1.2-1.4)*	0.8 (0.8-0.9)*	1.2 (1.0-1.3)*	
Capital area	793 (26.8)	7 493 (22.7)	639 (31.5)	4 657 (23.7)	1.2 (1.2-1.3)*	1.5 (1.4-1.6)*	0.9 (0.9-1.0)*	1.1 (1.0-1.2) <sup>#</sup>	
<b>Ethnicity</b>									
Danish-citizenship	02 220 (97.9)	03 194 (97.3)	105 (98.0)	01 899 (97.8)	1 reference	1 reference	1 reference	1 reference	X <sup>2</sup> =12.4, P<0.001
Non-Danish citizenship	18 (2.1)	566 (2.7)	05 (2.0)	311 (2.2)	0.8 (0.7-0.9)*	0.9 (0.7-1.1)	0.6 (0.5-0.7)*	1.1 (0.8-1.3)	

<sup>#</sup>: p<0.05; \* : p<0.01.

<sup>†</sup>: Crude odds ratios were adjusted for sex, age and calendar time through matching.

<sup>‡</sup>: Adjusted odds ratios were further adjusted for physical and mental health status and all variables in the table simultaneously.

<sup>§</sup>: Test of sex interaction with each variable in the table was examined with likelihood ratio test.

Suicide risk increased progressively with decreasing income in both men and women. However, when controlling for additional factors, the association of suicide risk with level of income suggested a U shape, with people in the lowest income quartile having the highest risk and those in the middle groups having risk lower or equivalent to that of the highest (reference) income group. The general influence of income on suicide differed significantly by sex (sex interaction test:  $p < 0.001$ ). The elevated risk associated with lowest quartile income was particularly dominant among men while the reduced risk associated with a middle level income was more prominent among women.

The effect of marital status did not vary by sex (sex interaction test:  $p = 0.118$ ), but those who were single or cohabiting had elevated risk, with a tendency of progressively increased risk along with the status of being married, living with a partner (cohabiting) and living alone as a single.

Parenting a young child was protective against suicide and its effect was significantly stronger among women than among men (sex interaction test:  $p < 0.001$ ), with the protective effect for women diminishing with increasing age of the child. For men, the protective effect remained significant only for fathers having a child under 2 years old.

Compared with people living in rural areas, those living in urbanized areas are at a higher risk for suicide for both men and women, with a progressively increased risk with increasing degree of urbanicity of dwelling. However, after adjusting for other socioeconomic and health related factors the excess risk was eliminated in women, and even reversed for men (sex interaction test:  $p < 0.001$ ).

Living in Denmark as a non-Danish citizen appeared to lower risk for suicide compared with counterparts with Danish citizenship. However, after adjusting data for other factors, the reduced risk remained significant only in men (sex interaction test:  $p < 0.001$ ).

#### **4. Discussion**

This nested case control study based on a national sample of deaths by suicide accumulated over 16 years is among the largest in terms of number of suicide deaths (cases) and variables examined. We have shown that suicide, in both men and women aged 18 to 65 years, is strongly associated with a range of commonly measured indicators of SES, and that the association does vary by sex even after adjusting for these SES measures simultaneously and controlling for the effect of health status. Low economic status, measured as low income, unskilled blue-collar work, unspecific wage work and unemployment, tends to increase suicide risk more prominently in men than in women; marital status seems to have a comparable influence on suicide risk in the both sexes and the risk is significantly higher among the singlers; parenthood is protective against suicide and the protective effect is statistically stronger for women; living in a big city tends to raise suicide risk for women but reduce the risk for men; Foreign citizens living in Denmark have a lower risk for suicide compared with Danish dwellers but the reduced risk is mainly confined to male immigrants.

Our finding of a positive gradient between male suicide risk and movement from high to low SES, especially by labour market status, is consistent with a number of other studies (e.g., (Blakely et al., 2003; Page, Morrell, & Taylor, 2002; Platt et al., 2000; Taylor, Morrell, Slaytor, & Ford, 1998). However, these (and similar) studies are unable to control for the potential

confounding effect of mental illness, which is known to be strongly causally associated with suicide (Qin & Nordentoft, 2005; Beautrais et al., 2007) and is also associated with lower SES and reduced labour market participation. We believe our unique ability to control for the effect of mental or other illness severe enough to cause significant sickness, absence from work, and mental illness requiring hospitalisation, and a range of other SES variables, confirms this association. In particular, low income is associated with a greater burden of risk for men than women, as is being an unspecified wage worker. Men in the unspecified wage worker class group had an almost three-fold increased risk of suicide compared to men in the salaried employee (reference) category. Jobs included in this category are normally spouse assistance or other assistant jobs with no specification. These jobs are also more likely to be part-time and temporary posts. Such jobs may offer fewer opportunities for development of supportive work relationships, and for many men work usually is an important source of social support. This finding is of interest because it cannot be due to low income alone. It is consistent with findings such as those of the Whitehall studies which have shown that decreased job security and other forms of occupational stress are causally associated with poorer mental health status (Stansfeld, Head, Fuhrer, Wardle, & Cattell, 2003; Cheng, Chen, Chen, & Chiang, 2005; Stansfeld, Fuhrer, Shipley, & Marmot, 1999). Serial cohort data from the New Zealand setting suggests that risk of suicide accumulates in younger men in the context of employment market change to a higher proportion of jobs of a part time, temporary nature and with high unemployment rates (Collings et al 2005), whereas the present study shows that this excess vulnerability exists regardless of age.

Being in a management role or having a skill was protective for men but conferred no advantage on women. The finding for men is consistent with evidence that having extent of control in the

workplace is positively associated with health status (Cheng et al., 2005; Griffin, Fuhrer, Stansfeld, & Marmot, 2002). However, to our awareness, the present study is probably the first one that demonstrates no advantage or even a disadvantage for women in managerial roles, in terms of suicide risk. In Denmark, employees are normally paid according to standard salary scales from the state or unions, meaning that women normally receive the same or comparable payment as men for the same job. Therefore, our primary explanation to this finding is that women may experience more stress in a traditionally male-dominated job position and thus become more suicidal. It may also reflect a selection on personality trait that women in a management role at work are probably more aggressive, independent and self-valued, which may make them reluctant to seek for help when experiencing setbacks or stressful situations.

Overall our results suggest that men may be socially and psychologically more vulnerable than women to the effects of job position, labour market status and income level, in respect of death by suicide. These results support the hypothesis that men respond more strongly to poor economic conditions than women do (Brockington, 2001; Crombie, 1990). The different roles and expectations of men and women in family and society may affect their propensity to commit suicide. Although economic stressors are common to both genders, one could hypothesize that failure in living up to expectations may lead to loss of self-esteem worse in men than women, thus make men more vulnerable to suicide. On the other hand, it is possible that we are observing the uncontrolled effect of mental illness that did not result in hospitalisation or time off work. Although this is plausible given that men are less likely than women to seek help for psychological distress (Beck, Palyo, Canna, Blanchard, & Gudmundsdottir, 2006; Biddle, Gunnell, Sharp, & Donovan, 2004), our findings also reflect the reality of the social distribution of increased risk of suicide.

Interestingly, once a range of SES indicators and health status were controlled for there was no differential effect of marital status by sex. This finding is somehow contrary to the observation in a previous Danish study (Qin et al., 2003), probably because the present study was restricted to subjects of 18 to 65 years only whilst the previous one was of persons at all ages. However, our finding of the progressively increased suicide risk along with the status of being married, living with a partner (cohabiting) and living alone as a single, is consistent with previous studies, regardless of sex and age (Qin, Agerbo, & Mortensen, 2005), and supports the Durkheim's theory of the protective effect of marriage on suicide (Emile Durkheim, 1966). Also, it is widely expected that childbearing is most often a positive life event which may prevent people from ending their life (Adam, 1990; Emile Durkheim, 1966). The presence of a young child may increase parents' feelings of self-worth, possibly based on her/his perception of being needed, which would be especially the case for mothers. Also, there might be a selection-effect that people in a better socioeconomic standard and health are more likely to get a child. These theories may largely explain the finding that parents, especially mothers, to a young child, were less likely to commit suicide, as demonstrated in this study and earlier research (Brockington, 2001; Qin et al., 2005).

Our finding of suicide risk increasing with the degree of urbanicity of dwelling in the crude analysis is concordant with some studies from Western countries reporting that people living in large urban areas were at an increased risk of suicide (Heikkinen et al. 1994; Johansson et al. 1997; Micciolo, Williams, Zimmermann-Tansella, & Tansella, 1991; Middleton et al., 2003). However, when further adjusted for other SES measures and health status, the excess risk associated urban dwelling attenuated obviously but remained significantly in women, however,



it became reversed in men. These findings suggest that the gradient of urban-rural suicide could, to a large extent, be accounted for by the urban-rural disparities of other SES factors and, in particular, psychiatric problems which are generally worse among city dwellers (McGrath et al., 2004; Sundquist, Frank, & Sundquist, 2004). Once the effect of those factors are controlled for, living in big cities may entail, for example, better job opportunities and career potentials, which often benefit men more whereas women may be more vulnerable in a competitive environment than their male counterparts. Such explanation may apply in particular to young and middle age adults, the socio-economically active part of the population.

Contrary to other reports, e.g., a Swedish study by Johansson et al. (Johansson et al., 1997a), the present study showed a generally lower risk for suicide among individuals living in Denmark with a foreign citizenship although this observation confined to male immigrants only, when controlling for the effect of other SES measures and health factors. Denmark is generally a non-immigrant country, only 5.45% of the total residents are foreign citizens, and most of them are youth or middle age adults (Danmarks Statistik, 2008). These people come to Denmark normally because of a job offer, study opportunity, family visiting, or as a refugee. Our observation of the reduced risk for suicide among those foreign citizens aged 18 to 65 years as well as the observed sex differences may, to a large extent, reflect a selection as who are able to come to Denmark and what are the purposes of staying there. It is likely that men immigrated to Denmark often for the purpose of work or business rather than marriage as for women, so they are more independent and have better contacts to other people and social network. The fact that a relatively large proportion of immigrants came from Islamic countries where suicide rates traditionally are low may also contribute to our findings.

The social economic environment in Denmark is similar to other Scandinavian countries, and would probably also be comparable to most Western European countries. However, one should be cautious when generalizing the results from the present study to other countries with different social, economic or cultural conditions. At the same time, there are a number of limitations existing in this study. For instance, the measure of SES used in this study does cover a range, but not all, relevant aspects of an individual's location in the socioeconomic system, and individuals in the analysis were assigned a social class based on their own socioeconomic status rather than their head of household's SES or through a dominance approach. Also, the present work does not include socioeconomic factors that operate at the neighborhood and higher levels in the analyses. Nevertheless, this large population study provides strong evidence on suicide risk in relation to a range of commonly measured indicators of SES, as well as their effect differences by sex. The results demonstrate that the strength of the association and its direction varies a lot when looking at different elements of the broad domain of socioeconomic status, suggesting the necessity of including various SES proxies and health factors into consideration mutually and simultaneously for a better understanding of this association. The findings also underline the importance of stratifying SES by sex, suggesting that prevention strategies should be differently articulated for men and women.

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