

Research

JAMA Psychiatry | [Original Investigation](#)

Association Between Spousal Suicide and Mental, Physical, and Social Health Outcomes

A Longitudinal and Nationwide Register-Based Study

Annette Erlangsen, PhD; Bo Runeson, MD, PhD; James M. Bolton, MD; Holly C. Wilcox, PhD; Julie L Forman, PhD; Jesper Krogh, DMSc; M. Katherine Shear, MD; Merete Nordentoft, DMSc; Yeates Conwell, MD

[← Editorial](#)

[+ Supplemental content](#)

IMPORTANCE Bereavement after spousal suicide has been linked to mental disorders; however, a comprehensive assessment of the effect of spousal suicide is needed.

OBJECTIVE To determine whether bereavement after spousal suicide was linked to an excessive risk of mental, physical, and social health outcomes when compared with the general population and spouses bereaved by other manners.

DESIGN, SETTING, AND PARTICIPANTS This nationwide, register-based cohort study conducted in Denmark of 6.7 million individuals aged 18 years and older from 1980 to 2014 covered more than 136 million person-years and compared people bereaved by spousal suicide with the general population and people bereaved by other manners of death. Incidence rate ratios were calculated using Poisson regressions while adjusting for sociodemographic characteristics and the presence of mental and physical disorders.

MAIN OUTCOMES AND MEASURES Mental disorders (any disorder, mood, posttraumatic stress disorder, anxiety, alcohol use disorders, drug use disorders, and self-harm); physical disorders (cancers, diabetes, sleep disorder, cardiovascular diseases, chronic lower respiratory tract diseases, liver cirrhosis, and spinal disc herniation); causes of mortality (all-cause, natural, unintentional, suicide, and homicide); social health outcomes; and health care use.

RESULTS The total study population included 3 491 939 men, 4814 of whom were bereaved by spousal suicide, and 3 514 959 women, 10 793 of whom were bereaved by spousal suicide. Spouses bereaved by a partner's suicide had higher risks of developing mental disorders within 5 years of the loss (men: incidence rate ratio, 1.8; 95% CI, 1.6-2.0; women: incidence rate ratio, 1.7; 95% CI, 1.6-1.8) than the general population. Elevated risks for developing physical disorders, such as cirrhosis and sleep disorders, were also noted as well as the use of more municipal support, sick leave benefits, and disability pension funds than the general population. Compared with spouses bereaved by other manners of death, those bereaved by suicide had higher risks for developing mental disorders (men: incidence rate ratio, 1.7; 95% CI, 1.5-1.9; women: incidence rate ratio, 2.0; 95% CI, 1.9-2.2), suicidal behaviors, mortality, and municipal support. Additionally, a higher level of mental health care use was noted.

CONCLUSIONS AND RELEVANCE Exposure to suicide is stressful and affects the bereaved spouse on a broad range of outcomes. The excess risks of mental, physical, and social health outcomes highlight a need for more support directed toward spouses bereaved by suicide.

JAMA Psychiatry. doi:10.1001/jamapsychiatry.2017.0226
Published online March 22, 2017.

Author Affiliations: Author affiliations are listed at the end of this article.

Corresponding Author: Annette Erlangsen, PhD, Research Unit, Mental Health Centre Copenhagen, Kildegaardsvej 28, DK-2900 Hellerup, Denmark (annette.erlangsen@regionh.dk).

Copyright 2017 American Medical Association. All rights reserved.

E1

Each year, more than 800 000 people die by suicide,¹ each person leaving behind up to 60 relatives and friends directly affected.² The emotional response to suicide loss may include shock, denial, anger, guilt, shame, or relief, and complicated grief might arise.^{3,4} Support programs exist but are not broadly available and, to our knowledge, many have not been evaluated.^{5,6}

Stress has been defined as situations in which “environmental demands tax or exceed the adaptive capacity of an organism, resulting in psychological and biological changes that may place persons at risk for disease.”⁷ Psychological stressors, such as bereavement by suicide, might lead to mental disorders such as depression, anxiety, posttraumatic stress disorder (PTSD), and psychosis as well as self-harm and death by suicide.⁸⁻¹³ Assortative mating might further exacerbate the effect of a suicide loss.¹² Through various mechanisms, psychological stress has been linked to physical disorders,^{7,14,15} such as cardiovascular diseases, cancers, infections, type 2 diabetes, sleep disorders, and disorders related to alcohol misuse, such as liver cirrhosis.^{14,16-19} Furthermore, increased health care use and higher risks of mortality have been observed.^{12,20} Studies have linked mental health outcomes to spousal suicide and evidence of an effect on physical and social health outcomes is lacking.^{12,21-23} Also, those bereaved by other causes of sudden death experience mental disorders.²⁴ To our knowledge, however, whether any aspects of loss by suicide are worse than bereavement in general remains unexamined.

The purpose of this study was to examine whether spousal suicide is linked to adverse mental, physical, and social health outcomes when compared with the general population and people bereaved by other manners of death.

Methods

A cohort study design was applied to individual-level data on all people aged 18 years or older living in Denmark during 1980 to 2014 (n = 7 006 898). Data from the following registries were linked using a unique, personal identifier: the Civil Registration System,²⁵ the Cause of Death Registry,²⁶ the Psychiatric Central Research Register,²⁷ the National Hospital Registry,²⁸ and the Registry of Social Pension and Income.²⁹ The unique identifier is assigned at birth or first entry into the country.³⁰ The study was approved by the Danish Data Protection Agency and informed consent was waived.

Exposed

People who died by suicide since 1970 were identified in the Cause of Death Registry using the *International Classification of Diseases, Eighth and Tenth Revision (ICD-8 and ICD-10)*.^{31,32} Data were linked to surviving spouses, defined as those married, cohabiting, or living in a registered partnership as of January 1 of the calendar year when the death took place, to identify those bereaved by suicide.³³

Unexposed

Two comparison groups were formed: (1) the general population consisting of all people in the study population,

Key Points

Question Does the suicide of a spouse affect the health of the surviving partner?

Findings In this nationwide register-based cohort study, an increased risk of mental and physical disorders, mortality, and adverse social events were noted among people bereaved by spousal suicide. Bereavement by suicide differed from bereavement by other manners of death.

Meaning Surviving partners are affected on a broad range of mental, physical, and social health outcomes, suggesting a need for more proactive outreach.

regardless of civil status, who were not bereaved by suicide but could be bereaved by other manners of death (group A) and (2) people bereaved by spousal death because of any other manner who were identified in similar manners as described earlier (group B).

Outcomes

The examined outcomes included mental disorders (any disorder, mood, PTSD, anxiety, alcohol use disorders, drug use disorders, and self-harm); physical disorders (cancers, diabetes, sleep disorders, cardiovascular diseases, chronic lower respiratory tract diseases, liver cirrhosis, and spinal disc herniation); causes of mortality (all causes, natural, unintentional, suicide, and homicide); social health outcomes (divorce, children placed outside the home, a need for municipal family support, sick leave, unemployment, and disability pension); and health care utilization. Detailed specifications of the examined outcomes are listed in eTable 1 in the [Supplement](#).

Diagnoses from the Psychiatric Central Research Register and the National Hospital Registry were used as markers of mental and physical disorders. Additionally, data from the Prescription Registry were assessed to identify people with prescriptions for antidepressants. Causes of death were identified in the Cause of Death register. The examined social outcomes were based on data from municipal records and income registers. Finally, data on health care use were derived from hospital and Health Service registers.

Follow-up

All persons aged 18 years or older on January 1, 1980, were followed up until December 31, 2014. People who later migrated into the country or had their 18th birthday after January 1, 1980, entered the study population on the date of the respective event. People were considered unexposed until the date of their spouse's suicide. Similarly, those bereaved because of other manners of death were included in group B at the date of spousal death. The follow-up period ended at date of the outcome of interest, emigration, death, or the end of the study.

Statistical Analyses

We used a Poisson regression analysis to compare the incidence rates among the exposed relatives with those of groups A and B. Results were expressed as incidence rate ratios (IRRs) with 95% confidence intervals.

Only the first onset of any outcome was considered. Long-term models assessed the effect of spousal suicide from the date of bereavement until the end of observation while models with a 5-year follow-up measured more immediate effects. Multivariate regression models were adjusted for calendar period, country of birth, age, civil status, household income level, presence of chronic physical disorders,³⁴ mental disorders, and self-harm. Time-varying covariates were used while the presence of mental disorders and self-harm were measured at baseline. The unit of measurement was person-days expressed as person-years.

The distribution in risk over time was assessed by calculating Kaplan-Meier survival curves for a subset of outcomes.

The statistical analyses were carried out using SAS version 9.4 (SAS Global).³⁵

Results

The total study population consisted of 3 491 939 men and 3 514 959 women who were observed over 79 050 358 and 81 033 322 person-years, respectively. In all, 4814 men (mean age [SD], 54.0 [14.2]) and 10 793 women (mean age [SD], 49.6 [15.2]) bereaved by a spouse's suicide were followed up over 75 683 and 184 863 person-years.

The general population, group A, was followed up over 79 126 041 person-years for men and 81 218 1853 for women. Group B, people bereaved by spousal deaths other than suicide, covered 251 863 men (mean age [SD], 70.1 [12.8]) and 536 915 women (mean age [SD], 67.9 years [12.1]) observed over 2 285 907 and 6 396 101 person-years, respectively. Characteristics for the participants are detailed in eTable 2 in the [Supplement](#).

Comparison With the General Population (Group A)

Multivariate regressions showed that people bereaved by spousal suicide had an elevated risk of a mental disorder (IRR: men, 1.8; 95% CI, 1.6-2.0; IRR: women, 1.7; 95% CI, 1.6-1.8) when compared with the general population ([Table 1](#) and [2](#)). Excess risks were noted for mood disorders, PTSD, anxiety disorders, alcohol use disorders, drug use disorders, receiving prescriptions for antidepressants, and self-harm.

Those bereaved by spousal suicide had an increased risk of cancer, cirrhosis, and spinal disc herniation. Over the 5-year follow-up, diabetes, cardiovascular diseases, and chronic lower respiratory tract diseases were observed significantly less frequently among those bereaved by suicide. Over the long-term follow-up, increased risks of sleep disorders were noted as well as an increased risk of chronic lower respiratory tract diseases among women.

Among those bereaved by a partner's suicide, men had higher risks of dying by any cause (men: IRR, 1.3; 95% CI, 1.2-1.4; women: IRR, 1.3; 95% CI, 1.2-1.3) and men had higher risks of dying by natural causes (men: IRR, 1.1; 95% CI, 1.0-1.2; women: IRR, 1.0; 95% CI, 0.9-1.1) than the general population. A 6- to 8-fold (men: IRR, 6.4; 95% CI, 5.3-7.8; women: IRR, 8.5; 95% CI, 7.0-10.5) higher risk of suicide was also noted in the first 5 years as well as a higher risk of death by homicide for women, while few events were observed for men.

After a spouse's suicide, people who later remarried were less likely to get a divorce than members of the general population after adjusting for civil status. People bereaved by suicide were more likely to require municipal-directed family support and have a child placed outside the home by authorities. Additionally, extended periods of sick leave from work, unemployment, and the use of disability pensions were observed.

People bereaved by a spouse's suicide were more likely to be admitted to psychiatric hospitals and attend therapy sessions with privately practicing psychologists or psychiatrists. Women bereaved by suicide were less likely to be hospitalized for somatic disorders and see general practitioners.

Comparison With People Bereaved by Other Manners of Death (Group B)

When comparing spouses bereaved by a partner's suicide with spouses bereaved by other outcomes in [Figure 1](#) and [2](#), a higher risk of mental disorders was observed (men: IRR, 1.7; 95% CI, 1.5-1.9; women: IRR, 2.0; 95% CI, 1.8-2.2). There was an excess risk for the following disorders after bereavement by a spouse's suicide: mood disorders (men: IRR, 1.7; 95% CI, 1.4-2.1; women: IRR, 1.3; 95% CI, 1.2-1.5), PTSD (men: IRR, 5.6; 95% CI, 2.7-11.4; women: IRR, 3.6; 95% CI, 2.3-5.5), anxiety (men: IRR, 1.4; 95% CI, 1.0-1.9; women: IRR, 1.1; 95% CI, 0.9-1.3), drug use disorders (men: IRR, 1.4; 95% CI, 1.0-2.1; women: IRR, 1.0; 95% CI, 0.8-1.3), and deliberate self-harm (men: IRR, 1.3; 95% CI, 1.0-1.8; women: IRR, 1.5; 95% CI, 1.2-1.8).

Spousal suicide was linked to a lower risk of spouses receiving a subsequent diagnosis of cancers (men: IRR, 0.8; 95% CI, 0.7-0.9; women: IRR, 0.8; 95% CI, 0.7-0.9), diabetes (men: IRR, 0.6; 95% CI, 0.4-0.7; women: IRR, 0.6; 95% CI, 0.5-0.8), cardiovascular (men: IRR, 0.9; 95% CI, 0.8-0.9; women: IRR, 0.9; 95% CI, 0.8-1.0), and chronic lower respiratory tract disorders (men: IRR, 0.8; 95% CI, 0.7-1.0; women: IRR, 0.7; 95% CI, 0.6-0.8). Those recently bereaved by a spouse's suicide had elevated risks of dying by any cause (men: IRR, 1.2; 95% CI, 1.1-1.3; women: IRR, 1.4; 95% CI, 1.3-1.5), but the risk was accentuated for suicide (men: IRR, 3.5; 95% CI, 2.8-4.3; women: IRR, 4.2; 95% CI, 3.3-5.2) and women faced an increased risk of dying by homicide (IRR, 33.8; 95% CI, 22.0 to 51.8).

While women bereaved by suicide were less likely to get a divorce after remarrying than those bereaved by other disorders (IRR, 0.7; 95% CI, 0.6-0.9), they were somewhat more likely to require municipal intervention (IRR, 1.3; 95% CI, 1.1-1.5). People bereaved by suicide were less likely to take sick leave (men: IRR, 0.8; 95% CI, 0.7-0.9; women: IRR, 0.8; 95% CI, 0.7-0.8) or experience unemployment (men: IRR, 0.9; 95% CI, 0.8-1.0; women: IRR, 0.8; 95% CI, 0.8-0.9).

An increased use of psychiatric in patient care was noted among people bereaved by a spouse's suicide (men: IRR, 1.5; 95% CI, 1.1-2.0; women: IRR, 1.6; 95% CI, 1.3-1.9) as well as 1 or more appointments with private psychiatrists or psychologists (men: IRR, 2.0; 95% CI, 1.5-2.5; women: IRR, 1.7; 95% CI, 1.5-1.9). Somatic hospital use was less for women (IRR, 0.9; 95% CI, 0.8 to 1.0), while men were less likely to see a general practitioner than those bereaved by other manners of death (IRR, 0.9; 95% CI, 0.8-1.0).

Table 1. Men Bereaved by Suicide Compared With the General Population (Group A) in Denmark Aged 18 Years and Over During 1980 to 2014

Outcome	5-y Follow-up						Long-term Follow-up
	Spouses Bereaved by Suicide		General Population		IRR (95% CI)		Adjusted ^a
	No.	IR per 100 000 PY	No.	IR per 100 000 PY	Unadjusted	Adjusted ^a	
Mental disorders^b							
Any mental disorder	243	1163	324 524	437	2.7 (2.3-3.0)	1.8 (1.6-2.0)	1.2 (1.1-1.3)
Mood disorders	101	444	109 563	140	3.2 (2.6-3.8)	2.2 (1.8-2.7)	1.2 (1.1-1.4)
PTSD	10	43	9569	12	3.5 (1.9-6.5)	12.1 (6.4-22.7)	2.6 (1.5-4.6)
Anxiety disorders	35	151	43 623	56	2.7 (2.0-3.8)	2.5 (1.8-3.4)	1.4 (1.1-1.8)
Alcohol use disorder	100	448	175 325	229	2.0 (1.6-2.4)	1.5 (1.2-1.8)	1.4 (1.3-1.6)
Drug use disorder	27	116	65 501	83	1.4 (1.0-2.0)	1.7 (1.2-2.5)	1.5 (1.2-1.8)
Prescribed antidepressants	257	1174	593 486	798	1.5 (1.3-1.7)	1.3 (1.2-1.5)	1.0 (1.0-1.1)
Deliberate self-harm	44	192	52 507	67	2.9 (2.1-3.9)	2.0 (1.5-2.7)	1.6 (1.3-2.0)
Physical disorders							
Cancer ^c	199	878	419 249	543	1.6 (1.4-1.9)	1.2 (1.0-1.4)	1.2 (1.2-1.3)
Diabetes ^c	59	257	194 828	252	1.0 (0.8-1.3)	0.8 (0.6-1.1)	1.0 (1.0-1.2)
Sleep disorder	12	51	54 427	69	0.7 (0.4-1.3)	1.4 (0.8-2.5)	1.4 (1.1-1.7)
Cardiovascular diseases	467	2468	1 076 658	1569	1.6 (1.4-1.7)	1.0 (0.9-1.1)	1.0 (1.0-1.1)
Chronic lower respiratory tract diseases ^c	113	496	245 790	320	1.6 (1.3-1.9)	1.0 (0.8-1.2)	1.1 (1.0-1.1)
Liver cirrhosis ^c	28	120	44 142	56	2.1 (1.5-3.1)	1.6 (1.1-2.3)	1.5 (1.2-1.8)
Spinal disc herniation	62	276	170 396	222	1.2 (1.0-1.6)	1.5 (1.2-1.9)	1.3 (1.1-1.5)
Mortality							
Any death	687	2915	996 735	1260	2.3 (2.1-2.5)	1.3 (1.2-1.4)	1.1 (1.0-1.1)
Natural death	557	2363	930 886	1177	2.0 (1.8-2.2)	1.1 (1.0-1.2)	1.1 (1.0-1.1)
Unintentional	24	102	42 083	53	1.9 (1.3-2.9)	0.7 (0.5-1.1)	0.7 (0.5-0.8)
Suicide	103	437	22 910	29	15.1 (12.4-18.3)	6.4 (5.3-7.8)	3.6 (3.1-4.3)
Homicide	3	13	1883	2	NA	NA	NA
Social and work-related events							
Divorce	35	165	407 837	559	0.3 (0.2-0.4)	0.2 (0.2-0.3)	0.6 (0.6-0.7)
Children placed outside home	84	379	88 654	115	3.3 (2.7-4.1)	3.6 (2.9-4.5)	2.5 (2.1-2.9)
Municipal family support	50	217	84 250	108	2.0 (1.5-2.7)	3.7 (2.8-5.0)	1.8 (1.5-2.2)
Sick leave	411	2202	990 053	1556	1.4 (1.3-1.6)	2.3 (2.1-2.5)	1.5 (1.4-1.6)
Unemployed	357	1990	1 177 152	2061	1.0 (0.9-1.1)	2.1 (1.9-2.3)	1.7 (1.6-1.8)
Disability pension	16	68	19 533	25	2.8 (1.7-4.5)	2.9 (1.8-4.8)	1.8 (1.3-2.6)
Service usage							
Somatic hospitalization	362	1711	640 224	881	1.9 (1.8-2.2)	1.2 (1.0-1.3)	1.0 (1.0-1.1)
Psychiatric hospitalization	47	207	56 159	72	2.9 (2.2-3.8)	2.7 (2.1-3.7)	2.0 (1.6-2.5)
GP contact	730	4407	2 045 002	4211	1.0 (1.0-1.1)	1.1 (1.0-1.1)	1.1 (1.1-1.1)
Psychological/psychiatric therapy	71	306	58 581	75	4.1 (3.2-5.2)	5.8 (4.6-7.4)	2.4 (2.0-2.8)

Abbreviations: GP, general practitioner; IR, incidence rate; IRR, incidence rate ratio; NA, not applicable; PTSD, posttraumatic stress disorder; PY, person-years.

^a Multivariate models were adjusted for calendar period, country of birth, age groups, civil status, household income level, presence of chronic physical disorders (measured using the Charlson Index), previous psychiatric hospitalization, and previous records of self-harm.

^b As a person could have been diagnosed with more than 1 mental disorder, the total number of people with any mental disorders is smaller than the sum of people with specific disorders.

^c The examined physical disorder is included in the Charlson Index, so an adaptation of the Charlson Index without the specific physical disorder was used for the multivariate model.

The Kaplan-Meier plots revealed several group differences between the examined groups (eFigure in the Supplement).

Discussion

To our knowledge, this is the largest and most comprehensive study of spouses bereaved by a partner's suicide. Using nation-

wide data, exposure to spousal suicide was linked to higher risks for developing mental disorders, suicidal behavior, specific physical disorders, any cause of mortality, suicide, dying by homicide, adverse social events, and mental health care use when compared with the general population. Those bereaved by a spouse's suicide were more affected by mental disorders, mortality, select social outcomes, and mental health care use than those bereaved by other manners of death.

Table 2. Women Bereaved by Suicide Compared With the General Population (Group A) in Denmark Aged 18 Years and Over During 1980 to 2014^a

	5-y Follow-up				Long-term Follow-up		
	Spouses Bereaved by Suicide		General Population		IRR (95% CI)		
	No.	IR per 100 000 PY	No.	IR per 100 000 PY	Unadjusted	Adjusted ^a	
Mental disorders^b							
Any psychiatric diagnosis	587	1235	386 846	512	2.4 (2.2-2.6)	1.7 (1.6-1.8)	1.1 (1.0-1.1)
Mood disorders	231	445	184 072	233	1.9 (1.7-2.2)	1.5 (1.3-1.7)	1.1 (1.0-1.1)
PTSD	29	54	9678	12	4.5 (3.1-6.5)	8.7 (6.0-12.5)	2.6 (1.9-3.6)
Anxiety disorders	95	180	87 962	110	1.6 (1.3-2.0)	1.4 (1.1-1.7)	1.1 (1.0-1.2)
Alcohol use disorder	140	266	81 809	102	2.6 (2.2-3.1)	2.3 (1.9-2.7)	2.0 (1.8-2.2)
Drug use disorder	62	116	57 724	72	1.6 (1.3-2.1)	1.6 (1.2-2.1)	1.6 (1.4-1.8)
Prescribed antidepressants	803	1665	876 917	1197	1.4 (1.3-1.5)	1.3 (1.2-1.3)	1.1 (1.0-1.1)
Deliberate self-harm	114	218	62 753	79	2.8 (2.3-3.3)	2.1 (1.8-2.6)	1.6 (1.4-1.8)
Physical disorders							
Cancer ^c	334	643	445 274	570	1.1 (1.0-1.3)	1.2 (1.0-1.3)	1.2 (1.2-1.3)
Diabetes ^c	89	167	166 151	209	0.8 (0.6-1.0)	0.7 (0.6-0.9)	1.0 (0.9-1.1)
Sleep disorder	12	22	21 821	27	0.8 (0.5-1.4)	1.4 (0.7-2.8)	1.4 (1.0-1.8)
Cardiovascular diseases	749	1632	1 116 171	1595	1.0 (1.0-1.1)	0.9 (0.8-1.0)	1.0 (1.0-1.1)
Chronic lower respiratory tract diseases ^c	172	326	253 059	321	1.0 (0.9-1.2)	0.9 (0.7-1.0)	1.2 (1.1-1.2)
Liver cirrhosis ^c	37	69	26 043	32	2.1 (1.5-2.9)	2.1 (1.5-2.9)	2.0 (1.6-2.3)
Spinal disc herniation	151	288	176 892	224	1.3 (1.1-1.5)	1.5 (1.3-1.8)	1.4 (1.3-1.5)
Mortality							
Any death	796	1465	988 209	1218	1.2 (1.1-1.3)	1.3 (1.2-1.3)	1.1 (1.0-1.1)
Natural death	596	1097	935 957	1153	1.0 (0.9-1.0)	1.0 (0.9-1.1)	1.0 (1.0-1.1)
Unintentional	27	50	40 047	49	1.0 (0.7-1.5)	0.9 (0.6-1.3)	0.9 (0.8-1.1)
Suicide	95	175	11 085	14	12.8 (10.5-15.7)	8.5 (7.0-10.5)	4.5 (3.7-5.4)
Homicide	78	144	1126	1	103.5 (82.2-130.1)	62.7 (48.5-81.2)	30.6 (23.8-39.3)
Social and work-related events							
Divorce	64	129	420 088	564	0.2 (0.2-0.3)	0.2 (0.1-0.2)	0.5 (0.5-0.6)
Children placed outside home	208	409	89 175	113	3.6 (3.2-4.1)	4.8 (4.2-5.5)	3.7 (3.3-4.1)
Municipal family support	198	376	85 888	107	3.5 (3.0-4.0)	5.7 (4.9-6.5)	2.9 (2.6-3.2)
Sick leave	1184	2891	1 017 316	1533	1.9 (1.8-2.0)	3.5 (3.3-3.7)	2.2 (2.1-2.3)
Unemployed	1019	2911	1 242 117	2220	1.3 (1.2-1.4)	2.3 (2.1-2.4)	1.9 (1.8-2.0)
Disability pension	48	89	24 316	30	3.0 (2.2-3.9)	3.3 (2.5-4.4)	2.8 (2.3-3.3)
Service usage							
Somatic hospitalization	632	1332	854 221	1200	1.1 (1.0-1.2)	0.7 (0.7-0.8)	0.8 (0.8-0.9)
Psychiatric hospitalization	136	260	61 313	77	3.4 (2.9-4.0)	3.2 (2.8-3.9)	2.2 (2.0-2.5)
GP contact	1,663	15 327	2 105 681	13 220	1.2 (1.1-1.2)	0.9 (0.9-1.0)	1.0 (1.0-1.0)
Psychological/psychiatric therapy	310	587	107 043	134	4.4 (3.9-4.9)	5.3 (4.7-5.9)	2.1 (2.0-2.3)

Abbreviations: IR, Incidence rate; IRR, incidence rate ratio; PTSD, posttraumatic stress disorder; PY, person-years.

^a Multivariate models were adjusted for calendar period, country of birth, age groups, civil status, household income level, presence of chronic physical disorders (measured using the Charlson Index), previous psychiatric hospitalization, and previous records of self-harm.

^b As a person could have been diagnosed with more than 1 mental disorder, the total number of people with any mental disorders is smaller than the sum of people with specific disorders.

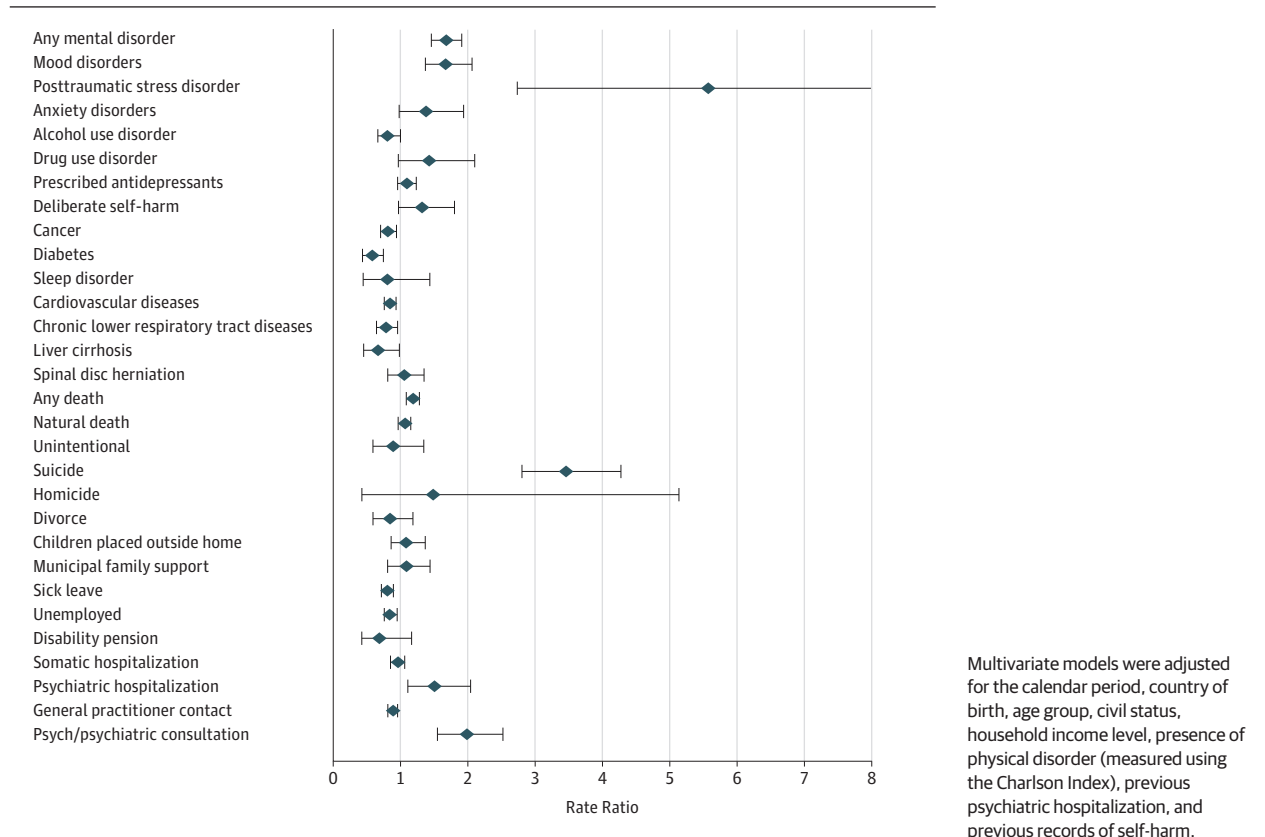
^c The examined physical disorder is included in the Charlson Index, so an adaptation of the Charlson Index without the specific physical disorder was used for the multivariate model.

Mental Health

Spouses bereaved by suicide had higher risks for all examined mental disorders, including deliberate self-harm, when compared with the general population. While previous studies have linked spousal suicide to depression and death by suicide,^{12,22} the current study extends our knowledge of which mental disorders might arise after the suicide of a spouse.

Excess risks of mood disorders and PTSD were found when comparing spouses bereaved by suicide with those bereaved by other manners. Previous studies of similar groups are limited to measuring depression.^{22,24} No differences were noted for alcohol and drug use disorders, which suggests that these may be pervasive across all types of bereavement.³⁶

Figure 1. Men Bereaved by Suicide Compared With Men Bereaved by Other Manners of Death Over a 5-Year Follow-up (Group B)



Physical Health

Spousal suicide has, to our knowledge, not previously been linked to physical disorders. The excess risks of cancer and cirrhosis, as well as sleep disorders and chronic lower respiratory tract diseases (long-term), might be attributed to unhealthy coping styles, such as alcohol use disorder, or a weakening of the immune system, both related to psychosocial stress.^{14,37} A spouse’s death by any cause has previously been linked to smoking and alcohol consumption.³⁸

The elevated risk of spinal disc herniation could be spurious, however, the association remained significant across sex and follow-up periods. Although conflicting evidence exists, an association between levels of stress, pain pressure sensitivity, and depressive symptoms could indicate an increased pain sensitivity among bereaved people.^{39,40} Additionally, bereavement is associated with weight loss, and unexpected weight loss may precede back pain.^{41,42}

A lower risk of some physical diagnoses was noted for spouses bereaved by a partner’s suicide, particularly within the first 5 years, although there was an excess in overall mortality. People bereaved by a spouse’s suicide might be less inclined to seek medical attention for health concerns (eg, being distracted by their grief to a degree of self-neglect),⁴ and the partially lower use of somatic hospitals supports this notion. Competing risks, as reflected in the elevated risk of mortality, is another possible explanation.

Mortality

Those bereaved by suicide had higher rate ratios of overall mortality than the general population and those bereaved by other manners. To our knowledge, excess mortality has not been studied among spouses bereaved by suicide, but has been shown to exist among bereaved spouses generally.³⁸ Most of these deaths were natural deaths (men: 81%; women: 75%); thus, a person’s neglect of his or her health could be a potential explanation.

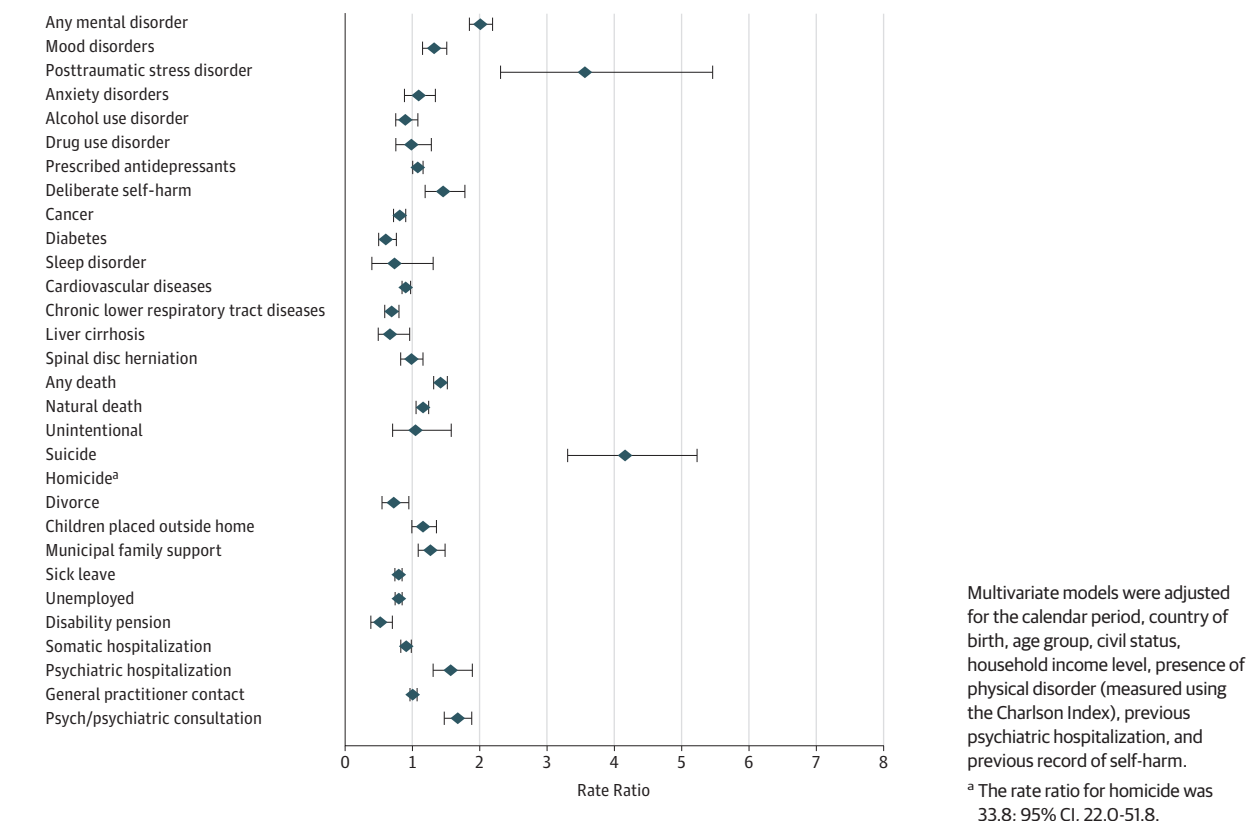
The excess risk of suicide is supported by previous studies.^{12,24} Exposure to a loss by suicide might lessen barriers to engage in suicidal behavior.⁴³ Assortative mating is another option,¹² which is supported by higher suicide risks among spouses bereaved by suicide than other family members.⁴⁴

The increased risk of dying by homicide is, to our knowledge, a new observation. Although homicides recorded on the same or following day after a spouse’s suicide were not included, some of these cases might be dyadic suicides.⁴⁵

Social Health

Increased risks of having a single marital status, low income, and criminal conduct have been reported for parents and children bereaved by suicide, but we have no information on the social health of spouses.^{11,20} The observed lower risk of getting a divorce could imply a more precautious partner selection. The

Figure 2. Women Bereaved by Suicide Compared With Women Bereaved by Other Manners of Death Over a 5-Year Follow-up (Group B)



fewer episodes of taking sick leave days or experiencing unemployment when compared with people bereaved by other manners might relate to the social stigmatization of suicide.⁴² The mean age (>67 years) for those bereaved by other manners of death implies that only a subsample were working and assortative mating might have increased their rate of absence.

Health Care Use

Increased mental health care use was noted. The reduced use of somatic hospitals is contradictory to the excess mortality among spouses bereaved by suicide and raises concerns regarding the identification and the treatment of health conditions.

Clinical Implications

It is important to note that most people bereaved by suicide do not experience health complications; 1 in 200 spouses bereaved by suicide received a diagnosis of a mood disorder compared with 1 in 500 among the general population.

Women bereaved by suicide had less contact with their general practitioners than the general population, and men bereaved by suicide had less primary care contact than those bereaved by other manners of death. This is concerning, as primary care could provide an access point for support and suggests the need for more aggressive outreach following bereavement by suicide.

Studies have linked spousal bereavement to complicated grief.⁴ Furthermore, this association could be mediated through other mental disorders.⁴⁶ An elevated risk of misuse disorders was noted for people bereaved by suicide. Future research might address whether mental disorders following bereavement could be an indication of a complicated grief.³⁶

Short-term interventions have shown promising results regarding treating complicated grief.^{5,47} In Denmark, people bereaved by suicide are entitled to state-subsidized treatment with a psychologist or psychiatrist.^{5,48} Although bereaved spouses used mental health care, the elevated risks of adverse social outcomes illustrates the high societal costs and need for professional help. Still, most support for those bereaved by suicide is left for volunteer organizations.⁴⁹

Strengths and Limitations

Nationwide register data were collected on a uniform basis for both exposed and unexposed people, which improved internal validity and avoided recall bias. By including all spouses bereaved by suicide, the selection bias noted in previous studies was avoided.²⁴ Longitudinal data on civil statuses and household identifiers let us identify those living together at the time of bereavement. Additionally, the large sample size, the long observation period, and no loss to follow-up were other strengths.

Limitations include that only people who had entered a formal union or cohabitation were considered. Danish suicide records might underestimate the actual figure, although a recent study noted a good reliability.⁵⁰ Also, hospital diagnoses might represent underestimates of actual incidences.⁵¹ The effect of stressful exposures might be modified through personality traits, individual coping strategies, the presence of children and social support or intensified through multimorbidity.⁵² Although the analysis was adjusted for relevant covariates, unmeasured confounders cannot be excluded. Similarly, type I errors are possible. The findings are representative of Scandinavia but might also apply to other countries with different social structures and cultural values, or different ethnic or racial composition.

Conclusions

Bereavement following suicide constitutes a psychological stressor and remains a public health burden. The excess risk of mental disorders, select physical disorders, mortality, and adverse social events illustrate the breadth of consequences of bereavement by spousal suicide. Furthermore, we find indications that people bereaved by spousal suicide had higher risks of mental disorders, mortality, and mental health care use than people bereaved by other manners of death. Higher risks of drug and alcohol use disorder were noted for people bereaved by suicide. More proactive outreach and linkage to support mechanisms is needed for people bereaved by spousal suicide to help them navigate their grief.

ARTICLE INFORMATION

Accepted for Publication: January 31, 2017.

Published Online: March 22, 2017.

doi:10.1001/jamapsychiatry.2017.0226

Author Affiliations: Danish Research Institute for Suicide Prevention, Mental Health Centre, Copenhagen, Denmark (Erlangsen, Krogh, Nordentoft); Department of Mental Health, Johns Hopkins Bloomberg School of Public Health, Baltimore, Maryland (Erlangsen, Wilcox); iPSYCH, Lundbeck Foundation Initiative for Integrative Psychiatric Research, Copenhagen, Denmark (Erlangsen, Nordentoft); Institute of Regional Health Research, University of Southern Denmark, Odense, Denmark (Erlangsen); Centre for Psychiatry Research, Department of Clinical Neuroscience, Karolinska Institutet, Stockholm, Sweden (Runeson); Department of Psychiatry, University of Manitoba, Winnipeg, Manitoba, Canada (Bolton); Department of Psychiatry and Behavioral Sciences, Johns Hopkins School of Medicine, Baltimore, Maryland (Wilcox); Section of Biostatistics, Department of Public Health, University of Copenhagen, Copenhagen, Denmark (Forman); Columbia School of Social Work, Columbia University College of Physicians and Surgeons, New York, New York (Shear); Center for the Study and Prevention of Suicide, Department of Psychiatry, and Office for Aging, University of Rochester Medical Center, Rochester, New York (Conwell).

Author Contributions: Dr Erlangsen had full access to all the data in the study and takes responsibility for the integrity of the data and the accuracy of the data analysis.

Study concept and design: Erlangsen, Runeson, Bolton, Wilcox, Forman, Shear, Conwell.

Acquisition, analysis, or interpretation of data: Erlangsen, Runeson, Bolton, Wilcox, Forman, Krogh, Nordentoft, Conwell.

Drafting of the manuscript: Erlangsen.

Critical revision of the manuscript for important intellectual content: All authors.

Statistical analysis: Erlangsen, Runeson, Wilcox, Forman.

Obtained funding: Erlangsen, Nordentoft, Conwell.

Administrative, technical, or material support: Nordentoft.

Supervision: Runeson, Wilcox, Forman, Krogh, Nordentoft, Conwell.

Conflict of Interest Disclosures: None reported.

Funding/Support: The study was supported by American Foundation for Suicide Prevention and the Danish Health Insurance Foundation.

Role of the Funder/Sponsor: The American Foundation for Suicide Prevention and the Danish Health Insurance Foundation had no role in the design and conduct of the study; collection, management, analysis, and interpretation of the data; preparation, review, or approval of the manuscript; and decision to submit the manuscript for publication.

REFERENCES

- World Health Organization. Preventing suicide: a global imperative. http://apps.who.int/iris/bitstream/10665/131056/1/9789241564779_eng.pdf?ua. Accessed November 27, 2014.
- Berman AL. Estimating the population of survivors of suicide: seeking an evidence base. *Suicide Life Threat Behav*. 2011;41(1):110-116.
- Dunne-Maxim K. Survivors of suicide. *J Psychosoc Nurs Ment Health Serv*. 1986;24(12):31-35.
- Shear K, Shair H. Attachment, loss, and complicated grief. *Dev Psychobiol*. 2005;47(3):253-267.
- Shear MK, Reynolds CF III, Simon NM, et al. Optimizing treatment of complicated grief: a randomized clinical trial. *JAMA Psychiatry*. 2016;73(7):685-694.
- McDaid C, Trowman R, Golder S, Hawton K, Sowden A. Interventions for people bereaved through suicide: systematic review. *Br J Psychiatry*. 2008;193(6):438-443.
- Cohen S, Kessler RC, Gordon L. Strategies for measuring stress in studies of psychiatric and physical disorders. In: Cohen S, Kessler RC, Gordon L, eds. *Measuring Stress*. New York, NY, Oxford University Press; 1997:3-28.
- Brent DA, Moritz G, Bridge J, Perper J, Canobbio R. The impact of adolescent suicide on siblings and parents: a longitudinal follow-up. *Suicide Life Threat Behav*. 1996;26(3):253-259.
- Cerel J, Fristad MA, Weller EB, Weller RA. Suicide-bereaved children and adolescents: a controlled longitudinal examination. *J Am Acad Child Adolesc Psychiatry*. 1999;38(6):672-679.
- Dyregrov K, Dyregrov A. Siblings after suicide—"the forgotten bereaved." *Suicide Life Threat Behav*. 2005;35(6):714-724.
- Wilcox HC, Kuramoto SJ, Lichtenstein P, Långström N, Brent DA, Runeson B. Psychiatric morbidity, violent crime, and suicide among children and adolescents exposed to parental death. *J Am Acad Child Adolesc Psychiatry*. 2010;49(5):514-523.
- Agerbo E. Midlife suicide risk, partner's psychiatric illness, spouse and child bereavement by suicide or other modes of death: a gender specific study. *J Epidemiol Community Health*. 2005;59(5):407-412.
- Maple M, Cerel J, Sanford R, Pearce T, Jordan J. Is exposure to suicide beyond kin associated with risk for suicidal behavior? a systematic review of the evidence [Published online October 27, 2016]. *Suicide Life Threat Behav*. doi:10.1111/sltb.12308
- Reiche EM, Nunes SO, Morimoto HK. Stress, depression, the immune system, and cancer. *Lancet Oncol*. 2004;5(10):617-625.
- McEwen BS. Mood disorders and allostatic load. *Biol Psychiatry*. 2003;54(3):200-207.
- McEwen BS. Stress, adaptation, and disease. allostasis and allostatic load. *Ann N Y Acad Sci*. 1998;840(1):33-44.
- Fang F, Fall K, Mittleman MA, et al. Suicide and cardiovascular death after a cancer diagnosis. *N Engl J Med*. 2012;366(14):1310-1318.
- Irwin M, Pike J. Bereavement, depressive symptoms, and immune function. In: Stroebe W, Hansson RO, eds. *Handbook of Bereavement: Theory, Research, and Intervention*. Cambridge, United Kingdom. Stroebe, MS: Cambridge University Press; 1999:160-172.
- Irwin M, Patterson T, Smith TL, et al. Reduction of immune function in life stress and depression. *Biol Psychiatry*. 1990;27(1):22-30.
- Bolton JM, Au W, Leslie WD, et al. Parents bereaved by offspring suicide: a population-based longitudinal case-control study. *JAMA Psychiatry*. 2013;70(2):158-167.
- Agerbo E. Risk of suicide and spouse's psychiatric illness or suicide: nested case-control study. *BMJ*. 2003;327(7422):1025-1026.
- Kessing LV, Agerbo E, Mortensen PB. Does the impact of major stressful life events on the risk of

- developing depression change throughout life? *Psychol Med*. 2003;33(7):1177-1184.
23. Séguin M, Lesage A, Kiely MC. Parental bereavement after suicide and accident: a comparative study. *Suicide Life Threat Behav*. 1995;25(4):489-492.
24. Pitman A, Osborn D, King M, Erlangsen A. Effects of suicide bereavement on mental health and suicide risk. *Lancet Psychiatry*. 2014;1(1):86-94.
25. Pedersen CB. The Danish Civil Registration System. *Scand J Public Health*. 2011;39(7)(suppl):22-25.
26. Helweg-Larsen K. The Danish Register of Causes of Death. *Scand J Public Health*. 2011;39(7)(suppl):26-29.
27. Mors O, Perto GP, Mortensen PB. The Danish Psychiatric Central Research Register. *Scand J Public Health*. 2011;39(7)(suppl):54-57.
28. Andersen TF, Madsen M, Jørgensen J, Mellemkjoer L, Olsen JH. The Danish National Hospital Register. a valuable source of data for modern health sciences. *Dan Med Bull*. 1999;46(3):263-268.
29. Baadsgaard M, Quitzau J. Danish registers on personal income and transfer payments. *Scand J Public Health*. 2011;39(7)(suppl):103-105.
30. Erlangsen A, Fedyszyn I. Danish nationwide registers for public health and health-related research. *Scand J Public Health*. 2015;43(4):333-339.
31. *International Statistical Classification of Diseases and Related Health Problems*. 8th revision ed. Geneva, Switzerland: World Health Organization; 1965.
32. *International Statistical Classification of Diseases and Related Health Problems*. 2007; 10th revision. <http://apps.who.int/classifications/apps/icd/icd10online/>. Accessed July 30, 2016.
33. Christensen G. The Building and Housing Register. *Scand J Public Health*. 2011;39(7)(suppl):106-108.
34. Charlson ME, Pompei P, Ales KL, MacKenzie CR. A new method of classifying prognostic comorbidity in longitudinal studies: development and validation. *J Chronic Dis*. 1987;40(5):373-383.
35. *SAS system for SunOP* [computer program]. Version 9.4. Cary, NC: SAS Institute Inc.; 2003.
36. Pilling J, Thege BK, Demetrovics Z, Kopp MS. Alcohol use in the first three years of bereavement: a national representative survey. *Subst Abuse Treat Prev Policy*. 2012;7(1):3.
37. Mansfield AJ, Kaufman JS, Marshall SW, Gaynes BN, Morrissey JP, Engel CC. Deployment and the use of mental health services among U.S. Army wives. *N Engl J Med*. 2010;362(2):101-109.
38. Martikainen P, Valkonen T. Mortality after the death of a spouse: rates and causes of death in a large Finnish cohort. *Am J Public Health*. 1996;86(8):1087-1093.
39. Bergmann N, Ballegaard S, Bech P, et al. The effect of daily self-measurement of pressure pain sensitivity followed by acupuncture on depression and quality of life versus treatment as usual in ischemic heart disease: a randomized clinical trial. *PLoS One*. 2014;9(5):e97553.
40. Marras WS, Davis KG, Heaney CA, Maronitis AB, Allread WG. The influence of psychosocial stress, gender, and personality on mechanical loading of the lumbar spine. *Spine (Phila Pa 1976)*. 2000;25(23):3045-3054.
41. Waddell G, McIntosh A, Hutchinson A, Feder G, Lewis M. *Clinical Guidelines for the Management of Acute Low Back Pain*. London, England: Royal College of General Practitioners; 1999.
42. Stroebe M, Schut H, Stroebe W. Health outcomes of bereavement. *Lancet*. 2007;370(9603):1960-1973.
43. Joiner TE. *Why people die by suicide*. Cambridge, MA: Harvard University Press; 2007.
44. Tidemalm D, Runeson B, Waern M, et al. Familial clustering of suicide risk: a total population study of 11.4 million individuals. *Psychol Med*. 2011;41(12):2527-2534.
45. Berman AL. Dyadic death: a typology. *Suicide Life Threat Behav*. 1996;26(4):342-350.
46. Simon NM, Shear KM, Thompson EH, et al. The prevalence and correlates of psychiatric comorbidity in individuals with complicated grief. *Compr Psychiatry*. 2007;48(5):395-399.
47. Shear K, Frank E, Houck PR, Reynolds CF III. Treatment of complicated grief: a randomized controlled trial. *JAMA*. 2005;293(21):2601-2608.
48. Sundhedsstyrelsen. Henviisning til psykolog [Referral to psychologist]. <https://www.sundhed.dk/sundhedsfaglig/information-til-praksis/sjaelland/patientforloeb/psykiatrien/henviisning-psykolog>. Accessed November 22, 2016.
49. American Foundation for Suicide Prevention. Survivor Outreach Program. <https://afsp.org/find-support/ive-lost-someone/survivor-outreach-program/>. Accessed December 23, 2016.
50. Tøllefsen IM, Helweg-Larsen K, Thiblin I, et al. Are suicide deaths under-reported? nationwide re-evaluations of 1800 deaths in Scandinavia. *BMJ Open*. 2015;5(11):e009120.
51. Wang PS, Aguilar-Gaxiola S, Alonso J, et al. Use of mental health services for anxiety, mood, and substance disorders in 17 countries in the WHO world mental health surveys. *Lancet*. 2007;370(9590):841-850.
52. Cohen S, Gottlieb BH, Underwood LG. Social relationships and health: challenges for measurement and intervention. *Adv Mind Body Med*. 2001;17(2):129-141.