Mortality after the Death of a Spouse: Rates and Causes of Death in a Large Finnish Cohort

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ABSTRACT

Objectives. This study examines excess mortality among Finnish persons after the death of a spouse, by sex, the subject's cause of death, duration of bereavement, and age.

Methods. The subjects were 1 580 000 married Finnish persons aged 35 through 84 years who were followed up from 1986 through 1991.

Results. Excess mortality among the bereaved was high from accidental, violent, and alcohol-related causes (50% to 150%), moderate for chronic ischemic heart disease and lung cancer (20% to 35%), and small for other causes (5% to 15%). Excess mortality was greater at short (<6 months) rather than long durations of bereavement and among younger rather than older bereaved persons for most causes of death; it was also greater among men than women.

Conclusions. The results are consistent with the hypothesis that excess mortality after the death of a spouse is partly caused by stress. The loss of social support or the inability to cope with stress may explain why men suffer from bereavement more than do women. (*Am J Public Health.* 1996;86:1087–1093)

Introduction

Earlier large-scale follow-up studies have shown high mortality among bereaved persons.[1–10] This excess mortality may be due to confounding factors and sources of bias or to the causal effects of the loss of a spouse. Although no studies have been able to control adequately for all potential biases, the accumulated evidence strongly suggests that excess mortality among bereaved persons persists after potential confounding factors are controlled for.[1,4,7,10] The loss of a spouse thus seems to have a real causal effect on mortality. Several causal mechanisms leading from bereavement to poor health and mortality have been proposed. The three most commonly suggested psychosocial mechanisms are[10–13]

(1) Emotional stress and grief caused by the death of the spouse. As a major stressful life event, the loss of a spouse should, if the stress theory of disease is valid, have an effect on mortality.

(2) Loss of social support, either through the direct effects of the death of a spouse or through the loss of social networks maintained primarily by the deceased spouse.

(3) Loss of material or task support. The loss of a spouse through death may alter the surviving spouse's living environment in a way that may cause high mortality. These changes include a fall in income or the loss of care and support in everyday tasks such as cleaning, preparing food, and taking medication.

Physical consequences of stress and social support are also being uncovered.[14] Several studies indicate that various measures of stress (such as poor marital quality, loneliness, depressed mood, dissatisfaction with social support, unemployment, and bereavement) are related to immune "suppression" or to the functioning of the immune system in general.[15–19] The relationships between stress, the immune system, and disease are, however, not well understood, and it is not certain how important changes observed in the immune system are to the development of chronic disease.

A common weakness of earlier studies has been the small number of deaths among widowed persons. This has made a precise analysis of cause of death impossible or has restricted it to broad classes of causes. The existence of a system of personal identification numbers makes the computerized linkage of deaths and census records possible in Finland and allows for the construction of larger data sets than was possible in earlier studies.

The purpose of this study is to elaborate the relationship between the loss of a spouse and mortality by using detailed data on the cause of death. The following three research questions are considered for both sexes separately. First, we attempt to determine to what extent the effects of bereavement on mortality are specific for some causes of death and to what extent they are more general, affecting all causes of death. Second, we examine the cause-specific pattern of excess mortality by duration after bereavement, and third, we analyze the extent of cause-specific excess mortality in three broad age groups. Such analyses are likely to be helpful in

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This paper was accepted November 28, 1996.

TABLE 1—Age-Standardized Relative Mortality Rates and Number of Deaths among the Bereaved, by Cause of Death, for Married Finnish Men and Women Aged 35 through 84 at the Start of the Follow-Up, 1986 through 1991

Cause of Death	Men			Women		
	Relative Mortality	95% CI	No. Deaths	Relative Mortality	95% CI	No. Deaths
All causes[a] (ICD 000–999)	1.21	1.17, 1.24	4570	1.09	1.06, 1.12	5365
All diseases (ICD 000–799)	1.17	1.14, 1.21	4295	1.07	1.04, 1.11	5143
Cancer (ICD 140–239)	1.16	1.09, 1.24	1015	1.06	0.99, 1.13	1151
Lung cancer (ICD 162)	1.24	1.10, 1.40	299	1.21	0.95, 1.54	82
Stomach cancer (ICD 151)	1.13	0.91, 1.40	89	1.05	0.84, 1.31	100
Breast cancer (ICD 174)	...	...	...	1.05	0.88, 1.24	153
Other cancers	1.13	1.04, 1.23	627	1.05	0.97, 1.13	816
Circulatory diseases (ICD 390–459)	1.17	1.12, 1.22	2418	1.10	1.06, 1.15	2997
Ischemic heart disease (ICD 410–414)	1.18	1.12, 1.25	1529	1.12	1.06, 1.19	1648
Acute myocardial infarction (ICD 410)	1.11	1.04, 1.19	1016	1.06	0.99, 1.13	1128
Chronic ischemic heart disease (ICD 411–414)[b]	1.36	1.24, 1.49	513	1.30	1.17, 1.44	520
Cerebrovascular disease (ICD 430–438)	1.13	1.03, 1.23	516	1.07	0.99, 1.16	831
Other circulatory diseases	1.18	1.06, 1.32	373	1.10	0.99, 1.21	518
Respiratory diseases (ICD 460–519)	1.12	1.01, 1.24	421	1.06	0.92, 1.21	291
Alcohol-related diseases[c]	2.40	1.68, 3.42	33	2.22	1.43, 3.45	25
Other diseases[d]	1.17	1.06, 1.30	408	0.95	0.87, 1.03	679
Accidents and violence[a] (ICD E800–E999)	1.94	1.71, 2.20	275	1.51	1.30, 1.76	222
Motor vehicle accidents[a] (ICD E800–E830)	1.45	1.06, 1.99	43	1.31	0.91, 1.88	37
Suicide (ICD E950–E959)	2.31	1.83, 2.92	80	1.74	1.27, 2.39	46
Other accidents and violence	1.92	1.62, 2.28	152	1.47	1.21, 1.80	139

Note. Not bereaved = 1.00. CI = confidence interval.
[a]Deaths from accidents or violence common to both spouses are excluded.
[b]In the eighth revision of the *International Classification of Diseases* (ICD), more than 95% of the deaths from this group were from chronic conditions (ICD 412).
[c]Alcohol psychosis (ICD 291), alcoholism (ICD 303), and alcohol-related chronic liver diseases, cirrhosis of the liver (ICD 5710–5713), and pancreatitis (ICD 5770D–F, 5771C, D).
[d]All diseases except cancers, circulatory diseases, respiratory diseases, and alcohol-related diseases.

assessing the relevance of the causal mechanisms put forward.

Study Population

This study is based on the 1985 census records in Finland linked with all deaths during the period 1986 through 1991. The linkage of data sets was carried out by the Central Statistical Office of Finland through the use of personal identification numbers.[20] About 0.3% of deaths could not be matched to a census record. This analysis covers all married men and women 35 through 84 years old at the time of the 1985 census. These people were followed up during the next 5 years for death of spouse. The reference person was followed up to the end of 1991. The date of the death of a spouse was obtained by linking the death records of all married people to those of their surviving spouse of 1985. Remarriage during the follow-up was not recorded, and the effects of remarriage were not considered.

There were about 820 000 married men and 760 000 married women in the study population at the beginning of the follow-up. The data include more married men than women because men, on average, are married to younger women. The number of person-years lived by the total male and female study population in the follow-up period was approximately 9.15 million, and the number of deaths was 116 000; of this, 270 000 person-years and almost 10 000 deaths occurred among the widowed. All together, 22 294 men and 61 686 women were widowed during the follow-up period. Person-years were calculated on a daily basis. Deaths in 1986 have been classified according to the eighth revision of the *International Classification of Diseases* (ICD), and those from 1987 through 1991, according to the Finnish version of the ninth revision. Deaths from accidents or violence involving both spouses have been excluded. The similarity of the spouse's cause of death was assessed at the 3-digit level of the ICD.

Analysis

The Poisson regression is used as the method of analysis.[21] This is appropriate given that the response data are in the form of counts. The deaths and exposures are cross-tabulated according to the variables included in the analysis. The cell is taken to be the unit of analysis. The model describing the relationship between mortality and the explanatory variables is the following:

$$\log(E(d_i)) = \log(V_i) + a + b_1x_{i1} + b_2x_{i2} + \cdots + b_px_{ip},$$

where $E(d_i)$ is the expected number of deaths in the i^{th} cell, V_i is the number of person-years lived in the i^{th} cell, $x_1, \ldots, x_p$ are the explanatory variables, and $a, b_1, \ldots, b_p$ are the parameters to be estimated.[22] The GLIM statistical package is used in fitting the models.[23] In this program, the dependent variable is the number of deaths from 1986 through 1991. The population at risk, that is, the

TABLE 2—Age-Standardized Relative Mortality Rates and Number of Deaths among the Bereaved, by Duration of Bereavement and Cause of Death, for Married Finnish Men and Women Aged 35 through 84 at the Start of the Follow-Up, 1986 through 1991

Cause of Death	Bereavement <6 Months			Bereavement >6 Months		
	Relative Mortality	95% CI	No. Deaths	Relative Mortality	95% CI	No. Deaths
Men						
All causes[a]	1.29	1.20, 1.39	761	1.19	1.15, 1.23	3809
All diseases	1.24	1.14, 1.34	704	1.16	1.12, 1.20	3591
Cancer	1.24	1.06, 1.45	168	1.15	1.07, 1.24	847
Lung cancer	1.32	1.00, 1.75	51	1.23	1.07, 1.40	248
Stomach cancer	1.64	1.06, 2.55	21	1.03	0.80, 1.32	68
Other cancers	1.14	0.93, 1.40	96	1.13	1.03, 1.24	531
Circulatory diseases	1.25	1.13, 1.38	401	1.16	1.11, 1.21	2017
Ischemic heart disease	1.23	1.08, 1.40	250	1.18	1.11, 1.25	1279
Acute myocardial infarction	1.14	0.98, 1.33	167	1.11	1.03, 1.19	849
Chronic ischemic heart disease	1.45	1.16, 1.81	83	1.34	1.21, 1.48	430
Cerebrovascular disease	1.39	1.14, 1.71	97	1.08	0.97, 1.19	419
Other circulatory diseases	1.11	0.85, 1.46	54	1.19	1.06, 1.34	319
Respiratory diseases	1.11	0.86, 1.43	62	1.12	1.00, 1.25	359
Alcohol-related diseases	2.46	1.00, 6.05	5	2.39	1.61, 3.53	28
Other diseases[b]	1.31	1.03, 1.67	68	1.15	1.02, 1.29	340
Accidents and violence[a]	2.53	1.94, 3.29	57	1.82	1.58, 2.10	218
Motor vehicle accidents[a]	0.42	0.11, 1.68	2	1.65	1.19, 2.30	41
Suicide	4.09	2.68, 6.24	23	1.96	1.49, 2.59	57
Other accidents and violence	2.60	1.82, 3.72	32	1.79	1.46, 2.18	120
Women						
All causes[a]	1.22	1.13, 1.31	813	1.07	1.03, 1.10	4552
All diseases	1.18	1.10, 1.27	764	1.06	1.02, 1.09	4379
Cancer	1.06	0.90, 1.24	159	1.06	0.99, 1.14	992
Lung cancer	0.87	0.42, 1.77	8	1.26	0.97, 1.64	74
Stomach cancer	0.79	0.43, 1.45	11	1.09	0.86, 1.39	89
Breast cancer	1.05	0.68, 1.61	22	1.05	0.86, 1.26	131
Other cancers	1.11	0.92, 1.34	118	1.04	0.96, 1.13	698
Circulatory diseases	1.25	1.13, 1.37	460	1.08	1.03, 1.13	2537
Ischemic heart disease	1.28	1.13, 1.46	258	1.09	1.03, 1.16	1390
Acute myocardial infarction	1.18	1.01, 1.37	177	1.03	0.96, 1.11	951
Chronic ischemic heart disease	1.60	1.28, 2.02	81	1.25	1.12, 1.40	439
Cerebrovascular disease	1.29	1.08, 1.54	133	1.04	0.95, 1.13	698
Other circulatory diseases	1.07	0.84, 1.36	69	1.10	0.99, 1.23	449
Respiratory diseases	1.04	0.74, 1.46	36	1.06	0.92, 1.23	255
Alcohol-related diseases	3.26	1.31, 8.13	5	2.05	1.26, 3.36	20
Other diseases[b]	1.15	0.94, 1.40	104	0.92	0.83, 1.01	575
Accidents and violence[a]	2.33	1.74, 3.11	49	1.37	1.16, 1.63	173
Motor vehicle accidents[a]	1.39	0.60, 3.18	6	1.30	0.87, 1.93	31
Suicide	3.91	2.30, 6.66	15	1.36	0.93, 2.00	31
Other accidents and violence	2.16	1.46, 3.19	28	1.36	1.09, 1.69	111

Note. Not bereaved = 1.00. CI = confidence interval.
[a]Deaths from accidents or violence common to both spouses are excluded.
[b]All diseases except cancers, circulatory diseases, respiratory diseases, and alcohol-related diseases.

number of person-years lived, is effectively "moved" to the left side of the equation by defining it as an OFFSET term. The error term is assumed to be Poisson distributed and the link function is logarithm.

The goodness of fit and the statistical importance of an added term are measured by scaled deviance. Scaled deviance is asymptotically chi-square distributed. The results of the Poisson regression models are presented as relative mortality rates. The first category of each explanatory variable is taken as a reference group, with a relative rate of 1. The relative rates for other categories are obtained by taking antilogarithms of the parameter estimates.

Age was modeled as a categorical variable in single-year increments. In addition to age, year is included (controlled for) in all models. Controlling for period is necessary because the study cohort ages during the follow-up period, and this creates an upward bias in the relative mortality rates at longer durations of bereavement.[10]

Results

Excess Mortality of Widowed Men and Women by Cause of Death

Table 1 shows sex- and cause-specific age-standardized relative mortality rates for all widowed persons in relation to

TABLE 3—Age-Standardized Relative Mortality Rates and Number of Deaths among the Bereaved, by Age and Cause of Death, for Married Finnish Men and Women Aged 35 through 84 at the Start of the Follow-Up, 1986 through 1991

Cause of Death	Aged 35–64			Aged 65–74			Aged 75–84		
	Relative Risk	95% CI	No. Deaths	Relative Risk	95% CI	No. Deaths	Relative Risk	95% CI	No. Deaths
Men									
All causes[a]	1.66	1.54, 1.79	713	1.22	1.16, 1.28	1650	1.08	1.03, 1.13	2207
All diseases	1.56	1.44, 1.70	618	1.21	1.14, 1.27	1576	1.06	1.01, 1.11	2101
Cancer	1.31	1.12, 1.54	161	1.26	1.14, 1.39	426	1.07	0.97, 1.19	428
Lung cancer	1.49	1.16, 1.91	66	1.37	1.15, 1.63	145	1.04	0.83, 1.30	88
Stomach cancer	1.49	0.90, 2.47	16	0.94	0.64, 1.38	28	1.24	0.90, 1.72	45
Other cancers	1.17	0.93, 1.47	79	1.24	1.09, 1.42	253	1.06	0.93, 1.20	295
Circulatory diseases	1.57	1.41, 1.75	350	1.17	1.09, 1.26	881	1.08	1.01, 1.15	1187
Ischemic heart disease	1.52	1.34, 1.73	253	1.16	1.07, 1.27	579	1.09	1.01, 1.19	697
Acute myocardial infarction	1.30	1.10, 1.53	154	1.11	1.00, 1.23	400	1.06	0.96, 1.17	462
Chronic ischemic heart disease	2.08	1.69, 2.55	99	1.31	1.12, 1.53	179	1.17	1.02, 1.35	235
Cerebrovascular disease	1.47	1.08, 2.01	43	1.09	0.93, 1.28	167	1.11	0.98, 1.25	306
Other circulatory diseases	1.97	1.50, 2.60	54	1.35	1.13, 1.62	135	0.97	0.83, 1.14	184
Respiratory diseases	1.71	1.19, 2.47	31	1.21	1.01, 1.45	134	1.03	0.90, 1.18	256
Alcohol-related diseases	3.08	2.06, 4.61	26	1.69	0.72, 3.97	6	0.67	0.08, 5.41	1
Other diseases[b]	2.18	1.63, 2.90	50	1.27	1.05, 1.52	129	0.99	0.86, 1.14	229
Accidents and violence[a]	2.75	2.24, 3.39	95	1.60	1.25, 2.04	74	1.56	1.25, 1.93	106
Motor vehicle accidents[a]	1.52	0.81, 2.85	10	1.05	0.58, 1.90	12	1.80	1.11, 2.94	21
Suicide	3.02	2.15, 4.24	36	2.03	1.35, 3.08	26	1.72	1.01, 2.91	18
Other accidents and violence	3.05	2.27, 4.08	49	1.62	1.14, 2.30	36	1.45	1.11, 1.91	67
Women									
All causes[a]	1.25	1.17, 1.35	862	1.10	1.05, 1.16	2212	1.00	0.95, 1.05	2291
All diseases	1.19	1.11, 1.29	778	1.10	1.05, 1.15	2139	1.00	0.95, 1.05	2226
Cancer	1.04	0.92, 1.18	294	1.10	1.00, 1.22	512	1.07	0.94, 1.22	345
Lung cancer	1.56	1.08, 2.26	34	0.98	0.66, 1.45	32	1.13	0.61, 2.07	16
Stomach cancer	1.13	0.71, 1.81	20	0.98	0.69, 1.38	42	1.11	0.75, 1.64	38
Breast cancer	0.97	0.73, 1.28	54	1.08	0.81, 1.45	60	1.37	0.92, 2.02	39
Other cancers	0.99	0.85, 1.16	186	1.13	1.01, 1.27	378	1.02	0.88, 1.19	252
Circulatory diseases	1.38	1.24, 1.54	367	1.11	1.04, 1.19	1248	1.01	0.95, 1.08	1382
Ischemic heart disease	1.41	1.22, 1.63	220	1.12	1.02, 1.21	717	1.04	0.95, 1.14	711
Acute myocardial infarction	1.31	1.10, 1.56	153	1.08	0.98, 1.19	519	0.96	0.86, 1.08	456
Chronic ischemic heart disease	1.71	1.31, 2.23	67	1.22	1.04, 1.44	198	1.22	1.04, 1.43	255
Cerebrovascular disease	1.30	1.04, 1.63	88	1.12	0.99, 1.27	341	0.96	0.85, 1.08	402
Other circulatory diseases	1.40	1.06, 1.84	59	1.10	0.93, 1.30	190	1.03	0.89, 1.20	269
Respiratory diseases	0.67	0.40, 1.13	16	1.23	0.98, 1.55	102	1.02	0.85, 1.23	173
Alcohol-related diseases	2.91	1.79, 4.73	20	1.27	0.46, 3.48	5	0.04	0.00, 1.04	0
Other diseases[b]	1.12	0.88, 1.41	81	0.98	0.86, 1.13	272	0.86	0.75, 0.98	326
Accidents and violence[a]	2.19	1.73, 2.76	84	1.30	0.99, 1.70	73	1.06	0.78, 1.43	65
Motor vehicle accidents[a]	1.52	0.85, 2.71	13	1.22	0.71, 2.12	17	1.53	0.61, 3.87	7
Suicide	2.30	1.59, 3.33	33	0.92	0.47, 1.78	11	7.49	0.75, 74.70	2
Other accidents and violence	2.45	1.73, 3.47	38	1.47	1.04, 2.09	45	0.98	0.71, 1.36	56

Note. Not bereaved = 1.00. CI = confidence interval.
[a]Deaths from accidents or violence common to both spouses are excluded.
[b]All diseases except cancers, circulatory diseases, respiratory diseases, and alcohol-related diseases.

those not widowed. The excess total mortality of widowed men is 21%. This is more than twice the excess among women. For both sexes, all major groups of diseases (cancer, circulatory disease, respiratory diseases, and other diseases) show excess mortality around or below the level observed for all causes of death. Among women, however, only the 10% excess for circulatory diseases reaches the 5% statistical significance level. For accidental and violent causes of death, the excess is very large: 94% among men and 51% among women.

Among men, all specific diseases included in Table 1 except stomach cancer show statistically significant excess mortality. For most specific causes, the excess is around 15%, but alcohol-related diseases show a very large excess of 140%. Excess mortality seems to be slightly higher for lung cancer than for other diseases. Widowed men have less elevated mortality for acute myocardial infarction (ICD 410) than for other ischemic heart disease (ICD 411–414). In this paper, *other ischemic heart disease* will be referred to as *chronic ischemic heart disease;* in the eighth revision of the ICD, more than 95% of the deaths from this group were from chronic conditions (ICD 412).

Among widowed women, who have lower overall excess mortality than men, excess disease mortality reaches the 5% significance level only for chronic ische-

mic heart disease and alcohol-related diseases. For these two causes, the excess is only slightly lower than among men: 30% and 122%, respectively. Women also have lower excess mortality from acute myocardial infarction than from chronic ischemic heart disease.

Of the specific accidental and violent causes of death, suicide shows the largest excess mortality among both sexes. This excess, 131% for men and 74% for women, is still lower than that observed from alcohol-related diseases. Mortality from motor vehicle accidents is elevated among widowed men and women.

Excess Mortality of Widowed Men and Women by Duration of Widow(er)hood and Cause of Death

For both sexes and most major groups of causes of death, excess mortality is larger at shorter than at longer durations of widow(er)hood. In Table 2, the duration of widow(er)hood is divided into two broad groups: up to 6 months and more than 6 months (but less than 6 years). This division is based on the turning point of the curve of excess total mortality by duration of widow(er)hood observed in these data.[10] Among men, excess mortality from cancer and circulatory diseases is around 25% in the first 6 months and around 15% thereafter. Among women, excess mortality is lower than among men at all durations of bereavement. Circulatory diseases show a 25% excess in the first 6 months, but only 8% thereafter. Excess mortality for cancer is 6% at all durations. Among both men and women, relative mortality from alcohol-related diseases is high at all durations of bereavement.

In the first 6 months of widow(er)hood, mortality from accidents and violence is 153% and 133% higher among widowed than nonwidowed men and women correspondingly. After the first 6 months, the excess is only 37% among women but 82% among men.

Excess Mortality of Widowed Men and Women by Age and Cause of Death

Table 3 presents excess mortality rates in the three broad age-groups: ages 35 through 64, ages 65 through 74, and ages 75 through 84. Among younger widowed persons (aged 35 through 64), excess mortality is very high, especially among young men, who have an excess total mortality of almost 70%. Among younger women, the excess is only 25%. Among 65- through 74-year-old widowed persons, the total excess mortality is more modest, about 20% among men and 10% among women. In the oldest age group, the excess is nonexistent among women and less than 10% among men.

The pattern of excess mortality for most groups of causes of death is similar in all three age groups; that is, there is a greater excess mortality at younger ages. Excess mortality is particularly high among 35- through 64-year-old men and women for accidents and violence and for alcohol-related diseases. Among 35- through 64-year-old bereaved men and women, a large proportion (40%) of all accidental and violent causes are suicides. Among women, excess mortality for cancer is low and is similar at all ages.

Discussion

The results of this study can be summarized in four points:

(1) In this cohort, excess mortality among bereaved men and women is evident for most causes of death although, among women, the parameter estimates often fail to reach conventional levels of statistical significance. The relative excess is very large for accidental and violent causes of death as well as for alcohol-related diseases, moderate for chronic ischemic heart disease and lung cancer, and small for all other causes of death studied here.

(2) Excess mortality after widow(er)-hood is greater among men than among women for all causes of death examined here.

(3) Excess mortality is greater at short rather than long durations of bereavement for all causes of death (except female cancer).

(4) Relative excess mortality is greater among younger than among older widowed persons for all causes of death (except female cancer).

The possible remarriage of the widowed has not been taken into account. For two reasons, however, we do not consider remarriage to be a relevant problem from the point of view of this study. First, the problem posed by remarriage is not relevant at short durations of widow(er)hood, when the highest excess mortality is observed. Second, the main purpose of this follow-up study has been to evaluate the mortality effects of the stressful event of bereavement regardless of other later events, be they remarriage, birth of a child, change of residence, or anything else. The purpose of the study has not been to quantify the level of mortality of the widowed population in cross section.

The data do not allow us to account for divorce during the follow-up that occurs before the death of one of the spouses. The error caused by divorce, however, is likely to be very small; among married women in Finland in the late 1980s, the divorce rate was around 1.5% per year for those 35 through 44 years old and 0.5% for those 50 through 64 years old.[24]

Comparison of the findings of this study with those of other large-scale follow-up studies is difficult. None of the previous studies have been able to carry out cause-specific analysis at a level of detail similar to that of the present study; usually, only four or five large groups of causes of deaths have been distinguished. Furthermore, two major studies with relatively good cause-specific data[5–8] have used reference groups that include all marital status groups. Such a choice is inappropriate when one is interested in the mechanisms that lead from loss of spouse to excess mortality; loss of spouse can, obviously, occur only among men and women who have a spouse.

Like this study, two earlier studies[5,8] found relative excess mortality to be very large for accidental and violent causes of death for both men and women. For other large groups of causes of death distinguished in the earlier studies, mortality was found to be quite small (about 5% to 15%). Furthermore, a common finding of the major earlier studies is that men have higher excess mortality after the loss of a spouse than women.[4,7–10] Similar results were obtained from this study.

As was true of this study, most other studies[1,7–10] show the highest excess mortality immediately following the loss of a spouse for both men and women. This is especially evident for accidental and violent causes of death. According to two earlier studies, excess mortality in the first 6 months after the loss of a spouse is somewhat larger for circulatory diseases than for other diseases, at least among men,[1,8] but possibly among women also.[8] These studies have been used as evidence for the claim that the loss of a spouse causes excess mortality especially from circulatory diseases.[12,13] However, as these results are based on small numbers of deaths and are not in agreement with this study or the study by Jones and coworkers,[6,7] the claim should be taken cautiously.

The strong pattern of larger differentials observed in the younger age groups

for most causes of death in this study could not be as clearly seen in the two other large-scale studies of bereavement that have presented results by age.[7,8] The utilization of open-ended age groups and the use of the total population as a comparison group may have obscured the age effect in those two studies.

Many married couples share at least some aspects of their socioeconomic environment and lifestyle. If this common environment (for example, substandard housing or an unhealthy diet) is hazardous to health, both spouses run the risk of early death, and times of deaths tend to correlate. The analysis presented in this paper does not control for such confounding effects. Earlier research on these data[10] as well as other research,[1,4,7,8] however, shows that controlling for such confounders is of very little importance. The confounding effects of incomplete age adjustment and common accidents and violence have been taken into account in this study. This has been achieved by modeling age in single-year increments and by excluding deaths due to a common accident.

Three mechanisms leading from loss of spouse to mortality have been proposed. These are (1) emotional stress and grief, (2) loss of social support, and (3) loss of material and task support. Although it is difficult to draw conclusions about the relative importance of these mechanisms, two findings lend support to the hypothesis that immediate stress and grief after the loss of a spouse play an important role in creating excess mortality among widowed men and women. First, excess mortality is highest shortly after (6 months) widow(er)hood, a time when stress and grief may be assumed to be felt most strongly. Second, excess mortality is high among young widowed persons. The death of a spouse may be most disruptive and perhaps also very unexpected at younger ages. Furthermore, at younger ages, loss of care is unlikely to contribute much to the excess mortality.

A large part of the excess disease mortality of bereaved men and women is general, affecting most diseases and most age groups. It thus seems that bereavement leads to an overall weakening of a person's ability to resist and cope with disease. On the basis of these data, it is not possible to assess directly whether the death of a spouse influences mainly the incidence of disease or case fatality. However, excess mortality is evident at short durations of bereavement even for major chronic diseases with long latency periods. Furthermore, this study, as well as studies with much longer follow-up periods (up to 11 years),[1,7,9] shows that the loss of a spouse causes no, or only weak, long-term excess mortality. Thus, bereavement cannot be seen mainly as causing disease, but as accelerating or exacerbating a preexisting health problem. Analysis of other sources of information, such as disease registers, would provide more direct evidence of the effects of bereavement on disease incidence.

It could be assumed that immediate stress after the loss of a spouse influences mortality from the more acute conditions. It is important to note, however, that excess mortality is in fact lower for acute myocardial infarction than for chronic ischemic heart disease. Furthermore, early excess mortality (<6 months) for acute myocardial infarction is only slightly larger than the excess at longer durations. In addition, respiratory diseases, most of which are acute, show smaller than average excess mortality. A partial explanation of the greater excess mortality for chronic ischemic heart disease may be that in addition to stress and grief, loss of social support and loss of care exert an influence on mortality. It is possible that loss of care may quickly intensify a long-standing chronic disease to a fatal phase.

Postbereavement stress is also likely to affect mortality through an increase in stress-alleviating behaviors. In addition to grief, this seems to be the most likely explanation for the high excess mortality from lung cancer and especially alcohol-related diseases. Again, however, one must remember that these diseases take a very long time to develop, and thus, some form of threshold or intensifying mechanisms have to be assumed. The high excess mortality for alcohol- and tobacco-related diseases may also partly reflect selective marriage of persons with health-degrading behaviors. Such selectivity has been shown to marginally affect excess mortality among bereaved men and women.[10]

For accidents and violence, the immediate stress and grief of bereavement and the subsequent loss of the "will to live" seem to be the most powerful mechanisms leading from the loss of a spouse to mortality. The excess mortality in the 6 months following bereavement is extremely high and declines rapidly thereafter, although it still remains at a high level. The stress and grief mechanism is, of course, most plausible for suicide. The stress-alleviating use of alcohol may also be an important factor behind many accidental causes of death. Furthermore, some lethal accidents may in fact be suicides that have not been classified as such.

Excess mortality after widow(er)hood is greater among men than among women. Loss of social and material support and the inability to find or use alternative sources of social support may at least partly explain why men suffer more and longer from the loss of a spouse than women.[12,13,25,26] Men depend more than women on their spouses to keep up social ties, especially after retirement, when many men lose their occupational roles and relationships with coworkers. Furthermore, men depend more on their spouses for care and support in everyday household tasks,[27] such as shopping, cleaning, and preparation of food. However, it is also conceivable that women are better able to cope with a stressful life event than men; men, for example, may more easily take up unhealthy stress-alleviating behaviors (smoking and excessive use of alcohol) than women. □

Acknowledgments

This work has been supported by the Social Science Research Council of the Academy of Finland.

We are grateful to Seppo Koskinen for helpful suggestions on earlier drafts and to Statistics Finland for permission to use the data (permit number TK-53-69-87).

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Errata

In: North FM, Syme SL, Feeney A, Shipley M, Marmot M. Psychosocial work environment and sickness absence among British civil servants: the Whitehall II Study. *Am J Public Health.* 1996;86:332–340.

In the first paragraph in the section "Externally Assessed Work Characteristics and Sickness Absence," the numbers given as *P* values are correlation coefficients; the *P* symbol should have been a rho.

In: Samuel MC, Osmond DE. Annotation: uncertainties in the estimation of HIV prevalence and incidence in the United States. *Am J Public Health.* 1996;86:627–628.

Dennis Osmond's middle initial should have been H, not E.

In: Susser M, Susser E. Choosing a future for epidemiology: I. eras and paradigms. *Am J Public Health.* 1996;86:668–673.

In the reference list, references 1 through 3 were incorrectly ordered: reference 1 should have been Susser M, "Epidemiology today"; reference 2, Kuhn TS, *The Structure of Scientific Revolutions*; reference 3, Susser M, "Epidemiology in the United States after World War II." The reference numbers in the text are correct.

In: Susser M, Susser E. Choosing a future for epidemiology: II. from black box to Chinese boxes and eco-epidemiology. *Am J Public Health.* 1996;86:674–677.

In the third paragraph in the section "The Need for a New Paradigm," the superscript 3 at the end of the first sentence should have been a 4.