Preventive Medicine 89 (2016) 251–256

Contents lists available at ScienceDirect

Preventive Medicine

journal homepage: www.elsevier.com/locate/ypmed

Increased risk of death immediately after losing a spouse: Cause-specific mortality following widowhood in Norway

Tormod Brenn [a,*], Elinor Ytterstad [b]

[a] Department of Community Medicine, UiT The Arctic University of Norway, N-9037 Tromsø, Norway
[b] Department of Mathematics and Statistics, UiT The Arctic University of Norway, N-9037 Tromsø, Norway

ARTICLE INFO

Article history:
Received 2 November 2015
Received in revised form 25 April 2016
Accepted 12 June 2016
Available online 14 June 2016

Keywords:
Norway
Cause-specific mortality
Epidemiology
Survival analysis
Widowhood
Marriage

ABSTRACT

Objective. This paper examines the short-term risk of cause-specific death following widowhood.

Method. We followed all individuals registered as married in Norway in 1975 for marital status and mortality until 2006. Widowed individuals were followed for mortality for 7 years following widowhood. Causes of death were categorized into five cause-groups. Life tables were used in survival analyses.

Results. Deaths among the widowed were most frequent in the week following widowhood. In this week and compared to married individuals, there were more deaths including those from malignant cancer in men (hazard ratio (HR) of 1.51; 95% CI: 1.12, 1.89), from external causes in men (HR = 3.64; 95% CI: 2.01, 5.28), and from respiratory diseases (HR = 2.18; 95% CI: 1.52, 2.84 in men and HR = 3.18; 95% CI: 2.26, 4.09 in women). A majority of respiratory deaths were from pneumonia. Thereafter excess mortality among the widowed dropped gradually. Although these numbers stabilized, they were still elevated in year 7. Excess mortality was particularly high in the youngest age group considered (55–64 years) and decreased with age, though more so in men than in women. Only a few more widowed individuals than expected died of a condition in the same cause-group as their spouses.

Conclusion. A novel finding was that excess deaths in the week following widowhood also were from cancer and respiratory diseases. Men in the youngest age group seemed most vulnerable. Prevention should be considered directly after the death of a spouse, and measures should be aimed at virtually all causes of death.

1. Introduction

A large number of publications have dealt with the "widowhood effect", i.e., high mortality after the loss of a spouse (Manzoli et al., 2007; Moon et al., 2011; Shor et al., 2012) and reported a mortality risk that is elevated by up to 30%. This risk is higher just after widowhood, but remains elevated even after several years. Sex and age differences have also been reported, with higher excess mortality among men than women, and a decline in excess mortality with age, though more so in men than women (Ytterstad and Brenn, 2015). However, most studies on mortality following widowhood did not have sufficient data to investigate various causes or timing of death. The temporality of mortality after widowhood is of particular interest, as it may reveal the best time frame to implement intervention strategies to reduce the risk of, and thereby prevent such deaths.

There is some knowledge about the causes of death of widowed individuals. In Finland, excess mortality from accidental, violent, and alcohol-related causes in this group was particularly high (Martikainen and Valkonen, 1996a). Similar findings have been reported from Scotland (Hart et al., 2007). Another Finnish study found a more than two-fold and three-fold risk of ischemic heart disease for men and women, respectively, shortly after widowhood (Kaprio et al., 1987).

One of the most excessive causes of death among the bereaved is suicide (Stroebe et al., 2005). In the United States, extremely high suicide rates were observed among widowed men under 50 years of age (Luoma and Pearson, 2002); in Denmark, the majority of older persons who commit suicide are widowed (Erlangsen et al., 2004); and in Switzerland, suicide risk was shown to be increased in widowed individuals (Ajdacic-Gross et al., 2008). However, the small number of deaths due to causes like suicide create a challenge when trying to pinpoint the excess risk a few days after widowhood.

A wide range of publications have dealt with the possible mechanisms behind the widowhood effect (Stroebe et al., 2005; Jones, 1987; Murray Parkes, 1998; Byrne et al., 1999; Nystedt, 2006; Buckley et al., 2010; Möller et al., 2011; van den Berg et al., 2011), including physical and mental pathways. Plausible explanations for the immediate increased mortality risk after widowhood, such as shock and emotional stress, have also been put forth. In the long run, smoking, drinking,

* Corresponding author at: Department of Community Medicine, Faculty of Health Sciences, UiT The Arctic University of Norway, N-9037 Tromsø, Norway.
E-mail addresses: tormod.brenn@uit.no (T. Brenn), elinor.ytterstad@uit.no (E. Ytterstad).

http://dx.doi.org/10.1016/j.ypmed.2016.06.019
0091-7435/

diet, less social support, and loss of income have been found to have the most impact on mortality following widowhood.

The aim of this study was to examine cause-specific excess mortality following widowhood by sex and age in Norway. We also compared the causes of death in both spouses to reveal possible similarities. The large amount of data, 1.8 million individuals, made it possible to estimate short-term excess mortality following widowhood.

2. Methods

2.1. Study population

Data were based on the 1970 population census and provided by Statistics Norway, which collects data on sex, year of birth, marital status, date of death, and cause of death (by International Classification of Diseases (ICD) code). All information in Statistics Norway is updated annually. These data are not available to the public, and a detailed description of the material has been given elsewhere (Ytterstad and Brenn, 2015). Briefly, a total of 1,801,456 individuals who were registered as married in Statistics Norway in 1975 were followed for 32 years (from 1 January 1975 to 31 December 2006) for marital status and death, and widowed individuals were followed for mortality for 7 years following widowhood.

During the 32-year follow-up, 198,786 individuals were separated or divorced, and 20,414 had missing information on marital status, and these individuals were censored. Altogether 508,592 individuals died while married, leaving the same number of widowed individuals. However, after excluding widowed individuals born outside Norway, those under 18 years of age and those with missing information on marital status, 494,735 widowed individuals were eligible for the present study. Among the widowed individuals, 277,952 died before 31 December 2006. An additional 8882 remarried (1.8%), and 928 had missing information on marital status and were censored. Spousal pairs who died on the same day (582 married individuals) were treated as individuals who died while married, as it was unknown who died first. We excluded 23 individuals who died within 3 weeks of their spouse of the same external cause (20 due to traffic and 3 due to fire), as it was likely that a common accident caused their deaths.

As there were few deaths among young people, and only a small number of deaths were observed among very young and very old widowed individuals, we present results for the 452,788 widowed men and women between 55 and 94 years of age only.

2.2. Statistical analyses

During the 32-year follow-up period, ICD revisions 8, 9, and 10 were in use. According to previous studies in the field (Jones, 1987; Jones and Goldblatt, 1987; Berntsen, 2011), we grouped the causes of death into 5 cause-groups: 1) malignant cancers (ICD-10 C00–C97); 2) circulatory diseases (I00–I99), with subgroup analyses of heart disease (ischemic heart disease (I20–I25) and heart failure (I50)); 3) respiratory diseases (J00–J99); 4) external causes (V01–Y89), with subgroup analyses of suicides (X60–X84, Y87); and 5) other causes.

We produced life tables for married individuals for each cause-group by sex, age (from 54 to 100 years), and 5-year calendar period (from 1975 to 2006). The mortality of widowed men and women was then compared with the mortality rates in the life tables using survival analysis. Survival time for each of the 452,788 individuals who were widowed during follow-up was defined as days from date of spousal death until the death of the widowed individual, censoring due to remarriage or missing information on marital status, or the end of the study period, whichever occurred first. Cause-specific hazard rates for widowed individuals were estimated with the Nelson-Aalen estimator (Andersen et al., 2012). Hazard ratios (HRs) for widowed versus married individuals were computed as the Nelson-Aalen estimator divided by the accumulated average married mortality based on the cause-specific life tables. A more detailed description is found elsewhere (Ytterstad and Brenn, 2015). The HR is a function of time since spousal death. A possible sex and age variation was accounted for by categorizing the data into 10-year age groups before estimating the HRs. We also calculated the number of expected deaths from the life tables by applying survival analysis to corresponding married individuals. These numbers represent the number of deaths in a given cause-group that would be expected had spouses not died.

For the subgroup analyses of heart disease and suicide, there were too few deaths to use the life-table approach. Instead the number of deaths and the number of individuals at risk were used to derive rates among widowed and married individuals by sex and age.

To determine similarities in the causes of death of the widowed and their deceased spouses, we produced 5 by 5 contingency tables using the 5 cause-groups for each 5-year age group. Then we calculated the expected numbers using Pearson's chi-squared test of independence. The age-specific contingency tables were then combined into one by summing up the values for all age groups. The diagonal elements then contained both the observed as well as the expected number of deaths from the same cause-group in both spouses. Finally we repeated this procedure 10,000 times on bootstrap samples of widowed men and women, and estimated 95% confidence intervals (CIs) for the observed/expected ratio.

We used the statistical computing language R (R Development Core Team, 2012) and the survival package in R (Therneau, 2012) for the calculations.

3. Results

Almost half of all deaths in the first year following widowhood were due to circulatory diseases. The observed number of deaths in this cause-group was considerably higher than the expected number, resulting in a HR of 1.28 for men and women. Excess mortality due to malignant cancer was the least pronounced, but was still elevated. Men had a more than two-fold excess mortality due to external causes, and the HRs were in between for both sexes for respiratory causes (Table 1).

Among men, the largest HRs were observed for external causes and were particularly high in the youngest age group considered (55–64 years). Short-term HRs for external causes were much higher than those for the other cause-groups and dropped with age. HRs for circulatory diseases and respiratory diseases also dropped with age, whereas HRs for malignant cancers showed no consistent pattern with age. In women, HRs were highest in the youngest age group but were generally lower than those in men. Variations by age were also smaller among women than men, but they were still present (Fig. 1 and Fig. 2).

There was a general trend toward a gradual decrease in excess mortality during the year following widowhood, which stabilized at an elevated level during the subsequent 6 years. Interestingly, and more so in men than in women, the long-term HRs for external causes remained higher than those for any other cause-group, even 6 to 7 years following widowhood (Table 2).

When the subgroup of ischemic heart disease and heart failure were considered, widowed individuals had higher rates than married ones across both sexes and all age groups. The highest excess morality in the heart disease subgroup was seen in women aged 55–64 years, in whom the ratio between widowed and married women was almost doubled. Few men took their lives immediately following widowhood, but suicide rates among widowed men were still consistently higher than those among married men. There was also a distinct drop in suicides with age in widowed men, in contrast to the stable rates observed for married men. Suicides were less frequent in widowed women (Table 3).

When looking at the number of widowed individuals who died due to the same cause-group as their deceased spouses, observed numbers were only slightly higher than expected numbers. For instance, after