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Patterns of Widowhood Mortality

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Objectives. Becoming widowed is a known risk factor for mortality. This article examines the magnitude of, explanations for, and variation in the association between widowhood and mortality. Previous research on widowhood mortality has revealed variation by socioeconomic status (SES), in that SES is not protective in widowhood, and by gender, such that men's mortality increases more than women's mortality after the death of spouse.

Method. Using data from the Health and Retirement Study, we estimated Cox proportional hazard models to estimate the association between widowhood and mortality.

Results. Becoming widowed is associated with a 48% increase in risk of mortality. Approximately one third of the increase can be attributed to selection, in that those who become widows are socioeconomically disadvantaged. In contrast to previous studies, SES is protective for widows. Widowhood mortality risk increases for men if their wives' deaths were unexpected rather than expected; for women, the extent to which their husbands' death was expected matters less.

Discussion. Widowhood's harmful association with mortality show how strongly social support and individual's health and mortality are related. These findings support the larger literature on the importance of social support for health and longevity.

Key Words: Hazard model—Marital status—Mortality—Social support—Widowhood.

DEATH of a spouse is associated with an increased age-specific probability of dying for the surviving spouse relative to married women or men (Elwert & Christakis, 2008; Kaprio, Koskenvuo, & Rita, 1987; Moon, Kondo, Glymour, & Subramanian, 2011; Parkes, Benjamin, & Fitzgerald, 1969; Stroebe, Schut, & Stroebe, 2007; Thierry, 2000). Widowhood not only disrupts long-standing companionship and social support patterns but also entails financial adjustments and other major lifestyle modifications. Adapting to these changes may lead to poor health outcomes for the surviving spouse.

Few studies have investigated whether or how the "widowhood effect"—excess mortality among widows compared with those who remain married—varies among demographic subpopulations (Elwert & Christakis, 2006). In this article, we examine widowhood effect using data from the Health and Retirement Study (HRS). We study the widowhood effect by gender, age, and socioeconomic status (SES) and whether the death of the predecedent spouse was expected or unexpected. Differences in the predictors of mortality between widows and their married counterparts and within widows may provide insights into the relationship between social support and health (Elwert & Christakis, 2006).

Explanations for Elevated Widowhood Mortality

Explanations for the widowhood effect can be divided into three general categories: selection into widowhood, the direct effect of shock, and new living conditions (Thierry, 2000). First, the relationship between widowhood and mortality risk could be spurious. Selection into widowhood may play a role as those who are more likely to become widows may also have an independent elevated mortality risk because of shared household characteristics. For example, those with lower SES are more likely to die than those with higher SES of the same age and are also more likely to be married to a low SES spouse. Thus, those with low SES are simultaneously more likely to become widowed and more likely to die, independent of any widowhood effect (Bowling, 1987). Elevated widowhood mortality may also reflect selection *out* of widowhood, in that the healthiest individuals remarry and leave the widowed state, leaving only the frailest as widows. Prior research on this subject indicates that selection is not the most important explanation for the association between widowhood and subsequent mortality (Allison & Christakis, 2006; Bowling, 1987; Boyle, Feng, & Raab, 2011; Espinosa & Evans, 2008; Martikainen & Valkonen, 1996).

Widowhood may also directly cause higher mortality (Stroebe, 1994). One possibility is through general "wear and tear" associated with caregiving for a dying spouse (Pruchno, Cartwright, & Wilson-Genderson, 2009), especially if the decedent spouse's death occurred after a lengthy illness. Caring for an ill spouse increases both the risk of illness (Christakis & Allison, 2006; Shaw et al., 1997) and mortality (Christakis & Allison, 2006; Schulz & Beach, 1999). The wear and tear of caregiving may be manifested in neuroendocrine changes (Kim & Jacobs, 1993) or suppressed immune functioning (Irwin & Pike, 1993). Alternately, spouse loss may trigger deleterious

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changes in health behaviors, which increase the risk of related mortality (Luoma & Pearson, 2002; Martikainen & Valkonen, 1996; Umberson, 1992). Following the death of spouse, individuals are more likely to engage in poor health behaviors such as increased smoking and drinking (Zisook, Shuchter, & Mulvihill, 1990).

Finally, becoming widowed compels the surviving spouse to make adjustments to his or her living environment. In particular, the sudden death of a spouse may be especially damaging because relative to an expected death, there is less time to develop other sources of social and emotional support (Smith & Zick, 1996). Men may be particularly vulnerable because they are less likely than women to have a close confidant other than wives (Shumaker & Hill, 1991). Similarly, role theory explains daily behavior of individuals acting out particular roles, such as husband or wife. After losing a spouse, role theory predicts that the surviving spouse will struggle to adjust to the loss of both material and task support (Bowling, 1987). Couples depend on each other to exchange the outputs of these activities (Becker, 1991). Specialization, however, can exaggerate difficulties for widows, who must compensate for the loss of the other spouse's production. Efforts to replace the specialized production of the decedent spouse can drain physical and mental health and elevate mortality risk for the surviving spouse (Bowling, 1987).

Variation in Mortality Among the Widowed

Ample theory suggests that widowhood increases mortality risk, but not all widows are affected equally. The association between mortality and widowhood may vary by gender, age, and SES and whether the death of the predecedent spouse was sudden or expected. The interaction between widowhood and gender is informative. Some evidence suggests that men's mortality increases more than women's after the death of a spouse (Lusyne, Page, & Lievens, 2001; Martikainen & Valkonen, 1996; Smith & Zick, 1996; Stroebe et al., 2007). Men have shown greater mortality risk in widowhood, perhaps because marriage represents their primary source of social support (Christenson & Johnson, 1995; Dupre, Beck, & Meadows, 2009; Johnson, Backlund, Sorlie, & Loveless, 2000; Ross, Mirowsky, & Goldsteen, 1990; Waite, 1995). Differences in the widowhood effect by gender may additionally reflect household specialization (Becker, 1991). "Replacing" the decedent spouse's production is very different for men and women in specialized households. Husbands from earlier cohorts may be less accustomed to doing housework; if the wife died suddenly, there would be little time for her to transfer her knowledge to her spouse (Smith & Zick, 1996). Wives may struggle to find alternate sources of income. Evidence shows that upon losing a spouse, household resources are diminished due to reductions in Social Security benefits and employer-sponsored pensions or resources spent on the dying spouse (Johnson, Mermin, & Uccello, 2005; Karamcheva & Munnell, 2008; McGarry & Schoeni, 2005; Sevak, Weir, & Willis, 2003/2004).

The impact of widowhood on mortality may also differ by age. Individuals who are widowed at younger ages may be more resilient and better able to adjust to changing living conditions. Older individuals may be less able to compensate for the loss of spousal social support (Christakis & Allison, 2006). Alternately, spousal deaths that occur at younger ages may represent greater emotional shock for the surviving spouse. As individuals age and spousal death becomes more common among peers, widowhood may present a less unexpected transition. Previous work on the widowhood effect indicates that widows' mortality disadvantage tends to narrow at older ages (Kaprio et al., 1987; Moon et al., 2011; Smith and Zick, 1996). Our analysis examines whether the widowhood effect declines with age. We test a continuous interaction between age and widowhood in our proportional hazards models. We additionally examine the widowhood effect using a dichotomous measure of age, comparing surviving spouses who are 65 years or older to those younger than 65 years.

The inverse relationship between SES and mortality is well documented; higher SES is nearly always associated with longer life and better health (Christenson & Johnson, 1995; Elo, 2009; Elo, Martikainen, & Smith, 2006; Kitagawa & Hauser, 1973). In widowhood, however, the relationship is less clear. On one hand, SES could be protective in widowhood. Education is associated with larger or more supportive social networks (Mirowsky & Ross, 2003), which could protect against own mortality after losing a spouse. Wealth may also benefit those whose spouses died after a long, costly illness. Those with more wealth may be better able to afford caretaking assistance for the dying spouse and will have more wealth remaining after the spouse's death. On the other hand, high SES may not be protective in widowhood if high-SES individuals are more vulnerable to depression from grief due to losing a spouse than those with lower SES (Bowling, 1987, 1989; Manor & Eisenbach, 2003; Martikainen & Valkonen, 1998; Parkes et al., 1969; Wortman, Silver, & Kessler, 1993). Higher SES may also be associated with more specialized gender roles in a marriage, increasing the difficulty of compensating for the loss of a spouse (Manor & Eisenbach, 2003).

Widowhood mortality risk may vary by whether the death of the predecedent spouse was sudden or expected. Sudden, unexpected deaths may be more stressful for the surviving spouse, by allowing less time to prepare emotionally or financially for the loss of the partner (Sanders, 1988) or to develop alternative sources of social support. These effects might vary by gender, given that men and women benefit somewhat differently from marriage. The direct shock of unexpected deaths may lead to poorer health outcomes for the surviving spouse, particularly for men, who lose their primary source of social support. Alternately, a lengthy

illness preceding death may be worse for the mortality risk of the surviving spouse, particularly for younger women, due to stress from the chronic nature of the spouse's illness (Christakis & Allison, 2006; Elwert & Christakis, 2008; Smith & Zick, 1996). Expected deaths may place additional financial burden on the surviving spouse, both in terms of the direct cost of the death and the decline in resources directly following the death.

Limitations of Previous Studies

Many previous studies on widowhood mortality use data from population registries (Lusyne et al., 2001; Manor & Eisenbach, 2003; Martikainen & Valkonen, 1998). A major strength of these registries is the large number of respondents. At the same time, these data often report only baseline marital status and subsequent mortality and are unable to track changes in marital status over time, particularly divorce, which is common and associated with mortality (Johnson et al., 2000). Registries additionally do not provide information on whether widows and widowers remarry. These limitations could lead to biased results.

Studies on expectedness of spouse death are rare, presumably due to the difficulty in obtaining this type of data. The few that exist use death certificate information. One looked at cause of death to see how many months prior to the death the condition began (Smith & Zick, 1996). Another determined how the magnitude of the widowhood effect varied by cause of the decedent spouse's death (Elwert & Christakis, 2008). These contain valuable information about the circumstances of death but may not accurately represent the experience of surviving family members with respect to the expectedness of the death.

Hypothesis 1

We predict that some of the elevated mortality risk of widows will be explained by socioeconomic disadvantage and other risk factors of the surviving spouse. Not all the elevated risk, however, will be explained. Evidence will suggest that widowhood is causally associated with mortality risk.

Hypothesis 2

Previous literature on the role of SES in widowhood predicts that higher levels of SES will be harmful (Lusyne et al., 2001; Manor & Eisenbach, 2003). Given the robustness of the larger SES literature, however, we expect *instead* that education and wealth will be protective against mortality in widowhood for both men and women. We expect no significant interaction between SES and widowhood status.

Hypothesis 3

Sudden, unexpected deaths of wives will be more harmful for men than expected wife deaths as men gain more from marriage and may need more assistance compensating for the loss of a wife. The opposite will occur among wives. Women may provide more care to spouses with chronic conditions, which may have harmful effects on their health.

Data and Methods

We use data from the HRS (Juster & Suzman, 1995), a prospective panel study representative of adults aged 50 and older in the United States sponsored by the National Institute on Aging and the Social Security Administration. An advantage of the HRS is that age-eligible respondents and their spouses are interviewed regardless of the spouse's age. In the event that a marriage terminates, the HRS continues to follow each respondent and incorporates new spouses into the panel.

This study includes three cohorts and their spouses: the cohort born between 1931 and 1941 entering the study in 1992, the cohort born between 1942 and 1947 entering the study in 1998, and the cohort born between 1948 and 1953 entering the study in 2004. Information used here extends from 1992 to 2008, for a maximum of 16 years of follow-up. The sample is limited to respondents who were married or partnered at their baseline interview and are observed at least twice (including death) and have complete information on predictor variables. Twenty-one individuals were removed due to missing information (2 missing birthdate, 8 missing education, and 11 missing marital status), making potential bias only a minor issue. The total sample size is 15,935 respondents. The inclusion or exclusion of the partnered adults (less than 1% of all observation time) did not affect the results, and partnered adults are included to improve statistical power. Married and partnered adults exhibit no statistically significant difference in mortality hazard ($p = .52$).

Information on deaths comes from linkages to the National Death Index (NDI) and from exit interviews. The HRS conducts these interviews with a decedent's spouse or other close family member or friend beginning in 1995. These interviews contain information similar to that collected in core interviews and additional details on respondents in the months prior to their deaths and the circumstances of their death (Health and Retirement Study, 2008). In the models, widowhood status is included as a time-dependent variable. Respondents can remain married or partnered, die, or divorce. Divorced or deceased spouses are censored at the time of divorce or death. Those who become widowed stay in the widowed state until death or remarriage, at which time they are censored. In addition to widowhood status, relevant background characteristics include basic demographic controls: age, gender, and race/ethnicity (non-Hispanic White, non-Hispanic Black, Hispanic, and Other/Missing). We control for age by specifying age as the time scale in a Cox regression model rather than time on study because mortality is more closely associated with age than

with time on study (Korn, Graubard, & Midthune, 1997; Thiébaut & Benichou, 2004).

We measure SES using education and wealth because different dimensions of SES can have distinct associations with health (Elo, 2009). We use four education categories: less than a high school diploma, a high school diploma or General Educational Development (GED), some college, and a college degree and beyond. Wealth is measured in dollars standardized to the year 2008. It is the value of all household assets minus household debt. All missing baseline wealth values were imputed by RAND (RAND Center for the Study of Aging, 2010). Wealth ranges widely from −$5,499,273 to $91,100,000; in analyses, wealth is measured in quartiles. We use wealth reported at baseline HRS interview to obtain a less biased estimate of the association between widowhood and mortality.

At each interview wave, the HRS asks respondents how they would rate their health, a robust predictor of subsequent mortality (DeSalvo, Bloser, Reynolds, He, & Muntner, 2006; Idler & Benyamini, 1997). Most respondents report being in good, very good, or excellent health (79.6%). Health may also respond to becoming widowed; therefore, we use only baseline health status.

Information on whether the predecedent spouse's death was anticipated or unanticipated comes from the exit interview. The next-of-kin is asked, "Was the death expected at about the time it occurred, or was it unexpected?" This information was available for 1,724 predecedent spouses. In 283 instances, this information was missing, so we simulate whether the death was anticipated using the Imputation by Chained Equations (ICE) procedure in Stata and then used the MIM (multiple imputation) procedure to conduct survival analysis (Royston, 2005). The decedent spouse's death type was imputed using all independent variables in the mortality model as reported by the decedent spouse in his or her last HRS interview as well as diagnosed chronic conditions, nursing home stays, and cause of death. Chronic conditions and nursing home stays came from the decedent spouse's HRS interviews prior to death. Cause of death comes from the HRS-NDI cause of death file. In additional testing, a logistic model predicting whether a death was expected or not on cases with no missing data showed a large and significant improvement in model fit with the inclusion of these additional predictors.

We calculate descriptive statistics using HRS-provided weights, which are scaled to reflect the Current Population Survey's report of the U.S. population for the year of data collection by gender and race/ethnicity (Health and Retirement Study, 2011). Models include unweighted data and controls for gender and race/ethnicity. We estimate the relative mortality risk of widows using Cox proportional hazard models (Cleves, 2008). Respondents enter the analysis at their first HRS interview, and observation continues until their last interview while married or widowed or until their death. Because husbands and wives share common household characteristics, we estimate all models clustered by household and report robust standard errors (Rabe-Hesketh & Skrondal, 2008).

We first estimate a model predicting mortality as a function of a time-varying covariate for widowhood status (married vs. widowed). The second model adds basic demographic controls (gender and race/ethnicity). The third model examines whether controls for SES (education and wealth) reduce or eliminate the excess risk for widows. We include health status in a fourth model to determine whether baseline health status attenuates the association between widowhood and mortality. Finally, we include an interaction between gender and widowhood status to examine whether the widowhood effect varies between men and women. We also investigate whether the associations between these explanatory variables and mortality vary between the married and the widowed by introducing interactions between widowhood status and SES. These interactions inform whether SES has the same association with mortality for widows as it does for the married or whether the association between widowhood and mortality varies by SES.

Although we include robust measures of SES and health, we still cannot rule out that the relationship between widowhood and mortality is spurious. To address this concern, we use a case-time-control method fixed effects model, using conditional logistic regression (Allison & Christakis, 2006). Conditional logistic regression necessitates variation on the dependent variable (Allison & Christakis, 2006), such that only those who become widowed are included in these analyses. The goal is to compare individual's experiences in widowhood with their experiences as married individuals, controlling for unobserved shared characteristics of the couple. We create a categorical variable reflecting widowhood status and duration of widowhood: still married, widowed between 0 and 6 months ago, widowed between 7 months and 2 years ago, and widowed more than 2 years ago. The 6-month cutoff point is required to ensure that all cases have more than one observation in order to include individual fixed effects and is recommended by the developers of the method (Allison & Christakis, 2006).

We are additionally interested in whether mortality varies among the widowed. For the final set of models, we restrict the sample to those widowed between 1992 and 2008. Respondents enter the model at their age on the date their spouse dies. They can then survive as a widow, such that they are censored at their last survey, or are followed until death. Those who remarry (12% of widows) are censored at the time of marriage. We estimate Cox models of widows only, examining expectedness of spouse death.

Results

Details on the sample are presented in Table 1. The first column shows descriptive information on all eligible

Table 1. Descriptive Statistics, Married/Partnered Health and Retirement Study Cohorts Entering the Study in 1992, 1998, and 2004[a]; percent or mean (*SD*)

	Total sample, *N* = 15,935	Remain married/partnered, *N* = 13,883	Become widowed, *N* = 2,052	*p*-Value married vs. widowed
Demographic characteristics				
% Men	55.8	58.7	29.3	0.00
Age at entry	56.2 (5.8)	55.9 (55.9)	59.1 (7.9)	0.00
Race/ethnicity				
% White	83.0	83.0	82.2	0.42
% Black	7.2	7.0	9.4	0.00
% Hispanic	7.0	7.1	6.0	0.10
% Other/missing	2.9	2.9	2.4	0.40
Socioeconomic status				
Years of education	13.0 (3.0)	13.1 (2.9)	12.0 (3.3)	0.00
Degree				
% <High school	16.1	15.2	24.8	0.00
% High school	34.5	33.5	43.7	0.00
% Some college	23.7	24.2	18.9	0.00
% College or more	25.6	27.1	12.6	0.00
Wealth (in 100 ks)[b]	457 (916)	471 (922)	329 (749)	0.00
% Baseline self-rated health fair or poor	18.6	18.2	21.8	0.00
Final status				
Dead	15.4	15.6	14.0	0.12
Average time on study	10.1	9.8	12.5	0.00
Average time on study as widow	n/a	n/a	5.2	n/a

Notes. [a]Data are weighted at respondent level to the U.S. population for year of data collection.
[b]Wealth is standardized to dollars in the year 2008.

respondents, the second column refers to respondents who do not become widowed over the course of observation, and the third column refers to respondents whose spouse dies while under observation. The group that becomes widowed has a lower proportion of men, is older, and has less education, on average, than those who remain married. A higher proportion of individuals who remain married throughout the follow-up period die than do individuals who are widowed during the study period, though the difference is not significant. This can be explained in part by the nature of the widowed sample: in order for a respondent to become widowed, a married respondent (their spouse) must die. Widows are more likely to be members of the 1992 entry cohort than of the later cohorts, such that they are older in 2008 and are observed for longer periods of time, making them more likely to die.

Fixed Effects Models of Widowhood and Mortality Risk

A critique of research on the association between widowhood and mortality is that unobserved characteristics of couples may be associated with the likelihood of becoming widowed and with mortality risk. Table 2 presents results from the fixed effects model that addresses this concern by reducing the effects of variables that could be producing a spurious relationship between widowhood and mortality. In all cases, becoming widowed is associated with an increase in mortality risk. In the first 6 months of widowhood, widows experience 61% greater odds of death than when they were married. For the period between 7 and 24 months, the odds ratio is substantially reduced and is no longer significant although it is still in the expected direction. These results suggest that the excess mortality among widows does not entirely reflect unobserved selection into widowhood. We may conclude that some of the association is causal.

Table 2. Odds Ratios of Death for Surviving Spouse Within Varying Intervals of Spouse's Death Using Fixed Effects Model, Health and Retirement Study Widow Sample

	Spouse died within	
	6 Months	7 Months–2 years
Case-time-control method		
Odds ratio	1.61	1.18
p Value	.03	.32

Note. Table includes only couples where both the husband and wife died.

Widowhood and Mortality Risk

The first set of models indicates that being widowed is associated with a higher risk of mortality than being married. Table 3 presents the hazard ratios of mortality from proportional hazards models predicting mortality as a function of widowhood status. Model 1 indicates that the risk of death is 26% greater during follow up for widows than for the married with no controls. Adjusting for sociodemographic characteristics (race/ethnicity and gender) in Model 2, becoming widowed is associated with a 48% increase in the risk of death. This magnitude is consistent with some previous research on the association between

Table 3. Hazard Ratio of Mortality for Bereaved Versus Nonbereaved by Socioeconomic Status (SES) and Health, Married Health and Retirement Study Sample, 1992–2008

	Model 1	Model 2: Model 1 + gender and race	Model 3: Model 2 + SES	Model 4: Model 3 + health	Model 5: Model 4 + gender-widowhood interaction
Marital status (married)					
Widowed	1.26***	1.48***	1.32***	1.34***	1.29**
Gender (male)					
Female		0.57***	0.57***	0.57***	0.57***
Race/ethnicity (White)					
Black		1.40***	1.02	0.98	0.98
Hispanic		0.99	0.70***	0.66***	0.66***
Other/missing		1.18	1.02	0.96	0.95
SES					
Education (<high school)					
High school			0.87**	1.00	1.00
Some college			0.85*	1.06	1.07
College degree			0.62***	0.81**	0.81**
Wealth (lowest quartile)					
Low			0.75***	0.84**	0.85**
High			0.60***	0.71***	0.72***
Highest 25%			0.45***	0.56***	0.56***
Self-rated health (good, very good, or excellent)					
Fair or poor				2.67***	2.68***
Women × Widowed					1.07
Log pseudolikelihood	−20,016	−19,916	−19,778	−19,548	−19,541
Wald χ^2	12.78	207.84	484.81	981.25	988.62
Generalized R^2	0.00	0.013	0.030	0.060	0.060

Notes. Reference category in parentheses. Hazard ratios refer to relative mortality risk per year of exposure. Models adjust standard errors for 15,935 household clusters.

*$p < .05$. **$p < .01$. ***$p < .001$.

widowhood and mortality with only very basic controls (Boyle et al., 2011; Johnson et al., 2000). Model 3 adjusts for education and wealth in addition to the demographic controls. Education and wealth are both protective against mortality in this model. We find a decrease of 35% in the excess mortality risk (a decrease from 48% to 32%) associated with widowhood; with these controls, widows have a 32% higher relative risk of dying compared with the married, comparable to other studies (Espinosa & Evans, 2008; Hart, Hole, Lawlor, Davey Smith, & Lever, 2007). Model 4 adds baseline self-rated health. Being in fair or poor health substantially increases mortality risk relative to being in better health. Self-rated health is a strong predictor of mortality and greatly improves the model's explanatory power, but self-rated health does not explain a significant amount of the widowhood effect. The baseline health of widows was slightly worse than those who remain married, but the difference was not large (21.8% in fair or poor health vs. 18.2% for the married). Model 5 in Table 3 adds an interaction between gender and widowhood status. The interaction indicates that there is no significant difference in the impact of widowhood for men and women ($p = .62$).

Variation in Mortality Among the Widowed

To examine variation in the widowhood effect by the age of the surviving spouse, we examine two interactions between age and widowhood in our models. First, we use a continuous measure of age with a test of the proportional hazards assumption with respect to widowhood status. Because age is built directly into the observation time of the Cox proportional hazards model, a violation of the proportionality assumption implies an interaction between age and the widowhood effect. We tested the proportional hazards assumption using the Schoenfeld residuals. We find no statistically significant deviation from proportionality ($p = .25$). We also test a dichotomous measure of age whether the widowhood effect varies for widows aged 65 and older compared with younger widows. We find no evidence that the widowhood effect is statistically significantly different for these two broad age groups ($p = .20$).

To examine whether the effect of widowhood status varies by education and wealth, we run a Cox model that included interactions between each measure and widowhood (Table 4). The results show that additional education (Table 4a) and wealth (Table 4b) are associated with lower mortality for both widows and the married. Neither interaction was significant, indicating that the associations between wealth and education and mortality are not significantly different between the married and the widowed. In contrast to previous studies, we find no evidence that the widowhood effect varies significantly by SES (Lusyne et al., 2001; Manor & Eisenbach, 2003; Martikainen & Valkonen, 1998).

Table 4. Hazard Ratios of Mortality by Marital Status and Socioeconomic Status, Married Health and Retirement Study Sample, 1992–2008

	Model 1
a. Hazard ratios of mortality by marital status and education	
Marital status (married)	
Widowed	1.44***
Gender (male)	
Female	0.56***
Race/ethnicity (white)	
Black	1.22***
Hispanic	0.81**
Other/missing	1.18
Education (<high school)	
High school	0.76***
Some college	0.74***
College degree	0.47***
Widowed × education (<high school)	
Widowed × high school	1.03
Widowed × some college	0.75
Widowed × college degree	1.23
b. Hazard ratios of mortality by marital status and wealth	
Marital status (married)	
Widowed	1.17
Gender (male)	
Female	0.58***
Race/ethnicity (white)	
Black	1.06
Hispanic	0.75***
Other/missing	0.99
Wealth (lowest quartile)	
Low	0.70***
High	0.54***
Highest 25%	0.38***
Widowed × wealth (<least wealthy)	
Widowed × low wealth	1.24
Widowed × high wealth	1.15
Widowed × highest 25% wealth	1.37

Notes. Reference category in parenthesis. Models adjust standard errors for 15,935 household clusters.
*$p < .05$. **$p < .01$. ***$p < .001$.

Table 5. Hazard Ratios of Widow Mortality by Gender and Whether Spouse's Death Was Expected, Health and Retirement Study Sample, 1992–2008

	Male widowers	Female widows
Race/ethnicity (white)		
Black	0.69*	0.92
Hispanic	2.35*	1.79*
Other/missing	1.24	0.98
Education (<high school)		
High school	0.86**	0.76**
Some college	0.46***	0.62***
College degree	0.66***	0.55***
Spouse's death (expected)		
Unexpected	1.54*	0.80

Notes. Reference category in parenthesis. Separate models were run for male and female respondents.
*$p < .05$. **$p < .01$. ***$p < .001$.

Table 5 presents the relative hazard of mortality by expectedness of spouse's death, adjusted for age, race/ethnicity, and education. To consider variation in mortality among widows, models contain only widowed respondents and are stratified by gender. The interaction between gender and expectedness was significant for unexpected deaths ($p < .01$), consistent with previous research on this topic (Smith & Zick, 1996). Men experience 54% higher mortality risk in widowhood if their spouse's death was unexpected compared with expected. Women's mortality in widowhood does not vary significantly by expectedness of spouse death. Adding or removing controls for education does not alter the substantive results.

Discussion

Widowhood's harmful association with mortality exemplifies the relationship between social support and health (Elwert & Christakis, 2008). Widows experience higher mortality than their married counterparts although little is known about the specific dynamics of mortality among widows. Our study makes two important contributions. First, we generate a robust prediction of the portion of the widowhood effect that reflects a causal relationship between widowhood and subsequent mortality. We show that mortality risk is substantially elevated immediately following widowhood and is reduced over time (Boyle et al., 2011). Second, we examine the predictors of mortality among widows, particularly SES, gender, age, and expectedness of spousal death. Our results add to the literature on widowhood mortality and inform a more general research agenda on the relationship between social support and health among older adults.

We found that becoming widowed, controlling for age and gender, is associated with an increased mortality risk of 48%, comparable to other studies (Boyle et al., 2011; Johnson et al., 2000; Martikainen & Valkonen, 1998; Stroebe, 1994). Educational and wealth differences between widows and the married explain approximately one third of the elevated mortality of widows in this sample, consistent with other research on this topic (Boyle et al., 2011; Espinosa & Evans, 2008; Hart et al., 2007; Schaefer, Quesenberry, & Wi, 1995). The remaining two thirds cannot be explained by differences in education or wealth. Our fixed effects models control for omitted, stable variables, and yet still find a robust effect of widowhood. Although unobserved characteristics, such as joint lifestyle decisions made within households (Allison & Christakis, 2006), may explain some of the excess mortality among widows, widowhood itself may also be causally related to mortality.

Our analysis revealed important ways in which the widowhood effect does and does not vary across demographic subgroups. We find little evidence that men and women differ in mortality penalty of widowhood. Net of demographic and socioeconomic controls, both widows and widowers experienced slightly more than 30% higher mortality risk compared

with those who remain married. This finding contrasts with previous research that documents a stronger widowhood effect for men (Bowling, 1987; Stroebe et al., 2007). Previous research also suggests that younger widows (younger than 65 years) experience substantially higher mortality burden than older widows, suggesting that spousal deaths represent less of a shock at older ages when they become more common (Bowling, 1987; Moon et al., 2011). In contrast, we find no strong evidence that the widowhood effect becomes less pronounced at older ages using both continuous and categorical measures of age. However, we cannot specify whether the acute impact of bereavement declines at older ages.

Despite the robust literature on SES and mortality that consistently displays a strong and inverse association between SES and mortality, previous research found SES not to be protective in widowhood (Bowling, 1989; Lusyne et al., 2001; Martikainen & Valkonen, 1998; Parkes et al., 1969). These studies hold that higher SES individuals are more susceptible to grief from losing a spouse (Bowling, 1987; Manor & Eisenbach, 2003; Wortman et al., 1993) or that high SES marriages display greater specialization, making it more difficult for the surviving spouse to complete the roles performed by the decedent spouse (Manor & Eisenbach, 2003). We found no evidence for this reversed relationship; here both education and wealth were protective against mortality in widowhood. Our study sample (born between 1931 and 1951) came of age in a time of rapidly changing marriage and divorce patterns as well as gender roles, such that previous, older research on this topic may not apply to this cohort. Specialization has decreased across cohorts as more women obtain higher levels of education and participate the labor force (Jacobsen, 2007; Stevenson & Wolfers, 2007). Our findings may be more consistent with the wider literature on SES differences in social support that conclude SES confers higher levels of social support (Ajrouch, Blandon, & Antonucci, 2005; Cohen, Kaplan, & Salonen, 1999; Cohen & Wills, 1985; House, Umberson, & Landis, 1988; Krause, 2001).

We also find that the men and women differ in their response to unexpected versus expected spouse deaths. Our study is unique in that data regarding this question are collected from next of kin. For men, we find mild evidence of the role played by emotional shock; expected wife deaths are much less harmful than unexpected wife deaths. Men whose wives died unexpectedly are at a nearly 70% higher risk of dying than men whose wives' deaths were expected. This finding may reflect the fact that men receive a greater social support benefit from marriage than do women and may thus have more difficulty adapting to new conditions (Christenson & Johnson, 1995; Dupre et al., 2009). An expected death may allow for more time to develop alternate sources of support and new task skills and may thus help ease the burden of the transition to widowhood, consistent with both specialization and social support theories on marriage and widowhood. We find no significant difference in the effect of an expected versus an unexpected death among surviving women. Some literature suggests that the burden of caring for a spouse may lead to increased physical and emotional wear and tear and might be more common for those with "expected" spousal deaths (Christakis & Allison, 2006; Schulz & Beach, 1999). We may find no effect, possibly because caretaking is not always provided by the surviving spouse. Although adapting to new living conditions may partially explain the widowhood effect for women, it does not depend on the expectedness of the spouse's death.

The limitations of this study primarily reflect a lack of more detailed data on the living conditions of widows following spousal death. First, we are unable to accurately model the role of changes in resources following widowhood. It is very likely that some of the widowhood effect reflects adjustment to new financial living conditions (Elwert and Christakis, 2008), and decreases in wealth may have negative impacts on health for the surviving spouse. Because HRS interviews take place only every 2 years, many widows die prior to the subsequent HRS interview. In these cases, wealth changes following widowhood are not captured in the survey. Similarly, because respondents are interviewed on average 1 year after the loss of a spouse, we are limited in our ability to measure the immediate physical health, mental health, or behavioral effects of losing a spouse. We are unable to distinguish between the direct effect of the shock of losing a spouse and adaptation to new living conditions or sources of social support. Developing a solution to this problem will be an important avenue for future research on widowhood.

The HRS only is representative of the noninstitutionalized population. Although HRS follows individuals if they enter hospitals or nursing homes after entering the sample, HRS will fail to capture individuals who are institutionalized prior to sampling. If the least healthy and most frail couples are already institutionalized and do not enter the study, we may underestimate the true impact of widowhood on subsequent mortality.

Our measure of "expectedness" of deaths may mask extensive variation, especially among "expected" deaths. Some such deaths entail high-stress, high-intensity caregiving, whereas other expected deaths entail lower levels of stress and caregiving for the surviving spouse (Burton, Haley, & Small, 2006). Disentangling this variation may yield stronger results for expected deaths that involve drawn-out high-stress caregiving requirements for the surviving spouse.

Our study contributes to the growing body of literature examining the specific ways in which social support is associated with health outcomes, particularly among older adults. For many adults, marriage represents the primary source of social support, and adjusting to the sudden loss of a spouse represents an important transition that can have substantial effects on health and longevity. Our investigation of variation in the widowhood effect by subgroup helps to illuminate this fact. Although men and women do not

appear to respond differently to widowhood, men have significantly higher excess mortality when their wife's death was sudden and unexpected. Women are more resilient when faced with the unexpected death of their husbands, which likely reflects a broader network of social and emotional support among women. We should also not discount the fact that losing a spouse even at older ages implies increased risk of death that may reflect adjusting to rapidly changing social conditions (Smith and Zick, 1996).

Although some of the excess mortality among widows is due to selection, we conclude that direct emotional shock and issues associated with adapting to new living conditions in widowhood contribute to this association as well. An important question for future research will be to disentangle the specific social support pathways through which widowhood contributes to worse health. In addition, research should identify possible factors that individuals use to ameliorate the shock of losing a spouse and how individuals respond to changes in social support in later life.

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