



Marital loss and risk of dementia: Do race and gender matter?

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ARTICLE INFO

Keywords:

Marital status
Race
Dementia
Widowhood
Divorce
Gender
Income
United States

ABSTRACT

Recent studies have found that marital loss through divorce or widowhood is associated with a higher risk of dementia for older adults. However, whether these associations vary by race and gender is less clear. To address this gap, we drew upon longitudinal data from the Health and Retirement Study (2000–2016) to investigate the association between marital loss and dementia risk, separately for non-Hispanic Whites and non-Hispanic Blacks. We further examined gender variations in the link between marital loss and dementia risk within each racial group. Results from discrete-time event history models suggested that widowhood is significantly associated with a higher risk of dementia for both Whites and Blacks, controlling for basic demographic characteristics. However, while divorce is significantly associated with a higher risk of dementia for Blacks, the association is marginally significant ($p < 0.1$) for Whites. There are few significant gender variations in these associations except for the effect of divorce among Whites. Even after controlling for economic and health-related factors, we found that divorce is associated with a higher risk of dementia among White men but not among White women. Economic resources explain a significant portion of the association between widowhood and dementia risk, more so for Whites than for Blacks. Our findings call for more research into the pathways through which marital loss shapes the risk of dementia across racial and ethnic groups.

1. Introduction

Dementia is a neurodegenerative disease that is characterized by progressive declines in cognitive functioning (i.e., memory, thinking, and problem solving) that are severe enough to affect daily life and social functioning. The risk of dementia increases sharply with age (Hughes and Ganguli, 2009). Currently, over 5 million Americans live with Alzheimer's disease, the most common form of dementia, and it is estimated that in 2020 dementia will cost the United States \$305 billion (Alzheimer's Association, 2020). Although the causes of dementia are multifactorial, a small but growing literature suggests that marital loss (i.e., divorce or widowhood) may put adults at higher risk of dementia in later life (Liu et al., 2020a, b; Sommerlad et al., 2018; Sundstrom et al., 2016). Despite recent interest in examining divorce and widowhood as risk factors for dementia, most of the studies have been conducted in European countries, and race has not been considered in the analyses (Sommerlad et al., 2018). We know little about whether the association between marital loss and dementia varies by race and even less about the mechanisms underlying the associations between marital loss and dementia in different racial groups. Blacks in the United States have fewer

socioeconomic resources and suffer from higher rates of morbidity and mortality than Whites. Recent studies also find that they often have dementia at earlier ages and face two to three times higher dementia risk than Whites (Mayeda et al., 2016; Umberson et al., 2020; Zhang et al., 2016). Meanwhile, there are well-documented racial differences in union formation, marital quality, and dissolution. Blacks have lower rates of marriage, face higher rates of divorce, become widowed at earlier ages and spend less time in marriage than Whites (Bulanda and Brown, 2007; Dupre, 2016; Liu et al., 2020b; Raley and Sweeney, 2020). Against this backdrop, it is important to examine whether the effects of marital dissolution on dementia risk vary by race as well as the underlying mechanisms in each racial group.

Drawing on nine waves (2000–2016) of the Health and Retirement Study (HRS), we aim to examine whether the effects of divorce and widowhood on the risk of dementia vary by race and gender and the extent to which economic resources and health-related factors (i.e., chronic disease and health behaviors) explain the links between marital loss and dementia risk in different racial groups.

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2. Theoretical background

2.1. Marital loss and dementia risk

A recent meta-analysis of 15 studies (all conducted in countries other than the United States) found that widowed people had a 20% higher risk of dementia than married people (see Helmer et al., 1999, for an exception), while divorce did not significantly elevate dementia risk. The authors attributed the lack of robust effects of divorce on dementia risk to small sample sizes of divorced people in those studies (Sommerlad et al., 2018). At least two studies that had larger sample sizes have reported that the divorced had a significantly higher risk of dementia than the married, especially among the young-old (50–64), in the United States and Sweden (Liu et al., 2020a; Sundström et al., 2016).

Explanations for the effects of marital dissolution on dementia risk have centered on two frameworks: the marital resource model and the stress model. The marital resource model argues that divorce and widowhood increase the risk of dementia because of the loss of health-enhancing resources (e.g., economic and social support) associated with marriage. In terms of economic resources, marriage leads to an increase in income and wealth through within-household specialization, economies of scale, and the pooling of wealth. More economic resources increase access to nutritious food and medical or other health-enhancing resources, which are beneficial for maintaining cognitive health in later life (Killewald and Gough, 2013; Liu et al., 2020a). Compared to the married, the divorced and the widowed have lower household income and are more likely to live in poverty (de Vaus et al., 2017; Lin et al., 2017). Previous research has suggested that lower income can significantly increase older adults' exposure to stress associated with financial strains, which in turn leads to faster cognitive decline (Aggarwal et al., 2014; Chiao et al., 2014). Moreover, a growing body of studies has shown that self-reported household income is significantly associated with cognitive health in later life (Lynch et al., 1997; Sczufca et al., 2010; Yaffe et al., 2013). Marital dissolution also means the divorced and the widowed may lack the daily marital interaction and cognitive stimulation that are often provided by a spouse, resources that are protective against dementia (Fratiglioni et al., 2004; Mousavi-Nasab et al., 2012; Zhang et al., 2019).

The stress model puts more emphasis on the role of stress process associated with divorce and widowhood, both of which have long topped the list of the most stressful events in life. The ordeal of going through a marital loss and dealing with its aftermath can lead to grief, changes in residence and daily routines, loss of social support, an increase in financial hardships, and sometimes single or co-parenting (Booth and Amato, 1991; McFarland et al., 2013; Williams and Umberson, 2004; Zhang and Hayward, 2006). Research also suggests that the death of a spouse can have stronger emotional consequences (e.g., psychological distress and loneliness) and thus more negative effects on health than divorce (Pudrovska and Carr, 2008). Mounting evidence shows that stress may elevate the risk of dementia through multiple biochemical and behavioral mechanisms. For example, researchers have suggested that stress may lead to the blunting of the hypothalamic-pituitary-adrenal (HPA) axis and synaptic plasticity changes, which may have deleterious effects on memory (Greenberg et al., 2014; Yan et al., 2018). In addition, stress can increase the risk of multiple chronic diseases, including cardiovascular disease and stroke, which are associated with an increased risk of dementia (Morley, 2017; Ramirez-Moreno et al., 2020; Zhang et al., 2016). People are also more likely to adopt unhealthy behaviors (e.g., smoking and inactivity) to deal with stressful situations such as divorce and widowhood. These unhealthy behaviors can significantly increase dementia risk (Zhou et al., 2014). For example, smoking may "accelerate cerebral atrophy, perfusional decline and white matter lesions," leading to increased risk of cognitive decline and dementia (Peters et al., 2008, p.1). Lack of physical exercise can harm cognitive health through multiple mechanisms including decreased cerebral perfusion and an increase in vascular

diseases such as hypertension and diabetes (Bherer et al., 2013; Hughes and Ganguli, 2009). Taking this evidence together, we expect that divorce and widowhood can increase the risk of dementia through multiple sociobiological pathways.

2.2. The role of race

As far as we know, most studies on marital status and dementia have been carried out in European countries, and race has not been included in the analyses. In the United States, race is often included as a control variable in studies of marital status and dementia risk without considering potential racial differences (e.g., Li et al., 2018; Liu et al., 2020a). Previous studies on marital status, race, and different health outcomes (e.g., mental health and mortality) have suggested that although the general mechanisms underlying the negative effects of marital loss on health are similar across racial groups, for Blacks they may be either weakened due to the racial divide in marriage patterns and coping strategies (Brown et al., 2012; Raley et al., 2015) or compounded by the chronic stress of living in a racialized society (Umberson et al., 2020). Researchers have proposed two contrasting hypotheses. One group of researchers thinks that divorce and widowhood may have less detrimental effects on health among Blacks than among Whites (Dupre, 2016; Elwert and Christakis, 2006). They suggest that the non-married statuses (e.g., separated/divorced) are less stigmatized and more common among Blacks and therefore may have less detrimental consequences for their health than that of Whites. Divorced and widowed Blacks may also have more supportive coping resources to deal with marital loss (e.g., the Black Church and the extended family) than Whites (Brown et al., 2012; Kitson and Holmes, 1992; Liu and Zhang, 2013). Moreover, marriage may provide fewer social, psychological, and economic resources for Blacks than for Whites because of the legacy of racism, the relatively disadvantaged socioeconomic status of Blacks, and the reported lower marital quality among Black couples (Broman, 1993; Bulanda and Brown, 2007; James, 2014; McLoyd et al., 2000). A few studies have reported findings that are consistent with this line of argument. For example, Williams et al. (1992) found that the relative risk of mental illnesses among the divorced or separated relative to the married was lower among Blacks than Whites. Dupre (2016) found that divorce was significantly associated with risk of stroke for Whites but not Blacks. Similarly, widowhood did not increase the risk of mortality among Blacks older than age 65 but had a strong effect among Whites (Elwert and Christakis, 2006).

Another group of researchers suggest that Blacks may be more vulnerable to divorce and widowhood because, compared to their White counterparts, Blacks have fewer socioeconomic resources to cope with marital loss on top of a myriad of other stressors in life, such as racism and discrimination, high incarceration rates, and the loss of family members due to poverty, illness, and discrimination (Ajrouch et al., 2001; Dupre, 2016; Umberson et al., 2020). Moreover, marriage among Blacks in later life may be more selective of healthy individuals due to their lower rates of (re)marriage and higher rates of marital dissolution than Whites. Supporting this line of argument, several studies have reported that the association between marital loss and health seemed to be stronger among Blacks than among Whites. For example, using a nationally representative survey of retirement-age Americans (the HRS), Pienta and coauthors (2000) found that divorce and widowhood had stronger negative effects on fatal and nonfatal chronic diseases as well as disability among Blacks than among Whites. In a recent paper on widowhood and mortality among respondents aged 51 years and older, it was found that widowhood had stronger effects on mortality among Black women than White women (Liu et al., 2020b).

These mixed results on racial differences in the health consequences of marital loss may be partially due to differences in research designs (cross-sectional vs. longitudinal), age groups (younger than 65 vs. 65 and above), and health outcomes examined (mental or physical illness vs. mortality). We will extend the current literature by exploring racial

variation in the association between marital loss and dementia risk.

2.3. The role of gender

Studies on gender differences in the effects of marital loss on dementia are rare and have provided mixed evidence. For example, two studies have reported a stronger impact of marital loss on the risk of cognitive impairment and dementia for men than for women in the United States (Liu et al., 2020a, b) and Singapore (Feng et al., 2014), although another study in Sweden did not find significant gender differences in the association between divorce and dementia risk after confounders were adjusted (Sundström et al., 2016). More research has been conducted to examine gender differences in marital loss links to other health outcomes (e.g., mental health, cardiovascular health, mortality, etc.) (Rendall et al., 2011; Williams and Umberson, 2004; Zhang and Hayward, 2006). Although a few studies found that marital loss tended to have greater effects on women's cardiovascular risks than on men's (Dupre et al., 2015; Zhang and Hayward, 2006), a majority of empirical studies in this line have suggested that marital loss had stronger negative effects on men's health than on women's, including a more rapid decline in self-rated health (Williams and Umberson, 2004), lower subjective well-being (Leopold and Kalmijn, 2016), and greater feelings of loneliness and social isolation (Dykstra and Fokkema, 2007) — all factors predicting a higher risk of dementia. Indeed, the evidence of greater impacts of marital loss on men's health than on women's is consistent with the long-held tenet of sociology that men tend to receive greater health benefits from their marriages than do women (Williams and Umberson, 2004; Liu and Umberson, 2008). This is because, within traditional marriage, women tend to take major responsibility for maintaining social connections to families and friends, and they are also more likely to provide emotional support and health information to their husbands, whereas men are more likely to receive such benefits from their wives (Williams and Umberson, 2004; Liu and Umberson, 2008). In this sense, divorced and widowed men may lose more health-promoting benefits following marital loss than divorced and widowed women. Taking these findings together, we expect that marital loss will have greater effects on men's risk of developing dementia than on women's.

More importantly, gender may interact with race to modify the effects of marital loss on the risk of dementia. Previous research has found that gender roles were historically less rigid for Blacks than for Whites. A larger proportion of Black women participate in the labor force than White women, and the household division of labor among married couples is more egalitarian among Blacks than Whites (Johnson and Loscocco, 2015; Stanik and Bryant, 2012). Married Black men also have fewer economic opportunities in the labor market than their White counterparts and bring home less income (Liu et al., 2020b). The more flexible gender roles among Black couples suggest that gender differences in the association between marital loss and dementia risk may be less strong among Blacks than among Whites.

Building on previous studies on marital status and dementia risk, the present study aims to extend our understanding of how marital loss is associated with dementia risk among Blacks and Whites respectively, and whether the mechanisms generating this association vary by race. We propose and test the following hypotheses:

Hypothesis 1. Marital loss (i.e., divorce and widowhood) is associated with a higher risk of dementia among both Whites and Blacks.

Hypothesis 2. The association between marital loss and dementia risk is partially accounted for by economic resources and health-related factors.

Competing Hypothesis 3a. The association between marital loss and dementia risk is stronger among Whites than among Blacks.

Competing Hypothesis 3b. The association between marital loss and dementia risk is stronger among Blacks than among Whites.

Hypothesis 4. The association between marital loss and dementia risk is stronger among men than among women, and this gendered pattern is stronger among Whites than among Blacks.

3. Data and methods

3.1. Data

This study draws on data from nine waves of the Health and Retirement Study (2000–2016) to analyze the relationship between marital loss and the risk of dementia among Blacks and Whites. Since 1998, the HRS has surveyed a nationally representative sample of 21,384 noninstitutionalized adults over 50 years old every two years, either by telephone or in person. It oversamples Blacks and Hispanics and collects detailed information on cognitive, physical, economic, work, and family conditions as well as health behaviors. We did not use the 1998 wave because one of the key variables used in our assessment of dementia (i.e., interviewer assessment of the respondent's difficulty in finishing the survey due to cognitive limitations) only become available in the 2000 wave. Some of the covariates (e.g., household income) come from the RAND HRS DATA FILES, a cleaned and streamlined version of the HRS developed by RAND. Our analytic sample is restricted to community-dwelling, non-Hispanic Whites (hereafter, Whites) and non-Hispanic Blacks (hereafter, Blacks) aged 52 and older (in 2000) who either participated in the cognitive tests or had proxy reports on their cognitive status ($N = 16,383$). We excluded respondents who had never married as of 2000 ($n = 494$), had dementia in 2000 ($n = 943$) or had missing data on some of our key independent variables ($n = 158$). The final analytic sample included 14,788 respondents (1,953 Blacks and 12,835 Whites), contributing to 77,896 person-periods in total. We followed these 14,788 respondents until they experienced the onset of dementia, died, or dropped out of the study. From 2000 to 2016, 2,610 individuals (17.7%) experienced the onset of dementia, 4,619 (31.2%) died, and 2,741 (18.5%) dropped out. Among Blacks, 570 (29.2%) had developed dementia during the follow-up compared to 2,040 (15.9%) among Whites.

3.2. Measures

Dementia. The measurement of cognitive status in the HRS differs for self-respondents and proxy respondents. For self-respondents, the HRS assesses cognitive function using the modified version of the Telephone Interview for Cognitive Status (TICS). For individuals who were unable to participate in the cognitive tests due to health issues, cognitive status was measured using the proxy's assessment of the respondent's cognitive status. Following previous research, we first constructed a summary measure of cognitive status, which is based on the modified version of the TICS. Self-respondents' cognitive scores are based on tests of immediate and delayed recall of a list of 10 words (20 points), five trials of serial 7s (5 points), and backward counting (2 points). The summary score ranges from 0 (severely impaired) to 27 (high functioning). The HRS has developed a multiple imputation strategy that imputes missing cognitive variables for all waves. We used the imputed cognitive variables released by the HRS (Fisher et al., 2017). Following previous work (Crimmins et al., 2016; Farina et al., 2020), we classified respondents with scores 0–6 as having dementia and those with scores 7–27 as having no dementia. For respondents who were unable to participate in the cognitive tests due to health issues, an 11-point scale was developed using three sources of data: the proxy's assessment of the respondent's memory (0 = excellent, 1 = very good, 2 = good, 3 = fair, 4 = poor); an assessment of the respondent's limitations in five instrumental activities of daily living (IADLs) (i.e., managing money, taking medication, preparing hot meals, using the phone, and shopping for groceries) (0–5); and the interviewer's assessment of the respondent's difficulty completing the interview because of cognitive limitations (on a scale of 0–2, where 0 = none, 1 = some, and 2 = prevents completion).

Respondents with scores 6–11 were classified as having dementia, and those with scores 0–5 were classified as having no dementia.

Marital Status. Marital status is our key independent variable, which had three categories: married (reference), divorced/separated, and widowed.

Potential Mediators. We tested two types of potential mediators: household income and health-related factors. Household income measured the total household income in the year prior to each interview wave. To adjust for the skewed distribution of income and different household sizes, we divided the values by the square root of household size, added 1 to eliminate zero incomes, and applied the logarithm (Glymour et al., 2008). Health-related factors included three measures: chronic diseases, smoking, and exercise. We measured health using a comorbidity index (0–4) which is a summary score of the presence of four major chronic conditions that are risk factors for dementia: stroke, diabetes, heart disease, and high blood pressure. The health measure was based on self-report of a doctor's diagnosis of the diseases. Health behaviors included smoking (1 = current smoking) and exercise (1 = participation in vigorous physical activities three or more times a week over the last 12 months). Because the question on exercise changed over waves, we included exercise at baseline (2000) in the analysis.

Other Covariates. Age was measured as a continuous variable. Gender (1 = woman) was measured as a dummy variable. Education was measured in four categories: less than 8 years (reference), 8–11 years, 12 years, and 13 or more years. We also included a dummy variable to indicate whether a proxy respondent was used for an individual who was unable to participate in the cognitive tests. The analyses were stratified by race (Blacks and Whites). All analytic variables are time-varying except for gender, education, and exercise.

3.3. Analytic strategy

We employed a discrete-time event history modeling approach to examine the association between marital loss and the onset of dementia. To take account of competing risks, the dependent variable in the model had four outcomes: dementia, death, loss to follow-up, and no dementia (the base category). Person-period files were created for the two-year intervals from 2000 to 2016, and a multinomial logit modeling approach was used for the discrete-time event history analysis (Allison, 2010; Umberson et al., 2020). An individual could potentially contribute between 1 and 8 person-periods to the analysis. Models were stratified by race to fully consider the fundamental differences between racial groups. For both the Black and White subsamples, we estimated five models. The first model included marital loss and basic sociodemographic controls (i.e., age, gender, education, and proxy reports). We then introduced potential mediating variables in a series of nested models to evaluate through which mechanisms marital loss influenced dementia risk for Blacks and Whites respectively. All time-varying covariates were lagged by one wave in the prospective analyses (e.g., marital status in 2000 was used to predict dementia status in 2002) to reduce temporal ambiguity when marital loss and dementia status were reported in the same wave. Finally, we conducted formal mediation analysis using the Karlson–Holm–Breen (KHB) method to examine whether household income and health-related factors mediate the associations between marital loss and dementia risk for Whites and Blacks. The KHB method decomposes the total effects of a predictor variable on the outcome variable into direct and indirect effects in both linear and nonlinear probability models (Hsieh and Waite, 2019; Karlson and Holm, 2011). We estimated all models using Stata16 and adjusted for the complex sampling design of the HRS. All analyses were weighted using 2000 HRS sampling weights.

4. Results

4.1. Sample characteristics

We present the weighted descriptive statistics for Whites and Blacks in Table 1. At baseline (2000), Blacks were more likely to be divorced/separated (27.61%) and widowed (25.25%) than their White counterparts (12.25% divorced/separated and 19.34% widowed). On average, Blacks had roughly one-half of Whites' household income. In terms of health and health behaviors, Blacks had a significantly higher number of chronic conditions (1.10 on a scale of 0–4) than Whites (0.8), and a higher proportion of Blacks (19.98%) than Whites (15.51%) were current smokers. There was no significant racial difference in participation in exercise at baseline. The mean age of Black respondents (64.31) was younger than that of Whites (66.13). Blacks reported lower levels of education, and a higher proportion of Blacks (9.05%) had proxy reports than Whites (6.03%).

4.2. Marital loss and dementia risk among Whites

Next, we turn to a series of nested multinomial logistic regression models to examine the association between marital loss and risk of dementia among Whites. Table 2 shows the results from the models predicting dementia incidence (results from models predicting death or dropout are available upon request). We find in Model 1 that the odds of dementia among the divorced/separated Whites were 26% ($p < 0.1$) higher than those of their married counterparts; the widowed Whites had 19% ($p < 0.01$) higher odds of dementia than the married Whites, after adjusting for age, gender, education, and proxy reports. However, after household income was added in Model 2, the significantly higher odds of dementia among the widowed were reduced and became statistically nonsignificant at $p < 0.05$. In Model 3, where we added health-related variables in addition to the control variables, the widowed Whites still had significantly higher odds of dementia, and all the health-related variables (i.e., chronic disease, current smoking, and exercise) were significantly associated with dementia risk. In Model 4, our full model, we included all the covariates, and neither divorce nor widowhood was significantly associated with dementia risk. To investigate

Table 1
Weighted descriptive statistics by race, Health and Retirement Study (HRS), 2000 ($N = 14,788$).

	Whites ($n = 12,835$)	Blacks ($n = 1,953$)
Marital Status (%)		
Married (ref)	68.41	47.13*
Divorced/ Separated	12.25	27.61*
Widowed	19.34	25.25*
Economic Resources		
Household income (\$)	66,371 (110,154)	37,040 (45,771)*
Health and Health Behaviors		
Chronic disease (0–4)	0.80 (0.91)	1.10 (0.96)*
Current smoking (%)	15.51	19.98*
Exercise (%)	46.28	38.13
Controls		
Age	66.13 (9.50)	64.31 (8.93)*
Women (%)	54.83	57.96
Education (%)		
0–7 years (ref)	2.46	11.58*
8–11 years	16.54	28.58*
12 years	36.96	29.68*
13–17 years	44.04	30.16*
Proxy (%)	6.03	9.05*

Note: * Statistically significant difference between Whites and Blacks at the 0.05 level.

Table 2
Estimated odds ratios from discrete-time event history models among Whites, HRS 2000–2016.

	Dementia vs. No dementia				
	Model 1	Model 2	Model 3	Model 4	Model 5
Marital Status (ref: married)					
Divorced/Separated	1.26+	1.10	1.19	1.05	1.58*
Widowed	1.19**	1.08	1.16*	1.06	1.01
Economic Resources					
Household income		0.78***		0.79***	0.79***
Health and Health Behaviors					
Chronic disease			1.21***	1.20***	1.20***
Current smoking			1.50***	1.45***	1.45***
Exercise			0.87**	0.89**	0.89**
Interaction					
Divorced/Separated × Women					0.51**
Widowed × Women					1.02
Controls					
Age	1.12***	1.12***	1.12***	1.12***	1.12***
Women	1.01	0.97	1.03	0.99	1.05
Education (ref: 0–7 years)					
8–11 years	0.48***	0.50***	0.49***	0.51***	0.51***
12 years	0.25***	0.28***	0.27***	0.29***	0.30***
13–17 years	0.18***	0.22***	0.20***	0.24***	0.24***
Proxy	2.73***	2.73***	2.67***	2.68***	2.71***

Note: N of person-periods = 68,758.

***p < 0.001, **p < 0.01, *p < 0.05, + p < 0.10.

whether the association between marital loss and dementia risk differed by gender among Whites, we added two product terms (divorce × women and widowhood × women); the results in Model 5 showed that the interaction between divorce and gender was statistically significant (odds ratio = 0.51, p < 0.05), suggesting that association between divorce and dementia risk was stronger among White men than White women. Specifically, among White men, the odds of dementia were 58% higher among the divorced than among their married counterparts. However, additional analysis showed that among White women, the association between divorce and dementia risk was not statistically significant at p < 0.05 (results not shown).

We then conducted formal mediation analysis among Whites to see the extent to which household income and health-related factors accounted for the significant association between marital loss and dementia risk. Results from Table 3 show that among White men, household income and health-related factors together accounted for about 23% of the association between divorce and dementia risk. Specifically, household income and smoking played significant mediating roles, accounting for 13% and 11% of the association, respectively. In comparison, household income and health-related factors accounted for as much as 71% of the association between widowhood and dementia risk.

Table 3
Mediation effects of economic resources and health-related factors for Whites.

	Divorced/Separated (Men Only)			Widowed		
	Coef.	Z	% Explained	Coef.	Z	% Explained
Total effect	0.54**	3.27		0.19**	2.96	
Direct effect	0.42*	2.51	76.71	0.05	0.85	29.15
Indirect effect	0.13***	5.10	23.29	0.13***	10.58	70.85
Household income			12.97			51.61
Chronic disease			−0.38			2.95
Current smoking			10.50			12.55
Exercise			0.20			3.74

***p < 0.001, **p < 0.01, *p < 0.05.

Household income was the most important mediator, accounting for 52% of the association, followed by smoking (13%), exercise (4%), and chronic disease (3%).

4.3. Marital loss and dementia risk among Blacks

We ran the same sets of analyses for the Black sample (Table 4). Results in Model 1 indicated that both divorce and widowhood were significantly associated with higher odds of dementia among Blacks, adjusting for age, gender, education, and proxy reports. Specifically, compared to their married counterparts, the odds of dementia were 48% (p < 0.05) higher among divorced Blacks and 58% (p < 0.01) higher among widowed Blacks. After adjusting for household income in Model 2, the odds of dementia risk for both divorced and widowed Blacks were reduced, and the effect of divorce was no longer statistically significant at p < .05. However, the widowhood effect remained statistically significant (odds ratio = 1.48, p < 0.05). One important finding is that although household income was significantly associated with a lower risk of dementia for both Whites and Blacks, the protective effect of income was smaller for Blacks (odds ratio = 0.85) than for Whites (odds ratio = 0.78). In Model 3, after we added health-related factors, the odds of dementia among divorced Blacks became marginally significant (odds ratio = 1.41, p < 0.1), but the odds of dementia among widowed Blacks were reduced slightly and remained significant (odds ratio = 1.54, p < 0.05). In Model 4, we added all the covariates, and the association between divorce and the risk of dementia was no longer statistically significant. However, the odds of dementia among the widowed were reduced from 1.58 to 1.44 and remained statistically significant. To test whether the association between marital loss and dementia risk was modified by gender, we added two gender interaction terms, and neither was statistically significant.

To further examine the underlying mechanisms linking marital loss and dementia risk among Blacks, we conducted a KHB mediation test. Results in Table 5 show that household income and health-related factors accounted for 37% of the association between divorce and dementia risk among Blacks; household income and smoking accounted for 25% and 11% of the association, respectively. In comparison, household income and health-related factors accounted for only 24% of the

Table 4
Estimated odds ratios from discrete-time event history models among Blacks, HRS 2000–2016.

	Dementia vs. No dementia				
	Model 1	Model 2	Model 3	Model 4	Model 5
Marital Status (ref: married)					
Divorced/Separated	1.48*	1.34	1.41+	1.28	1.59
Widowed	1.58**	1.48*	1.54*	1.44*	1.37
Economic Resources					
Household income		0.85***		0.86***	0.85***
Health and Health Behaviors					
Chronic disease			1.14**	1.13*	1.13**
Current smoking			1.40+	1.37	1.35
Exercise			0.96	0.98	0.97
Interaction					
Divorced/Separated × Women					0.69
Widowed × Women					1.01
Controls					
Age	1.08***	1.08***	1.08***	1.08***	1.08***
Women	1.04	0.97	1.07	1.00	1.10
Education (ref: 0–7 years)					
8–11 years	0.65*	0.68*	0.63**	0.66*	0.65**
12 years	0.37***	0.41***	0.37***	0.40***	0.40***
13–17 years	0.17***	0.20***	0.17***	0.20***	0.20***
Proxy	2.40***	2.35***	2.41***	2.36***	2.39***

Note: N of person-periods = 9,138.

***p < 0.001, **p < 0.01, *p < 0.05, + p < 0.10.

Table 5
Mediation effects of economic resources and health-related factors for Blacks.

	Divorced/Separated			Widowed		
	Coef.	Z	% Explained	Coef.	Z	% Explained
Total effect	0.40*	2.41		0.48***	3.53	
Direct effect	0.25	1.48		0.37**	2.68	75.75
Indirect effect	0.15***	4.46	37.18	0.12***	4.53	24.25
Household income			24.52			18.90
Chronic disease			1.32			0.12
Current smoking			11.00			4.98
Exercise			0.34			0.25

*** $p < 0.001$, ** $p < 0.01$, * $p < 0.05$.

association between widowhood and dementia risk. Household income again was the most important mediator, accounting for 19% of the association, followed by smoking (5%), exercise (0.25%), and chronic disease (0.12%).

5. Discussion

Studies using a variety of data have often shown that divorce and widowhood have detrimental effects on a range of health outcomes, including self-rated health, cardiovascular health, and risk of inflammation (Liu, 2012; Sbarra, 2009; Zhang and Hayward, 2006), but few studies have examined dementia — an emerging public health concern in the context of rapid population aging — in relation to marital loss. This study is among the first to extend the evidence of the long-observed negative health impacts of marital loss to dementia across racial groups. Our analysis of nationally representative longitudinal data from the HRS (2000–2016) suggests that divorced/separated and widowed Blacks and Whites (except for divorced/separated White women) had higher odds of developing dementia during the 16-year study period in comparison to their married counterparts — largely supporting our general hypothesis (Hypothesis 1). More importantly, we advance this line of literature by finding gender and race variations in the links between dementia and marital loss, as we discuss next.

We find that the effects of both divorce and widowhood on dementia seem stronger for Black older adults than for White older adults — consistent with Hypothesis 3b. This result is in line with some recent studies that also find stronger effects of marital loss on mortality and other health outcomes for Blacks than for Whites (e.g., Liu et al., 2020b; Pienta et al., 2000). Leading scholars have long argued that social structure and social stratification produce different opportunities, constraints, and demands in social conditions that contribute to racial disparities in health (Williams and Sternthal, 2010; Umberson et al., 2020). Blacks may be more vulnerable to divorce and widowhood than their White counterparts because Blacks experience greater constraints in society, which can limit their access to social and economic resources to cope with life stressors such as marital loss (Umberson et al., 2020). Given that the prevalence of marriage is much lower among Blacks than among Whites (47.13% vs. 68.41% in our analytic sample), it is also likely that marriages in later life among Blacks are more selective of healthy individuals than among Whites, which may partially explain the observed racial differences in dementia in relation to marital loss.

Moreover, we find that the effect of divorce (but not widowhood) on dementia is stronger for White men than for White women (partially consistent with Hypothesis 4), although there is no evidence for significant gender difference in the effect of marital loss (either divorce/separation or widowhood) on dementia among Black adults. This gender difference among Whites is robust to controlling for household income and health-related factors. This finding is consistent with recent studies which found that divorce was more strongly associated with a higher

risk of dementia for men than for women in Sweden (Sundström et al., 2016) and in the general U.S. population (Liu, et al., 2020a). This gendered finding is also consistent with the general premise on gender, marriage, and health: In a traditional marriage, women are more likely than men to provide emotional support to their spouse, maintain network connections, and regulate health behaviors of other family members, which all may benefit men's health more than women's (Williams and Umberson, 2004). Therefore, the loss of a spouse from either divorce or widowhood may hurt men's health and well-being, including cognitive health, more than women's (Lee et al., 2001; Liu and Umberson, 2008). It has been suggested that this gendered dynamic is less relevant to Black couples than to White couples (Stanik and Bryant, 2012), which may partly explain the insignificant gender differences in links between marital loss and dementia among Blacks.

Another contribution of this study is that we move beyond documenting basic associations between marital loss and dementia by testing potential underlying mechanisms. Consistent with our expectation (Hypothesis 2), our results suggest that the effects of divorce and widowhood on dementia are partially explained by household income and, to a lesser extent, health-related factors. Indeed, income is particularly important for White people as a key underlying mechanism through which widowhood harms cognitive function, explaining more than half of the estimated widowhood effect on dementia in the White sample. This finding is consistent with a recent study suggesting that economic resources played a more important role in explaining the widowhood effect on mortality risk for Whites than for Blacks (Liu et al., 2020b). Because Whites tend to earn more than Blacks, loss of a spouse may result in more noticeable changes in the standard of living and increase financial strain more profoundly for Whites than the loss of a spouse among Blacks; and perceived stress was associated with faster cognitive decline and a higher risk of dementia (Aggarwal et al., 2014; Johansson et al., 2010).

In addition to household income, health-related factors also explained some of the effects of widowhood and divorce on dementia risk for both Whites and Blacks, but the mediating role of health-rated factors was much weaker than that of income in accounting for the association between marital loss and dementia. We note that our health measures were limited and did not fully capture the key health-related components that contribute to the negative effects of divorce and widowhood on dementia. Future studies should explore additional health factors (e.g., sleep quality and inflammation) along with other sociopsychological factors (e.g., social support) in shaping the risk of dementia in relation to marital loss.

This study has several limitations. First, we examined the overall effect of marital loss on dementia risk among Whites and Blacks without considering the duration of divorce or widowhood. Previous research has been very limited and mixed on this topic. For example, a recent study has shown that older adults who had been widowed for 2 or more years had greater memory decline than those who were married, whereas those who were recently widowed were not significantly different from the married at the 2-year follow-up (Zhang et al., 2019). Another study in Korea found that widowhood duration of 4–6 years was associated with a steeper cognitive decline compared with non-widowhood; other widowhood durations (less than 2 years, 2–4 years, and 6 years or more) were not associated with cognitive decline (Lyu et al., 2019). Future studies with larger samples of the divorced and widowed may benefit from considering whether the effects of marital loss vary by key characteristics of the individual's marital history, such as the duration of marital loss as well as marital quality before the marital loss.

Second, our measure of dementia is based on cognitive tests and proxy reports rather than clinical diagnosis. We note that although the HRS battery of cognitive tests is more limited than a standard neurological diagnostic examination, previous research has validated the HRS dementia measures by demonstrating that these cognitive tests and proxy reports correctly classify 74% and 86%, respectively, of HRS

subjects into clinical diagnosis categories of normal or dementia cases (Crimmins et al., 2011). Third, although we built our research hypotheses based on causal implications from two theoretical models—the marital resource model and the stress model — our analysis cannot distinguish the two models or fully determine causality. Although we have lagged marital status by one wave, which significantly reduced the influence of reverse causation (i.e., dementia occurring before or during marital loss), we cannot rule out the possibility that the underlying pathological process before the onset of dementia may have contributed to marital stress and dissolution. Moreover, we did not examine a full range of potential mediators linking marital loss to dementia due to data limitations. Future studies should continue to investigate other potential pathways (e.g., loss of social support) through which marital loss shapes the risk of dementia in potentially different ways for men and women and for Blacks and Whites. Finally, the analytic sample was relatively small for Blacks, which may explain some of the insignificant findings (e.g., gender interaction for Blacks). We also could not examine other racial-ethnic groups due to small sample sizes. Future studies should explore how marital loss may affect the risk of dementia among other racial-ethnic minority groups such as Hispanics, Native Americans, and Asian Americans.

6. Conclusion

Despite these limitations, the current study makes important contributions to the general literature on health impacts of marital loss by extending prior research to dementia risk in later life as well as examining the racial and gender variations in that risk. The results, which are based on 16-year data drawn from a nationally representative sample of U.S. older adults, suggest that remaining divorced or widowed in midlife and beyond may be a risk factor for the onset of dementia for Blacks as well as Whites, and that the effect of marital loss on dementia is stronger for Blacks than for Whites and stronger for White men than for White women. The importance of this finding is highlighted by the significantly higher prevalence of divorce and widowhood among Blacks than among Whites. It is important to further explore the complex pathways that might contribute to a higher risk of dementia among Blacks following divorce and widowhood so that effective interventions can be implemented to reduce those risks.

Credit author statement

Zhenmei Zhang: Conceptualisation, Methodology, Writing – original draft, Writing – review & editing, Supervision, Funding acquisition. **Hui Liu:** Conceptualisation, Writing – original draft, Writing – review & editing, Funding acquisition. **Seung-won Emily Choi:** Data curation, Formal analysis, Visualization, Writing – review & editing.

Declaration of competing interest

None.

Acknowledgments

This work was supported in part by the National Institute on Aging (Grants R03 AG062936 and R01 AG061118); the Center for Family and Demographic Research, Bowling Green State University, which has core funding from the Eunice Kennedy Shriver National Institute of Child Health and Human Development (P2CHD050959). We would like to thank Rachel Kamins for proofreading the manuscript.

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