MARITAL BIOGRAPHY AND CHRONIC DISEASE PROGRESSION IN MID- AND LATE LIFE

By

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ABSTRACT

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In light of lengthening life expectancy with chronic disease and increasingly diverse marital experiences over the life course among older adults in the US, this dissertation investigates how marital biography is linked to chronic disease progression among older adults aged 50 years old and over in the US. I use three papers to address this overarching research question. The data are from the Health and Retirement Study (HRS), 1994-2012, a national panel sample representative of noninstitutionalized civilian adults aged at least 50 years old in the US. My first paper evaluates *how current marital status and current marriage duration are associated with the development of functional limitations among older adults diagnosed with diabetes*, using multilevel growth curve models. The findings show that remarried, cohabiting and divorced/separated older adults with diabetes report significantly more functional limitations at age 50 than their peers who stay in their first marriage. Although widowed older adults with diabetes report significantly fewer functional limitations than the first-time married at age 50, they show a faster decline in their functional health over time. The never-married show a similar functional health trajectory as the first-time married. The second paper assesses *the link between marital quality and functional limitations among older adults diagnosed with cardiovascular disease*. Multilevel models are used to estimate the associations between marital quality and functional health and control for household-level clustering effects. My analyses show that while negative dimensions of marital quality are significantly associated with worse functional health subsequently in two years for both older men and women with cardiovascular disease, positive

dimensions of marital quality are significantly linked to better functional health only for men. Additionally, improvements in positive marital quality over a four-year period are significantly associated with better functional health four years later. The third paper examines *differential mortality risk by marital trajectories among older adults with cardiovascular disease, focusing on their lifetime exposure to marital losses* with Cox regression models. The analyses show that among the remarried, only those who are one-time widowed exhibit a significantly higher mortality risk than the first-time married. Both the currently divorced/separated and widowed experience significant mortality disadvantage compared to their peers in their first marriage. Additionally, older cohabitors with cardiovascular disease also show a heightened mortality risk. The never-married, however, show comparable mortality risk to that of the first-time married. Overall, the findings from this dissertation point to the significance of marriage for maintaining physical functioning for older adults while they manage major chronic illnesses such as diabetes and cardiovascular disease. However, the benefits of marriage for chronic disease management are also contingent upon past marital experience and relationship quality. I expect the findings to have important implications for healthcare professionals working with chronic disease patients and public policies regarding chronic disease management.

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CHAPTER ONE

INTRODUCTION

Marriage is an important social context for individual well-being. Research on marital status and health has generally established that married people have better physical as well as mental health, report fewer chronic illnesses and enjoy longer life expectancy (Pienta, Hayward and Jenkins 2000; Rendall et al. 2011; Waite and Gallagher 2000). Cross-sectional studies on marital status and health have consistently indicated a significant link between marital status and health, but have not elucidated how change in marital status contributed to the development of health over time. Recent research on marital biography and health brought in a dynamic perspective to the study of marriage and health, illuminating how marriage promotes health over time, and how the lack of it damages health. In the case of marital biography and chronic diseases, the current scholarship has accumulated a wealth of findings on the link between marital biography and chronic illness. Yet, most of the literature focuses the relationship of marital biography with either the onset of chronic diseases or the prevalence. How marital biography shapes health after the onset of a chronic disease is much less discussed.

With increasing life expectancy, individuals with chronic illness tend to live longer with the diseases compared to their predecessors, and the quality of life with chronic diseases has become a prominent interest to researchers as well as health practitioners (Crimmins 2004; Crimmins, Hayward and Saito 1994). As marriage is one of the most important social relationships to individual well-being, and many people living with chronic health conditions spend a significant part of their adult life in and out of marriage, it is important to investigate how marital experiences over the life course shape the course of chronic illness after the onset. Understanding how health develops over the marital life course for individuals with chronic health conditions should have informative implications for the quality of life and health management in mid- and later life, particularly for chronic disease patients.

In this dissertation, I use three papers that answer three different but related research questions to inform how marital experiences over the life course may affect the health trajectory of chronic disease patients. In the first paper, I ask "*how is marriage associated with the development of functional limitations after older adults are diagnosed with diabetes?*" In this paper, I first examine how current marital status is linked to functional health trajectories among older adults diagnosed with diabetes. In light of health implications of marital history and cohabitations, I distinguish the remarried from the first-time married, and cohabitors from the unmarried. Among the currently married older adults with diabetes, I then assess how duration in current marriage is linked to the development of functional limitations. My second paper investigates an important dimension of marriage in the household production of health–marital quality. Specifically, I ask "*how marital quality is linked to the development of functional limitations among older adults diagnosed with cardiovascular disease?*" I examine the respective contribution of positive and negative marital quality to the functional health of older adults with cardiovascular disease (CVD). Lastly, in the third paper, I examine *how marital trajectory is associated with mortality risk among older adults diagnosed with CVD,* focusing on older adults' lifetime exposure to marital losses. Specifically, I compare mortality risks among different marital status groups distinguished by their lifetime exposure to divorce and widowhood.

CHAPTER TWO

MARRIAGE AND THE PROGRESSION OF FUNCTIONAL LIMITATIONS AMONG OLDER ADULTS DIAGNOSED WITH DIABETES IN THE US

Introduction

Diabetes is the 7th leading cause of death in the US in 2013, according to the latest report on final death estimates. Additionally, it is also highly comorbid with heart disease and stroke, both of which are among the top 5 leading causes of death, and closely correlated with obesity (Bishop, O'Connor and Desai 2010). Therefore, diabetes exerts a prominent impact on the US population health. As the prevalence of diabetes has been growing over the past decade among the middle-aged and particularly older adults (National Center for Health Statistics 2015), the death rates of diabetes among adults aged 55 years old and over have been decreasing (Xu et al. 2016), suggesting that older adults with diabetes now live longer with the disease and very likely with various health complications. Thus, effective management of diabetes and maintaining the quality of life become more critical issues for diabetic patients.

As an important social context for maintaining good health and managing diseases (Waite and Gallagher 2000), marriage, particularly those of higher quality, has been shown to be associated with better diabetes management, including fewer mental health complications and better blood glucose control (Nicklett and Liang 2010; Trief et al. 2006). Nevertheless, little research has examined different marital contexts as a risk factor for physical disability associated with diabetes which can considerably hamper the quality of life for diabetic patients (Kalyani et al. 2010; Wray et al. 2005). Better understanding of marital contexts as a risk factor for the physical disability of diabetic patients can potentially inform more effective diabetes management plans for health professionals and policies addressing this issue. To bridge this research gap, the current study examines how various marital contexts contribute to the development of functional limitations among older adults in the US diagnosed with diabetes, using data from the Health and Retirement Study, 1994 to 2012. I adopt a life course perspective to take into account older adults' marital history. Specifically, I distinguish between older adults remaining married in their first marriage and those in higher-order marriages, and consider the health implication of current marriage duration for diabetic patients. The following specific research objectives are addressed in this study: (1) to examine *how current marital status and current marriage duration are associated with the development of functional limitations among US older adults diagnosed with diabetes*, (2) to investigate *whether there are gender differences in the observed associations*.

Theoretical Frameworks

Several theoretical frameworks explain the link between marital status and health, and can inform how different marital contexts contribute to functional health with diabetes.

The Marital Resource Model

The marital resource model posits that married people acquire resources protective of health from marriage, resources important for maintaining good health as well as managing diseases. First of all, married people accumulate economic resources via economies of scale, the pooling of assets and specialization of household and market labor in marriage, which can then be invested to acquire health-enhancing goods and services such as nutritious food and high-quality health care services (Waite 1995). These economic resources are even more crucial when individuals try to battle with diabetes. Managing diabetes can be a costly endeavor. For example, access to health insurance is pivotal to managing diabetes as patients need to pay regular medical visits and procure medical treatments such as insulin shots or specialized medical examinations.

Health insurance can be helpful in covering medical expenses. As married people have greater economic resources to purchase quality health insurance plans, to pay regular medical visits, and adhere to medical regimens with fewer financial burdens, they are better equipped financially to manage diabetes than their unmarried peers.

In addition to economic gains, married people also benefit from marriage through increased social resources. One major form of social resources in promoting married people's health is the social control of health behavior by their spouses (Umberson 1992). Marriage promotes salubrious health behaviors because married people, mostly the wives, monitor their spouses' health conditions, and make them adopt a healthier lifestyle, such as to quit smoking, to drink moderately, and to follow regular sleeping schedules. The spousal regulation of health behavior is particularly important for individuals living with diabetes (Beverly, Miller and Wray 2007). To properly manage diabetes, patients need to rigorously adhere to oftentimes specialized medical regimens. Married diabetic patients benefit from spousal regulations of health behavior as managing diabetes involves a significant component of behavioral adjustments such as quitting smoking, dietary change and exercise (Gallant, Spitze and Prohaska 2007). Such health monitoring is less available to the unmarried, which makes managing diabetes a more difficult task for them. Research has shown that social support, particularly from married spouses, helps chronic disease patients to follow complex treatment regimens, and thus is conducive to chronic disease management (Lett et al. 2005; Lutfey and Freese 2005; Nicklett and Liang 2010).

Lastly, marriage enhances health through providing emotional support. The emotional benefits of marriage not only work in health but also in sickness. Epidemiological studies have identified stress as a major modifiable risk factor for the incidence and complication of diabetes (Von Korff et al. 2005). Thus, maintaining positive emotions is crucial for managing diabetes.

The emotional support married people with chronic illness gain from their spouses can play a crucial role in buffering psychological distress associated with the disease. The sense of personal control and belonging married people get from marriage provide diabetic patients with psychological strength to continue battling with chronic diseases. Thus, married people are emotionally better-off than their unmarried peers to manage chronic diseases (Umberson and Montez 2010).

It is clear that the marital resource model would predict that with the protective resources afforded by marriage, married people should be better-off in managing diabetes and thus better health than the unmarried. Yet, an important lesson from the life course paradigm suggests that past life events or experiences may have a lasting effect on future outcomes (Elder and Giele 2009). Thus, an important question to ask is if and how past marital experience moderate the health benefits marriage. Thus, I distinguish the first-time married from the remarried among currently married individuals to assess the impact of past marital history. Additionally, recent studies have shown that cohabitation provides certain "marriage-like" resources that are protective of health, and yet does not benefit health as much as a legal marriage (Carr and Springer 2010; Liu and Reczek 2012). Therefore, I also examine the role cohabitation plays for functional health of people with diabetes in their mid- and late life compared to the first-time married. Additionally, the notion of cumulative processes suggests that the accumulation of resources over time in a status of advantage should further enhance individuals' well-being later in life (O'Rand 2009). As a result, the theoretical expectation is that as people stay longer in a marriage, they should accumulate greater resources protective of health than those with shorter marriage duration. Building on this theoretical formulation, I expect that longer marriage duration should be protective of functional health after the onset of diabetes.

The Stress Model

Divorce/separation and widowhood are considered very stressful life events that cause immediate elevated stress around the occurrence of marital disruption. The elevated stress can thus cause direct physiological impairments and indirectly compromise individuals' health via behavioral changes in adopting unhealthy life style such as smoking, binge drinking, irregular diet and loss of sleep (Amato 2000; Carr and Bodnar-Deren 2009). Individuals with diabetes can be particularly vulnerable to such immediate stress when experiencing marital loss. First, psychological distress, a known risk factor of many chronic illnesses, can directly impose damage on diabetic patients' already compromised physiological systems and further cause a downward spiral of their health. Moreover, stress-induced unhealthy behaviors such as smoking, heavy drinking, abnormal diet and poor adherence to medical regimens, can also put diabetic patients at a greater risk of developing a host of health complications (Bishop et al. 2010; Greenfield et al. 2011). In addition to short-term health damage, marital dissolution is also associated with a host of chronic stressors (e.g., economic hardships, negotiation with ex-spouse regarding shared parenting) that can cause long-term insults to mental as well as physical health (Amato 2010; Carr and Bodnar-Deren 2009). These chronic strains incurred by marital loss such as economic distress and reduced social support can be a major source of deterrents to diabetes management (Baum and Posluszny 1999; Lutfey and Freese 2005). Thus, the stress model should predict that the previously married have worse health trajectories after diabetes diagnosis than the first-marrieds.

Also, embedded in the life course framework, stressful life events such as divorce or widowhood may have a lingering impact on individual well-being later in life even after individuals transition out of these events (Elder and Giele 2009), suggesting that although marriage may protect people's health, previous marital dissolutions should put the remarried at a higher risk of worse health than the first-time married. Consistent with the theoretical prediction, recent studies also show that remarriages present a greater health risk than continuous first marriage (McFarland, Hayward and Brown 2013; Zhang and Hayward 2006). Thus, I expect that compared to the first-time married, the remarried should have worse health trajectories after the onset of diabetes.

The Selection Model

The selection model posits that healthy individuals with salubrious lifestyles make more desirable marital partners compared to those with worse health conditions and deleterious health habits (Liu 2009). Individuals with health problems and unhealthy lifestyles such as excessive drinking and drug abuse are also more likely to experience marital breakups (Fu and Goldman 1996). According to this model, individuals with diabetes are expected to be less likely to enter marriage and stay married as the stress of managing the disease and the burden of caregiving on the spouse may take a toll on marital relationships, which in turn leads to divorce or separation (Burman and Margolin 1992). Alternatively, the marriage may dissolve due to premature mortality of the sick spouse. Therefore, the selection model should predict that married people with diabetes are healthier than their unmarried counterparts due to the interplay of positive and adverse selection effects of health on marriage. Despite less empirically supported, the health selection perspective has been acknowledged to play a role in the marriage-health link (Carr and Springer 2010). For example, a recent study by Karraker and Latham (2015) shows that married women in the mid- and later life experience an elevated risk of divorce after the onset of serious physical illness.

Given the discussions above, it is clear that marriage should be associated with better functional health with diabetes. Nevertheless, this positive link should also be conditioned by individuals' marital history. Guided by the theoretical frameworks, I propose my first two hypotheses:

H1: older adults diagnosed with diabetes who remain in their first marriage should report fewer functional limitations at baseline and experience a slower decline in their functional health than their remarried, cohabiting, divorced/separated, widowed and never-married counterparts.

H2: among the currently married diagnosed with diabetes, longer years in current marriage are associated with fewer functional limitations and a slower decline in functional health.

Gender Differences

Research on health implications of the gendered nature of marriage suggests that the associations of current marital status and current marriage duration with functional health may be different between old men and women diagnosed with diabetes. While both men and women similarly reap mental health gains from marriage (Simon 2002; Williams 2003), married men are suggested to have greater physical health advantage than married women (Waite 2009). Additionally, research also shows that while divorce seems to exert a greater toll on women's physical health, widowhood carries greater consequences for men's physical health and mortality (Carr and Bodnar-Deren 2009; Waite 2009). More importantly, men's and women's health benefit from marriage differently.

While the health advantage of marriage for men primarily results from the social control of health behaviors, and emotional support from their wives, marriage benefits women's health primarily through economic gains (Waite and Gallagher 2000). It is well recognized that diabetes management involves a substantial behavioral component such as dietary adjustments, rigorous physical activity and regular monitoring of blood glucose level (Chen, Sloan and Yashkin 2015). Health reminders from the spouse facilitate the adherence to complex medical regiments involved in managing diabetes (Gallant 2003) and married men benefit from such health reminders from their spouses more than women (August and Sorkin 2010; Waite 1995). Additionally, emotional support is critical in diabetes management as managing such a chronic illness can incur significant psychological distress, and depression is a common mental health complication for diabetic patients (Lustman and Clouse 2005). While married women have multiple sources of emotional support, married men almost exclusively depend on their spouse for psychological comfort (Waite and Gallagher 2000). Thus, drawing on the theoretical and empirical insights on gender differences in marriage and health, I propose the following hypotheses regarding gender differences.

H3: the link between current marital status and the trajectory of functional health among older adults with diabetes is stronger for men than women.

H4: the association between current marriage duration and the trajectory of functional health among older adults with diabetes is stronger for men than for women.

Data and Methods

Data

Data used are from the 9 waves of the Health and Retirement Study (HRS) from 1994 to 2012, a household-based panel survey of a sample representative of the U.S. adults aged 50 years and older. The study regularly collects information on a wide range of topics such as health, work status, marital status and economic well-being. Information needed in the analysis is extracted from the RAND HRS Version N Data files (RAND Center for the Study of Aging

2014), a consolidated dataset of all HRS respondents ever interviewed, and the 2012 tracker file, also created by RAND. The panel nature of the HRS allows the current project to examine the association between marital experiences and health progression after the onset of diabetes over the life course. The first wave in 1992 is excluded in the analysis because of changes in question wording on functional limitations, making them incomparable with later waves (Haas 2008).

Respondents are selected based on self-reports of whether they were ever diagnosed of diabetes or high blood sugar by a medical doctor. I restrict my sample to the newly diagnosed cases of diabetes to reduce the potential bias associated with close link between disease duration and functional health. If a respondent reports having no diabetes at a wave, and confirms the diagnosis of the disease in the next wave, he or she is considered a newly diagnosed case and then selected into the analytic sample. My observation starts at the wave when respondents report diagnosis of diabetes. I further restrict my sample to age-eligible respondents aged at least 50 years old with non-zero baseline weights for sample representativeness. A total of 3,871 age-eligible newly diagnosed cases were selected. After dropping one case with missing information on functional limitations and three missing cases on race/ethnicity, my final sample consists of 3,867 respondents, 1,817 of whom are men and 2,050 are women, contributing to 13,802 person-intervals.

Measures

The outcome of this study, *functional limitations*, is measured by a series of questions asking about respondents' difficulty in performing the following twelve tasks: "walking several blocks", "jogging one mile", "walking one block", "sitting for about 2 hours", "getting up from a chair after sitting for long periods", "climbing several flights of stairs without resting", "climbing one flight of stairs without resting", "lifting or carrying weights over 10 lbs", "stooping, kneeling or crouching", "reaching arms above shoulder level", "pushing or pulling large objects", and "picking up a dime from the table." A respondent is coded as "1" if s/he reports at least some difficulty in performing a task and "0" if no difficulty. I created a time-varying summary measure that adds up respondents' values across all twelve tasks to indicate their level of functional limitations. The value ranges from 0 to 12.

Current union status is a recoded variable using the information from the RAND HRS data files and includes the following categories: first-time married (the reference category), remarried, cohabitors, the divorced/separated, the widowed and the never-married. *Current marriage duration* is created by RAND, indicating the length of the current marriage in years. The analysis of current marital duration is limited to the first-time married and the remarried. All marital history variables are time-varying.

Socioeconomic resources are indexed by three time-varying variables: household income, net assets and insurance status. *Household income* and *net assets* (excluding the secondary residence) are adjusted for household size by dividing the square root of household size and taking the naturally-logged values. *Insurance status* is a binary indicator indexing whether the respondent is under any health insurance plan (no=0).

Health behaviors are measured by four time-varying variables: drinking, smoking, weight status and physical activity. *Drinking* is a recoded variable that includes abstainers, light to moderate drinkers (reference category), and heavy drinkers. Following past research, respondents who consume one to two drinks per day are categorized as light/moderate drinkers, and those consuming three drinks or more as heavy drinkers (Zhang and Hayward 2006). Smoking is a recoded variable that contains the following categories: non-smokers (reference category), past smokers, and current smokers. Weight status is recoded from respondents' BMI measures from the following scheme: BMI<18.5 (underweight), 18.5<=BMI <=24.9 (normal, reference category), 25<=BMI<=29.9 (overweight) and 30<=BMI (obese). *Physical activity* is a binary indicator indexing whether respondents engage in vigorous physical activity at least more than once a week (no=0).

Two time-varying indicators are used to measure psychological distress. The RAND HRS version N data file provides a summary score of a shortened 8-item version of the CES-D scale, including "feeling depressed", "feeling that everything is an effort", "restless sleep", "feeling lonely", "feeling sad", "could not get going", "feeling happy" and "enjoying life". High scores indicate more depressive symptoms. Approximately 6% of the respondents (N=234) are missing on the depression score. I imputed the missing cases with a single-equation approach based on their age, gender, race, immigration status, education, marital status, annual household income and net assets. The values for depression scores range from 0 to 8. Another binary indicator measures whether respondents have been diagnosed with any emotional, nervous or psychiatric problems (no=0).

A series of sociodemographic covariates are controlled across all the models. *Gender* is a binary indicator, with men as the reference category. *Race/ethnicity* includes non-Hispanic white (reference), non-Hispanic black, non-Hispanic other races and Hispanic. *Immigration status* includes immigrants (reference) vs. respondents born in the US. *Education* contains the following categories: "less than high school" (reference), "high school graduates", "some college" or "college graduates and above." Two indicators of the presence of chronic health conditions highly comorbid with diabetes and physical functioning are also controlled: *high blood pressure* and *cardiovascular disease*. I include dummy variables to flag missing cases on the covariates.

Analytic Approach

The multi-wave design of the HRS facilitates the investigation of health trajectories. To take advantage of the data, I use multilevel growth curve models to examine the links of current marital status and current marriage duration to the development of functional limitations among US older adults with diabetes. The time metric used in this study is age, centered at 50 years old. All the time-varying covariates are included in the first level and time-invariant covariates in the second. I first run a baseline model that includes the sociodemographic controls and the marital history variables. The second model then adds interaction terms between gender and marital history variables to test for gender differences. The final model adjusts for all the covariates, including the sociodemographic controls, socioeconomic, health behavior and psychological distress indicators. Full maximum likelihood estimation was employed to take into account all the information each respondent provides regardless of the number of waves he or she contributes. Growth curve models using this estimation method has the advantage of handling an unbalanced data structure. Additionally, following previous research, I control for sample attrition due to unobserved heterogeneity by including an indicator of the number of waves a respondent was observed and a binary indicator indexing whether respondents died during the observation period (Warner and Brown 2011). Currently available versions of SAS, including the latest 9.4 version, do not support complex survey weighting for PROC MIXED procedure. Moreover, past methodological work shows that unweighted results of multilevel analysis show minimal difference from those obtained through scale-weighted data (Carle 2009). Thus, unweighted results of growth curve analysis are presented here.

Findings

Table 2-1 reports baseline sample characteristics by current marital status. The first-time married are the reference category for all the group comparisons in the Wald tests. I briefly discuss differences by current marital status in important sample characteristics. First, the results show that divorced/separated and widowed older adults with diabetes are female-dominant and less likely to be college-educated than the first-time married. Additionally, they are also more likely to have either hypertension or cardiovascular disease. In terms of socioeconomic resources, indexed by annual household income, net assets and health insurance status, the unmarried, particularly the divorced/separated are at a significant disadvantage compared to their counterparts in their first marriage. For health behaviors, the divorced/separated are more likely to be heavy drinkers, and the remarried, the cohabiting and the divorced/separated are more likely to be current smokers. However, the divorced/separated and the widowed are less likely to be either overweight or obese than the first-time married. The widowed are less likely to be physically active. Lastly, in terms of the mental health profile, the remarried and the unmarried are all more vulnerable to mental health problems than their first-time married peers.

Current Marital Status

Table 2-2 presents analysis on the differential development of functional limitations by current marital status. The results show that overall, functional health trajectories of older adults diagnosed with diabetes differ significantly by current marital status.

Functional Limitations Age 50

First, the baseline model (model 1) in table 2-2 shows that as expected, at age 50, the remarried, cohabitors and the divorced/separated diagnosed with diabetes report significantly more functional limitations than the first-time married. Contrary to the theoretical expectation, widowed and never married older adults with diabetes report similar levels of functional limitations at age 50 as their first-married counterparts. Model 2 demonstrates that none of the gender interaction terms for the baseline level is statistically significant, suggesting no gender difference in the link between current marital status and functional limitations at age 50. In other words, the functional health gaps by current marital status at age 50 are comparable for older men and women diagnosed with diabetes. Model 3 further adjusts for socioeconomic, health behavior and psychological distress indicators. After adjusting for all the covariates, the functional health gaps at age 50 between the remarried, the divorced/separated and the first-time married become statistically non-significant compared to the results in model 1. The difference between cohabitors and the first-time married is also significantly reduced. The widowed report significantly fewer functional limitations at age 50 than the first-time married in the full model whereas the never-married show similar levels of functional health as the first-time married.

Rate of Change

In additional to baseline gaps, functional health trajectories of older adults with diabetes also show interesting patterns by current marital status over time. First, model 1 in table 2 shows that although remarried and divorced/separate older adults report significantly more functional limitations than their first-time married peers at age 50, they actually show a similar rate of decline over time in their functional health as the first-time married. Additionally, , the significant and negative age slope coefficient for older cohabitors with diabetes suggests that their functional trajectory gradually converges over time with that of those staying married in their first marriage. Although the widowed report a similar level of functional limitations as their first-time married counterparts, they show a significantly faster rate of decline in their functional health over time. Lastly, the never-married experience a similar rate of decline over time in their functional health as their first-time married peers.

Results in model 2 indicate that there is no significant gender difference in the link between current marital status and the rate of decline in functional health among older adults diagnosed with diabetes. Model 3 shows that adjusting for all the covariates does not explain differences in rate of change by marital status. I conducted additional analyses to respectively adjust for socioeconomic resources, health behaviors and psychological distress (see results in the Appendix). The results show that adjusting for psychological distress significantly explains the worse functional health of the remarried, cohabiting and divorced/separated at age 50 than their first-time married peers. Overall, the results in table provide partial empirical support for hypothesis 1 on functional health trajectories by current marital status, but do not support hypothesis 3 on gender differences.

Current Marriage Duration

Table 3 presents results on the association between current marriage duration and trajectories in functional health among currently married older adults diagnosed with diabetes. Model 1 in table 3 shows that at age 50, longer years in the current marriage are significantly associated fewer functional limitations. However, the coefficient for the age slope suggests that this positive link between longer marriage and better functional health among married older adults with diabetes slowly weakens over time. The findings from model 1 provide partial support for hypothesis 2. Results in model 2 show that the observed association in model 1 between current marriage duration and functional trajectory is similar for men and women as the gender interactions are not statistically significant. Hypothesis 4 is not supported. Adjusting for all the covariates does not significantly explain the link between current marriage duration and functional health at age 50, but the coefficient becomes statistically non-significant.

Discussion

Building on the fundamental tenets of the marriage-health link, the current study focuses on how marriage contributes to health progression among older adults in US diagnosed with diabetes. Specifically, I examine, from a life course perspective, the associations of current marital status and current marriage duration with the development of functional limitations, a prominent health complication of diabetic patients (Wray et al. 2005). This study makes important contributions to the current scholarship. First, it considers the implication of marital history to maintaining health with a major chronic health condition and takes into account the diversity of romantic partnerships by incorporating cohabitors in the analysis. Previous research rarely goes beyond the contrast between the married and the unmarried (Gallant 2003). Moreover, this study examines an important and yet less discussed health complication of diabetes– functional limitations– to complement the current scholarship's heavier focus on the survival prospect of diabetes in relation to social support.

Marriage Matters and So Does Past Marital Experience

The primary message from this is research is that marriage matters for maintaining the physical functioning and decelerating health declines over time with diabetes. However, equally important is that this health advantage of marriage in preserving physical health in diabetes is also conditional on marital history. Consistent with the literature, this study shows that being married is associated with better functional health compared to being in an unmarried state after the diagnosis of diabetes, lending additional support for the positive link between marriage and diabetes management as well as other chronic illnesses documented so far (Gallant 2003).

However, my analysis also shows that remarried older adults with diabetes report significantly worse functional health than those staying married in their first marriage, pointing to long-term health implications of past marital experience. This sheds light on the weaker health advantage of higher-order marriages compared to first marriages documented in past research (Carr and Springer 2010; Zhang and Hayward 2006) and lends support to the lasting impact of previous marital dissolution on health (Hughes and Waite 2009).

Older cohabitors with diabetes show an interesting pattern compared to the first-time married. At age 50, they report significantly more functional limitations than those in their first marriage, but this health gap narrows as they age. On the one hand, the heath gap observed in this study is consistent with past research that also found less favorable health profiles of cohabitors than married people (Carr and Springer 2010). On the other hand, the convergence of the two groups also bears important implications. First of all, this may suggest that nonmarital partnership gradually resemble legal marriages at older ages and provide similar health benefits for managing a chronic illness like diabetes (Musick and Bumpass 2012) as research demonstrates that cohabiting unions formed among older adults, unlike those of younger ones, tend to be more stable and are more likely to be an alternative to marriage (Brown, Bulanda and Lee 2012). Nonetheless, selection processes may also be at work. As, in general, older cohabitors are still more disadvantaged and experience a higher mortality risk than the married (Brown, Lee and Bulanda 2006; Liu and Reczek 2012), older cohabitors who survive chronic diseases to develop health complications may be a more robust group and therefore, show fewer health differences over time from the married.

Additionally, widowed and divorced/separated older adults are also identified in this study as the two groups at a higher risk of decline functional health with diabetes. While the divorced/separated show significantly worse functional health earlier in late life than the first-time married, the widowed experience a steeper decline in their physical functioning as they age with diabetes. In light of widowhood as a more common state in later life, greater attention is needed for widowed older adults living with diabetes, particularly older women, who are more likely to be widowed than their male counterparts (Carr and Bodnar-Deren 2009). Also, as the experience of divorce in later life has been increasingly shared by many US older adults (Brown and Lin 2012), future research should also continue to heed implications of divorce in late adulthood for chronic disease management.

Finally, never-married older adults with diabetes do not significantly differ from the first-time married in trajectories of functional health. This might suggest that the lack of marital resources do not seem to put never-married older adults at a higher risk of developing functional limitations than their first-time married peers when managing diabetes, resonating with recent research that found a shrinking health gap over historical time between the never-married and their married counterparts (Liu and Umberson 2008). Nevertheless, selection may also play a part in light of the never-married's vulnerability to premature death (Carr and Springer 2010). Never-married older adults in the US has been argued to be a unique group and much understudied (McFarland et al. 2013). More research is warranted to better understand how never-married older adults in the US maintain their health and manage chronic disease.

Current Marriage Duration

Building on the notion of cumulative processes, I also examine current marriage duration and the development of functional limitations among married older adults with diabetes. The results provide partial empirical support for the theoretical expectation that marriage duration is positively associated with better functional health trajectories with diabetes. On the one hand, longer years in current marriage predict better functional health with diabetes at age 50, suggesting a positive feedback of accumulating marital resource on later health outcome over time. On the other hand, this positive link slowly weakens as married older adults age with diabetes. Although seemingly at odds with the theoretical expectation, this finding may suggest that while marriage provides greater survival advantage for diabetic patients (Rook and Zettel 2005), as married older adults age with diabetes, the debilitating effect of aging gradually takes over the course of disease progression, leading to greater frailty at very old age.

Limitations

Several limitations underlie the current study. First, as this research examines the development of functional health for people who are at least 50 years old and diagnosed with diabetes, the analytic sample is a select group of people who live long enough to develop diabetes. Because mortality risks are stratified by marital status (Rendall et al. 2011), it is possible that some unmarried cases die before they can even develop any discernible symptoms for diabetes. Thus, the findings may likely be conservative estimates of differentials in functional health by current marital status among older adults with diabetes. Moreover, lack of information on the accurate timing of diagnosis is also a limitation of this study. While some older adults may have been diagnosed at a later time when diabetes has been fully developed, others may have detected symptoms at the early stage before diabetes becomes full-fledged. Nonetheless, research has shown that the timing of diagnosis is also associated with marital status, and married people are more likely to get an earlier diagnosis of diseases than the unmarried (Neal and Allgar 2005). Thus, the observed link between current marital status and functional health should also capture some effects of the timing of diagnosis.

Conclusion

In sum, the current study demonstrates marriage as an important social context for managing a chronic health condition like diabetes, and alludes to the bigger picture of the significance of social relationships for chronic disease management. Findings from this research calls for greater attention to social contexts where aging and chronic disease management take place to complement the heavier focus on proximate risk factors such as smoking and obesity in the present policy

CHAPTER THREE

MARITAL QUALITY AND SUBSEQUENT FUNCTIONAL LIMITATIONS AMONG OLDER ADULTS WITH CARDIOVASCULAR DISEASE

Introduction

Marital relationships have important implications for cardiovascular health. Married people, especially those with no previous marital disruptions, are less likely to have cardiovascular disease (CVD), and when diagnosed with CVD, they tend to have a better prognosis compared to their unmarried counterparts (Floud et al. 2014; Zhang 2006). However, recent research consistently suggests that the health benefits of marriage depend on the quality of the relationship (Kiecolt-Glaser and Newton 2001; Williams 2003). While substantial literature has established the link between marital quality, cardiovascular risks, mental health consequences and the prognostic outcome of CVD (Coyne et al. 2001; Liu and Waite 2014; Rohrbaugh et al. 2002), less is known about how marital quality contributes to the physical health of individuals diagnosed with CVD.

Research has established functional limitations as a major health complication of CVD (Masoudi et al. 2004). Disability associated with CVD not only affects patients' quality of life, but causes substantial financial burdens on individual families and the US healthcare system (Newschaffer, Liu and Sim 2010). Furthermore, it presents a great challenge to the healthy aging of the elderly population in the US (Marengoni et al. 2011). As marriage is an important social context where health production and disease management take place, particularly for older people (Umberson and Williams 2005; Waite and Gallagher 2000), it is of prominent interest for researchers as well as health practitioners to evaluate how risk factors associated with marriage contribute to chronic disease progression. Extending the current literature on marital quality and cardiovascular health, the current study examines the link between marital quality and subsequent functional limitations among older adults in the US diagnosed with CVD, using data from the 2006-2012 Health and Retirement Study. Specifically, it addresses the following research questions: (1) how is marital quality (both positive and negative) associated with subsequent functional limitations among older adults diagnosed with CVD? (2) Given the gendered nature of marriage, are there gender variations in the observed associations? (3) Can health behaviors and psychological distress explain the associations? (4) How is the improvement or worsening of marital quality associated with functional limitations among older adults with CVD?

Theoretical Perspectives

Marital relationships provide health-enhancing resources and may serve as a stress buffer against health-compromising stressors in life. However, such health benefits my depend on relationship quality (Waite and Gallagher 2000). Marital quality influences health both directly and indirectly. One the one hand, marital quality can have a direct impact on individuals' physiological functioning through altering the cardiovascular, neuroendocrine, immune and other physiological systems. On the other hand, it also indirectly affects health via its influence on mental health and health behaviors (Kiecolt-Glaser and Newton 2001). These direct and indirect effects of marital quality are not only important for health maintenance, but even more crucial for the development and progression of CVD.

First, marital quality can have a direct physiological impact on the physical health of CVD patients. Research, both clinical as well as population-based studies, shows that marital strains are significantly associated with greater cardiovascular reactivity such as heightened blood pressure and faster heart rate (Liu and Waite 2014; Robles and Kiecolt-Glaser 2003), which has a direct link to the worsening of CVD. Distressed marriages can also compromise the neuroendocrine system, leading to cardiovascular, metabolic and immune irregularities (Robles et al. 2014). Recent research has found evidence for the association between marital quality and metabolic disorders such as central obesity, high blood pressure and dyslipidemia (Whisman and Uebelacker 2012). Additionally, as recent research evidence shows, marital conflict can also arouse inflammatory reactions in the human body, which are suggested to be another important biological risk factor for the development and progression of CVD (Donoho, Crimmins and Seeman 2013; Kiecolt-Glaser, Gouin and Hantsoo 2010). This literature on the direct link between marital strains and the dysregulation of cardiovascular, neuroendocrine and immune systems suggest that low marital quality can directly compromise the physical health of CVD patients via these physiological pathways.

Marital quality can also affect the physical health of people diagnosed with CVD through its impact on psychological well-being (Kiecolt-Glaser and Newton 2001). Marriage provides psychological resources such as emotional support and a sense of belonging, which may in turn contribute to better physical health. However, research shows that this mental benefit significantly depends on the quality of marital relationships. A low-quality marriage not only confers little psychological gains but can even cause negative mental health consequences (Williams 2003). Studies have shown that better marital quality can help CVD patients develop adequate psychological adjustment and buffer the depression that may result from coping with the disease whereas marital distress may contribute to the worsening of the disease via additional psychological insults (Brecht et al. 1994; Rohrbaugh et al. 2002; Roijers et al. 2016). Recent developments in behavioral cardiology has established psychological distress as a major risk factor for the development and worsening of CVD, including decline in functional capacity (Das and O'Keefe 2006; Vaccarino et al. 2001). Thus, it is expected that through its impact on the psychological well-being, marital quality can also affect the physical health of people diagnosed with CVD.

Lastly, an important type of health-enhancing resources, particularly for married men, is the social control of health behaviors (Umberson 1992). Married people enjoy health monitoring from their spouses, thereby promoting their health. However, spousal controls of health may be conditional on the relationship quality as well (Waite and Gallagher 2000). Marital satisfaction can foster salubrious heath habits and facilitate adherence to medical regimens, which are particularly important for the prognosis of chronic disease patients whereas negative marital functioning can incur unhealthy lifestyle such as substance abuse and poor adherence to medications (Kiecolt-Glaser and Newton 2001). For example, Trevino and colleagues (Trevino et al. 1990) found that higher marital adjustment is significantly associated with better compliance with anti-hypertension medication. More recent research also shows that greater health-related spousal support, such as listening to one's concerns about health and assistance in taking care of one's health, can encourage healthy behaviors such as engagement in physical activity and healthy diet among heart disease patients (Franks et al. 2006). As the importance of self-care for managing CVD has been consistently emphasized in the literature (Gallant 2003; Sayers et al. 2008), it is also expected that marital quality may affect the physical health of people diagnosed with CVD via change in health-related behaviors.

Empirical Evidence on Marital Quality and Cardiovascular Outcomes

Past research has generally established the link between marital quality and cardiovascular risks, providing evidence for both the benefit of positive marital quality and the consequence of negative marital quality for cardiovascular health (Robles et al. 2014). First, marital quality has been demonstrated to have a significant association with the incidence of CVD. For example, De Vogli and colleagues (De Vogli, Chandola and Marmot 2007) found that negative experiences in a close relationship with significant others like intimate partners significantly predict the incidence of coronary events such as myocardial infarction and angina in a sample of British civil servants. Liu and Waite (Liu and Waite 2014) showed age- and gender-specific associations between marital quality and the incidence of self-reported cardiovascular events among a nationally representative sample of older adults in the US. However, Eaker et al. (2007) only found a significant link between one measure of marital strains and the incidence of coronary heart disease among men: whether wives' work was disruptive to home life. Self-reported disruption of wives' work to home life is significantly associated with a higher risk of coronary heart disease. No significant associations were found for more conventional measures such as marital satisfaction, happiness or disagreement. They suggest that these conventional characteristics of marital quality may play a more prominent role in the prognosis of CVD.

Indeed, research consistently presents evidence for a significant link between marital quality and prognostic outcomes of CVD. For example, Coyne and colleagues (Coyne et al. 2001) reported that marital quality significantly predicted the survival prospect of a sample of patients with congestive heart failure 4 years after the diagnosis. Using the same sample, Rohrbaugh et al. (Rohrbaugh, Shoham and Coyne 2006) showed that marital quality significantly predicted the mortality of heart failure patients in an 8-year period. In addition to mortality risk, marital quality also has important bearing on the progression of CVD. Orth-Gomer et al.'s (Orth-Gomer et al. 2000) study showed that greater marital stress significantly predicts recurrent coronary events such as cardiac death, acute myocardial infarction and revascularization procedures in a female patient sample in Stockholm. Kulik and Mahler (2006) also showed that lower marital quality is significantly associated with longer hospital stays after a coronary bypass surgery.

Finally, burgeoning research has examined the link between marital quality and cardiovascular risk measures, and the results generally support the significance of marital quality for physiological pathways to cardiovascular health. For example, Nealy-Moore and colleagues (Nealey-Moore et al. 2007) showed that negative marital interactions are significantly associated with greater cardiovascular reactivity such as increases in blood pressure and heart rate. A recent study by Donoho et al. (Donoho et al. 2015) found a significant link between satisfying marital relationships and greater heart rate variability. Gallo et al.'s (2003) research also demonstrated a significant association between higher marital quality and lesser atherosclerosis. In addition to cardiovascular activity, recent research by Donoho et al. (Donoho et al. 2013) and Liu and Waite (Liu and Waite 2014) also found empirical evidence for a significant link between marital quality and measures of inflammation, an important physiological mechanism for the development and progression of CVD.

Overall, past research shows a close link between marital quality, the morbidity and mortality of CVD patients. However, it pays less attention to the physical health complications of CVD. The current study bridges this research gap. Building on the existing literature on marital quality and cardiovascular health, I propose my first hypothesis.

H1: higher positive marital quality significantly predicts fewer functional limitations while higher negative marital quality significantly predicts more functional limitations among older adults diagnosed with CVD.

Gender Differences

Gender has been a moderator of great interest in the study of marital quality and health. Theoretically, it is suggested that in heterosexual marriages, due to gendered experiences of socialization and gender inequality in power within marriage, which tend to favor men, women are emotionally more sensitive to marital quality than men do (Proulx, Helms and Buehler 2007; Umberson and Williams 2005). Kiecolt-Glaser and Newton (Kiecolt-Glaser and Newton 2001) suggest that such gendered responsiveness to marital quality is manifested well in gender differences in the associations between marital functioning, physiological and psychological responses as research consistently shows a stronger effect of marital quality on women's physiological functioning and mental well-being than men's. However, a more recent review by Robles et al. (2014) indicates that findings on gender differences in the link between marital quality and physical health are more mixed, with significant gender differences mostly in CVD-related outcomes. In line with this conclusion, a recent population-based study on older adults in the US showed significant associations between marital quality and cardiovascular risks for women, but found little evidence for men (Liu and Waite 2014).

Consistent with the reviews above, empirical studies on the link between marital quality and the prognosis of CVD also show significant gendered patterns. For example, studies by Coyne et al. (2001) and Rohrbaugh et al. (2006) both show a stronger association between marital quality and the survival of heart failure patients for women than men. Kulik and Mahler (Kulik and Mahler 2006) also found that marital quality significant predicted lengths of hospital stays for female patients after a major cardiac surgery but not for male. In light of the gendered responsiveness to marital quality and the significant gendered patterns found in the literature on marital quality and the prognosis of CVD, I expect significant gender variations will also be observed in the link between marital quality and functional limitations among older adults diagnosed with CVD. I propose my second hypothesis below to test this gender difference.

H2: the observed associations between marital quality, both positive and negative, and functional limitations among older adults with CVD are stronger for women than men.

Additionally, recent developments in behavioral cardiology suggest that psychological distress and health behaviors are two major risk factors for the development and progression of CVD (Das and O'Keefe 2006). These two interrelated factors are also posited to be important pathways through which marital quality affects physical health (Kiecolt-Glaser and Newton 2001). Thus, I propose my third hypothesis to test for the predictive power of these two factors.

H3: psychological distress and health behaviors significantly explain the link between marital quality and functional limitations among older adults diagnosed with CVD.

Finally, as an ancillary analysis, I utilize the two waves of data on marital quality to answer the following question: given that marital quality is important for the physical health of elderly CVD patients, does change in marital quality also significantly predict their functional limitations? Building on the discussion of the theoretical and empirical literature above, I hypothesize that

H4: increases in positive marital quality are significantly associated with fewer functional limitations while increments in negative marital quality are significantly linked to more functional limitations.

Data and Methods

Data

Data are from the Health and Retirement Study (HRS), 2006-2012, sponsored by the National Institute on Aging and conducted by the University of Michigan. The HRS is a multi-stage longitudinal household survey and contains a probability sample representative of non-institutionalized civilian adults aged at least 50 years old in the US with oversamples of Blacks, Hispanics and residents of the state of Florida. It routinely collects rich information on respondents' sociodemographic, socioeconomic characteristics and health conditions biennially.

With the aim of better understanding the psychosocial dimensions of aging experiences of the US elderly, the HRS launched a pilot study in 2004 and officially included a module in 2006 to collect additional information on psychosocial measures of the respondents with a self-administered leave-behind questionnaire. The HRS conducts the leave-behind questionnaire on a rotating basis with a random half of the total HRS sample in 2006, and the other half in 2008, and collects longitudinal information on the psychosocial measures every four years (Smith et al. 2013). The measures of marital quality used in this study are extracted from the baseline psychosocial modules in 2006 and 2008 and their respective follow-ups in 2010 and 2012.

For the purpose of this study, I focus on married and cohabiting older adults diagnosed with CVD. Respondents with CVD are identified via their self-reports on the question asking whether they have been told by a doctor that they had a heart problem (e.g. heart attack, coronary heart disease or congestive heart failure) or stroke (including transient ischemic attack). I only include respondents who reported no diagnosis of CVD in a survey wave and confirmed diagnosis in the next wave across all HRS waves to reduce the bias potentially caused by disease duration. As the primary objective of this study is to examine the health implications of relationship quality, I do not distinguish between union types and the term, "spouse", will be used throughout the text to refer to either spouses or cohabiting partners. Nevertheless, respondents' baseline union types are controlled in all analytic models.

My observation starts from 2006 when the official psychosocial information from the leave-behind module became available. Since the psychosocial module is conducted on a rotating basis as described earlier in the data section, I combine the sample surveyed for psychosocial information in 2006 and the other one in 2008 into my joint baseline sample, and observe the associations between marital quality, marital quality change and functional limitations over four years until 2010 and 2012. A total of 2,830 partnered older adults with CVD interviewed in 2006 and 2008 were randomly selected to receive the leave-behind questionnaire and 2,349 respondents returned the questionnaire. Two final samples are created for my analyses. As my first analysis examines the link between the baseline marital quality (i.e. 2006 and 2008) and subsequent functional limitations in two years (i.e. 2008 and 2010), I keep only cases that were alive two years after they were first interviewed for the psychosocial module. I then further restrict this sample to those who were at least 50 years old at the baseline and have a nonzero weight to represent the US older adults aged 50 and over, the target population of the HRS. The final sample for the first analysis is 2,158 respondents. My second analysis investigates how change in marital quality over the four-year period is linked to functional limitations after four years. Thus, I restrict second my analysis to respondents who were alive and stayed partnered after four years when they received their follow-up interviews on the psychosocial module. The final sample for my second analysis contains 1,706 respondents.

Measures

Functional limitations, the outcome of this study, are measured by twelve questions that ask respondents about their perceptions of difficulty in performing the following 12 tasks: "walking several blocks", "jogging one mile", "walking one block", "sitting for about 2 hours", "getting up from a chair after sitting for long periods", "climbing several flights of stairs without resting", "climbing one flight of stairs without resting", "lifting or carrying weights over 10 lbs", "stooping, kneeling or crouching", "reaching arms above shoulder level", "pushing or pulling large objects", and "picking up a dime from the table". A binary indicator was created by RAND for each of the twelve tasks, where "0" indicates having no difficulty in performing a particular task and "1", at least some difficulty. A summary measure of functional limitations is created by totaling respondents' answers across all twelve questions. The logical value ranges from 0 to 12.

Marital quality is measured by eight questions that tap into respondents' perceived support from their spouses, which are designed to gauge the relationship quality. The following three questions assess respondents' perceptions of spouses' positive support: (1)"*How much do they really understand the way you feel about things?*" (2) "*How much can you rely on them if you have a serious problem?*" (3) "*How much can you open up to them if you need to talk about your worries*?" Four questions evaluate respondents' perceptions of spouses' negative support: (1) "*How often do they make too many demands on you?*" (2) "*How much do they criticize you?*" (3) "*How much do they let you down when you are counting on them?*" (4) "*How much do they get on your nerves?*" The response categories for these seven questions are (1) a lot, (2) some, (3) a little, and (4) at not all. Respondents' raw values were recoded so that for the positive support questions, higher values indicate more positive support from spouses, and likewise for the negative support questions. The last question asks respondents about their perceived closeness to their spouses: "*How close is your relationship with your spouse or partner?*" The response categories contain: (1) very close, (2) quite close, (3) not very close and (4) not at all close. The raw values for this measure were also recoded to allow higher values to indicate greater relationship closeness. The Crobach's alpha for the baseline marital quality measures in 2006 and

2008, and their respective follow-ups ranges from 0.83 to 0.85, indicating high internal reliability across the measures.

Past research suggests that marital quality contains both positive and negative dimensions, two distinct constructs not exclusive of each other (Umberson et al. 2006). To create summary measures that index these two distinct dimensions of marital quality, I conducted exploratory factory analysis for the eight marital quality measures respectively for 2006 and 2008 and their two follow-ups with the iterated principle factor method and an oblique varimax rotation. Results from the factory analysis show that these eight measures load on two distinct factors, which I refer to as positive and negative marital quality. I then compute two summary scores respectively for positive and negative marital quality using the factor loadings. Change in marital quality is calculated by subtracting the baseline marital quality from marital quality four years afterwards at the follow-up. Following previous research, I use 0.35 as the cutoff point for the inclusion of factor loadings into the calculation (Liu and Waite 2014). Table 3-1 summarizes the results of the factory analysis.

Health behaviors are measured by four variables: smoking, drinking, physical activity and body weight. *Drinking* is recoded into three categories: abstainers, light to moderate drinkers (reference) and heavy drinkers. Respondents who consume one to two drinks per day are categorized as light to moderate drinkers, and those who have three drinks or more as heavy drinkers (Zhang and Hayward 2006). *Smoking* includes the following categories: non-smokers (reference), past smokers and current smokers. Physical activity is a binary indicator of whether respondents engage in vigorous physical activity at least more than once a week (yes=1, no=0). I also include *body weight* measured by BMI as an indicator for health behavior because body weight is not only a significant metabolic risk factor for CVD but also reflects one's health behavior and lifestyle.

Psychological distress includes two measures: depression and presence of emotional problems. *Depression* is measured by a short eight-item version of the CES-D scale asking whether respondents experienced the following feelings: feeling depressed, feeling that everything is an effort, restless sleep, feeling lonely, feeling sad, could not get going, feeling happy and enjoying life. I use the summary score created by the RAND HRS dataset, ranging from 0 to 8, with higher values indicating more depressive symptoms. Presence of *emotional problems* is measured by the question asking whether respondents have been diagnosed with any emotional, nervous or psychiatric problems (yes=1, no=0).

A series of sociodemographic and socioeconomic covariates are controlled in all the models. *Gender* is a binary indicator with male as the reference category. *Age at baseline* is controlled as age is closely related to the level of physical frailty. *Race/ethnicity* includes four categories: non-Hispanic white (reference), non-Hispanic black, non-Hispanic other races, and Hispanic. *Birthplace* is indexed by a dichotomous indicator with regions other than the South as the reference category. Respondents' *immigration status* is controlled and immigrants are the reference group. *Current marital status* at the baseline includes three groups: first-time married (reference), remarried and cohabiting. Two chronic illnesses comorbid with CVD are also controlled: presence of *hypertension* and *diabetes* at the baseline. The two binary variables are measured by respondents' self-reports of whether a doctor ever diagnosed him/her of the disease. No diagnosis is the reference category. Although very few cases in my sample experienced either divorce or widowhood during the two-year period (i.e. 2006/2008 to 2008/2010), I use a binary indicator to control for whether respondents remain partnered after two years in my first analysis on baseline marital quality and subsequent functional limitations. A binary indicator of the *baseline survey wave* is also controlled (year 2006=0 and year 2008=1). Finally, to reduce the bias introduced by disease severity, I control for respondents' number of functional limitations at the baseline in all the models.

The socioeconomic controls include: education, annual household income, net asset and insurance status. All the socioeconomic measures are taken at the baseline. *Education* is measured with years of formal schooling. *Annual household income* is measured in nominal dollars by the sum of all income from the respondent and the spouse, not including other household members. *Net assets* are measured by the sum of all wealth components (excluding the second residency) minus all debts. Since both annual household income and net assets have substantial missing values, the HRS imputes the missing cases. Following past research, I adjusted annual household income and net assets for household size by dividing the original value with the square root of the total number of people in the household. Naturally-logged values were then taken to adjust to the skewed distribution of the two variables. *Insurance status* is coded as "0" if the respondent reports not having any kind of public or private health insurance and "1" if at least one type of health insurance.

Table 3-2 presents sample characteristics at the baseline separately for men and women. To briefly summarize the key characteristics, table 2 shows that on average, men rate the quality of their marriage more positively than women. Additionally, men report a smaller decline in positive marital quality and a larger decrease in negative marital quality than women. The results are consistent with the literature suggesting women tend to report lower marital quality than their male counterparts (Umberson and Williams 2005). Men are significantly more likely to have engaged in unhealthy behaviors, but be more physically active than women while women report significantly more depressive symptoms and are more likely to have emotional problems. As for the outcome, women consistently report more functional limitations than men.

Analytical Approach

Past research suggests that positive and negative marital quality are two distinct and yet interdependent constructs and should be examined separately (Liu and Waite 2014). As expected, the Pearson correlation analysis shows that the scores of positive and negative marital quality in my data are highly correlated ($r = -0.55$). To avoid the high collinearity, all the analyses are conducted separately for positive and negative marital quality.

My analyses consist of two parts. The first part examines the link between baseline marital quality in 2006/2008 (referred to as T1) and subsequent functional limitations in two years (i.e. 2008/2010, referred to as T2). I start with the baseline model that controls for sociodemographic and socioeconomic covariates. The second model then tests for gender differences. Models 3 and 4 respectively assess the role of health behaviors and psychological distress in explaining the observed associations. Model 5 contains the full model. All the covariates controlled in the models were measured at T1 except the variable that indexes whether respondents remain partnered at T2. The second part of the analysis examines how change in marital quality over the four-year period is associated with functional limitations in the fourth year (i.e. 2010/2012, referred to as T3). All the covariates measured at T1 are controlled in the second analysis.

As marital quality is closely related to mortality risk, mortality selections may occur during the observation. To reduce mortality selection bias, I estimated two logistic models of the probability of death separately for the two samples used in the first and second analyses using the whole HRS sample at T1. The first logistic model estimates respondents' probability of death at T2, and the second one estimates the probability of death at T3, using baseline covariates known to predict mortality, including age, gender, race/ethnicity, education, household income, insurance status, smoking and depression. The estimated death probability at T2 is controlled in all models in the first analysis while the estimated death probability at T3 is controlled in all models in the second analysis.

I use multilevel linear models to estimate the associations between marital quality and functional limitations with individuals as Level 1 and household as Level 2 since more than 10% of my samples are partnered couples living in the same household, and assessments of marital quality are highly correlated between spouses. Analysis from an unconditional model (not shown here) indicates that almost 26% (i.e. I.C.C.=0.258) of the total variance comes from the household level. To control the clustering effects at the household level, the intercepts are estimated as random effects in all my models. Currently available versions of SAS, including the latest version, 9.4, do not support complex survey weighting for PROC MIXED procedure. Moreover, past methodological work shows that unweighted results of multilevel analysis show minimal difference from those obtained through scale-weighted data (Carle 2009). Thus, unweighted results of growth curve analysis are presented here.

To address missing values in the data, I use multiple imputation techniques to impute the datasets separately for the two samples. Ten multiply imputed datasets were created with the PROC MI procedure in SAS and the model results were consolidated with the PROC MIANALYZE procedure.

Results

Tables 3-3 and 3-4 respectively demonstrate how positive and negative marital qualities at the baseline are associated with functional limitations after two years among older adults diagnosed with CVD in the US. Overall, the analysis shows a significant association between marital quality and functional limitations over the two-year period with significant gender variations.

Positive Marital Quality

Model 1 in table 3-3, the baseline model, shows that there is no significant relationship between positive marital quality and functional limitations over the two year period. However, when the gender interaction is added in model 2, both the main effect of positive marital quality and the gender interaction is statistically significant, suggesting that there is significant gender difference in the link between positive marital quality and functional limitations among older adults diagnosed with CVD. A closer look at the results indicates that while higher positive marital quality is significantly associated with fewer functional limitations, this association is evident primarily among older men with CVD. Gender-stratified analyses (not shown here) demonstrate that when examined separately, higher positive marital quality is significantly associated fewer functional limitations only among men, not women, lending additional credence to findings from model 2 in table 3-3. Nevertheless, findings from the analysis of gender interaction did not support my second hypothesis that the association between marital quality and functional limitations is stronger for older women with CVD.

Model 3 assesses health behaviors as an explanation for the observed link between positive marital quality and functional health among older men with CVD. The results show that adjusting for health behavior measures only explains a small portion (i.e. 8.8%) of the observed association in model 2 for men, although the coefficient of positive marital quality becomes non-significant. Model 4 evaluates the explanatory role of psychological distress. The results suggest that adding the two psychological measures explains substantially explains the association (i.e. 25%) between positive marital quality and functional health among older men with CVD, and the coefficient of positive marital quality also becomes non-significant. Model 5 presents the full model, and shows that the observed association between positive marital quality and functional limitations among older men diagnosed with CVD are fully explained by health behaviors, and particularly psychological distress. Taken together, the results from models 3 to 5 provide more empirical support for the role of psychological distress in explaining the link between positive marital quality and functional health among older men with CVD.

Negative Marital Quality

Table 4 presents the analysis on negative marital quality and functional limitations among older adults diagnosed with CVD. Model 1, the baseline model, shows a positive and significant association between negative marital quality and functional limitations over the two-year period, indicating that higher negative marital quality is linked to more functional limitations. Model 2 further includes the gender interaction term, and shows no significant gender difference in the significant association observed in the baseline model. The significant link between negative marital quality and functional health is similar for both men and women diagnosed with CVD.

Model 3 evaluates health behaviors as an explanation for the observed association in model 1. The results indicate that although the association between negative marital quality and functional limitations becomes non-significant after adjusting for health behavior measures, health behaviors only explain a small portion (i.e. 4.6%) of the observed link in model 1. Model 4 examines the contribution of psychological distress, and the results suggest that adjusting for psychological distress substantially explains the association (i.e. 26%) between negative marital quality and functional limitations among older adults with CVD. Model 5, the full, model, demonstrates that the significant association between negative marital quality and functional limitations is fully explained by health behaviors and especially, psychological distress. The results from models 3 to 5 together suggest that psychological distress plays a prominent role in the link between negative marital quality and functional health among older adults with CVD.

Overall, the first analysis on baseline marital quality and functional limitations presented in tables 3 and 4 provides empirical support for my first hypothesis that both positive and negative marital qualities are significantly associated with functional limitations among older adults diagnosed with CVD. The second hypothesis of a stronger association for women is not support. Finally, the results support the third hypothesis that health behaviors and particularly psychological distress substantially explain the link between marital quality and functional health.

Change in Marital Quality and Functional Limitations

Finally, to answer the question on whether change in marital quality is associated with later functional health among older adults diagnosed with CVD, I conducted an ancillary analysis using the follow-up information 4 years after the baseline. The first model in table 3-5 shows that after controlling for all the covariates at the baseline, including positive marital quality, increases in positive marital quality over the four-year period is significantly associated with fewer functional limitations in year four, while decreases in marital quality is associated with more functional limitations later. In contrast, the second model shows that controlling for all the baseline covariates, including negative marital quality, change in negative marital quality over the four-year period is not significantly associated with functional limitations in the fourth year. Overall, the results in table 3-5 suggest that change in marital quality over the four-year period is significantly associated with functional health among older adults diagnosed with CVD, and this relationship is primarily manifested in the change in positive marital quality.

Discussion

Research consistently shows that a significant link between marital quality, cardiovascular risk and survival prospects of CVD patients (Coyne et al. 2001; Liu and Waite 2014). Surprisingly, much less attention has been paid to how marital quality contributes to the physical health of CVD patients despite the close link between CVD and functional disability. The current study contributes to the literature by addressing this important research gap. Overall, my findings demonstrate that both positive and negative marital qualities matter for the functional health of older adults diagnosed with CVD.

Gender, Marital Quality and Physical Health

Although past research has found less evidence on the influence of positive marital quality on physical health (Umberson and Williams 2005), my analysis shows that positive marital quality is significantly associated with subsequent functional health among older men diagnosed with CVD. Moreover, change in positive marital quality over the four-year period is also significantly linked to later functional health. Taken together, these findings lend additional support for previous studies that also found a significant physical health impact of positive marital quality, including a recent study by Choi et al. (Choi, Yorgason and Johnson 2016), which also uses the HRS data. In contrast to men, older women with CVD don't seem to enjoy the physical health advantage of positive marital quality. This finding on gender difference resonates with previous research which found that wives' blood pressure was unrelated to supportive exchanges during problem-solving discussion tasks but was responsive to hostile interactions (Ewart et al. 1991). More generally, it also aligns with recent literature that suggests men are more responsive to positive experiences in marriage than women (Carr, Cornman and Freedman 2016).

Negative marital quality is also significantly associated with subsequent functional health among older adults diagnosed with CVD, and both men and women are vulnerable to the physical health consequences of such unsupportive behaviors in marriage. Although no significant gender variation was found in the link between negative marital quality and functional limitations, analysis on gender difference in marital quality (presented in table 2) shows that women report significantly higher negative marital quality score than men do, suggesting women's greater exposure to marital strains. This finding echoes Umberson and Williams' (2005) argument that gender inequality in the impact of marital strains on health should take into account differential exposures of marital strains by gender in addition to the gender difference in vulnerability.

Taken together, these findings suggest a gendered pattern in how marital quality contributes to the physical health of CVD patients during the course of disease progression. On the one hand, older women with CVD don't seem to enjoy the health benefits of marital support as their male counterparts do. On the other, women are similarly vulnerable to the physical health insults of negative marital experiences and more exposed to marital strains than men. In broader strokes, this gendered pattern seems to point to the gendered nature of marriage where "his" experiences are different from "hers" (Boerner et al. 2014; Kiecolt-Glaser and Newton 2001). Future research should investigate potential sources for gender differences in chronic disease progression, and relatedly, disease management. Also, this finding should have informative implications for health professionals working with CVD patients. Greater attention should be paid to married female patients than their male peers as women are at a greater risk of marital strains and the associated health consequences.

The Significance of Psychological Distress

Psychological distress is shown in my analysis to play a major role in the link between marital quality and functional health among older adults diagnosed with CVD, followed by health behaviors. This finding resonates with recent developments in behavioral cardiology that emphasizes the importance of psychological well-being to cardiovascular health together with its impact on health habits (Das and O'Keefe 2006). Although, the two measures used in the current study significantly explain the link between marital quality and functional health among CVD patients, they are more general measures of mental health. Future research should also examine other aspects of mental well-being such anxiety, loneliness and sense of hopelessness and stress specific to manage CVD to gain a more detailed understanding of how marital quality affects the progression of CVD via psychosocial pathways.

Limitations

Although commonly used in research, the measures used in this study only tap into a limited dimension –i.e. supportive and unsupportive behaviors– of marital quality as a complex construct. In light of the significance of marital quality on chronic disease management, future research should employ other validated measures such as the Dyadic Adjustment Scale and the Marital Adjustment Test to investigate how other dimensions of marital quality contribute to the progression of CVD and other chronic illnesses. Additionally, to the degree that marital quality is closely related to marital stability, the current study may be subject to this selection bias because marriages of very low marital quality may have already dissolved before the study's observation began. On this note, findings from this study may be considered more conservative estimates.

Research suggests that marital quality and health have reciprocal relationships where marital quality can affect health and vice versa (Liu and Waite 2014). For the purpose of this study, I only consider how marital quality affects subsequent physical health among older adults with CVD. However, the mental and physical burdens of disease management and caregiving for both patients and their partners can exert a toll on the relationship quality (Choi and Marks 2006). Future research should examine the reciprocal relationships between marital quality and chronic disease management to gain a better understanding of how marital quality contributes to chronic disease progression. On a related note, in light of marriage as an interdependent context, future research should also adopt a dyadic approach that considers the effects of both patients' and their partners' assessments of marital quality on disease management. lastly, although the current study does not attempt to distinguish between cohabitation and marriage partly for the small sample size of cohabitors, in light of cohabitation as an growing alternative of romantic relationship among older adults in addition to marriage, future research should examine whether the link between relationship quality and chronic disease progression differs between the married and the cohabiting.

Conclusion

It is suggested that marriage confers health benefits, and this health advantage of marriage also depends on the quality of the relationship (Carr and Springer 2010). Along this line of inquiry, the current study provides population-based empirical evidence on the significance of marital quality for the physical well-being of the chronically-ill, which has been relatively unheeded in the existing literature. As marriage continues to be one of the most important social relationships to individuals' well-being, particularly for older adults, and is now also a legally available option for the LGBT community, research should keep pursuing this line of inquiry to shed light on the link of marital quality to health in general, and particularly to chronic disease progression.

CHAPTER FOUR

MARITAL TRAJECTORY AND MORTALITY AMONG OLDER ADULTS DIAGNOSED WITH CARDIOVASCULAR DISEASE

Introduction

Cardiovascular disease (hereafter, CVD) has been ranked as the leading cause of death in the US for years (Newschaffer et al. 2010). In 2013, a total of 611,105 people died of heart diseases, contributing to 23.5% of total deaths in the same year (National Center for Health Statistics 2015). Researchers have made substantial efforts to identify biological, behavioral as well as psychosocial risk factors that contribute to the progression of CVD. Among them, marital status has been documented as an important risk factor that differentiates the survival prospect of CVD patients (Koskenvuo et al. 1980). Studies consistently show that married people, in general, have a lower mortality risk from CVD than their unmarried counterparts (Chandra et al. 1983; Quinones et al. 2014). Yet, research along this line of inquiry has focused heavily on the association between current marital status and the survival of CVD patients. Much less attention has been paid to the impact of past marital experiences. In light of the significant health of marital losses to cardiovascular risks (Dupre et al. 2015; Zhang and Hayward 2006) and recent rise of divorce among older adults in the US (Brown and Lin 2012), I consider *how marital trajectories informed by past experience of marital dissolution are linked to the survival prospect of CVD patients*.

Using data from the 1994-2012 Health and Retirement Study, I consider lifetime exposure to marital dissolution and take a more detailed account of how marital history is associated with the mortality risk of CVD patients. The research objectives are threefold. First, I compare the mortality risk of the remarried, divorced/separated, widowed, cohabitors and the never-married to the first-time married among older adults diagnosed with CVD, taking into account their lifetime exposure of marital losses. Second, I investigate if the observed association of marital biography to mortality differs by gender among CVD patients. Lastly, I evaluate the relative contribution of the following factors in explaining the link between marital biography and mortality among those diagnosed with CVD.

Marriage, Cardiovascular Disease and Mortality

Empirical evidence

A significant body of literature has identified marital status as an independent risk factor for the progression and survival prospect of individuals diagnosed with CVD (Molloy et al. 2009). In general, married people have a better survival prospect in CVD than their unmarried counterparts (Randall, Bhattacharyya and Steptoe 2009). For example, an early study by Koskenvuo et al. (Koskenvuo et al. 1980) shows that married people diagnosed with ischemic heart disease have a lower mortality risk than the divorced and widowed. Similarly, recent research also demonstrates the survival advantage of married people compared to the unmarried after major cardiac surgeries (Idler, Boulifard and Contrada 2012; King and Reis 2012).

Despite substantial evidence on the survival benefits of marriage for CVD patients, past research has undertaken a simplified characterization of the link between marital contexts and CVD-associated mortality by focusing heavily on the effect of current marital status. While current marital status is an important dimension of marital history, it does not solely define individuals' lifetime marital experiences. What happened in the past also matters. From a life course perspective, it is argued that people accumulate past marital events and experiences as they age and these critical events and experiences may theoretically have a lasting impact on their well-being in later life (Elder, Johnson and Crosnoe 2003). Substantial research has provided rich empirical evidence that shows the merit of examining other aspects of individuals' marital history in better understanding how various marital contexts contribute to health over the life course (Waite 2009). Thus, it is important to go beyond the effect of current marital status and take a closer look at how CVD patients' marital history contributes to their survival chance. Building on existing scholarship, the current study takes a life-course approach to examine how marital history is associated with mortality risk among individuals diagnosed with CVD. My arguments are guided by the three major theoretical frameworks often invoked to explain the marriage-health link: marital resource model, stress model and the selection model.

Marital Resource Model

The marital resource model posits that health differentials by marital status primarily result from the economic, social and psychological resources accruing to marriage which are otherwise less available to the unmarried (Liu 2009). These resources resulting from marriage are not only important for maintaining good health but even more crucial for managing chronic health conditions like CVD. Managing CVD is a lifelong process and entails stable financial resources to support the necessary medication, medical equipments such as a blood pressure monitor and even surgical procedures to stabilize health conditions (Newschaffer et al. 2010). Married people possess greater economic resources from pooling incomes together, economies of scale and task specialization, and are thus more financially stable than the unmarried (Waite 1995). As a result, they are more able to afford the financial cost produced during the process of managing CVD. Additionally, married people are more likely to have health insurance and better utilization of healthcare services than their unmarried peers, which allow them to detect the symptoms of chronic health conditions such as CVD and manage the disease at an earlier stage (Cornwell and Waite 2012; Iwashyna and Christakis 2003).

Married people's health also benefits from the social control of health behaviors from their spouses, an important social resource that facilitates the management of CVD (Umberson 1987; Umberson and Montez 2010). Epidemiological literature clearly indicates that effective management of CVD requires substantial behavioral adjustment to a healthy lifestyle such as adopting a low-carb and low-sodium diet, regular exercise and quitting smoking. Additionally, rigorous adherence to medical regimens including taking medication on time and regular health checkups to monitor one's health conditions are also critical for CVD patients to manage the disease (Newschaffer et al. 2010). Health reminders and monitoring have been demonstrated to facilitate the management of chronic disease (August and Sorkin 2010). As married people, particularly married men, tend to have greater social control of health habits than the unmarried, they are more likely to adhere to medical orders and follow a health-enhancing lifestyle, thereby enhancing their disease management and in turn, life expectancy (Umberson 1992; Waite and Gallagher 2000).

Lastly, marriage also provides psychological resources, such as emotional support from the spouse, a sense of integration and responsibility, which are not only important to sustain good health, but even more critical when one has to fight with chronic disease on a long-term basis. Psychological strains have been shown to be a major modifiable risk factor for the onset and progression of CVD (Newschaffer et al. 2010) and spousal support has been shown to benefit the prognosis of CVD patients (Lett et al. 2005). Compared to the unmarried, married CV patients benefit from greater social support in general and particularly emotional support from their spouses, which motivate them to keep going and help them manage the disease. Consequently, they are more likely to enjoy better health and longer life expectancy with CVD.

Married people accumulate health-enhancing resources as they continue to stay in marriage. However, the process of resource accumulation can be affected by the occurrence of critical marital events (Ferraro and Morton 2016). People who stay married in their first marriage may enjoy the most cumulative advantage as they amass health-enhancing resources over time, which continues to boost their health over the life course. On the contrary, those who experienced marital disruption in the past are at a more disadvantaged place compared to their continuously married counterparts because their processes of resource accumulation are interrupted divorce, separation or spousal death. From a life course perspective, the collecting of health benefits from marriage not only depends on currently being married, but also past marital experiences. Thus, it is expected that people with CVD who stay in their first marriage should have the lowest mortality risk compared to their peers who have experienced marital losses in the past, those in a cohabiting relationship and those who are never married.

Stress Model

The stress model suggests that the short-term stress and the long-term chronic strains associated with divorce, separation and widowhood are the primary contributors to health and mortality differentials between the married and the previously married (Liu 2009; Liu and Umberson 2008). Immediate stress following marital disruption can exert direct physiological insults on human bodies and also induce unhealthy habits such as smoking, binge drinking or irregular sleep schedules (Baum and Posluszny 1999; Booth and Amato 1991; Carr and Bodnar-Deren 2009). Additionally, chronic strains associated with a marital loss, such as stress from negotiating child custody for the divorced, managing household work alone and loss of economic support, can also have long-term health consequences. Ending a marriage through divorce or death of the spouse can have a lasting imprint on health that cannot be recovered even after remarrying (Hughes and Waite 2009; Williams and Umberson 2004).

Psychosocial stress has been identified as a major risk factor for the onset and progression of CVD (Newschaffer et al. 2010). Stress can increase cardiovascular risks through direct pathways such as metabolic abnormalities and inflammation, and indirectly via increased unhealthy habits and nonconformity to medications (Baum, Herberman and Cohen 1995; Das and O'Keefe 2006). Therefore, from the stress model, divorce/separation and widowhood should have a negative effect on the prognosis of CVD patients. Furthermore, the life course theory asserts that past life experience can have a lasting impact on outcomes in later life (Elder et al. 2003). Thus, past exposure to marital disruption should also have a long-term effect on the mortality risk of CVD patients in addition to the current marital state (Hughes and Waite 2009). Taken together, it is expected that CVD patients with previous marital losses, including the remarried, the divorced/separated and the widowed, should have a greater mortality risk than their first-time married peers.

Selection Model

The selection model attributes health and mortality differentials by marital status primarily to selection processes where healthy individuals with salubrious health habits are more likely to enter marriage and stay married whereas those with ill health and unhealthy behaviors are less likely to get and stay married (Carr and Springer 2010). Managing CVD, particularly with health complications such as physical or cognitive disability, requires substantial caregiving, usually by significant others of the ill person such as the spouse (Wolff and Kasper 2006). The burden of caregiving may cause increased marital strain, which further takes a toll on the marital stability

(Choi and Marks 2006). Additionally, chronic illnesses are also likely to break up a marriage due to premature mortality of the ill spouse. Recent research has provided empirical support for serious physical illness as a determinant of marital breakups via either divorce or widowhood (Karraker and Latham 2015). While I argue the link between marital history and mortality of the CVD-diagnosed primarily from the marital resource and stress perspectives, it is also possible that health-based selection processes also contribute to the expected association.

Gender Variation

Gender has been an important moderator for the link between marriage and health. In light of the gendered nature of marriage with specific roles and expectations, researchers often suspect that the health benefit of marriage and the consequence of marital dissolution may differ for men and women (Williams and Umberson 2004). Debates on the moderating effect of gender for the link between marriage/marital dissolution and health have not been concluded (Carr and Springer 2010). The complexity of the marital life course further complicates the investigation. Research suggests that gender patterns of the association between marital history and health really depends on which outcome, dimension of the marital life course and stage of life are being examined (Waite 2009; Williams and Umberson 2004). Although empirical findings on the gender difference in marital history and health are mixed, theories about gendered patterns in the link between marriage and health can provide some insights regarding expected gender variations in the link between marital history and mortality among older adults with CVD.

Marriage benefits men's and women's health through gender-specific pathways. In general, men's health benefits from marriage primarily through increased social control of health behaviors and emotional support from their wives whereas women enjoy health gains from marriage mainly via enhanced financial well-being (Lillard and Waite 1995; Waite 1995). In the case of managing CVD, behavioral adjustment is crucial for the survival prospect of CVD patients. Effective management of CVD requires substantial behavioral change to reduce modifiable risk factors such as smoking and unhealthy diet, cultivate healthy habits like regular exercise and adhere to medication regimens rigorously (Newschaffer et al. 2010). As married men benefit from the social control of health behaviors by their wives more than married women by their husbands, it is possible that married men with CVD benefit more from being married than their female counterparts in terms of their survival prospects (Umberson 1992). Additionally, in light of depression as a major modifiable risk factor for CVD, the emotional support by one's spouse in marriage can buffer the stress caused during the course of managing the disease (Gallant 2003). Compared to women, men depend more exclusively on their spouse for emotional support (Waite and Gallagher 2000). Since married men's health depend considerably on the health monitoring by their spouses and the emotional support they get from marriage (August and Sorkin 2010), ending a marriage and being divorced or widowed may take a greater toll on their health while trying to manage a major chronic health condition like CVD. Drawing on these theoretical insights, I expect that the observed association between marital history and mortality of older adults with CVD should be stronger for men than women.

Research Hypotheses

Building on the current scholarship of marriage and health, the current study goes beyond the effect of current marital status to examine the link between marital history and mortality risk among older adults diagnosed with CVD in their mid- and later life. Specifically, among older adults diagnosed with CVD, I compare the mortality risk of the remarried, the divorced/separated, the widowed, the cohabiting and the never-married to those who stay married in their first marriage, taking into account their lifetime exposure to marital dissolution. Based on the discussion of the theoretical frameworks and empirical findings in the previous section, I propose the following hypotheses:

H1: among older adults diagnosed with CVD, those who remain married in their first marriage have a lower mortality risk than their counterparts who are remarried with one divorce, one widowhood and multiple losses, divorced/separated with one loss and multiple losses, widowed with one loss and multiple losses, cohabiting and never-married.

H2: following H1, the observed associations between marital history and mortality among older adults diagnosed with CVD are stronger for men than women.

Moreover, I test for three sets of explanatory factors of theoretical significance – socioeconomic resources, health behaviors and psychological distress. Past research has demonstrated that these three factors explain health and mortality differentials by marital status (Carr and Springer 2010). Additionally, CVD has been suggested to be comorbid with a host of serious chronic health conditions such as hypertension, diabetes, cancer and chronic pulmonary obstructive disease (Mannino et al. 2008; Opie 2012). In light of the relationship between marriage and disease management, it is also possible that marital history is linked to subsequent mortality among CVD patients via the development of comorbid health conditions. Thus, comorbidity is also examined as a physiological pathway. Specifically, I hypothesize that

H3: socioeconomic resources, health behaviors, psychological distress and comorbidity jointly explain the associations between marital history and mortality among older adults diagnosed with CVD.

Data and Methods

Data

I use data from the Health and Retirement Study (HRS), 1994-2012 sponsored by the National Institute on Aging and conducted by the University of Michigan. The HRS is a multi-stage longitudinal household survey and contains a probability sample representative of non-institutionalized civilian adults aged at least 50 years old in the US with oversamples of Blacks, Hispanics and residents of the state of Florida. The HRS regularly collects rich information on respondents' sociodemographic, socioeconomic characteristics and health conditions biennially, including retrospective and prospective information on past marital events. Additionally, the HRS regularly tracks and updates respondents' vital status. Therefore, it is an ideal dataset for the research questions of the current study. The RAND Corporation developed a harmonized version of the dataset that contains systematic variable names and coding across different waves, which greatly facilitates data analysis for researchers. The majority of information used in my analyses comes from the RAND HRS Version N dataset (RAND Center for the Study of Aging 2014). Information on respondents' mortality status and weight variables is obtained from the 2012 tracker file.

The current study focuses its analysis on older adults diagnosed with CVD. To reduce the biased introduced by long-term illness, I only include the newly diagnosed cases of CVD. These newly diagnosed cases are identified through the question asking whether respondents were ever diagnosed by a doctor that he/she had a heart problem (e.g. heart attack, coronary heart disease or congestive heart failure) or stroke (including transient ischemic attack). If a respondent reports having no diagnosis of any cardiovascular condition at a wave, and confirms the diagnosis in the following wave, he /she is considered a newly diagnosed case of CVD. I then follow their mortality status after they are diagnosed with CVD until they either died or are censored. A total of 6,717 newly diagnosed cases of CVD are identified among 37,319 cases ever interviewed by the HRS. Respondents who were diagnosed with CVD between 2010 and 2012 (N=726), the last two waves of my data, are not included in my analysis since their mortality information required for the current study is not available until 2014. As the HRS sample is representative of non-institutionalized US civilians aged at least 50 years old, I further restrict my sample to cases at least 50 years old with a non-zero baseline weight. I also dropped 7 cases with missing information on mortality status and 2 missing on race/ethnicity. The final analytic sample consists of 5,589 new diagnosed cases of CVD, contributing to a total of 17,860 person-intervals.

Measures

Mortality status is ascertained through the HRS 2012 tracker file. A respondent is coded as "0" if he or she is either confirmed or assumed alive at a current wave, and coded as "1" if known deceased as of the current wave. The analysis time for the Cox regression analysis is age at death in months as the HRS tracker file contains information on respondents' years and months of interview and death. Among 5,589 cases, 1,978 died during the observation period. The average age at death is about 928.57 months old (i.e. 77.38 years old).

Marital history is coded using information on current marital status, cumulative number of divorce and cumulative number of widowhood as of a wave. I created a total of 10 different marital history type, taking into account lifetime exposure to marital disruption: (1) first-time married (reference), (2) remarried with one divorce, (3) remarried with one widowhood, (4) remarried with multiple losses, (5) divorced/separated with one marital loss, (6) divorced/separated with multiple losses, (7) widowed with one marital loss, (8) widowed with multiple losses, (9) cohabiting and (10) never-married.

Socioeconomic resources contain four measures: education, annual household income, net assets and insurance status. *Education* is measured with years of formal schooling. Four cases are missing on years of schooling and imputed with the mean value. *Annual household income* is measured in nominal dollars by the sum of all income from the respondent and the spouse, not including other household members. *Net assets* are measured by the sum of all wealth components (excluding the second residency) minus all debts. Since both annual household income and net assets have substantial missing values, the HRS imputes the missing cases. Following past research, I adjusted annual household income and net assets for household size by dividing the original value with the square root of the total number of people in the household. Naturally-logged values were then taken to adjust to the skewed distribution of the two variables. *Insurance status* is coded as "0" if the respondent reports not having any kind of public or private health insurance and "1" if at least one type of health insurance.

Health behaviors are indexed by smoking, drinking, physical activity and body weight. *Drinking* is recoded into three categories: abstainers, light to moderate drinkers (reference) and heavy drinkers. Respondents who consume one to two drinks per day are categorized as light to moderate drinkers, and those who have three drinks or more as heavy drinkers (Zhang and Hayward 2006). *Smoking* includes the following categories: non-smokers (reference), past smokers and current smokers. Physical activity is a binary indicator of whether respondents engage in vigorous physical activity at least more than once a week (yes=1, no=0). I also include *body weight* measured by BMI as an indicator for health behavior since body weight is not only a significant metabolic risk factor for CVD but also reflects one's health behavior and lifestyle. Body weight is categorized into four groups using the cutoffs suggested by the CDC:

underweight (BMI<18.5), normal (18.5≤BMI≤24.9), overweight (25≤BMI≤29.9) and obese (30≤BMI) (CDC 2015).

Psychological distress includes two measures: depression and presence of emotional problems. *Depression* is measured by a short eight-item version of the CES-D scale asking whether respondents experienced the following feelings: feeling depressed, feeling that everything is an effort, restless sleep, feeling lonely, feeling sad, could not get going, feeling happy and enjoying life. A summary score was created by the RAND HRS dataset, ranging from 0 to 8 with higher values indicating more depressive symptoms. Approximately 11.6% (N=651) of the respondents are missing on their depression scores. I used a single-equation approach to impute the cases with missing values. Presence of *emotional problems* is measured by the question asking whether respondents have been diagnosed with any emotional, nervous or psychiatric problems (yes=1, no=0).

Comorbidity is examined as a possible physiological pathway through which marital history is linked to mortality among CVD patients. Several chronic health conditions comorbid with CVD and associated with mortality are included in the analysis: hypertension, diabetes, cancer and lung disease (Mannino et al. 2008; Opie 2012). A binary indicator is created for each comorbid condition to index whether respondents were diagnosed with a particular disease.

I control for a series of sociodemographic covariates associated with health and mortality in all the analytic models: gender, baseline age, birthplace, race/ethnicity and immigrant status. *Gender* is a binary indicator with men (reference) coded as "0" and women "1." *Baseline age* is the age when respondents start to come under the observation of mortality risk, and is centered at age 50. *Birthplace* includes two categories: south (reference) vs. other regions. Race/ethnicity is coded into four groups: non-Hispanic white (reference), non-Hispanic black, non-Hispanic other races and Hispanic. Immigration status includes two categories: US-born (reference) vs. immigrants.

All the covariates used in the analysis are time-varying except education and the sociodemographic controls. Most of the covariates have a small portion of missing values (<2%) except depression (approximately 10%). I flag all the missing cases with a binary indicator to control for the potential bias introduced by missingness. Table 1 presents the descriptive statistics of the variables used in the analysis. To briefly summarize the sample characteristics, table 1shows that the majority of older adults in the analytic sample are still in their first marriage (44.26%) at the baseline and because widowhood is a common state in later life, about 24% of them are widowed, most of whom experienced one marital loss. Remarriage is also not uncommon as over 16% of older adults in the sample are in their second or higher-order marriages at the baseline. The sample consists of predominantly women and the average age is close to 70 years old. In terms of health conditions, respondents report an average of 4 functional limitations. Since this is a sample of older adults diagnosed with CVD, most of them (78.23%) report at least one other chronic health conditions at the baseline.

Analytic Approach

Cox regression models are employed to investigate the link between marital history and mortality among older adults diagnosed with CVD. Cox regression is appropriate as it assumes no underlying distribution in the hazards of an event over time, is flexible to accommodate time-varying covariates and often used in multivariable mortality analysis. The Efron method is used to adjust for tied events (Allison 2010). My multivariable analysis starts with the baseline model that controls for baseline age, gender, birthplace, race/ethnicity and immigration status and test for gender differences in the observed associations in the second model. Building on the results from these two models, I then adjust for socioeconomic resources, health behaviors, psychological distress and comorbidity sequentially to evaluate the contribution of these four sets of explanatory factors. I apply respondent-level baseline weights to all my models to adjust for the complex survey design of the HRS. Baseline weights are suggested to be appropriate for prospective analysis such as survival models employed in the current study (HRS website 2011). All the time-varying covariates are lagged for one wave to predict subsequent mortality risk in order to reduce causal ambiguity.

Findings

Marital History & Mortality among Older Adults with CVD

How is marital history linked to the survival prospect of older adults diagnosed with CVD beyond current marital status? Table 4-2 provides answers to this central question of the current study. In a nutshell, results in table 4-2 indicate that marital history does matter to the survival of older adults with CVD. Model 1, the baseline model, shows that among the older remarried diagnosed with CVD, neither those with one divorce in the past nor those who experienced multiple marital losses have a significantly higher mortality risk than the first-time married. Only the remarried who underwent spousal death once in the past suffer a significantly higher mortality than their peers who stay married in their first marriage after they were diagnosed with CVD. The death hazards of remarried CVD patients with a previous spousal loss are about 40% ($[\exp(0.338) - 1] \times 100\%$) higher than the first-time married.

The previously married older adults diagnosed with CVD are also significantly more vulnerable to a higher mortality risk than the first-time married, particularly the divorced/separated with multiple marital losses in the past. Among the divorced/separated, people who experienced marital dissolution once show a 43% ($[\exp(0.360) - 1] \times 100\%$)

higher mortality risk than their first-time married peers while those with multiple losses have 62% ($[\exp(0.483) - 1] \times 100\%$) higher death hazards than the first-time married, about 19% more than the gap between the divorced/separated with one loss and the first-time married. For the widowed diagnosed with CVD, those with one loss show a 36% ($[\exp(0.311) - 1] \times 100\%$) higher mortality risk than the first-time married while those widowed with multiple losses in the past are 43% ($[\exp(0.358) - 1] \times 100\%$) higher in their death hazards compared to their married peers in their first marriage.

Consistent with the theoretical expectation, older cohabitors diagnosed with CVD also have an unfavorable survival prospect. They exhibit a 41% higher mortality risk than their first-time married peers. Lastly, older adults with CVD who were never married were an advantaged group. They show a similar mortality risk as those who remain married in their first marriage. This finding is consistent with previous research suggesting that older never-married adults are a selective group with higher socioeconomic status and health conditions (Carr and Springer 2010; McFarland et al. 2013). Overall, the results in model 1 largely support my first hypothesis regarding the link between marital history and mortality risk.

To investigate gender variations in the observed link between marital history and the survival of older adults with CVD, I tested for gender interaction terms in model 2. Contrary to the theoretical expectations, no significant gender variation was found in the observed association. Hypothesis 2 is not supported.

Assessing the Theoretical Explanations

In the following models, I evaluate the relative contribution of the hypothesized theoretical explanations to the observed associations between marital history and mortality among older adults diagnosed with CVD. Models 3 to 6 respectively adjust for socioeconomic resources, health behaviors, psychological distress and comorbidity and are compared to the baseline model.

Model 3 shows that adjusting for the socioeconomic indicators moderately explains the significant mortality gaps observed in the baseline model between the first-time married and those who ever experienced marital disruption. The drops in the coefficients range from 11% to 14%. Differences in mortality risk remain significant after controlling for socioeconomic resources except for the cohabitiors. The differential death hazards between cohabitors and the first-time married became nonsignificant after the socioeconomic indicators were added to the model, suggesting that socioeconomic resources might play an important role in producing the mortality disadvantage of older cohabitors with CVD compared to their first-time married peers.

Model 4 shows that health behaviors are an important explanation for the mortality disadvantage of older adults with CVD who ever experienced marital losses. Adjusting for health behaviors considerably explains the mortality gaps observed in the baseline model. The change in the coefficients ranges from almost 20% to 50%. The higher mortality risks of the two divorced/separated groups and the widowed with multiple losses became nonsignificant after the model was adjusted for health behaviors. Controlling for health behaviors, however, did not explain the mortality disadvantage of cohabitors. The coefficient actually increased.

Model 5 controls for depression and the presence of emotional problems, the two indicators of psychological distress. Compared to socioeconomic resources and health behaviors, psychological distress plays a much minor role in the link between marital history and mortality risks among older adults with CVD. The statistically significant coefficients observed in the baseline model dropped for about 3% to 12% after adjusting for depression and emotional problems. One thing to note is that adding psychological distress indicators to the model both increased the estimated coefficient and standard error of the cohabitors and the coefficient is not statistically significant, suggesting that the estimate for the cohabitors may not be as robust as those of the other groups.

Although not comparable to health behaviors, model 6 shows that comorbidity is also a significant explanation for the mortality disadvantage of older adults with CVD who ever had marital disruptions in their lifetime, including the remarried with one widowhood, the divorced/separated and the widowed. Adjusting for the presence of comorbid chronic illnesses contributed to the drops in the coefficients of these groups for about 14% to 22%. Adding comorbid conditions to the model increased the gap between cohabitors and the first-time married, and the coefficient is statistically significant.

Finally, model 7 controls for all the hypothesized explanatory factors and show that these factors together explain almost all the mortality disadvantage of older adults diagnosed with CVD who ever experienced marital dissolutions over the life course. Only the estimate for the widowed with one loss remains statistically significant after adjustments for all the covariates, but the coefficient still dropped significantly. Adding all the covariates to the model actually increased the estimated coefficient and standard error of cohabitors and the coefficient became nonsignificant, another indication that this might not be a robust estimate. Results from model 7 largely support the third hypothesis.

Discussion

This study investigates the link between marital history and mortality among older adults in the US diagnosed with CVD. The current literature inquiring the association of marriage and cardiovascular mortality relies heavily on the dichotomy of married versus unmarried or static contrasts of mortality risks by current marital status. The current study bridges this significant gap by taking into account older CVD patients' lifetime exposure to marital dissolution to examine how past marital experience matters to the survival prospect of CVD patients beyond current marital status. The findings demonstrate the importance of marital history and show a more nuanced picture of the link between marriage and the prognosis of people diagnosed with CVD than the simple married-unmarried dichotomy.

The Remarried

First, the current study discovers that the survival advantage of being married for CVD patients is contingent upon marital history, reiterating the growing consensus on weaker health-protection effects of higher-order marriages (Carr and Springer 2010). Specifically, among the remarried, people who experienced one divorce and multiple losses over the life course show similar mortality risks as those who remain married in their first marriage whereas those with one spousal loss exhibit a significantly higher risk of death after diagnosis of CVD than their first-time married peers. From the marital resource and stress perspectives, remarriage has been shown to reduce chronic stress associated with marital dissolution and restore the flow of marital resources, which in turn promote the previously married's health (Waite 2009). The comparable mortality risks observed in this study between remarried older adults with one divorce and multiple losses also point to such health benefits of remarriage in terms of disease prognosis. Yet, the heightened mortality risk of the remarried with one spousal loss suggests that widowhood might have a lasting impact on health, which cannot even be reversed by remarriage.

Although both are major stressful life events, widowhood can be more taxing and traumatic than divorce to one's well-being. In nature, divorce is usually preceded by elevated marital strains sustaining for a period of time, which is already compromising one's health before the divorce takes place. Thus, research has shown that ending an unhappy marriage can actually contribute to long-term psychological gains whereas staying in one hurts more (Williams 2003). In contrast, widowhood can be particularly stressful due to the nature of how it ends a marriage. In widowhood, the surviving spouse needs to deal with the death of the ill spouse. Such experience can take a toll on the widowed's health on a long-term basis, particularly in a marriage with higher relationship quality and interdependence (Carr et al. 2000). Additionally, the psychological and financial burdens of caregiving before the ill spouse dies can also have a long-term impact on the bereaved spouse's health (Prokos and Keene 2005; Valdimarsdóttir et al. 2003). Thus, while the remarried with one divorce and those with multiple losses, which consists mostly of the multiply-divorced in my data, can benefit from remarriage to manage their CVD, those who were previously widowed seem disadvantaged by the previous spousal death.

Finding on the remarried who were previously widowed also echo past research that found evidence of worse cardiovascular health of the remarried compared to those in their first marriage. For example, Donoho and colleagues (Donoho et al. 2015) show that the remarried middle-aged people have significantly worse cardiovascular functioning (measured by high-frequency heart rate variability) than the continuously married. Studies by Zhang and colleagues also discover higher CVD prevalence and an earlier onset of CVD among the remarried compared to their peers in the first marriage (Zhang 2006; Zhang and Hayward 2006). Moreover, this finding is consistent with the perspective of resource accumulation from a life course perspective. As people enter marriage, the accumulation of health-enhancing resources is also initiated. Over the course of marriage, the accumulated marital resources continue to protect their health. The death of a spouse could interrupt this resource accumulation process, cause the loss in these health-enhancing resources (Waite 2009), and set the previously widowed apart from the continuously married over the life course in health production even after they reenter marriage.

The Previously Married

I also discover significantly higher mortality risks among the divorced/separated and the widowed with one loss and multiple losses compared to their first-time married counterparts. To explore whether the accumulation of negative marital events impose additional health insults compared to one single loss, I conducted Wald tests for the equality of death hazards between the single-loss and the multiple-loss, separately for the divorced/separated and the widowed (results not shown here). Although the contrasts did not pass the formal statistical tests, the larger estimated hazards ratio for the multiple-loss compared to their single-loss peers, particularly among those who are divorced/separated, can still have substantive implications. As the baseline model indicates, the mortality gap between the divorced/separated with multiple losses and the first-time married is 19% higher than that between the single-loss and the first-time married. Previous research also found evidence of additional cardiovascular health and mortality risks for multiple marital losses over the life course (Dupre, Beck and Meadows 2009; Dupre et al. 2015; Zhang 2006). Thus, from the perspective of cumulative disadvantage, the previously married older adults with multiple losses could be particularly disadvantaged in terms of their survival prospects in CVD.

The Cohabitors and the Never-Married

Older cohabitors diagnosed with CVD also show a sizable subsequent mortality disadvantage compared to their first-time married counterparts. This finding is consistent with past research that also found elevated cardiovascular risks among older cohabitors (Zhang 2006), and resonates with the general consensus in the literature on the health deficits of cohabitors compared to the married (Carr and Springer 2010). Little research has been conducted systematically to examine the role of cohabiting relationships in chronic disease management.

My study provides a glimpse of the significance of cohabitation for the survival prospect of older adults diagnosed with CVD. The result should be interpreted with caution as the estimates for cohabitors in my models are sensitive to the addition of covariates. Considering the growing number and significance of cohabitation among older adults in the US (Brown et al. 2006), future research systematically investigate the significance of cohabiting relationships for chronic disease management.

Never-married older adults diagnosed with CVD experience comparable mortality risk to that of their first-time married peers. In a similar vein, previous research also found no significant cardiovascular risk and risk of early onset of CVD (Zhang 2006; Zhang and Hayward 2006) among older adults in their middle and later life. The literature on marriage and health suggests that older adults in the US who are never married are a selective group on higher socioeconomic status (McFarland et al. 2013). This group presents particular theoretical and analytic challenges to the study of marriage and health as the results often defy the theoretical prediction. Preexisting selection factors are hard to filter out. Despite their small number, never-married older adults remain a portion that makes up the elderly in the US. Future research should also invest in further investigation of how the never-married manage their chronic illnesses in lack of health-enhancing resources generated by marriage (Carr and Springer 2010).

No Gender Variation

Contrary to the theoretical expectations, no gender variation was observed in the link between marital history and mortality risk among older adults diagnosed with CVD. Although substantial research has found evidence for a moderating role of gender in the link between marital history and health, investigations on gender variations are yet to be conclusive (Carr and Springer 2010; Waite 2009). An earlier study by Zhang (2006) also found similar cardiovascular risks for men and women. More important for the current study, gender difference in chronic disease management and progression may be more complex than moderating the effect of marital history on the ultimate outcome, i.e. mortality. Given the established gendered pathways through which marriage differentially benefits men and women, and gender-specific ways men and women respond to and are impacted by marital disruptions, future research should investigate how marital history may affect chronic disease management and subsequent health change over the course of disease progression differently for men and women via different pathways.

The Significance of Health Behaviors and Comorbidity

Analyses from models 3 to 6 show that health behaviors, and to a lesser extent, comorbidity are important explanations for the link between marital history and mortality for older adults diagnosed with CVD. The finding on the significance of health behaviors lends support for the consistent emphasis in the literature on the importance of self-care for chronic disease management in general, and specifically for CVD (Gallant 2003; Sayers et al. 2008). Considering the prominence of marriage in health control (Umberson and Montez 2010), this finding also bears practical implications for health practitioners to pay closer attention to CVD patients who ever experienced marital disruptions, particularly those with multiple losses, for developments of adverse health habits such as smoking, poor adherence to medications and unhealthy diet. The finding on the significant role of comorbidity points to the possible compound impacts of multiple chronic health conditions associated with CVD on mortality risk, and aligns with the increasing concern of multimorbidity in studies of aging and health (Marengoni et al. 2011). In light of the close connection of multimorbidity with functional loss and premature death (Fortin et al. 2004), future research should examine how different marital contexts contribute to the development of multiple chronic health conditions in CVD patients.

Although my analysis shows socioeconomic resources and psychological distress play minor roles, it does not discount their significance in the progression of CVD. The fact that the full model with all the covariates almost explains all the mortality disadvantage of older adults with past marital disruptions is a clear indication that the causes of the deterioration of CVD are multi-factorial. The four explanations considered in this study are all interrelated and can have additive or even multiplicative effects on the progression of CVD.

Limitations

Several limitations are present in the current study. A major limitation, common in many longitudinal studies of older adults, is mortality selection. Since the analytic sample in this study is a selective group who are newly diagnosed case of CVD, individuals had to live long enough to develop observable symptoms to be diagnosed as having CVD. The left-censoring of the outcome of this study may preclude some cases from being included in the study due to premature death. In light of the close link between marital history and mortality, this potential bias from mortality selection may lead to an underestimation of the associations observed in the current study. Ideally, following a group of individuals at a relatively younger age free of fatal chronic illnesses into their old ages would be better-suited for the purpose of the current study.

Additionally, light of our finding on the significance of health behaviors to the survival prospects of CVD patients, the measures used in this study are limited. Recent advances in behavioral cardiology suggest that other health behaviors such as sleep, rest and relaxation all play a role in the development and progression of CVD (Rozanski 2014). Future research should include more comprehensive measures of health behaviors to further understand their roles in mediating the effect of marital history on the prognosis of CVD patients. In a similar vein, the mental health measures used in this study are rather limited. Recent research has established the importance of psychosocial stress on cardiovascular health. More comprehensive mental health measures such as anxiety, hostility and sense of hopelessness should be included in future studies (Das and O'Keefe 2006).

Lastly, substantial research has demonstrated immediate health impacts of marital transitions in later life, whether in or out of marriage (Waite 2009). Investigations of the impact of the occurrence of these critical life events could further our understanding of marital history as a risk factor for chronic disease progression. Unfortunately, the current analytic sample is inadequate to examine potential immediate effects of marital transitions because these marital events, primarily divorce and entry into marriage, are rare during the observation period. Future research should undertake this task with a better-suited dataset.

Conclusion

The current study contributes to the existing literature on marital status and survival prospects of CVD patients by demonstrating the importance of marital history. As CVD continues to be the leading cause of death in the US, findings from this study also have significant implications for cardiac practice and public health intervention in CVD management. To further the scientific study of marriage and chronic disease, future studies in pursuit of this line of inquiry should incorporate biological markers to investigate the physiological pathways, such as inflammation and heart rate variability, through which marital history influences the progression of CVD.

CHAPTER FIVE

CONCLUSION

Establishing on the current knowledge of marriage, marital biography and health, this dissertation project examines how marital experiences over the life course are linked to the maintenance and deterioration of physical health of older adults over time when they manage major chronic illnesses such as diabetes and cardiovascular disease. Findings from this project point to the well-established significance of marriage to health production, but add dimensions of specificity to the current scholarship. First, findings from this project shed light on the significance of marriage for maintaining health in chronic disease in addition to producing good health, echoing researchers' continued interest in the link between social relationship and chronic disease management (National Institute on Aging 2007). Second, this project shows that the health benefits of marriage in chronic disease management are conditional on chronic disease patients' marital history as past experience of marital losses has a long-reaching connection to health outcomes in later life. This finding calls for greater attention to older patients' marital history and how they may affect their adherence to treatment regimens. Third, this project reveals health consequences of the "dark side" of marriage (Umberson and Montez 2010) in managing chronic disease by showing that the health benefits of marriage in managing chronic disease very much depend on the quality of marital relationships. In light of the increasing prevalence of major chronic health conditions like CVD or diabetes, and the significance of intimate partnership for chronic disease management, future research should continue the inquiry of marital biography and health progression among chronic disease patients to inform medical treatment plans and related public policies.

APPENDICES

APPENDIX A: Chapter 2 Tables

Table 2-1. Weighted Baseline sample characteristics of Older Adults aged 50 and over Diagnosed with Diabetes (N=3,867)

	First-time married	Remarried	Cohabiting	Divorced/separated	widowed	Never-married
# of functional limitations	3.07 [0.07]	3.54 [0.13]*	3.86 [0.51]	4.40 [0.17]***	4.32 [0.11]***	3.76 [0.30]*
Current marriage duration	41.05 [0.37]	20.88 [0.60]***	--	--	--	--
Age	65.12 [0.31]	63.53 [0.32]***	62.86 [0.75]**	63.67 [0.42]**	72.94 [0.48]***	64.19 [1.09]
Female (male=0, %)	41.91	41.12	35.71	60.03***	80.00***	53.50
Immigration Status						
US born	89.14	94.21***	92.55	86.41	90.19	90.48
Immigrants	10.76	5.79***	7.45	13.44	9.81	9.52
Missing	0.10	0.00	0.00	0.15	0.00	0.00
Race/ethnicity (%)						
Non-Hispanic white	77.92	80.00	76.33	64.24***	71.90*	65.19*
Non-Hispanic black	8.43	9.29	13.51	17.44***	15.88***	16.43*
Non-Hispanic other races	2.99	3.76	1.73	4.21	4.46	7.23
Hispanic	10.66	6.95**	8.43	14.12	7.76*	11.15
Education (%)						
Less than high school	21.21	20.90	22.90	27.13	35.57***	23.00
High school graduate	35.68	37.51	24.22*	32.72	39.46	22.66**
Some college	20.20	23.67	34.50*	25.34	15.83	26.75
College graduate or above	22.91	17.93	18.38	14.80**	9.14***	27.59
Hypertension (%)						
Yes	69.66	70.56	76.97	76.75*	76.91**	78.89*
No	30.27	29.44	23.03	22.62*	22.92**	21.11*
Missing	0.07	0.00	0.00	0.63	0.17	0.00
Cardiovascular disease (%)						
Yes	29.87	31.70	40.98	31.69	40.60***	23.88
No	69.97	68.30	58.73	68.31	59.40***	76.12
Missing	0.16	0.00	0.29	0.00	0.00	0.00
# of measurement occasions	3.60	3.36*	2.81**	2.89***	3.18***	2.88**
Whether died during observation (no=0, %)	20.42	18.19	13.66	20.28	34.33***	22.68

Note: *p<.05 **p<.01 ***p<.001. The first time married are the reference category for all the pair comparisons by current marital status in the Wald tests; numbers in parentheses are standard deviations. Annual household income and net assets are naturally logged and adjusted for household size.

Table 2-1 (cont'd)

	First-time married	Remarried	Cohabiting	Divorced/separated	widowed	Never-married
Annual household income	66567.11 [2427.48]	74652.18 [7687.44]	65954.54 [5354.28]	31625.56*** [2540.09]	23738.32*** [1096.45]	54585.75 [15500.08]
Total net assets	401650 [20561.83]	378000 [49135.28]	226527** [47684.62]	155704*** [18285.63]	199282*** [14687.41]	209035*** [31455.64]
Insurance status (%)						
Have health insurance	94.57	93.77	86.22	89.34*	94.76	92.31
No health insurance	5.40	6.08	13.78	10.29*	5.09	7.69
Missing	0.03	0.15	0.00	0.37	0.15	0.00
Drinking (%)						
Abstainer	73.71	71.39	64.01	73.49	86.20***	74.26
Light/moderate drinker	24.61	27.09	29.01	22.04	12.56***	24.87
Heavy drinker	1.49	1.44	5.79	4.46*	0.71	0.87
Missing	0.19	0.08	1.19	0.00*	0.53	0.00*
Smoking (%)						
Non-smoker	46.83	34.29***	25.28***	33.72***	46.09	42.29
Past smoker	44.18	51.66**	52.36	39.81	41.82	43.01
Current smoker	8.56	13.23*	21.43*	26.19***	11.71	14.30
Missing	0.43	0.82	0.93	0.27	0.39	0.39
Weight status (%)						
Underweight	0.50	0.82	0.00	1.20	1.98*	0.81
Normal	15.82	10.72**	8.77*	18.16	20.06	17.82
Overweight	35.30	37.78	34.20	29.10*	36.31	29.22
Obese	47.25	49.43	55.27	50.12	39.90**	49.36
Missing	1.14	1.25	1.77	1.42	1.75	2.80
Whether physically active (%)						
Yes	27.07	24.61	26.16	23.13	19.78**	18.50
No	72.74	74.85	73.84	76.78	79.60**	81.01
Missing	0.18	0.54	0.00*	0.09	0.62	0.49

Note: *p<.05 **p<.01 ***p<.001. The first time married are the reference category for all the pair comparisons by current marital status in the Wald tests; numbers in parentheses are standard deviations. Annual household income and net assets are naturally logged and adjusted for household size.

Table 2-2. Growth Curve Models for Current Marital Status on Functional Limitations (N=3,867)

	Model 1		Model 2		Model 3	
	Intercept	Age slope	Intercept	Age slope	Intercept	Age slope
Current marital status (first-time married=0)						
Remarried	0.50 [0.22]*	0.002 [0.01]	0.29 [0.30]	0.02 [0.01]	0.34 [0.20]	0.002 [0.01]
Cohabiting	1.12 [0.38]**	-0.04 [0.02]*	1.22 [0.51]*	-0.05 [0.03]	0.86 [0.36]*	-0.04 [0.02]*
Divorced/separated	0.79 [0.25]**	-0.01 [0.01]	1.21 [0.40]**	-0.04 [0.02]	0.28 [0.23]	-0.001 [0.01]
Widowed	-0.28 [0.20]	0.02 [0.01]**	-0.82 [0.41]*	0.04 [0.02]**	-0.70 [0.19]***	0.03 [0.01]***
Never-married	0.54 [0.41]	0.01 [0.02]	0.19 [0.68]	0.02 [0.03]	0.14 [0.38]	0.01 [0.02]
Current marital status × gender						
Remarried × female			0.55 [0.44]	-0.04 [0.02]		
Cohabiting × female			-0.18 [0.76]	0.01 [0.04]		
Divorced/separated × female			-0.62 [0.50]	0.04 [0.03]		
Widowed × female			0.72 [0.47]	-0.03 [0.02]		
Never-married × female			0.55 [0.86]	-0.02 [0.04]		
Annual household income					-0.11 [0.03]***	0.01 [0.002]**
Net asset					-0.36 [0.15]*	-0.01 [0.01]
Insurance status (no=0)						
Insured					0.26 [0.23]	-0.01 [0.02]
Missing					0.02 [1.21]	-0.01 [0.05]
Drinking (moderate=0)						
Abstainers					0.16 [0.13]	0.01 [0.01]
Heavy drinkers					0.37 [0.43]	-0.04 [0.02]
Missing					3.35 [1.20]**	-0.14 [0.06]*
Smoking (non-smoker=0)						
Past smokers					0.29 [0.17]	-0.0002 [0.01]
Current smokers					-0.06 [0.23]	0.02 [0.01]
Missing					0.58 [0.63]	-0.05 [0.04]

Note: * p<.05 ** p<.01 *** p<.001; numbers in parenthesis are standard errors. Annual household income and net assets are naturally logged and adjusted for household size.

Table 2-2 (cont'd)

	Model 1		Model 2		Model 3	
	Intercept	Age slope	Intercept	Age slope	Intercept	Age slope
Body weight (normal=0)						
Underweight					1.23 [0.76]	-0.02 [0.03]
Overweight					0.20 [0.16]	-0.004 [0.01]
Obese					0.78 [0.18]***	-0.01 [0.01]
Missing					0.64 [0.39]	-0.01 [0.02]
Whether physically active (no=0)						
Yes					-0.38 [0.11]***	-0.01 [0.06]*
Missing					-0.72 [0.84]	-0.01 [0.04]
Depression					0.27 [0.03]***	0.001 [0.001]
Whether diagnosed with emotional problems (no=0)						
Yes					1.49 [0.18]***	-0.02 [0.01]**
Missing					1.74 [1.54]	0.002 [0.08]
Female (male=0)	1.61 [0.18]***	-0.02 [0.008]*	1.49 [0.25]	-0.01 [0.01]	1.25 [0.17]	-0.01 [0.01]
Race/ethnicity (non-Hispanic White=0)						
Non-Hispanic Black	0.21 [0.23]	-0.01 [0.01]	0.22 [0.23]	-0.01 [0.01]	0.15 [0.21]	-0.01 [0.01]
Non-Hispanic Others	0.57 [0.51]	-0.03 [0.02]	0.60 [0.51]	-0.04 [0.02]	0.30 [0.45]	-0.03 [0.02]
Hispanic	0.27 [0.32]	0.002 [0.01]	0.28 [0.32]	0.002 [0.01]	0.04 [0.28]	0.002 [0.01]
Immigration status (immigrants=0)						
U.S. born	0.75 [0.31]*	-0.02 [0.01]	0.75 [0.31]	-0.02 [0.01]	0.54 [0.28]	-0.02 [0.01]
Missing	1.31 [2.20]	-0.03 [0.09]	1.37 [2.19]	-0.03 [0.09]	0.94 [1.94]	0.002 [0.08]
Education (less than high school=0)						
High school graduate	-0.72 [0.23]**	0.004 [0.01]	-0.71 [0.23]**	0.004 [0.01]	-0.38 [0.21]	0.003 [0.01]
Some college	-1.02 [0.26]***	0.004 [0.01]	-1.03 [0.25]***	0.004 [0.01]	-0.66 [0.24]**	0.01 [0.01]
College graduate or above	-1.89 [0.29]***	0.03 [0.01]*	-1.89 [0.29]***	0.03 [0.01]*	-1.28 [0.27]***	0.03 [0.01]**

Note: * p<.05 ** p<.01 *** p<.001; numbers in parenthesis are standard errors. Annual household income and net assets are naturally logged and adjusted for household size.

Table 2-2 (cont'd)

	Model 1		Model 2		Model 3	
	Intercept	Age slope	Intercept	Age slope	Intercept	Age slope
Whether have hypertension (no=0)						
Yes	-0.06 [0.16]	0.03 [0.01]***	-0.06 [0.16]	0.03 [0.01]***	-0.18 [0.15]	0.03 [0.01]***
Missing	3.06 [3.21]	-0.09 [0.10]	3.05 [3.21]	-0.09 [0.10]	1.47 [2.89]	-0.04 [0.10]
Whether have cardiovascular disease (no=0)						
Yes	0.91 [0.15]***	0.01 [0.01]	0.91 [0.15]***	0.01 [0.01]	0.67 [0.15]***	0.01 [0.01]
Missing	6.44 [2.02]**	-0.28 [0.10]**	6.48 [2.02]**	-0.29 [0.10]**	5.83 [1.97]**	-0.27 [0.09]**
# of measurement occasions	-0.20 [0.04]***	0.01 [0.002]***	-0.19 [0.04]***	0.01 [0.002]***	-0.11 [0.03]***	0.005 [0.001]**
Whether died during observations (no=0)	0.59 [0.22]**	0.01 [0.01]	0.59 [0.22]**	0.01 [0.01]	0.68 [0.20]***	-0.01 [0.01]
Mean	2.32 [0.45]***	0.004 [0.02]	2.36 [0.45]***	0.002 [0.02]	6.69 [2.13]**	0.13 [0.11]
Random Effects						
Level-2 intercept	9.89 [0.57]***		9.82 [0.57]***		6.76 [0.46]***	
Level-2 slope	0.01 [0.001]***		0.01 [0.001]***		0.01 [0.001]***	
Level-1 residual	2.78 [0.04]***		2.78 [0.04]***		2.72 [0.04]***	
-2 log likelihood	610297.7		61019.2		59687.8	

Note: * p<.05 ** p<.01 *** p<.001; numbers in parenthesis are standard errors. Annual household income and net assets are naturally logged and adjusted for household size.

Table 2-3. Growth Curve Models for Current Marriage Duration on Functional Limitations (N=2,436)

	Model 1		Model 2		Model 3	
	Intercept	Age slope	Intercept	Age slope	Intercept	Age slope
Remarried (first-time married=0)	0.04 [0.30]	0.03 [0.01]*	0.04 [0.30]	0.03 [0.01]*	-0.01 [0.27]	0.03 [0.01]*
Current marriage duration	-0.02 [0.009]**	0.002 [0.0004]***	-0.02 [0.01]	0.001 [0.0004]**	-0.02 [0.01]	0.001 [0.0003]***
Current marriage duration × female			-0.006 [0.01]	0.0003 [0.001]		
Annual household income					-0.17 [0.05]**	0.01 [0.003]**
Net asset					-0.33 [0.16]*	-0.01 [0.01]
Insurance status (no=0)						
Insured					0.01 [0.33]	0.01 [0.03]
Missing					-1.80 [3.22]	0.05 [0.11]
Drinking (moderate=0)						
Abstainers					0.09 [0.17]	0.01 [0.01]
Heavy drinkers					0.10 [0.55]	-0.02 [0.03]
Missing					2.17 [1.35]	-0.09 [0.07]
Smoking (non-smoker=0)						
Past smokers					0.21 [0.22]	0.002 [0.01]
Current smokers					-0.17 [0.30]	0.02 [0.02]
Missing					0.36 [0.83]	-0.06 [0.05]
Body weight (normal=0)						
Underweight					-0.03 [1.36]	0.03 [0.06]
Overweight					0.01 [0.21]	0.001 [0.01]
Obese					0.61 [0.23]**	-0.01 [0.01]
Missing					0.65 [0.49]	-0.01 [0.03]
Whether physically active (no=0)						
Yes					-0.48 [0.14]***	-0.002 [0.01]
Missing					-1.32 [1.13]	0.001 [0.05]

Note: * p<.05 ** p<.01 *** p<.001; numbers in parenthesis are standard errors. Annual household income and net assets are naturally logged and adjusted for household size.

Table 2-3 (cont'd)

	Model 1		Model 2		Model 3	
	Intercept	Age slope	Intercept	Age slope	Intercept	Age slope
Depression					0.25 [0.04]***	0.004 [0.002]*
Whether diagnosed with emotional problems (no=0)						
Yes					1.44 [0.24]***	-0.03 [0.01]*
Missing					2.70 [2.60]	-0.10 [0.18]
Female (male=0)	1.65 [0.22]	-0.02 [0.01]*	1.87 [0.49]***	-0.03 [0.02]	1.31 [0.21]***	-0.02 [0.01]
Race/ethnicity (non-Hispanic White=0)						
Non-Hispanic Black	-0.24 [0.31]	0.01 [0.02]	-0.24 [0.31]	0.01 [0.02]	-0.27 [0.28]	0.01 [0.01]
Non-Hispanic Others	0.41 [0.65]	-0.03 [0.03]	0.40 [0.65]	-0.03 [0.03]	0.02 [0.59]	-0.02 [0.03]
Hispanic	0.14 [0.39]	-0.01 [0.02]	0.13 [0.39]	-0.01 [0.02]	0.07 [0.36]	-0.01 [0.02]
Immigration status (immigrants=0)						
U.S. born	0.69 [0.39]	-0.03 [0.02]	0.69 [0.39]	-0.03 [0.02]	0.52 [0.35]	-0.03 [0.02]
Missing	-2.31 [4.54]	0.02 [0.16]	-2.26 [4.54]	0.02 [0.16]	-3.00 [4.23]	0.05 [0.15]
Education (less than high school=0)						
High school graduate	-0.30 [0.29]	-0.01 [0.01]	-0.30 [0.29]	-0.01 [0.01]	0.09 [0.27]	-0.01 [0.01]
Some college	-0.74 [0.33]*	-0.01 [0.02]	-0.74 [0.33]*	-0.01 [0.02]	-0.30 [0.30]	-0.01 [0.01]
College graduate or above	-1.40 [0.35]***	0.01 [0.02]	-1.39 [0.35]***	0.01 [0.02]	-0.77 [0.33]*	0.01 [0.02]
Whether have hypertension (no=0)						
Yes	0.12 [0.19]	0.02 [0.01]	0.12 [0.19]	0.02 [0.01]	-0.08 [0.18]	0.02 [0.01]*
Missing	2.26 [39.95]	-0.10 [1.29]	1.90 [39.96]	-0.09 [1.29]	11.89 [39.49]	-0.39 [1.27]
Whether have cardiovascular disease (no=0)						
Yes	1.28 [0.20]***	-0.01 [0.01]	1.27 [0.20]***	-0.01 [0.01]	1.03 [0.19]***	-0.005 [0.01]
Missing	5.17 [10.64]	-0.18 [0.50]	5.18 [10.64]	-0.18 [0.50]	6.92 [10.34]	-0.30 [0.49]

Note: * p<.05 ** p<.01 *** p<.001; numbers in parenthesis are standard errors. Annual household income and net assets are naturally logged and adjusted for household size.

Table 2-3 (cont'd)

	Model 1		Model 2		Model 3	
	Intercept	Age slope	Intercept	Age slope	Intercept	Age slope
# of measurement occasions	-0.16 [0.04]***	0.01 [0.002]***	-0.16 [0.04]***	0.01 [0.002]***	-0.09 [0.04]*	0.005 [0.002]*
Whether died during observations (no=0)	0.21 [0.29]	0.03 [0.01]*	0.21 [0.29]	0.03 [0.01]*	0.42 [0.26]	0.01 [0.01]
Mean	2.84 [0.64]***	-0.04 [0.03]	2.75 [0.66]***	-0.04 [0.03]	7.82 [2.30]***	0.02 [0.13]
Random Effects						
Level-2 intercept	9.23 [0.67]***		9.21 [0.67]***		6.48 [0.54]***	
Level-2 slope	0.01 [0.002]***		0.01 [0.002]***		0.01 [0.001]***	
Level-1 residual	2.56 [0.05]***		2.56 [0.05]***		2.51 [0.05]***	
-2 log likelihood	36251.5		36251.2		35416.7	

Note: * p<.05 ** p<.01 *** p<.001; numbers in parenthesis are standard errors. Annual household income and net assets are naturally logged and adjusted for household size.

APPENDIX B: Chapter 3 Tables

Table 3-1. Results of Factor Analysis for Marital Quality

	2006 PMQ	NMQ	2008 PMQ	NMQ	2010 PMQ	NMQ	2012 PMQ	NMQ
How close is your relationship with your spouse or partner?	**0.67**	-0.16	**0.69**	-0.12	**0.58**	-0.19	**0.66**	-0.16
How much do they really understand the way you feel about things?	**0.73**	-0.12	**0.69**	-0.12	**0.68**	-0.12	**0.67**	-0.14
How much can you rely on them if you have a serious problem?	**0.72**	0.03	**0.70**	-0.02	**0.62**	-0.06	**0.67**	-0.04
How much can you open up to them if you need to talk about your worries?	**0.79**	-0.08	**0.78**	-0.09	**0.90**	0.02	**0.78**	-0.05
How often do they make too many demands on you?	0.04	**0.66**	0.01	**0.71**	0.06	**0.70**	0.03	**0.72**
How much do they criticize you?	0.06	**0.73**	0.04	**0.71**	-0.02	**0.65**	0.00	**0.68**
How much do they let you down when you are counting on them?	-0.28	**0.52**	-0.25	**0.50**	-0.30	**0.50**	-0.32	**0.48**
How much do they get on your nerves?	-0.21	**0.64**	-0.18	**0.61**	-0.16	**0.63**	-0.16	**0.65**

Note: PMQ=positive marital quality; NMQ=negative marital quality. Factor loadings bold-faced are above the 0.35 threshold and thus used in the calculation of the summary scores for positive and negative marital quality.

Table 3-2. Sample Characteristics at Baseline (2006/2008) by Gender (N=2,158)

	Male (N=1,258)	Female (N=900)
Positive marital quality	10.31 [0.04]	9.71 [0.06]***
Negative marital quality	5.02 [0.05]	5.27 [0.06]**
Change in positive marital quality [a]	-0.32 [0.05]	-0.59 [0.06]***
Change in negative marital quality [a]	-0.19 [0.05]	-0.01 [0.07]**
Functional limitations at T2	3.32 [0.08]	4.34 [0.10]***
Functional limitations at T3 [a]	3.63 [0.09]	4.74 [0.11]***
Age	71.44 [0.23]	69.26 [0.26]***
Race/ethnicity (%)		
Non-Hispanic white	84.50	83.78
Non-Hispanic black	7.87	8.78
Non-Hispanic other races	1.51	1.44
Hispanic	6.12	6.00
US born (immigrants=0, %)	93.48	93.11
Born in the South (other regions=0, %)	30.96	34.44
Current marital status (%)		
First-time married	67.17	68.67
Remarried	28.70	27.44
Cohabiting	4.13	3.89
Presence of hypertension (no=0, %)	63.87	69.67**
Presence of diabetes (no=0, %)	26.52	23.00
Functional limitations at T1	2.98 [0.07]	4.10 [0.10]***
Whether partnered at T2 (no=0, %)	95.41	91.59**
Survey wave (year 2006=0, %)	42.21	43.89
Years of formal schooling	12.80 [0.09]	12.46 [0.09]*
Annual household income	77,968 [10924]	63,834 [3060]
Net assets	606,296 [30878]	567,848 [35807]
Whether have health insurance (no=0, %)	98.09	96.11**
Drinking (%)		
Abstainer	61.47	73.80***
Light drinker	34.72	24.97***
Heavy drinker	3.81	1.23***
Smoking (%)		
Non-smoker	30.66	51.94***
Past smoker	59.56	38.08***
Current smoker	9.78	9.98
Whether physically active (no=0, %)	27.90	18.47***
BMI	28.54 [0.15]	28.51 [0.22]
Depression	1.12 [0.05]	1.55 [0.67]***
Whether diagnosed with emotional problems (no=0, %)	10.31	22.12***
Probability of death at T2	0.11 [0.003]	0.07 [0.002]***
Probability of death at T3 [a]	0.11 [0.003]	0.08 [0.002]***

Note: *p<0.05 **p<0.01 ***p<0.001, indicating significant gender difference; numbers in brackets are standard deviations.

[a] The sample includes respondents alive and partnered at T3 (N=1,706)

Table 3-3. Positive Marital Quality and Functional Limitations among Older Adults Diagnosed with CVD (N=2,158)

	Model 1	Mode 2	Model 3	Model 4	Model 5
Positive marital quality	-0.026 [0.027]	-0.079 [0.038]*	-0.072 [0.038]	-0.059 [0.038]	-0.053 [0.038]
Positive marital quality × female		0.103 [0.051]*	0.097 [0.051]	0.110 [0.051]*	0.104 [0.051]*
Age at T1	0.010 [0.008]	0.010 [0.008]	0.014 [0.009]	0.018 [0.008]*	0.022 [0.009]*
Female (male=0)	0.368 [0.097]***	-0.674 [0.525]	-0.600 [0.523]	-0.773 [0.524]	-0.696 [0.523]
Race/ethnicity (non-Hispanic white=0)					
Non-Hispanic black	-0.214 [0.175]	-0.232 [0.175]	-0.241 [0.176]	-0.200 [0.175]	-0.207 [0.176]
Non-Hispanic other races	-0.131 [0.364]	-0.143 [0.363]	-0.122 [0.362]	-0.153 [0.362]	-0.134 [0.361]
Hispanics	-0.119 [0.222]	-0.126 [0.221]	-0.094 [0.221]	-0.158 [0.221]	-0.126 [0.221]
Born in the South (other regions=0)	0.013 [0.103]	0.016 [0.103]	0.023 [0.103]	0.012 [0.103]	0.021 [0.103]
US-born (immigrant=0)	0.371 [0.205]	0.361 [0.205]	0.325 [0.205]	0.373 [0.204]	0.338 [0.204]
Marital status at T1 (first-time married=0)					
Remarried	-0.062 [0.100]	-0.065 [0.100]	-0.075 [0.100]	-0.075 [0.100]	-0.087 [0.099]
Cohabiting	0.122 [0.230]	0.114 [0.230]	0.116 [0.230]	0.088 [0.229]	0.088 [0.229]
Diagnosed with hypertension (no=0)	0.144 [0.095]	0.142 [0.095]	0.109 [0.096]	0.144 [0.095]	0.110 [0.096]
Diagnosed with diabetes (no=0)	0.298 [0.103]**	0.298 [0.103]**	0.241 [0.106]*	0.282 [0.103]**	0.228 [0.105]*
Whether partnered at t2 (no=0)	0.075 [0.185]	0.067 [0.186]	0.120 [0.185]	0.070 [0.186]	0.124 [0.185]
Functional limitations at T1	0.668 [0.017]***	0.669 [0.017]***	0.651 [0.018]***	0.648 [0.018]***	0.631 [0.019]***
Probability of death at T2	3.370 [0.827]***	3.244 [0.828]***	3.196 [0.892]***	2.477 [0.854]**	2.378 [0.925]*
Survey wave (year 2006=0)	0.093 [0.113]	0.095 [0.113]	0.071 [0.116]	0.160 [0.114]	0.140 [0.118]
Years of formal education	-0.033 [0.017]	-0.035 [0.017]*	-0.032 [0.017]	-0.032 [0.017]	-0.029 [0.017]
Annual household income	-0.076 [0.059]	-0.076 [0.058]	-0.071 [0.058]	-0.074 [0.058]	-0.070 [0.058]
Net asset	-0.083 [0.090]	-0.087 [0.090]	-0.064 [0.091]	-0.100 [0.090]	-0.078 [0.091]
Having health insurance (no=0)	-0.815 [0.282]**	-0.832 [0.282]**	-0.803 [0.281]**	-0.777 [0.281]**	-0.750 [0.280]**
Drinking (moderate=0)					
Abstainer			0.106 [0.101]		0.095 [0.101]
Heavy drinker			0.918 [0.272]***		0.914 [0.272]***
Smoking (non-smoker=0)					
Past smoker			-0.036 [0.099]		-0.020 [0.100]
Current smoker			0.016 [0.175]		0.052 [0.175]

Note: *p<.05 **p<.01 ***p<.001; annual household income and net asset have been naturally logged and adjusted for household size.

Table 3-3 (cont'd)

	Model 1	Mode 2	Model 3	Model 4	Model 5
Physically active (no=0)			-0.322 [0.106]**		-0.314 [0.106]**
BMI score			0.016 [0.009]		0.016 [0.009]
Depression score					0.074 [0.031]*
Emotional problems (no=0)				0.076 [0.030]*	0.227 [0.134]
Intercept				0.227 [0.135]	1.891 [1.392]
Variance components					
Level-1 residual	3.628 [0.253]***	3.607 [0.252]***	3.522 [0.249]***	3.570 [0.250]***	3.496 [0.247]***
Level-2 variance, intercept	0.379 [0.232]	0.393 [0.232]	0.431 [0.231]	0.407 [0.230]	0.437 [0.229]
-2Log-Likelihood	9117.06	9112.89	9087.32	9100.56	9075.51
AIC	9163.06	9160.89	9147.32	9152.56	9139.51
BIC	9290.57	9293.94	9313.63	9296.70	9316.91

Note: *p<.05 **p<.01 ***p<.001; annual household income and net asset have been naturally logged and adjusted for household size.

Table 3-4. Negative Marital Quality and Functional Limitations among Older Adults Diagnosed with CVD (N=2,158)

	Model 1	Mode 2	Model 3	Model 4	Model 5
Negative marital quality	0.065 [0.027]*	0.098 [0.036]**	0.062 [0.027]	0.048 [0.027]	0.045 [0.027]
Negative marital quality × female		-0.071 [0.053]			
Age at T1	0.011 [0.008]	0.011 [0.008]	0.014 [0.009]	0.017 [0.008]*	0.021 [0.009]*
Female (male=0)	0.369 [0.096]***	0.736 [0.289]*	0.374 [0.098]***	0.334 [0.096]***	0.343 [0.098]***
Race/ethnicity (non-Hispanic white=0)					
Non-Hispanic black	-0.223 [0.175]	-0.224 [0.175]	-0.232 [0.175]	-0.197 [0.175]	-0.204 [0.175]
Non-Hispanic other races	-0.164 [0.363]	-0.172 [0.363]	-0.140 [0.362]	-0.162 [0.363]	-0.140 [0.362]
Hispanics	-0.130 [0.221]	-0.136 [0.222]	-0.100 [0.221]	-0.161 [0.221]	-0.130 [0.220]
Born in the South (other regions=0)	0.024 [0.103]	0.028 [0.103]	0.031 [0.103]	0.018 [0.103]	0.027 [0.103]
US-born (immigrant=0)	0.370 [0.204]	0.361 [0.204]	0.335 [0.204]	0.387 [0.204]	0.352 [0.204]
Marital status at T1 (first-time married=0)					
Remarried	-0.053 [0.100]	-0.056 [0.100]	-0.064 [0.099]	-0.065 [0.100]	-0.077 [0.099]
Cohabiting	0.143 [0.229]	0.139 [0.230]	0.142 [0.229]	0.114 [0.229]	0.111 [0.229]
Diagnosed with hypertension (no=0)	0.144 [0.095]	0.139 [0.095]	0.111 [0.096]	0.145 [0.095]	0.112 [0.096]
Diagnosed with diabetes (no=0)	0.292 [0.103]**	0.294 [0.103]**	0.237 [0.106]*	0.280 [0.103]**	0.227 [0.105]*
Whether partnered at t2 (no=0)	0.077 [0.185]	0.072 [0.185]	0.132 [0.185]	0.089 [0.185]	0.144 [0.184]
Functional limitations at T1	0.667 [0.017]***	0.667 [0.017]***	0.649 [0.018]***	0.648 [0.018]***	0.631 [0.019]***
Probability of death at T2	3.338 [0.825]***	3.323 [0.825]***	3.286 [0.889]***	2.653 [0.852]**	2.564 [0.923]**
Survey wave (year 2006=0)	0.105 [0.113]	0.105 [0.113]	0.080 [0.116]	0.159 [0.114]	0.137 [0.118]
Years of formal education	-0.034 [0.017]	-0.035 [0.017]*	-0.031 [0.017]	-0.031 [0.017]	-0.029 [0.017]
Annual household income	-0.075 [0.058]	-0.074 [0.058]	-0.071 [0.058]	-0.073 [0.058]	-0.070 [0.058]
Net asset	-0.077 [0.090]	-0.080 [0.090]	-0.054 [0.091]	-0.086 [0.090]	-0.065 [0.090]
Having health insurance (no=0)	-0.799 [0.281]**	-0.813 [0.281]**	-0.769 [0.280]**	-0.752 [0.281]**	-0.723 [0.280]**
Drinking (moderate=0)					
Abstainer			0.094 [0.101]		0.083 [0.101]
Heavy drinker			0.905 [0.272]***		0.902 [0.272]***
Smoking (non-smoker=0)					
Past smoker			-0.039 [0.099]		-0.025 [0.099]
Current smoker			0.010 [0.175]		0.042 [0.175]

Note: *p<.05 **p<.01 ***p<.001; annual household income and net asset have been naturally logged and adjusted for household size.

Table 3-4 (cont'd)

	Model 1	Mode 2	Model 3	Model 4	Model 5
Physically active (no=0)			-0.335 [0.106]***		-0.326 [0.106]**
BMI score			0.015 [0.009]		0.016 [0.009]
Depression score				0.068 [0.030]*	0.065 [0.031]*
Emotional problems (no=0)				0.192 [0.134]	0.193 [0.134]
Intercept	2.331 [1.261]	2.234 [1.262]	1.346 [1.353]	1.961 [1.265]	0.952 [1.359]
Variance components					
Level-1 residual	3.609 [0.251]***	3.598 [0.251]***	3.521 [0.249]***	3.580 [0.250]***	3.500 [0.247]***
Level-2 variance, intercept	0.388 [0.231]	0.396 [0.231]	0.430 [0.230]	0.400 [0.230]	0.435 [0.229]
-2Log-Likelihood	9111.80	9109.80	9086.02	9102.13	9076.84
AIC	9157.80	9157.80	9144.02	9152.13	9138.84
BIC	9285.31	9290.85	9304.79	9290.72	9310.70

Note: *p<.05 **p<.01 ***p<.001; annual household income and net asset have been naturally logged and adjusted for household size.

Table 3-5. Change in Positive & Negative Marital Quality and Functional Limitations among Older Adults Diagnosed with CVD (N=1,706)

	Model 1: Positive marital quality	Model 2: Negative marital quality
Change in positive marital quality between T1 & T3	-0.128 [0.049]**	
Positive marital quality at T1	-0.069 [0.038]	
Change in negative marital quality between T1 & T3		0.063 [0.044]
Negative marital quality at T1		0.144 [0.038]***
Age at T1	0.063 [0.011]***	0.062 [0.011]***
Female (male=0)	0.298 [0.119]*	0.333 [0.117]**
Race/ethnicity (non-Hispanic white=0)		
Non-Hispanic black	0.474 [0.213]*	0.455[0.213]*
Non-Hispanic other races	-1.279 [0.419]**	-1.370 [0.418]**
Hispanics	-0.068 [0.268]	-0.171 [0.266]
Born in the South (other regions=0)	0.094 [0.122]	0.113 [0.122]
US-born (immigrant=0)	0.134 [0.237]	0.134 [0.237]
Marital status at T1 (first-time married=0)		
Remarried	0.006 [0.119]	0.024 [0.119]
Cohabiting	0.488 [0.296]	0.475 [0.296]
Diagnosed with hypertension (no=0)	-0.048 [0.115]	-0.049 [0.115]
Diagnosed with diabetes (no=0)	0.199 [0.130]	0.192 [0.129]
Functional limitations at T1	0.618 [0.023]	0.620 [0.023]***
Probability of death at T3	-1.372 [1.096]	-1.309 [1.093]
Survey wave (year 2006=0)	-0.294 [0.129]*	-0.304 [0.129]*
Years of formal education	-0.046 [0.021]*	-0.047 [0.021]*
Annual household income	-0.059 [0.075]	-0.066 [0.075]
Net asset	-0.135 [0.104]	-0.108 [0.104]
Having health insurance (no=0)	-0.490 [0.342]	-0.460 [0.341]
Drinking (moderate=0)		
Abstainer	0.030 [0.121]	0.036 [0.121]
Heavy drinker	0.391 [0.338]	0.340 [0.338]
Smoking (non-smoker=0)		
Past smoker	-0.006 [0.121]	-0.012 [0.121]
Current smoker	0.398 [0.207]	0.393 [0.206]
Physically active (no=0)	-0.227 [0.124]	-0.237 [0.124]
BMI score	0.018 [0.010]	0.018 [0.010]
Depression score	0.075 [0.037]*	0.054 [0.037]
Emotional problems (no=0)	0.153 [0.166]	0.123 [0.165]
Intercept	1.160 [1.553]	-0.453 [1.554]
Variance component		
Level-1 residual	4.459 [0.312]***	4.443 [0.312]***
Level-2 variance, intercept	0.129 [0.274]	0.129 [0.275]
-2Log-Likelihood	7440.28	7434.31
AIC	7502.28	7496.31
BIC	7666.62	7660.64

Note: *p<.05 **p<.01 ***p<.001; annual household income and net asset have been naturally logged and adjusted for household size.

APPENDIX C: Chapter 4 Tables

Table 4-1. Weighted Sample Characteristics at the Baseline (N=5,589)

Marital history (%)	
First-time married	44.26
Remarried, one divorce	10.29
Remarried, one widowhood	2.02
Remarried, multiple loss	3.84
Divorced/separated, one loss	6.49
Divorced/separated, multiple losses	3.79
Widowed, one loss	20.86
Widowed, multiple losses	3.25
Cohabiting	1.98
Never-married	3.20
No. of functional limitations	4.07 [0.05]
Age at baseline	69.88 [0.20]
Female (%)	52.74
Birthplace (%)	
South	33.63
Other regions	66.29
Missing	0.08
Immigration status (%)	
US-born	93.15
Immigrant	6.77
Missing	0.08
Race/ethnicity (%)	
Non-Hispanic white	83.36
Non-Hispanic black	9.08
Non-Hispanic other races	1.97
Hispanic	5.59
Years of formal schooling	12.18 [0.08]
Annual household income	53309.6 [3488.66]
Net assets	396535.5 [18521.70]
Insurance status (%)	
Not insured	4.08
Insured	95.72
Missing	0.20
Smoking (%)	
Non-smoker	37.98
Past smoker	48.35
Current smoker	13.07
Missing	0.60
Drinking (%)	
Non-smoker	72.34
Past smoker	48.35
Current smoker	13.07
Missing	0.26

Note: all the statistics are weighted to adjust for complex survey design of the HRS; numbers in brackets are standard deviations.

Table 4-1 (cont'd)

Physical activity (%)	
Not physically active	74.79
Physically active	25.05
Missing	0.16
Body weight (%)	
Underweight	2.70
Normal	33.19
Overweight	35.55
Obese	27.72
Missing	0.85
Depression	1.87 [0.04]
Presence of emotional problem (%)	
No	82.25
Yes	17.67
Missing	0.08
Hypertension (%)	
No	34.39
Yes	65.46
Missing	0.15
Diabetes (%)	
No	77.11
Yes	22.79
Missing	0.10
Cancer (%)	
No	85.00
Yes	14.78
Missing	0.22
Lung disease (%)	
No	87.38
Yes	12.58
Missing	0.04

Note: all the statistics are weighted to adjust for complex survey design of the HRS; numbers in brackets are standard deviations.

Table 4-2. Estimated Death Hazards by Marital History among Cardiovascular Disease Patients Aged 50 Years and Older (N=5,589)

	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6	Model 7
Marital history (first-time married=0)							
Remarried, one divorce	.049 [.107]	.087 [.118]	.066 [.109]	.063 [.108]	.048 [.106]	.076 [.106]	.093 [.112]
Remarried, one widowhood	.338 [.134]*	.281 [.155]	.299 [.130]*	.271 [.129]*	.316 [.129]*	.271 [.142]	.192 [.131]
Remarried, multiple losses	.067 [.182]	-.041 [.194]	.032 [.185]	-.018 [.177]	-.006 [.181]	-.001 [.189]	-.104 [.182]
Singly divorced/separated	.360 [.133]**	.527 [.228]*	.308 [.133]*	.189 [.133]	.260 [.127]*	.279 [.132]*	.107 [.127]
Divorced/separated, multiple losses	.483 [.139]**	.451 [.233]	.427 [.149]**	.260 [.136]	.347 [.137]*	.407 [.135]**	.155 [.145]
Singly widowed	.311 [.057]***	.295 [.099]**	.269 [.063]***	.207 [.059]***	.237 [.058]***	.266 [.057]***	.148 [.062]*
Widowed, multiple losses	.358 [.122]**	.235 [.197]	.313 [.126]*	.176 [.116]	.261 [.123]*	.280 [.133]*	.094 [.125]
Cohabiting	.344 [.168]*	.503 [.166]**	.322 [.162]	.358 [.178]*	.279 [.173]	.382 [.182]*	.329 [.190]
Never-married	.284 [.146]	.244 [.234]	.262 [.146]	.143 [.167]	.216 [.151]	.288 [.148]	.140 [.171]
Marital history × gender							
Remarried, one divorce × female		-.150 [.234]					
Remarried, one widowhood × female		.155 [.329]					
Remarried, multiple losses × female		.362 [.452]					
Divorced/separated, one loss × female		-.268 [.268]					
Divorced/separated, multiple losses × female		.043 [.320]					
Widowed, one loss × female		.014 [.134]					
Widowed, multiple losses × female		.173 [.233]					
Cohabiting × female		-.693 [.367]					
Never-married × female		.059 [.337]					
Years of formal education			-.035 [.007]***				-.013 [.007]*
Annual household income			-.083 [.022]***				-.042 [.029]
Net assets			-.315 [.054]***				-.247 [.057]***

Note: *p<.05 **p<.01 ***p<.001; annual household income and net assets are naturally logged and adjusted for household size. The numbers in brackets are standard errors of the regression coefficients.

Table 4-2 (cont'd)

	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6	Model 7
Insurance status (no=0)							
Having health insurance			.103 [.227]				.192 [.249]
Missing			.667 [.465]				.735 [.520]
Smoking (non-smoker=0)							
Past smoker				.359 [.053]***			.234 [.050]***
Current smoker				.641 [.076]***			.494 [.074]***
Missing				.564 [.300]			.574 [.284]*
Drinking (light/moderate=0)							
Abstainer				.563 [.068]***			.411 [.066]***
Heavy drinker				.331 [.207]			.306 [.202]
Missing				.879 [.537]			.808 [.519]
Physical activity (not active=0)							
Active				-.890 [.092]***			-.696 [.094]***
Missing				-.259 [.409]			-.077 [.379]
BMI (normal=0)							
Underweight				.761 [.075]***			.719 [.083]***
Overweight				-.342 [.059]***			-.419 [.062]***
Obese				-.356 [.075]***			-.545 [.069]***
Missing				.011 [.134]			-.028 [.150]
Depression					.101 [.011]***		.063 [.012]***
Whether having emotional problems (no=0)							
Yes					.241 [.065]***		.122 [.006]
Missing					.650 [.564]		.768 [.534]
Presence of hypertension (no=0)							
Yes						.166 [.046]***	.190 [.048]***
Missing						-.101 [.719]	-.188 [.720]

Note: *p<.05 **p<.01 ***p<.001; annual household income and net assets are naturally logged and adjusted for household size. The numbers in brackets are standard errors of the regression coefficients.

Table 4-2 (cont'd)

	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6	Model 7
Presence of diabetes (no=0)							
Yes						.458 [.049]***	.493 [.054]***
Missing						-1.883 [1.097]	-2.200 [1.132]
Presence of cancer (no=0)							
Yes						.405 [.055]***	.406 [.060]***
Missing						-.858 [.948]	-.907 [.867]
Presence of lung disease (no=0)							
Yes						.839 [.049]***	.607 [.061]***
Missing						.397 [.645]	.328 [.668]
Age at baseline (centered at 50)	.064 [.003]***	.064 [.003]***	.063 [.003]***	.058 [.003]***	.066 [.003]***	.069 [.002]***	.063 [.003]***
Female (male=0)	-.260 [.056]***	-.252 [0.79]**	-.269 [.057]***	-.303 [.065]***	-.310 [.056]***	-.257 [.060]***	-.338 [.066]***
Birth place (south=0)							
Other regions	-.093 [.051]	-.091 [.052]	-.013 [.050]	.002 [.050]	-.060 [.052]	-.091 [.049]	.054 [.051]
Missing	.401 [.406]	.404 [.404]	.065 [.397]	.718 [.411]	.410 [.412]	.416 [.399]	.530 [.397]
Race/ethnicity (non-Hispanic white=0)							
Non-Hispanic black	.219 [.078]**	.218 [.078]**	.040 [.077]	.199 [.076]*	.190 [.080]*	.213 [.079]**	.101 [.081]
Non-Hispanic other races	-.025 [.253]	-.026 [.251]	-.084 [.250]	-.096 [.252]	-.044 [.247]	-.041 [.260]	-.119 [.236]
Hispanics	.110 [.105]	.117 [.104]	-.233 [.108]*	.033 [.118]	-.012 [.114]	.081 [.112]	-.220 [.130]
Not US-born (US-born=0)	-.112 [.099]	-.115 [.100]	-.207 [.107]	-.117 [.110]	-.151 [.104]	-.066 [.108]	-.139 [.122]

Note: *p<.05 **p<.01 ***p<.001; annual household income and net assets are naturally logged and adjusted for household size. The numbers in brackets are standard errors of the regression coefficients.

APPENDIX D: Supplemental Tables

Table A1. Growth Curve Models for Current Marital Status on Functional Limitations (N=3,867)

	Model 1		Model 2	
	Intercept	Age slope	Intercept	Age slope
Remarried (first-time married=0)	0.50 [0.22]*	0.002 [0.01]	0.29 [0.30]	0.02 [0.01]
Cohabiting	1.12 [0.38]**	-0.04 [0.02]*	1.22 [0.51]*	-0.05 [0.03]
Divorced/separated	0.79 [0.25]**	-0.01 [0.01]	1.21 [0.40]**	-0.04 [0.02]
Widowed	-0.28 [0.20]	0.02 [0.01]**	-0.82 [0.41]*	0.04 [0.02]**
Never-married	0.54 [0.41]	0.01 [0.02]	0.19 [0.68]	0.02 [0.03]
Current marital status × gender				
Remarried × female			0.55 [0.44]	-0.04 [0.02]
Cohabiting × female			-0.18 [0.76]	0.01 [0.04]
Divorced/separated × female			-0.62 [0.50]	0.04 [0.03]
Widowed × female			0.72 [0.47]	-0.03 [0.02]
Never-married × female			0.55 [0.86]	-0.02 [0.04]
Female (male=0)	1.61 [0.18]***	-0.02 [0.008]*	1.49 [0.25]	-0.01 [0.01]
Race/ethnicity (non-Hispanic White=0)				
Non-Hispanic Black	0.21 [0.23]	-0.01 [0.01]	0.22 [0.23]	-0.01 [0.01]
Non-Hispanic Others	0.57 [0.51]	-0.03 [0.02]	0.60 [0.51]	-0.04 [0.02]
Hispanic	0.27 [0.32]	0.002 [0.01]	0.28 [0.32]	0.002 [0.01]
Immigration status (immigrants=0)				
U.S. born	0.75 [0.31]*	-0.02 [0.01]	0.75 [0.31]	-0.02 [0.01]
Missing	1.31 [2.20]	-0.03 [0.09]	1.37 [2.19]	-0.03 [0.09]
Education (less than high school=0)				
High school graduate	-0.72 [0.23]**	0.004 [0.01]	-0.71 [0.23]**	0.004 [0.01]
Some college	-1.02 [0.26]***	0.004 [0.01]	-1.03 [0.25]***	0.004 [0.01]
College graduate or above	-1.89 [0.29]***	0.03 [0.01]*	-1.89 [0.29]***	0.03 [0.01]*
Whether have hypertension (no=0)				
Yes	-0.06 [0.16]	0.03 [0.01]***	-0.06 [0.16]	0.03 [0.01]***
Missing	3.06 [3.21]	-0.09 [0.10]	3.05 [3.21]	-0.09 [0.10]
Whether have cardiovascular disease (no=0)				
Yes	0.91 [0.15]***	0.01 [0.01]	0.91 [0.15]***	0.01 [0.01]
Missing	6.44 [2.02]**	-0.28 [0.10]**	6.48 [2.02]**	-0.29 [0.10]**
# of measurement occasions	-0.20 [0.04]***	0.01 [0.002]***	-0.19 [0.04]***	0.01 [0.002]***
Whether died during observations (no=0)	0.59 [0.22]**	0.01 [0.01]	0.59 [0.22]**	0.01 [0.01]
Mean	2.32 [0.45]***	0.004 [0.02]	2.36 [0.45]***	0.002 [0.02]
Random Effects				
Level-2 intercept	9.89 [0.57]***		9.82 [0.57]***	
Level-2 slope	0.01 [0.001]***		0.01 [0.001]***	
Level-1 residual	2.78 [0.04]***		2.78 [0.04]***	
-2 log likelihood	610297.7		61019.2	

Note: * p<.05 ** p<.01 *** p<.001; numbers in parenthesis are standard errors.

Table A2. Growth Curve Models for Current Marital Status on Functional Limitations, Adjusting for Socioeconomic Resources (N=3,867)

	Model 1		Model 3	
	Intercept	Age slope	Intercept	Age slope
Current marital status (first-time married=0)				
Remarried	0.50 [0.22]*	0.002 [0.01]	0.52 [0.22]*	0.0001 [0.01]
Cohabiting	1.12 [0.38]**	-0.04 [0.02]*	1.12 [0.38]**	-0.04 [0.02]*
Divorced/separated	0.79 [0.25]**	-0.01 [0.01]	0.67 [0.25]**	-0.01 [0.01]
Widowed	-0.28 [0.20]	0.02 [0.01]**	-0.34 [0.20]	0.02 [0.01]**
Never-married	0.54 [0.41]	0.01 [0.02]	0.42 [0.41]	0.01 [0.02]
Annual household income			-0.14 [0.03]***	0.01 [0.002]**
Net asset			-0.44 [0.16]**	-0.01 [0.01]
Insurance status (no=0)				
Insured			0.14 [0.24]	-0.003 [0.02]
Missing			-0.46 [1.24]	0.01 [0.05]
Female (male=0)	1.61 [0.18]***	-0.02 [0.008]*	1.60 [0.18]***	-0.02 [0.01]*
Race/ethnicity (non-Hispanic White=0)				
Non-Hispanic Black	0.21 [0.23]	-0.01 [0.01]	0.09 [0.23]	-0.01 [0.01]
Non-Hispanic Others	0.57 [0.51]	-0.03 [0.02]	0.55 [0.50]	-0.04 [0.02]
Hispanic	0.27 [0.32]	0.002 [0.01]	0.13 [0.31]	0.004 [0.01]
Immigration status (immigrants=0)				
U.S. born	0.75 [0.31]*	-0.02 [0.01]	0.76 [0.31]*	-0.02 [0.01]
Missing	1.31 [2.20]	-0.03 [0.09]	1.19 [2.18]	-0.02 [0.09]
Education (less than high school=0)				
High school graduate	-0.72 [0.23]**	0.004 [0.01]	-0.62 [0.23]**	0.003 [0.01]
Some college	-1.02 [0.26]***	0.004 [0.01]	-0.87 [0.26]***	0.002 [0.01]
College graduate or above	-1.89 [0.29]***	0.03 [0.01]*	-1.66 [0.29]***	0.03 [0.01]*
Whether have hypertension (no=0)				
Yes	-0.06 [0.16]	0.03 [0.01]***	-0.07 [0.16]	0.03 [0.01]***
Missing	3.06 [3.21]	-0.09 [0.10]	2.99 [3.19]	-0.09 [0.10]
Whether have cardiovascular disease (no=0)				
Yes	0.91 [0.15]***	0.01 [0.01]	0.93 [0.15]***	0.01 [0.01]
Missing	6.44 [2.02]**	-0.28 [0.10]**	6.57 [2.02]**	-0.29 [0.10]**
# of measurement occasions	-0.20 [0.04]***	0.01 [0.002]***	-0.20 [0.04]***	0.01 [0.002]***
Whether died during observations (no=0)	0.59 [0.22]**	0.01 [0.01]	0.53 [0.22]*	0.01 [0.01]
Mean	2.32 [0.45]***	0.004 [0.02]	9.47 [2.19]***	0.13 [0.11]
Random Effects				
Level-2 intercept	9.89 [0.57]***		9.57 [0.56]***	
Level-2 slope	0.01 [0.001]***		0.01 [0.001]***	
Level-1 residual	2.78 [0.04]***		2.78 [0.04]***	
-2 log likelihood	610297.7		60943.3	

Note: * p<.05 ** p<.01 *** p<.001; numbers in parenthesis are standard errors. Annual household income and net assets are naturally logged and adjusted for household size.

Table A3. Growth Curve Models for Current Marital Status on Functional Limitations, Adjusting for Health Behaviors (N=3,867)

	Model 1		Model 4	
	Intercept	Age slope	Intercept	Age slope
Current marital status (first-time married=0)				
Remarried	0.50 [0.22]*	0.002 [0.01]	0.47 [0.22]*	0.001 [0.01]
Cohabiting	1.12 [0.38]**	-0.04 [0.02]*	1.09 [0.37]**	-0.04 [0.02]*
Divorced/separated	0.79 [0.25]**	-0.01 [0.01]	0.73 [0.24]**	-0.01 [0.01]
Widowed	-0.28 [0.20]	0.02 [0.01]**	-0.29 [0.20]	0.02 [0.01]**
Never-married	0.54 [0.41]	0.01 [0.02]	0.51 [0.40]	0.01 [0.02]
Drinking (moderate=0)				
Abstainers			0.18 [0.14]	0.01 [0.01]
Heavy drinkers			0.59 [0.45]	-0.05 [0.02]*
Missing			3.14 [1.23]*	-0.14 [0.06]*
Smoking (non-smoker=0)				
Past smokers			0.38 [0.19]*	0.0002 [0.01]
Current smokers			0.16 [0.24]	0.01 [0.01]
Missing			0.40 [0.66]	-0.04 [0.04]
Body weight (normal=0)				
Underweight			1.34 [0.79]	-0.03 [0.03]
Overweight			0.12 [0.17]	-0.002 [0.01]
Obese			0.79 [0.19]***	-0.01 [0.01]
Missing			0.70 [0.40]	-0.01 [0.02]
Whether physically active (no=0)				
Yes			-0.43 [0.12]***	-0.01 [0.005]*
Missing			-0.70 [0.86]	-0.01 [0.04]
Female (male=0)	1.61 [0.18]***	-0.02 [0.008]*	1.54 [0.18]***	-0.02 [0.01]*
Race/ethnicity (non-Hispanic White=0)				
Non-Hispanic Black	0.21 [0.23]	-0.01 [0.01]	0.21 [0.22]	-0.01 [0.01]
Non-Hispanic Others	0.57 [0.51]	-0.03 [0.02]	0.57 [0.49]	-0.04 [0.02]
Hispanic	0.27 [0.32]	0.002 [0.01]	0.32 [0.31]	-0.002 [0.01]
Immigration status (immigrants=0)				
U.S. born	0.75 [0.31]*	-0.02 [0.01]	0.62 [0.30]*	-0.02 [0.01]
Missing	1.31 [2.20]	-0.03 [0.09]	1.50 [2.13]	-0.03 [0.09]
Education (less than high school=0)				
High school graduate	-0.72 [0.23]**	0.004 [0.01]	-0.62 [0.23]**	0.003 [0.01]
Some college	-1.02 [0.26]***	0.004 [0.01]	-0.92 [0.26]***	0.01 [0.01]
College graduate or above	-1.89 [0.29]***	0.03 [0.01]*	-1.68 [0.29]***	0.03 [0.01]*
Whether have hypertension (no=0)				
Yes	-0.06 [0.16]	0.03 [0.01]***	-0.12 [0.16]	0.03 [0.01]***
Missing	3.06 [3.21]	-0.09 [0.10]	2.84 [3.12]	-0.08 [0.10]
Whether have cardiovascular disease (no=0)				
Yes	0.91 [0.15]***	0.01 [0.01]	0.88 [0.15]***	0.01 [0.01]
Missing	6.44 [2.02]**	-0.28 [0.10]**	5.93 [2.01]**	-0.26 [0.10]**

Note: * p<.05 ** p<.01 *** p<.001; numbers in parenthesis are standard errors.

Table A3 (cont'd)

	Model 1		Model 4	
	Intercept	Age slope	Intercept	Age slope
# of measurement occasions	-0.20 [0.04]***	0.01 [0.002]***	-0.15 [0.03]***	0.01 [0.002]***
Whether died during observations (no=0)	0.59 [0.22]**	0.01 [0.01]	0.67 [0.22]**	-0.001 [0.01]
Mean	2.32 [0.45]***	0.004 [0.02]	1.60 [0.48]***	0.02 [0.02]
Random Effects				
Level-2 intercept	9.89 [0.57]***		8.90 [0.54]***	
Level-2 slope	0.01 [0.001]***		0.01 [0.001]***	
Level-1 residual	2.78 [0.04]***		2.78 [0.04]***	
-2 log likelihood	610297.7		60683.3	

Note: * p<.05 ** p<.01 *** p<.001; numbers in parenthesis are standard errors.

Table A4. Growth Curve Models for Current Marital Status on Functional Limitations, Adjusting for Psychological Distress (N=3,867)

	Model 1		Model 5	
	Intercept	Age slope	Intercept	Age slope
Current marital status (first-time married=0)				
Remarried	0.50 [0.22]*	0.002 [0.01]	0.34 [0.21]	0.004 [0.01]
Cohabiting	1.12 [0.38]**	-0.04 [0.02]*	0.87 [0.36]*	-0.04 [0.02]*
Divorced/separated	0.79 [0.25]**	-0.01 [0.01]	0.38 [0.23]	-0.004 [0.01]
Widowed	-0.28 [0.20]	0.02 [0.01]**	-0.65 [0.19]***	0.03 [0.01]***
Never-married	0.54 [0.41]	0.01 [0.02]	0.24 [0.39]	0.01 [0.02]
Depression			0.28 [0.03]***	0.0004 [0.001]
Whether diagnosed with emotional problems (no=0)				
Yes			1.61 [0.19]***	-0.03 [0.01]**
Missing			2.38 [1.56]	-0.02 [0.08]
Female (male=0)	1.61 [0.18]***	-0.02 [0.008]*	1.31 [0.17]***	-0.01 [0.01]
Race/ethnicity (non-Hispanic White=0)				
Non-Hispanic Black	0.21 [0.23]	-0.01 [0.01]	0.22 [0.21]	-0.01 [0.01]
Non-Hispanic Others	0.57 [0.51]	-0.03 [0.02]	0.25 [0.47]	-0.02 [0.02]
Hispanic	0.27 [0.32]	0.002 [0.01]	0.08 [0.29]	0.004 [0.01]
Immigration status (immigrants=0)				
U.S. born	0.75 [0.31]*	-0.02 [0.01]	0.64 [0.29]	-0.02 [0.01]
Missing	1.31 [2.20]	-0.03 [0.09]	0.86 [2.01]	-0.01 [0.09]
Education (less than high school=0)				
High school graduate	-0.72 [0.23]**	0.004 [0.01]	-0.52 [0.22]*	0.01 [0.01]
Some college	-1.02 [0.26]***	0.004 [0.01]	-0.85 [0.24]***	0.01 [0.01]
College graduate or above	-1.89 [0.29]***	0.03 [0.01]*	-1.61 [0.27]***	0.03 [0.01]*
Whether have hypertension (no=0)				
Yes	-0.06 [0.16]	0.03 [0.01]***	-0.10 [0.15]	0.03 [0.01]***
Missing	3.06 [3.21]	-0.09 [0.10]	1.64 [2.98]	-0.05 [0.10]
Whether have cardiovascular disease (no=0)				
Yes	0.91 [0.15]***	0.01 [0.01]	0.69 [0.15]***	0.01 [0.01]
Missing	6.44 [2.02]**	-0.28 [0.10]**	6.20 [1.98]**	-0.29 [0.09]**
# of measurement occasions	-0.20 [0.04]***	0.01 [0.002]***	-0.15 [0.03]***	0.01 [0.001]***
Whether died during observations (no=0)	0.59 [0.22]**	0.01 [0.01]	0.63 [0.21]**	-0.002 [0.01]
Mean	2.32 [0.45]***	0.004 [0.02]	1.67 [0.41]***	0.01 [0.02]
Random Effects				
Level-2 intercept	9.89 [0.57]***		7.65 [0.49]***	
Level-2 slope	0.01 [0.001]***		0.01 [0.001]***	
Level-1 residual	2.78 [0.04]***		2.72 [0.04]***	
-2 log likelihood	610297.7		60076.7	

Note: * p<.05 ** p<.01 *** p<.001; numbers in parenthesis are standard errors.

Table A5. Growth Curve Models for Current Marital Status on Functional Limitations, Full Model (N=3,867)

	Model 1		Model 6	
	Intercept	Age slope	Intercept	Age slope
Current marital status (first-time married=0)				
Remarried	0.50 [0.22]*	0.002 [0.01]	0.34 [0.20]	0.002 [0.01]
Cohabiting	1.12 [0.38]**	-0.04 [0.02]*	0.86 [0.36]*	-0.04 [0.02]*
Divorced/separated	0.79 [0.25]**	-0.01 [0.01]	0.28 [0.23]	-0.001 [0.01]
Widowed	-0.28 [0.20]	0.02 [0.01]**	-0.70 [0.19]***	0.03 [0.01]***
Never-married	0.54 [0.41]	0.01 [0.02]	0.14 [0.38]	0.01 [0.02]
Annual household income			-0.11 [0.03]***	0.01 [0.002]**
Net asset			-0.36 [0.15]*	-0.01 [0.01]
Insurance status (no=0)				
Insured			0.26 [0.23]	-0.01 [0.02]
Missing			0.02 [1.21]	-0.01 [0.05]
Drinking (moderate=0)				
Abstainers			0.16 [0.13]	0.01 [0.01]
Heavy drinkers			0.37 [0.43]	-0.04 [0.02]
Missing			3.35 [1.20]**	-0.14 [0.06]*
Smoking (non-smoker=0)				
Past smokers			0.29 [0.17]	-0.0002 [0.01]
Current smokers			-0.06 [0.23]	0.02 [0.01]
Missing			0.58 [0.63]	-0.05 [0.04]
Body weight (normal=0)				
Underweight			1.23 [0.76]	-0.02 [0.03]
Overweight			0.20 [0.16]	-0.004 [0.01]
Obese			0.78 [0.18]***	-0.01 [0.01]
Missing			0.64 [0.39]	-0.01 [0.02]
Whether physically active (no=0)				
Yes			-0.38 [0.11]***	-0.01 [0.06]*
Missing			-0.72 [0.84]	-0.01 [0.04]
Depression			0.27 [0.03]***	0.001 [0.001]
Whether diagnosed with emotional problems (no=0)				
Yes			1.49 [0.18]***	-0.02 [0.01]**
Missing			1.74 [1.54]	0.002 [0.08]
Female (male=0)	1.61 [0.18]***	-0.02 [0.008]*	1.25 [0.17]	-0.01 [0.01]
Race/ethnicity (non-Hispanic White=0)				
Non-Hispanic Black	0.21 [0.23]	-0.01 [0.01]	0.15 [0.21]	-0.01 [0.01]
Non-Hispanic Others	0.57 [0.51]	-0.03 [0.02]	0.30 [0.45]	-0.03 [0.02]
Hispanic	0.27 [0.32]	0.002 [0.01]	0.04 [0.28]	0.002 [0.01]
Immigration status (immigrants=0)				
U.S. born	0.75 [0.31]*	-0.02 [0.01]	0.54 [0.28]	-0.02 [0.01]
Missing	1.31 [2.20]	-0.03 [0.09]	0.94 [1.94]	0.002 [0.08]

Note: * p<.05 ** p<.01 *** p<.001; numbers in parenthesis are standard errors. Annual household income and net assets are naturally logged and adjusted for household size.

Table A5 (cont'd)

	Model 1		Model 6	
	Intercept	Age slope	Intercept	Age slope
Education (less than high school=0)				
High school graduate	-0.72 [0.23]**	0.004 [0.01]	-0.38 [0.21]	0.003 [0.01]
Some college	-1.02 [0.26]***	0.004 [0.01]	-0.66 [0.24]**	0.01 [0.01]
College graduate or above	-1.89 [0.29]***	0.03 [0.01]*	-1.28 [0.27]***	0.03 [0.01]**
Whether have hypertension (no=0)				
Yes	-0.06 [0.16]	0.03 [0.01]***	-0.18 [0.15]	0.03 [0.01]***
Missing	3.06 [3.21]	-0.09 [0.10]	1.47 [2.89]	-0.04 [0.10]
Whether have cardiovascular disease (no=0)				
Yes	0.91 [0.15]***	0.01 [0.01]	0.67 [0.15]***	0.01 [0.01]
Missing	6.44 [2.02]**	-0.28 [0.10]**	5.83 [1.97]**	-0.27 [0.09]**
# of measurement occasions	-0.20 [0.04]***	0.01 [0.002]***	-0.11 [0.03]***	0.005 [0.001]**
Whether died during observations (no=0)	0.59 [0.22]**	0.01 [0.01]	0.68 [0.20]***	-0.01 [0.01]
Mean	2.32 [0.45]***	0.004 [0.02]	6.69 [2.13]**	0.13 [0.11]
Random Effects				
Level-2 intercept	9.89 [0.57]***		6.76 [0.46]***	
Level-2 slope	0.01 [0.001]***		0.01 [0.001]***	
Level-1 residual	2.78 [0.04]***		2.72 [0.04]***	
-2 log likelihood	610297.7		59687.8	

Note: * p<.05 ** p<.01 *** p<.001; numbers in parenthesis are standard errors. Annual household income and net assets are naturally logged and adjusted for household size.

Table A6. Growth Curve Models for Current Marriage Duration on Functional Limitations (N=2,436)

	Model 1		Model 2	
	Intercept	Age slope	Intercept	Age slope
Remarried (first-time married=0)	0.04 [0.30]	0.03 [0.01]*	0.04 [0.30]	0.03 [0.01]*
Current marriage duration	-0.02 [0.009]**	0.002 [0.0004]***	-0.02 [0.01]	0.001 [0.0004]**
Current marriage duration × female			-0.006 [0.01]	0.0003 [0.001]
Female (male=0)	1.65 [0.22]	-0.02 [0.01]*	1.87 [0.49]***	-0.03 [0.02]
Race/ethnicity (non-Hispanic White=0)				
Non-Hispanic Black	-0.24 [0.31]	0.01 [0.02]	-0.24 [0.31]	0.01 [0.02]
Non-Hispanic Others	0.41 [0.65]	-0.03 [0.03]	0.40 [0.65]	-0.03 [0.03]
Hispanic	0.14 [0.39]	-0.01 [0.02]	0.13 [0.39]	-0.01 [0.02]
Immigration status (immigrants=0)				
U.S. born	0.69 [0.39]	-0.03 [0.02]	0.69 [0.39]	-0.03 [0.02]
Missing	-2.31 [4.54]	0.02 [0.16]	-2.26 [4.54]	0.02 [0.16]
Education (less than high school=0)				
High school graduate	-0.30 [0.29]	-0.01 [0.01]	-0.30 [0.29]	-0.01 [0.01]
Some college	-0.74 [0.33]*	-0.01 [0.02]	-0.74 [0.33]*	-0.01 [0.02]
College graduate or above	-1.40 [0.35]***	0.01 [0.02]	-1.39 [0.35]***	0.01 [0.02]
Whether have hypertension (no=0)				
Yes	0.12 [0.19]	0.02 [0.01]	0.12 [0.19]	0.02 [0.01]
Missing	2.26 [39.95]	-0.10 [1.29]	1.90 [39.96]	-0.09 [1.29]
Whether have cardiovascular disease (no=0)				
Yes	1.28 [0.20]***	-0.01 [0.01]	1.27 [0.20]***	-0.01 [0.01]
Missing	5.17 [10.64]	-0.18 [0.50]	5.18 [10.64]	-0.18 [0.50]
# of measurement occasions	-0.16 [0.04]***	0.01 [0.002]***	-0.16 [0.04]***	0.01 [0.002]***
Whether died during observations (no=0)	0.21 [0.29]	0.03 [0.01]*	0.21 [0.29]	0.03 [0.01]*
Mean	2.84 [0.64]***	-0.04 [0.03]	2.75 [0.66]***	-0.04 [0.03]
Random Effects				
Level-2 intercept	9.23 [0.67]***		9.21 [0.67]***	
Level-2 slope	0.01 [0.002]***		0.01 [0.002]***	
Level-1 residual	2.56 [0.05]***		2.56 [0.05]***	
-2 log likelihood	36251.5		36251.2	

Note: * p<.05 ** p<.01 *** p<.001; numbers in parenthesis are standard errors.

Table A7. Growth Curve Models for Current Marriage Duration on Functional Limitations, Adjusting for Socioeconomic Resources (N=2,436)

	Model 1		Model 3	
	Intercept	Age slope	Intercept	Age slope
Remarried (first-time married=0)	0.04 [0.30]	0.03 [0.01]*	0.08 [0.30]	0.03 [0.01]*
Current marriage duration	-0.02 [0.009]**	0.002 [0.0004]***	-0.02 [0.01]*	0.001 [0.0004]***
Annual household income			-0.22 [0.05]***	0.01 [0.003]**
Net asset			-0.38 [0.17]*	-0.01 [0.01]
Insurance status (no=0)				
Insured			-0.10 [0.34]	0.01 [0.03]
Missing			-2.64 [3.34]	0.08 [0.11]
Female (male=0)	1.65 [0.22]***	-0.02 [0.01]*	1.65 [0.22]***	-0.02 [0.01]*
Race/ethnicity (non-Hispanic White=0)				
Non-Hispanic Black	-0.24 [0.31]	0.01 [0.02]	-0.40 [0.31]	0.02 [0.02]
Non-Hispanic Others	0.41 [0.65]	-0.03 [0.03]	0.29 [0.65]	-0.03 [0.03]
Hispanic	0.14 [0.39]	-0.01 [0.02]	-0.04 [0.39]	-0.002 [0.02]
Immigration status (immigrants=0)				
U.S. born	0.69 [0.39]	-0.03 [0.02]	0.73 [0.39]	-0.03 [0.02]
Missing	-2.31 [4.54]	0.02 [0.16]	-2.06 [4.51]	0.02 [0.16]
Education (less than high school=0)				
High school graduate	-0.30 [0.29]	-0.01 [0.01]	-0.15 [0.29]	-0.01 [0.01]
Some college	-0.74 [0.33]*	-0.01 [0.02]	-0.51 [0.33]	-0.01 [0.02]
College graduate or above	-1.40 [0.35]***	0.01 [0.02]	-1.07 [0.36]**	0.01 [0.02]
Whether have hypertension (no=0)				
Yes	0.12 [0.19]	0.02 [0.01]	0.11 [0.19]	0.02 [0.01]
Missing	2.26 [39.95]	-0.10 [1.29]	-1.34 [39.90]	0.02 [1.29]
Whether have cardiovascular disease (no=0)				
Yes	1.28 [0.20]***	-0.01 [0.01]	1.30 [0.20]***	-0.01 [0.01]
Missing	5.17 [10.64]	-0.18 [0.50]	5.84 [10.63]	-0.21 [0.50]
# of measurement occasions	-0.16 [0.04]***	0.01 [0.002]***	-0.16 [0.04]***	0.01 [0.002]
Whether died during observations (no=0)	0.21 [0.29]	0.03 [0.01]*	0.12 [0.28]	0.03 [0.01]***
Mean	2.84 [0.64]***	-0.04 [0.03]	10.09 [2.35]***	0.05 [0.14]*
Random Effects				
Level-2 intercept	9.23 [0.67]***		8.86 [0.65]***	
Level-2 slope	0.01 [0.002]***		0.01 [0.001]***	
Level-1 residual	2.56 [0.05]***		2.56 [0.05]***	
-2 log likelihood	36251.5		36188.0	

Note: * p<.05 ** p<.01 *** p<.001; numbers in parenthesis are standard errors. Annual household income and net assets are naturally logged and adjusted for household size.

Table A8. Growth Curve Models for Current Marriage Duration on Functional Limitations, Adjusting for Health Behaviors (N=2,436)

	Model 1		Model 4	
	Intercept	Age slope	Intercept	Age slope
Remarried (first-time married=0)	0.04 [0.30]	0.03 [0.01]*	0.02 [0.29]	0.03 [0.01]*
Current marriage duration	-0.02 [0.009]**	0.002 [0.0004]***	-0.02 [0.01]**	0.001 [0.0004]***
Drinking (moderate=0)				
Abstainers			0.13 [0.17]	0.01 [0.01]
Heavy drinkers			0.35 [0.57]	-0.03 [0.03]
Missing			2.12 [1.38]	-0.09 [0.07]
Smoking (non-smoker=0)				
Past smokers			0.23 [0.23]	0.004 [0.01]
Current smokers			-0.001 [0.32]	0.02 [0.02]
Missing			0.05 [0.86]	-0.04 [0.05]
Body weight (normal=0)				
Underweight			-0.49 [1.44]	0.04 [0.06]
Overweight			-0.01 [0.22]	-0.001 [0.01]
Obese			0.66 [0.24]**	-0.01 [0.01]
Missing			0.78 [0.50]	-0.02 [0.03]
Whether physically active (no=0)				
Yes			-0.57 [0.14]***	0.0001 [0.007]
Missing			-1.57 [1.15]	0.02 [0.05]
Female (male=0)	1.65 [0.22]***	-0.02 [0.01]*	1.57 [0.23]***	-0.02 [0.01]
Race/ethnicity (non-Hispanic White=0)				
Non-Hispanic Black	-0.24 [0.31]	0.01 [0.02]	-0.20 [0.30]	0.01 [0.01]
Non-Hispanic Others	0.41 [0.65]	-0.03 [0.03]	0.35 [0.63]	-0.03 [0.03]
Hispanic	0.14 [0.39]	-0.01 [0.02]	0.21 [0.38]	-0.01 [0.02]
Immigration status (immigrants=0)				
U.S. born	0.69 [0.39]	-0.03 [0.02]	0.57 [0.38]	-0.03 [0.02]
Missing	-2.31 [4.54]	0.02 [0.16]	-2.48 [4.47]	0.03 [0.16]
Education (less than high school=0)				
High school graduate	-0.30 [0.29]	-0.01 [0.01]	-0.22 [0.29]	-0.01 [0.01]
Some college	-0.74 [0.33]*	-0.01 [0.02]	-0.66 [0.32]*	-0.01 [0.02]
College graduate or above	-1.40 [0.35]***	0.01 [0.02]	-1.20 [0.35]***	0.01 [0.02]
Whether have hypertension (no=0)				
Yes	0.12 [0.19]	0.02 [0.01]	0.01 [0.19]	0.02 [0.01]*
Missing	2.26 [39.95]	-0.10 [1.29]	15.62 [40.29]	-0.52 [1.30]
Whether have cardiovascular disease (no=0)				
Yes	1.28 [0.20]***	-0.01 [0.01]	1.23 [0.20]***	-0.01 [0.01]
Missing	5.17 [10.64]	-0.18 [0.50]	6.52 [10.60]	-0.24 [0.50]

Note: * p<.05 ** p<.01 *** p<.001; numbers in parenthesis are standard errors.

Table A8 (cont'd)

	Model 1		Model 4	
	Intercept	Age slope	Intercept	Age slope
# of measurement occasions	-0.16 [0.04]***	0.01 [0.002]***	-0.11 [0.04]**	0.01 [0.002]**
Whether died during observations (no=0)	0.21 [0.29]	0.03 [0.01]*	0.32 [0.28]	0.02 [0.01]
Mean	2.84 [0.64]***	-0.04 [0.03]	2.40 [0.68]***	-0.03 [0.03]
Random Effects				
Level-2 intercept	9.23 [0.67]***		8.25 [0.63]***	
Level-2 slope	0.01 [0.002]***		0.01 [0.001]***	
Level-1 residual	2.56 [0.05]***		2.57 [0.05]***	
-2 log likelihood	36251.5		36058.1	

Note: * p<.05 ** p<.01 *** p<.001; numbers in parenthesis are standard errors.

Table A9. Growth Curve Models for Current Marriage Duration on Functional Limitations, Adjusting for Psychological Distress (N=2,436)

	Model 1		Model 5	
	Intercept	Age slope	Intercept	Age slope
Remarried (first-time married=0)	0.04 [0.30]	0.03 [0.01]*	-0.02 [0.28]	0.03 [0.01]*
Current marriage duration	-0.02 [0.009]**	0.002 [0.0004]***	-0.02 [0.01]	0.001 [0.0004]***
Depression			0.26 [0.04]	0.004 [0.002]*
Whether diagnosed with emotional problems (no=0)				
Yes			1.59 [0.24]***	-0.03 [0.01]**
Missing			2.94 [2.64]	-0.08 [0.18]
Female (male=0)	1.65 [0.22]***	-0.02 [0.01]*	1.36 [0.21]***	-0.02 [0.01]*
Race/ethnicity (non-Hispanic White=0)				
Non-Hispanic Black	-0.24 [0.31]	0.01 [0.02]	-0.17 [0.28]	0.01 [0.01]
Non-Hispanic Others	0.41 [0.65]	-0.03 [0.03]	0.12 [0.60]	-0.02 [0.03]
Hispanic	0.14 [0.39]	-0.01 [0.02]	0.15 [0.37]	-0.01 [0.02]
Immigration status (immigrants=0)				
U.S. born	0.69 [0.39]	-0.03 [0.02]	0.60 [0.36]	-0.03 [0.02]
Missing	-2.31 [4.54]	0.02 [0.16]	-3.12 [4.31]	0.05 [0.15]
Education (less than high school=0)				
High school graduate	-0.30 [0.29]	-0.01 [0.01]	-0.07 [0.27]	-0.01 [0.01]
Some college	-0.74 [0.33]*	-0.01 [0.02]	-0.53 [0.31]	-0.01 [0.01]
College graduate or above	-1.40 [0.35]***	0.01 [0.02]	-1.16 [0.33]***	0.01 [0.02]
Whether have hypertension (no=0)				
Yes	0.12 [0.19]	0.02 [0.01]	0.04 [0.18]	0.02 [0.01]
Missing	2.26 [39.95]	-0.10 [1.29]	0.36 [39.25]	-0.04 [1.27]
Whether have cardiovascular disease (no=0)				
Yes	1.28 [0.20]***	-0.01 [0.01]	1.05 [0.19]***	-0.004 [0.01]
Missing	5.17 [10.64]	-0.18 [0.50]	5.15 [10.41]	-0.21 [0.49]
# of measurement occasions	-0.16 [0.04]***	0.01 [0.002]***	-0.12 [0.04]**	0.01 [0.002]***
Whether died during observations (no=0)	0.21 [0.29]	0.03 [0.01]*	0.38 [0.27]	0.01 [0.01]
Mean	2.84 [0.64]***	-0.04 [0.03]	2.01 [0.60]***	-0.03 [0.03]
Random Effects				
Level-2 intercept	9.23 [0.67]***		7.40 [0.58]***	
Level-2 slope	0.01 [0.002]***		0.01 [0.001]***	
Level-1 residual	2.56 [0.05]***		2.51 [0.05]***	
-2 log likelihood	36251.5		35640.8	

Note: * p<.05 ** p<.01 *** p<.001; numbers in parenthesis are standard errors.

Table A10. Growth Curve Models for Current Marriage Duration on Functional Limitations, Full Model (N=2,436)

	Model 1		Model 6	
	Intercept	Age slope	Intercept	Age slope
Remarried (first-time married=0)	0.04 [0.30]	0.03 [0.01]*	-0.01 [0.27]	0.03 [0.01]*
Current marriage duration	-0.02 [0.009]**	0.002 [0.0004]***	-0.02 [0.01]	0.001 [0.0003]***
Annual household income			-0.17 [0.05]**	0.01 [0.003]**
Net asset			-0.33 [0.16]*	-0.01 [0.01]
Insurance status (no=0)				
Insured			0.01 [0.33]	0.01 [0.03]
Missing			-1.80 [3.22]	0.05 [0.11]
Drinking (moderate=0)				
Abstainers			0.09 [0.17]	0.01 [0.01]
Heavy drinkers			0.10 [0.55]	-0.02 [0.03]
Missing			2.17 [1.35]	-0.09 [0.07]
Smoking (non-smoker=0)				
Past smokers			0.21 [0.22]	0.002 [0.01]
Current smokers			-0.17 [0.30]	0.02 [0.02]
Missing			0.36 [0.83]	-0.06 [0.05]
Body weight (normal=0)				
Underweight			-0.03 [1.36]	0.03 [0.06]
Overweight			0.01 [0.21]	0.001 [0.01]
Obese			0.61 [0.23]**	-0.01 [0.01]
Missing			0.65 [0.49]	-0.01 [0.03]
Whether physically active (no=0)				
Yes			-0.48 [0.14]***	-0.002 [0.01]
Missing			-1.32 [1.13]	0.001 [0.05]
Depression			0.25 [0.04]***	0.004 [0.002]*
Whether diagnosed with emotional problems (no=0)				
Yes			1.44 [0.24]***	-0.03 [0.01]*
Missing			2.70 [2.60]	-0.10 [0.18]
Female (male=0)	1.65 [0.22]***	-0.02 [0.01]*	1.31 [0.21]***	-0.02 [0.01]
Race/ethnicity (non-Hispanic White=0)				
Non-Hispanic Black	-0.24 [0.31]	0.01 [0.02]	-0.27 [0.28]	0.01 [0.01]
Non-Hispanic Others	0.41 [0.65]	-0.03 [0.03]	0.02 [0.59]	-0.02 [0.03]
Hispanic	0.14 [0.39]	-0.01 [0.02]	0.07 [0.36]	-0.01 [0.02]
Immigration status (immigrants=0)				
U.S. born	0.69 [0.39]	-0.03 [0.02]	0.52 [0.35]	-0.03 [0.02]
Missing	-2.31 [4.54]	0.02 [0.16]	-3.00 [4.23]	0.05 [0.15]

Note: * p<.05 ** p<.01 *** p<.001; numbers in parenthesis are standard errors. Annual household income and net assets are naturally logged and adjusted for household size.

Table A10 (cont'd)

	Model 1		Model 6	
	Intercept	Age slope	Intercept	Age slope
Education (less than high school=0)				
High school graduate	-0.30 [0.29]	-0.01 [0.01]	0.09 [0.27]	-0.01 [0.01]
Some college	-0.74 [0.33]*	-0.01 [0.02]	-0.30 [0.30]	-0.01 [0.01]
College graduate or above	-1.40 [0.35]***	0.01 [0.02]	-0.77 [0.33]*	0.01 [0.02]
Whether have hypertension (no=0)				
Yes	0.12 [0.19]	0.02 [0.01]	-0.08 [0.18]	0.02 [0.01]*
Missing	2.26 [39.95]	-0.10 [1.29]	11.89 [39.49]	-0.39 [1.27]
Whether have cardiovascular disease (no=0)				
Yes	1.28 [0.20]***	-0.01 [0.01]	1.03 [0.19]***	-0.005 [0.01]
Missing	5.17 [10.64]	-0.18 [0.50]	6.92 [10.34]	-0.30 [0.49]
# of measurement occasions	-0.16 [0.04]***	0.01 [0.002]***	-0.09 [0.04]*	0.005 [0.002]*
Whether died during observations (no=0)	0.21 [0.29]	0.03 [0.01]*	0.42 [0.26]	0.01 [0.01]
Mean	2.84 [0.64]***	-0.04 [0.03]	7.82 [2.30]***	0.02 [0.13]
Random Effects				
Level-2 intercept	9.23 [0.67]***		6.48 [0.54]***	
Level-2 slope	0.01 [0.002]***		0.01 [0.001]***	
Level-1 residual	2.56 [0.05]***		2.51 [0.05]***	
-2 log likelihood	36251.5		35416.7	

Note: * p<.05 ** p<.01 *** p<.001; numbers in parenthesis are standard errors. Annual household income and net assets are naturally logged and adjusted for household size.

REFERENCES

REFERENCES

Allison, P.D. 2010. *Survival analysis using SAS: a practical guide*: Sas Institute.

Amato, P.R. 2000. "The consequences of divorce for adults and children." *Journal of Marriage and Family* 62(4):1269-1287.

—. 2010. "Research on divorce: Continuing trends and new developments." *Journal of Marriage and Family* 72(3):650-666.

August, K.J.and D.H. Sorkin. 2010. "Marital status and gender differences in managing a chronic illness: The function of health-related social control." *Social Science & Medicine* 71(10):1831-1838.

Baum, A., H. Herberman, and L. Cohen. 1995. "Managing stress and managing illness: Survival and quality of life in chronic disease." *Journal of clinical psychology in medical settings* 2(4):309-333.

Baum, A.and D.M. Posluszny. 1999. "Health psychology: mapping biobehavioral contributions to health and illness." *Annual review of psychology* 50(1):137-163.

Beverly, E.A., C.K. Miller, and L.A. Wray. 2007. "Spousal support and food-related behavior change in middle-aged and older adults living with type 2 diabetes." *Health Education & Behavior*.

Bishop, D.B., P.J. O'Connor, and J. Desai. 2010. "Chapter 10: Diabetes." in *Chronic disease epidemiology and control*, edited by P.L. Remington, R.C. Brownson, and M.V. Wegner. Washington, DC, USA: American public health association.

Boerner, K., D.S. Jopp, D. Carr, L. Sosinsky, and S.-K. Kim. 2014. "“His” and “her” marriage? The role of positive and negative marital characteristics in global marital satisfaction among older adults." *The Journals of Gerontology Series B: Psychological Sciences and Social Sciences* 69(4):579-589.

Booth, A.and P. Amato. 1991. "Divorce and psychological stress." *Journal of Health and Social Behavior*.

Brecht, M.-L., K. Dracup, D.K. Moser, and B. Riegel. 1994. "The relationship of marital quality and psychosocial adjustment to heart disease." *Journal of Cardiovascular Nursing* 9(1):74-85.

Brown, S.L., J.R. Bulanda, and G.R. Lee. 2012. "Transitions into and out of cohabitation in later life." *Journal of Marriage and Family* 74(4):774-793.

Brown, S.L., G.R. Lee, and J.R. Bulanda. 2006. "Cohabitation among older adults: A national portrait." *The Journals of Gerontology Series B: Psychological Sciences and Social Sciences* 61(2):S71-S79.

Brown, S.L.and I.-F. Lin. 2012. "The gray divorce revolution: Rising divorce among middle-aged and older adults, 1990–2010." *The Journals of Gerontology Series B: Psychological Sciences and Social Sciences* 67(6):731-741.

Burman, B.and G. Margolin. 1992. "Analysis of the association between marital relationships and health problems: an interactional perspective." *Psychological bulletin* 112(1):39.

Carle, A.C. 2009. "Fitting multilevel models in complex survey data with design weights: Recommendations." *BMC Medical Research Methodology* 9(1):1.

Carr, D.and S. Bodnar-Deren. 2009. "Gender, Aging and Widowhood." Pp. 705-728 in *International Handbook of Population Aging*: Springer.

Carr, D., J.C. Cornman, and V.A. Freedman. 2016. "Marital Quality and Negative Experienced Well-Being: An Assessment of Actor and Partner Effects Among Older Married Persons." *The Journals of Gerontology Series B: Psychological Sciences and Social Sciences* 71(1):177-187.

Carr, D., J.S. House, R.C. Kessler, R.M. Nesse, J. Sonnega, and C. Wortman. 2000. "Marital quality and psychological adjustment to widowhood among older adults a longitudinal analysis." *The Journals of Gerontology Series B: Psychological Sciences and Social Sciences* 55(4):S197-S207.

Carr, D.and K.W. Springer. 2010. "Advances in families and health research in the 21st century." *Journal of Marriage and Family* 72(3):743-761.

CDC. 2015. "About Adult BMI." Atlanta, GA. Retrieved April 7 2016 (http://www.cdc.gov/healthyweight/assessing/bmi/adult_bmi/).

Chandra, V., M. Szklo, R. Goldberg, and J. Tonascia. 1983. "The impact of marital status on survival after an acute myocardial infarction: a population-based study." *American Journal of Epidemiology* 117(3):320-325.

Chen, Y., F.A. Sloan, and A.P. Yashkin. 2015. "Adherence to diabetes guidelines for screening, physical activity and medication and onset of complications and death." *Journal of Diabetes and its Complications* 29(8):1228-1233.

Choi, H.and N.F. Marks. 2006. "Transition to Caregiving, Marital Disagreement, and Psychological Well-Being A Prospective US National Study." *Journal of Family Issues* 27(12):1701-1722.

Choi, H., J.B. Yorgason, and D.R. Johnson. 2016. "Marital Quality and Health in Middle and Later Adulthood: Dyadic Associations." *The Journals of Gerontology Series B: Psychological Sciences and Social Sciences* 71(1):154-164.

Cornwell, E.Y.and L.J. Waite. 2012. "Social network resources and management of hypertension." *Journal of Health and Social Behavior* 53(2):215-231.

Coyne, J.C., M.J. Rohrbaugh, V. Shoham, J.S. Sonnega, J.M. Nicklas, and J.A. Cranford. 2001. "Prognostic importance of marital quality for survival of congestive heart failure." *The American journal of cardiology* 88(5):526-529.

Crimmins, E.M. 2004. "Trends in the health of the elderly." *Annu. Rev. Public Health* 25:79-98.

Crimmins, E.M., M.D. Hayward, and Y. Saito. 1994. "Changing mortality and morbidity rates and the health status and life expectancy of the older population." *Demography* 31(1):159-175.

Das, S.and J.H. O'Keefe. 2006. "Behavioral cardiology: recognizing and addressing the profound impact of psychosocial stress on cardiovascular health." *Current atherosclerosis reports* 8(2):111-118.

De Vogli, R., T. Chandola, and M.G. Marmot. 2007. "Negative aspects of close relationships and heart disease." *Archives of Internal Medicine* 167(18):1951-1957.

Donoho, C.J., E.M. Crimmins, and T.E. Seeman. 2013. "Marital Quality, Gender, and Markers of Inflammation in the MIDUS Cohort." *Journal of Marriage and Family* 75(1):127-141.

Donoho, C.J., T.E. Seeman, R.P. Sloan, and E.M. Crimmins. 2015. "Marital status, marital quality, and heart rate variability in the MIDUS cohort." *Journal of Family Psychology* 29(2):290.

Dupre, M.E., A.N. Beck, and S.O. Meadows. 2009. "Marital trajectories and mortality among US adults." *American Journal of Epidemiology* 170(5):546-555.

Dupre, M.E., L.K. George, G. Liu, and E.D. Peterson. 2015. "Association Between Divorce and Risks for Acute Myocardial Infarction." *Circulation: Cardiovascular Quality and Outcomes* 8(3):244-251.

Eaker, E.D., L.M. Sullivan, M. Kelly-Hayes, R.B. D'Agostino Sr, and E.J. Benjamin. 2007. "Marital status, marital strain, and risk of coronary heart disease or total mortality: the Framingham Offspring Study." *Psychosomatic medicine* 69(6):509-513.

Elder, G.H., Jr.and J.Z. Giele. 2009. "Life Course Studies: An Evolving Field." Pp. 1-24 in *The Craft of Life Course Research*, edited by G.H. Elder, Jr. and J.Z. Giele. New York: Guilford Press.

Elder, G.H., Jr., M.K. Johnson, and R. Crosnoe. 2003. "The Emergence and Development of Life Course Theory." Pp. 3-19 in *Handbook of the Life Course*, edited by J.T. Mortimer and M.J. Shanahan. New York: Kluwer.

Ewart, C.K., C.B. Taylor, H.C. Kraemer, and W.S. Agras. 1991. "High blood pressure and marital discord: not being nasty matters more than being nice." *Health Psychology* 10(3):155.

Ferraro, K.F.and P.M. Morton. 2016. "What Do We Mean by Accumulation? Advancing Conceptual Precision for a Core Idea in Gerontology." *The Journals of Gerontology Series B: Psychological Sciences and Social Sciences*:gbv094.

Floud, S., A. Balkwill, D. Canoy, F.L. Wright, G.K. Reeves, J. Green, V. Beral, and B.J. Cairns. 2014. "Marital status and ischemic heart disease incidence and mortality in women: a large prospective study." *BMC medicine* 12(1):42.

Fortin, M., L. Lapointe, C. Hudon, A. Vanasse, A.L. Ntetu, and D. Maltais. 2004. "Multimorbidity and quality of life in primary care: a systematic review." *Health and Quality of life Outcomes* 2(1):51.

Franks, M.M., M.A.P. Stephens, K.S. Rook, B.A. Franklin, S.J. Keteyian, and N.T. Artinian. 2006. "Spouses' provision of health-related support and control to patients participating in cardiac rehabilitation." *Journal of Family Psychology* 20(2):311.

Fu, H.and N. Goldman. 1996. "Incorporating health into models of marriage choice: demographic and sociological perspectives." *Journal of Marriage and the Family*:740-758.

Gallant, M.P. 2003. "The influence of social support on chronic illness self-management: a review and directions for research." *Health Education & Behavior* 30(2):170-195.

Gallant, M.P., G.D. Spitze, and T.R. Prohaska. 2007. "Help or hindrance? How family and friends influence chronic illness self-management among older adults." *Research on Aging* 29(5):375-409.

Gallo, L.C., W.M. Troxel, L.H. Kuller, K. Sutton-Tyrrell, D. Edmundowicz, and K.A. Matthews. 2003. "Marital status, marital quality, and atherosclerotic burden in postmenopausal women." *Psychosomatic medicine* 65(6):952-962.

Greenfield, C., M. Gilles, C. Porter, P. Shaw, and K. Willis. 2011. "It's not just about the HbA1c, Doc! Understanding the psychosocial is also important in managing diabetes?" *Australian Journal of Rural Health* 19(1):15-19.

Haas, S. 2008. "Trajectories of functional health: the 'long arm'of childhood health and socioeconomic factors." *Social Science & Medicine* 66(4):849-861.

HRS website. 2011. "Sampling Weights: Revised for Tracker 2.0 and Beyond. Retrieved February 22 2016 (http://hrsonline.isr.umich.edu/sitedocs/wghtdoc.pdf)."

Hughes, M.E.and L.J. Waite. 2009. "Marital biography and health at mid-life." *Journal of Health and Social Behavior* 50(3):344-358.

Idler, E.L., D.A. Boulifard, and R.J. Contrada. 2012. "Mending Broken Hearts Marriage and Survival Following Cardiac Surgery." *Journal of Health and Social Behavior* 53(1):33-49.

Iwashyna, T.J.and N.A. Christakis. 2003. "Marriage, widowhood, and health-care use." *Social Science & Medicine* 57(11):2137-2147.

Kalyani, R.R., C.D. Saudek, F.L. Brancati, and E. Selvin. 2010. "Association of diabetes, comorbidities, and A1C with functional disability in older adults results from the National Health and Nutrition Examination Survey (NHANES), 1999–2006." *Diabetes care* 33(5):1055-1060.

Karraker, A.and K. Latham. 2015. "In sickness and in health? Physical illness as a risk factor for marital dissolution in later life." *Journal of Health and Social Behavior* 56(3):420-435.

Kiecolt-Glaser, J.K., J.-P. Gouin, and L. Hantsoo. 2010. "Close relationships, inflammation, and health." *Neuroscience & Biobehavioral Reviews* 35(1):33-38.

Kiecolt-Glaser, J.K.and T.L. Newton. 2001. "Marriage and health: his and hers." *Psychological bulletin* 127(4):472.

King, K.B.and H.T. Reis. 2012. "Marriage and long-term survival after coronary artery bypass grafting." *Health Psychology* 31(1):55.

Koskenvuo, M., J. Kaprio, A. Kesäniemi, and S. Sarna. 1980. "Differences in mortality from ischemic heart disease by marital status and social class." *Journal of chronic diseases* 33(2):95-106.

Kulik, J.A.and H.I. Mahler. 2006. "Marital quality predicts hospital stay following coronary artery bypass surgery for women but not men." *Social Science & Medicine* 63(8):2031-2040.

Lett, H.S., J.A. Blumenthal, M.A. Babyak, T.J. Strauman, C. Robins, and A. Sherwood. 2005. "Social support and coronary heart disease: epidemiologic evidence and implications for treatment." *Psychosomatic medicine* 67(6):869-878.

Lillard, L.A.and L.J. Waite. 1995. "'Til death do us part: Marital disruption and mortality." *American Journal of Sociology*:1131-1156.

Liu, H. 2009. "Till Death Do Us Part: Marital Status and U.S. Mortality Trends, 1986-2000." *Journal of Marriage and Family* 71(5):1158-1173.

Liu, H.and C. Reczek. 2012. "Cohabitation and US adult mortality: An examination by gender and race." *Journal of Marriage and Family* 74(4):794-811.

Liu, H.and D.J. Umberson. 2008. "The times they are a changin': marital status and health differentials from 1972 to 2003." *Journal of Health and Social Behavior* 49(3):239-253.

Liu, H.and L. Waite. 2014. "Bad Marriage, Broken Heart? Age and Gender Differences in the Link between Marital Quality and Cardiovascular Risks among Older Adults." *Journal of Health and Social Behavior* 55(4):403-423.

Lustman, P.J.and R.E. Clouse. 2005. "Depression in diabetic patients: the relationship between mood and glycemic control." *Journal of Diabetes and its Complications* 19(2):113-122.

Lutfey, K.and J. Freese. 2005. "Toward Some Fundamentals of Fundamental Causality: Socioeconomic Status and Health in the Routine Clinic Visit for Diabetes1." *American Journal of Sociology* 110(5):1326-1372.

Mannino, D.M., D. Thorn, A. Swensen, and F. Holguin. 2008. "Prevalence and outcomes of diabetes, hypertension and cardiovascular disease in COPD." *European Respiratory Journal* 32(4):962-969.

Marengoni, A., S. Angleman, R. Melis, F. Mangialasche, A. Karp, A. Garmen, B. Meinow, and L. Fratiglioni. 2011. "Aging with multimorbidity: a systematic review of the literature." *Ageing research reviews* 10(4):430-439.

Masoudi, F.A., J.S. Rumsfeld, E.P. Havranek, J.A. House, E.D. Peterson, H.M. Krumholz, J.A. Spertus, and C.O.R. Consortium. 2004. "Age, functional capacity, and health-related quality of life in patients with heart failure." *Journal of cardiac failure* 10(5):368-373.

McFarland, M.J., M.D. Hayward, and D. Brown. 2013. "I've Got You Under My Skin: Marital Biography and Biological Risk." *Journal of Marriage and Family* 75(2):363-380.

Molloy, G.J., E. Stamatakis, G. Randall, and M. Hamer. 2009. "Marital status, gender and cardiovascular mortality: behavioural, psychological distress and metabolic explanations." *Social Science & Medicine* 69(2):223-228.

Musick, K.and L. Bumpass. 2012. "Reexamining the Case for Marriage: Union Formation and Changes in Well-being." *Journal of Marriage and Family* 74(1): 1-18.

National Center for Health Statistics. 2015. "Health, United States, 2014: With Special Feature on Adults Aged 55–64." Hyattsville, MD.

National Institute on Aging. 2007. *Living long & well in the 21st century [electronic resource] : strategic directions for research on aging*. [Bethesda, Md.]: National Institute on Aging, National Institutes of Health, U.S. Dept. of Health and Human Services.

Neal, R.and V. Allgar. 2005. "Sociodemographic factors and delays in the diagnosis of six cancers: analysis of data from the 'National Survey of NHS Patients: Cancer'." *British Journal of Cancer* 92(11):1971-1975.

Nealey-Moore, J.B., T.W. Smith, B.N. Uchino, M.W. Hawkins, and C. Olson-Cerny. 2007. "Cardiovascular reactivity during positive and negative marital interactions." *Journal of behavioral medicine* 30(6):505-519.

Newschaffer, C.J., L. Liu, and A. Sim. 2010. "Chapter 13: Cardiovascular Disease." in *Chronic Disease Epidemiology and Control*, edited by P.L. Remington, R.C. Brownson, and M.V. Wegner. Washington, DC: American Public Health Association.

Nicklett, E.J.and J. Liang. 2010. "Diabetes-related support, regimen adherence, and health decline among older adults." *The Journals of Gerontology Series B: Psychological Sciences and Social Sciences* 65(3):390-399.

O'Rand, A.M. 2009. "Cumulative Processes in the Life Course." Pp. 121-140 in *The Craft of Life Course Research*, edited by G.H. Elder, Jr. and J.Z. Giele. New York: Guilford Press.

Opie, L. 2012. "Cancer and cardio vascular disease: more tightly linked than by chance." *Lancet Oncol* 13:518-527.

Orth-Gomer, K., S.P. Wamala, M. Horsten, K. Schenck-Gustafsson, N. Schneiderman, and M.A. Mittleman. 2000. "Marital stress worsens prognosis in women with coronary heart disease: The Stockholm Female Coronary Risk Study." *Jama* 284(23):3008-3014.

Pienta, A.M., M.D. Hayward, and K.R. Jenkins. 2000. "Health Consequences of Marriage for the Retirement Years." *Journal of Family Issues* 21(5): 559-586.

Prokos, A.H.and J.R. Keene. 2005. "The Long-Term Effects of Spousal Care Giving on Survivors' Well-Being in Widowhood*." *Social science quarterly* 86(3):664-682.

Proulx, C.M., H.M. Helms, and C. Buehler. 2007. "Marital Quality and Personal Well-Being: A Meta-Analysis." *Journal of Marriage and Family* 69(3):576-593.

Quinones, P.A., I. Kirchberger, M. Heier, B. Kuch, I. Trentinaglia, A. Mielck, A. Peters, W. von Scheidt, and C. Meisinger. 2014. "Marital status shows a strong protective effect on long-term mortality among first acute myocardial infarction-survivors with diagnosed hyperlipidemia–findings from the MONICA/KORA myocardial infarction registry." *BMC Public Health* 14(1):1.

RAND Center for the Study of Aging. 2014. "RAND HRS Data, Version N." Santa Monica, CA.

Randall, G., M.R. Bhattacharyya, and A. Steptoe. 2009. "Marital status and heart rate variability in patients with suspected coronary artery disease." *Annals of Behavioral Medicine* 38(2):115-123.

Rendall, M.S., M.M. Weden, M.M. Favreault, and H. Waldron. 2011. "The protective effect of marriage for survival: a review and update." *Demography* 48(2):481-506.

Robles, T.F.and J.K. Kiecolt-Glaser. 2003. "The physiology of marriage: Pathways to health." *Physiology & behavior* 79(3):409-416.

Robles, T.F., R.B. Slatcher, J.M. Trombello, and M.M. McGinn. 2014. "Marital Quality and Health: A Meta-Analytic Review." *Psychological bulletin* 140(1):140-187.

Rohrbaugh, M.J., J.A. Cranford, V. Shoham, J.M. Nicklas, J.S. Sonnega, and J.C. Coyne. 2002. "Couples coping with congestive heart failure: role and gender differences in psychological distress." *Journal of Family Psychology* 16(1):3.

Rohrbaugh, M.J., V. Shoham, and J.C. Coyne. 2006. "Effect of marital quality on eight-year survival of patients with heart failure." *The American journal of cardiology* 98(8):1069-1072.

Roijers, J., M. Sunamura, E.M. Utens, K. Dulfer, N. ter Hoeve, M. van Geffen, J. Draaijer, R. Steenaard, and R.T. van Domburg. 2016. "Marital quality and loneliness as predictors for subjective health status in cardiac rehabilitation patients following percutaneous coronary intervention." *European journal of preventive cardiology*:2047487316636259.

Rook, K.S.and L.A. Zettel. 2005. "The Purported Benefits of Marriage Viewed through the Lens of Physical Health." *Psychological Inquiry* 16(2/3): 116-121.

Rozanski, A. 2014. "Behavioral cardiology: current advances and future directions." *Journal of the American College of Cardiology* 64(1):100-110.

Sayers, S.L., B. Riegel, S. Pawlowski, J.C. Coyne, and F.F. Samaha. 2008. "Social support and self-care of patients with heart failure." *Annals of Behavioral Medicine* 35(1):70-79.

Simon, R.W. 2002. "Revisiting the Relationships among Gender, Marital Status, and Mental Health." *American Journal of Sociology* 107(4):1065-1096.

Smith, J., G. Fisher, L. Ryan, P. Clarke, J. House, and D. Weir. 2013. "Psychosocial and Lifestyle Questionnaire, 2006-2010: Documentation Report, Core Section LB." Pp. 1-62. Ann Arbor, MI: Survey Research Center, Univeristy of Michigan, Ann Arbor.

Trevino, D.B., E.H. Young, J. Groff, and R.T. Jono. 1990. "The association between marital adjustment and compliance with antihypertension regimens." *The Journal of the American Board of Family Practice* 3(1):17-25.

Trief, P.M., P.C. Morin, R. Izquierdo, J. Teresi, J. Starren, S. Shea, and R.S. Weinstock. 2006. "Marital quality and diabetes outcomes: The IDEATel Project." *Families, Systems, & Health* 24(3):318.

Umberson, D. 1987. "Family status and health behaviors: Social control as a dimension of social integration." *Journal of Health and Social Behavior* 28(3):306-319.

—. 1992. "Gender, marital status and the social control of health behavior." *Social Science & Medicine* 34(8):907-917.

Umberson, D.and J.K. Montez. 2010. "Social Relationships and Health A Flashpoint for Health Policy." *Journal of Health and Social Behavior* 51(Special Issue):S54-S66.

Umberson, D.and K. Williams. 2005. "Marital quality, health, and aging: Gender equity?" *The Journals of Gerontology Series B: Psychological Sciences and Social Sciences* 60(Special Issue 2):S109-S113.

Umberson, D., K. Williams, D.A. Powers, H. Liu, and B. Needham. 2006. "You make me sick: Marital quality and health over the life course." *Journal of Health and Social Behavior* 47(1):1-16.

Vaccarino, V., S.V. Kasl, J. Abramson, and H.M. Krumholz. 2001. "Depressive symptoms and risk of functional decline and death in patients with heart failure." *Journal of the American College of Cardiology* 38(1):199-205.

Valdimarsdóttir, U., Á.R. Helgason, C.-J. Fürst, J. Adolfsson, and G. Steineck. 2003. "Long-term effects of widowhood after terminal cancer: a Swedish nationwide follow-up." *Scandinavian journal of public health* 31(1):31-36.

Von Korff, M., W. Katon, E.H. Lin, G. Simon, E. Ludman, M. Oliver, P. Ciechanowski, C. Rutter, and T. Bush. 2005. "Potentially modifiable factors associated with disability among people with diabetes." *Psychosomatic medicine* 67(2):233-240.

Waite, L.J. 1995. "Does Marriage Matter?" *Demography* 32(4): 483-507.

Waite, L.J. 2009. "Marital history and well-being in later life." Pp. 691-704 in *International handbook of population aging*, edited by P. Uhlenberg. New York: Springer.

Waite, L.J.and M. Gallagher. 2000. *The case for marriage: Why married people are happier, healthier and better off financially?* New York: Doubleday Books.

Warner, D.F.and T.H. Brown. 2011. "Understanding how race/ethnicity and gender define age-trajectories of disability: An intersectionality approach." *Social Science & Medicine* 72(8):1236-1248.

Whisman, M.A.and L.A. Uebelacker. 2012. "A longitudinal investigation of marital adjustment as a risk factor for metabolic syndrome." *Health Psychology* 31(1):80.

Williams, K. 2003. "Has the future of marriage arrived? A contemporary examination of gender, marriage, and psychological well-being." *Journal of Health and Social Behavior*:470-487.

Williams, K.and D. Umberson. 2004. "Marital status, marital transitions, and health: A gendered life course perspective." *Journal of Health and Social Behavior* 45(1):81-98.

Wolff, J.L.and J.D. Kasper. 2006. "Caregivers of frail elders: Updating a national profile." *The Gerontologist* 46(3):344-356.

Wray, L.A., M.B. Ofstedal, K.M. Langa, and C.S. Blaum. 2005. "The effect of diabetes on disability in middle-aged and older adults." *The Journals of Gerontology Series A: Biological Sciences and Medical Sciences* 60(9):1206-1211.

Xu, J., S.L. Murphy, K.D. Kochanek, and B.A. Bastian. 2016. "National Vital Statistics Reports, Deaths: Final Data for 2013." Hyattsville, MD: National Center for Health Statistics.

Zhang, Z. 2006. "Marital History and the Burden of Cardiovascular Disease in Midlife." *The Gerontologist* 46(2): 266-270.

Zhang, Z.and M.D. Hayward. 2006. "Gender, the marital life course, and cardiovascular disease in late midlife." *Journal of Marriage and Family* 68(3):639-657.