Marital Disruption and Chronic Disease in Older Adults

by

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ABSTRACT

The beginning of the large Baby Boomer cohort's retirement, coupled with the increased divorce rate among older adults, means that there will be more single older adults than ever before beginning to consider living arrangements and long-term care needs as they age. Using a cumulative (dis)advantage framework and logistic regression, this research examines whether marital disruption and social support at Wave 1 increase the odds of having a specific chronic disease at Wave 2, diabetes, heart failure, and hypertension. The sample consists of 2,261 adults age 57-85 who participated in the first two waves of the National Social Life, Health, and Aging Project (NSHAP). Being female and having more positive social support reduced the odds of having diabetes at Wave 2. Being older at Wave 1 increased the odds of having congestive heart failure at Wave 2. Being black and having a happy family life in childhood increased the odds of having hypertension at Wave 2. Suggestions for increasing positive social support are discussed, along with implications for long-term care and health education.

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* It seems appropriate to give a nod to HRC since I passed my dissertation defense on Election Day 2016.

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CHAPTER 1

INTRODUCTION

The aim of this research is to determine whether marital disruption is associated with specific chronic health conditions in older adults. This research is important for three reasons. First, the proportion of divorced adults age 50 and over in the US is higher than ever before (Brown and Lin 2012). Among the elderly, the proportion of widows and widowers is higher than other age groups. The beginning of the large Baby Boomer cohort's retirement, coupled with the increased divorce rate among older adults, means that there will be more single older adults than ever before beginning to consider living arrangements and long-term care needs as they age. It is important to examine whether marital disruption impacts chronic health conditions as this cohort begins to use Medicare.

The second reason relates to health research using the cumulative (dis)advantage theory (Dannefer 2003). An individual's marital status and experiences of marital disruption impact health through social support, economic factors, and stress. While there are advantages to being married, the disruption of that marriage through divorce or the death of a spouse can have negative consequences that impact health. The theoretical framework I use to examine this effect is the cumulative advantage/disadvantage theory (CAD). This theory maintains that the effects of life events and circumstances, as well as individual statuses, accumulate over time, so that at older ages, people who started out with more advantages have continued to acquire more advantages over their lifetimes (Zimmermann, Stuckelberger and Meyer 2006). The opposite effect occurs for people who have fewer advantages earlier in life—they don't acquire advantages like their more-

advantaged counterparts (Zimmermann, Stuckelberger and Meyer 2006). At older ages, the gap between the advantaged and disadvantaged is wider than at younger ages (Seabrook and Avison 2012, Zimmermann, Stuckelberger and Meyer 2006). Much research using the CAD framework examines the impact of events occurring during childhood on adult economic situations, adult health, and other adult outcomes (DiPrete and Eirich 2006, O'Rand and Hamil-Luker 2005). Life events occurring in adulthood as predictors of later life circumstances need to be researched using CAD (Seabrook and Avison 2012). There is relatively little research using CAD to examine the effects of divorce or widowhood on health in later life. This research aims to begin filling these gaps by examining marital disruption occurring in adulthood and its impact on chronic disease in later life.

I extend the work in the area of marital biography and health by using CAD; furthermore, I examine three chronic physical health conditions. Other researchers have explored the associations between marital biography and specific conditions, such as cardiovascular disease (e.g. McFarland, Hayward and Brown 2013, Zhang and Hayward 2006), but much of the research in this area looks at the impact of marital biography on mortality, mental health, or more general indicators of health, such as self-rated health (Dupre, Beck and Meadows 2009, Hughes and Waite 2009). Looking at specific outcomes can show differences and similarities between specific conditions, and may provide valuable insights for groups providing support to older populations. Furthermore, health education efforts can be targeted to specific disease populations, individuals who have experienced marital disruption, and older adults.

To explain this research, in chapter 2, I present the background relevant to this analysis and the theoretical framework, ending with hypotheses. Chapter 3 presents detailed information on methodological and statistical considerations. Results of the analyses make up the next three chapters, and finally, chapter 7 is a discussion of the results. The rest of this chapter briefly describes the content of subsequent chapters.

Chapter 2 defines marital biography and marital disruption, and considers ways that the consequences of divorce and widowhood impact chronic disease. The cumulative (dis)advantage theory is presented as a framework for understanding marital disruption and health. Three chronic health conditions are discussed: diabetes, heart failure, and hypertension. Gender differences are considered throughout, and hypotheses are presented.

Chapter 3 presents all the methodological considerations, describing the National Social Life, Health, and Aging Project (NSHAP) dataset, variable selection and coding, and statistical analysis.

Chapter 4 presents the results of the analysis of marital disruption prior to Wave 1 predicting diabetes status in Wave 2. Chapter 5 presents the results of the analysis of marital disruption prior to Wave 1 predicting heart failure status in Wave 2. Chapter 6 presents the results of the analysis of marital disruption prior to Wave 1 predicting hypertension status in Wave 2.

Chapter 7 is a discussion of the research and results. The implications and limitations of this research are considered. As I worked on this dissertation, I thought of numerous questions I wanted to explore using the NSHAP data; chapter 7 concludes with next steps and future avenues of research.

CHAPTER 2

BACKGROUND AND THEORETICAL FRAMEWORK

The aim of this research is to determine whether chronic health conditions in later life are associated with marital disruption. Changes in marital status through divorce or the death of a spouse impact the development of chronic diseases (Hughes and Waite 2009). Marital disruption also impacts economic status and social support, which are in turn related to health (Amato 2014). Marital status itself is related to health outcomes such as self-rated health (Liu and Umberson 2008), mortality (Lillard and Waite 1995), and cardiovascular health (McFarland, Hayward and Brown 2013). Given the shifts in marital status in older adults and the high prevalence of diabetes, heart disease, and hypertension, research is needed to examine disruptions to marriage that may impact chronic health conditions and their treatment. As the population continues to age, it is important to better understand chronic health conditions and how they impact health care and housing decisions related to older adults.

Marital Biography

The concept of marital biography, which includes an individual's transitions into and out of marriage and the ages at which they occur, gives a comprehensive account of different marital statuses and duration of statuses for an individual (Hughes and Waite 2009). Marital biography and health are related in two ways—through status effects and transition effects (Hughes and Waite 2009). Status effects are the costs or benefits received from being in a particular marital status for a particular length of time. For example, in general, married people live longer, have better mental health and greater overall happiness, and make more money than the unmarried (Waite and Lehrer 2003).

Transition effects are more likely to be the negative impacts associated with being divorced or widowed. These can include a lower standard of living, moving to a different residence or neighborhood, and arranging childcare (Amato 2014). The effects of marital biography are a combination of status effects and transition effects, and these effects accumulate over time (Hughes and Waite 2009:346-7). The following paragraph describes the financial and social effects associated with marital status and marital disruption.

In this study, marital disruption is defined as divorce or death of a spouse. Divorce may have a variety of negative consequences as well as the loss of the benefits of marriage (Amato 2014). Divorce impacts financial status. Household income is higher for married persons. Not only is there potential for two incomes, but living expenses are usually shared, so experiencing a divorce or death of a spouse can have a negative impact. Women, especially, experience significant decreases in economic well-being after divorce (Ross, Mirowsky and Goldsteen 1990). Five years after divorce most women are still well below the financial level they were when married (Holden and Smock 1991). Similarly, women who are widowed experience a substantial reduction in economic well-being when compared to men, who experience little or no decline (Holden and Smock 1991). Pension and Social Security benefits for widows are often lower or have age restrictions which delay distribution of benefits (Holden and Smock 1991). Often, insurance coverage on husbands is not adequate to meet the economic needs of widows (Holden and Smock 1991). Five years after being widowed, women are still facing reduced economic circumstances (Holden and Smock 1991). Whether divorced or widowed, part of this is explained by the wage gap between men and women, women

taking more responsibility for caring for children and the home, and reduced retirement benefits due to time out of the workforce for childbirth (Holden and Smock 1991). Social relationships change following divorce and widowhood; a single person may be left out of social events that usually involve couples. Divorced and widowed individuals can lose friendship and support from in-laws and other family members of the spouse. The benefits of marriage, including companionship and emotional support, are lost after marital disruption.

Cumulative (Dis)advantage Theory

One theory that explains this accumulation of the consequences of marital disruption over time is the cumulative disadvantage theory, also known as the cumulative advantage theory. (Hereafter, I will refer to the cumulative (dis)advantage theory as CAD.) The theory maintains that individuals who have fewer advantages early in life will continue to fall further behind, while individuals that have more advantages early in life will continue to gain advantages (Seabrook and Avison 2012). With age, the disparity between the haves and the have-nots increases (Seabrook and Avison 2012, Zimmermann, Stuckelberger and Meyer 2006). Socioeconomic and educational advantages early in life impact health throughout the life course, with better health outcomes for more advantaged groups later in life (O'Rand and Hamil-Luker 2005). The differences can be accounted for by differing exposure to risk factors and access to resources that can prevent disease or detect disease earlier (Seabrook and Avison 2012). The changes in economic well-being and social connections are part of a process of change that occurs for months and years after divorce occurs (Amato 2014). The longer period of change with diminished financial circumstances and reduced social connection

results in a period of cumulative chronic stress, which is associated with increased physical illness (Lorenz et al. 2006). Although self-rated health declines with age, chronic stressors exacerbate this decline, and seem to affect older individuals more than younger individuals (Umberson et al. 2006). Cumulative disadvantage may account for some of this effect; lowered immune function and increased prevalence of chronic conditions may make older individuals more susceptible to the stresses of negative marital experiences (Umberson et al. 2006).

Chronic Disease

Outcome variables for this research are whether the respondent has one of three specific chronic diseases, diabetes, heart failure, and hypertension. These are common conditions that have a great impact on quality of life and may lead to premature death. Treatment for all three diseases includes making lifestyle changes—eating healthfully and exercising regularly. As the next section explains, marital status influences lifestyle choices and changes.

Diabetes. When someone has diabetes, they have high blood glucose levels, which can be caused by the body not producing enough insulin or not making good use of the insulin it produces (Centers for Disease Control and Prevention 2011). Over a quarter of individuals age 65 and over in the United States have diabetes, the seventh leading cause of death in the United States (Centers for Disease Control and Prevention 2014a). About 90 to 95 percent of adults with diabetes have type 2 diabetes. Risk factors for Type 2 diabetes include being overweight or obese, older age, inactivity, a family history of diabetes, history of gestational diabetes, and race/ethnicity (Centers for Disease Control and Prevention 2011). African Americans, Hispanics, Native Americans, and some

Asian/Pacific Islanders are at higher risk for diabetes than Whites (Centers for Disease Control and Prevention 2011). Diabetes can have serious health consequences, such as heart disease, kidney disease, blindness, and lower-extremity amputations (Centers for Disease Control and Prevention 2011). Having diabetes puts an individual at twice the risk for death as someone of a similar age without diabetes (Centers for Disease Control and Prevention 2011).

Diabetes is a chronic metabolic disease that requires lifelong treatment consisting of self-care and self-monitoring by the patient as well as monitoring by physicians for conditions related to diabetes (Centers for Disease Control and Prevention 2014a). Individuals who have diabetes must monitor their blood glucose levels daily at home and have their blood tested on a regular basis to monitor average blood glucose levels (Centers for Disease Control and Prevention 2014a). Annual eye exams are recommended (Centers for Disease Control and Prevention 2014a). Diabetic patients must be careful not to injure their feet and are advised to check their feet daily (Centers for Disease Control and Prevention 2014a). While treatment for diabetes can include insulin or medication, individuals who are diagnosed with diabetes are encouraged to adopt healthy behaviors—eating a healthy diet and exercising (Centers for Disease Control and Prevention 2011). For some patients, blood glucose levels can be controlled through diet and exercise alone. Losing weight and increasing physical activity can also prevent or delay Type 2 diabetes (Centers for Disease Control and Prevention 2011).

In this research, respondents who have the condition at Wave 2 but not at Wave 1 will very likely have Type 2 diabetes rather than Type 1 diabetes. Differences between Type 1 and Type 2 diabetes are explained by the Centers for Disease Control and

Prevention (2014a). Type 1 diabetes used to be called juvenile-onset diabetes because it is often diagnosed in the mid-teens. Individuals who have Type 1 diabetes must use insulin to control the disease due to damage to beta cells in the pancreas that produce insulin. About 5 percent of adults in the United States who have diabetes have Type 1 (Centers for Disease Control and Prevention 2014a). In contrast, Type 2 diabetes used to be called adult-onset diabetes because it is usually diagnosed later than Type 1. Usually individuals first become resistant to insulin, meaning that their body is not using insulin properly. While an appropriate diet and exercise, along with medication can control blood glucose levels for some patients, others with Type 2 diabetes may eventually need insulin to control the disease (Centers for Disease Control and Prevention 2014a).

Heart failure. Also called congestive heart failure or cardiac failure, heart failure means that the heart is not pumping enough blood (not that the heart is not beating). Heart failure causes fluid to build up in the body, resulting in symptoms including trouble breathing and shortness of breath, fatigue, swelling in feet, ankles, legs, and abdomen, weight gain, frequent urination, and cough (National Heart 2015). Heart failure is common is the United States; about 5.7 million adults have it (Centers for Disease Control and Prevention 2016a). Heart failure is more common in people age 65 and over, and people who are overweight or have had a heart attack. Heart failure is more common in blacks than other races (National Heart 2015). Risk factors for heart failure are coronary heart disease (plaque buildup in coronary arteries), hypertension, diabetes, smoking, inactivity, obesity, and a diet high in fat, cholesterol, and salt (Centers for Disease Control and Prevention 2016a). Treatment for heart failure includes treating related conditions such as diabetes and hypertension, eating healthfully, engaging in

physical activity, losing weight, and quitting smoking (Centers for Disease Control and Prevention 2016a). Various types of medication may be prescribed for heart failure and surgery is sometimes performed (Centers for Disease Control and Prevention 2016a). Heart failure may reduce quality of life as patients find it harder to perform activities of daily living due to shortness of breath and fatigue (Centers for Disease Control and Prevention 2016a).

Hypertension. High blood pressure is very common; about one-third of adults in the United States have hypertension (Centers for Disease Control and Prevention 2016b). When considering all adult age groups, the hypertension rate is about the same for men and women, but over age 65 it is more common in women; 69 percent of women age 65-74 compared to 64.0 percent of men have hypertension (Yoon et al. 2012). The difference is even greater in the 75 and older age range—78.5 percent of women have hypertension, compared to only 66.7 percent of men (Yoon et al. 2012). Hypertension is more common in blacks than whites and less common in Mexican Americans than whites (Yoon et al. 2012). Hypertension in blacks and Mexican Americans is slightly more common in women than men (Yoon et al. 2012). Risk factors for hypertension are diabetes, diet high in sodium or low in potassium, physical inactivity, obesity, alcohol use, tobacco use, older age, and genetics. Blacks are more likely to have hypertension and develop it at an earlier age (Centers for Disease Control and Prevention 2014b).

Hypertension generally has no symptoms, but if left untreated, can have serious consequences, including heart disease (including heart failure), stroke, kidney damage, vision loss, erectile dysfunction, and memory loss (American Heart Association 2016). Treatment for hypertension includes eating a healthy diet, physical activity, reducing salt

intake, losing weight if needed, quitting smoking, and reducing stress. Medication is also prescribed to some patients (American Heart Association 2016).

Diabetes, heart failure, and hypertension are clearly interrelated. In adults diagnosed with diabetes, 71 percent have high blood pressure or use medication to lower blood pressure (Centers for Disease Control and Prevention 2014a). The death rate for cardiovascular disease is about 1.7 times higher for people who have been diagnosed with diabetes than people who have not been diagnosed with diabetes (Centers for Disease Control and Prevention 2014a). Both diabetes and hypertension can damage the heart and cause heart failure (Centers for Disease Control and Prevention 2016a). Untreated hypertension can lead to several types of heart disease including heart failure (American Heart Association 2016).

Marital Biography and Health

The link between marriage and better health is well established. Married people generally experience better overall physical and mental health and lower mortality than those who are divorced, separated, widowed, or never married (Ross, Mirowsky and Goldsteen 1990).

Gender differences. Men have more protective benefits from marriage than women regarding death, physical health, and psychological well-being (Ross, Mirowsky and Goldsteen 1990). Zhang and Hayward explored differences in cardiovascular health for men and women with different marital biographies (2006). Women who experience a marital loss are at higher risk of developing cardiovascular disease. Men who remarry have lower risk of heart disease than continuously married men. Never married men and women have similar or better cardiovascular health than continuously married men and

women (Zhang and Hayward 2006). The self-rated health of formerly-married individuals worsened since the 1970s compared to married individuals, with wider disparities for women than for men (Liu and Umberson 2008). Some of the gender differences in health are explained by women's healthier lifestyles; in addition, wives may discourage husbands from drinking and smoking, provide healthier meals, and make medical appointments for their husbands (Ross, Mirowsky and Goldsteen 1990). The economic and social consequences of marital disruption are more severe for women than men, limiting their access to protective resources. Thus I expect that women will have higher risk for chronic diseases than men.

Marital disruption. Differences in self-rated health associated with different marital statuses seem to reflect the stresses of divorce and widowhood more than the protective benefits of marriage (Williams and Umberson 2004). Marital disruption affects health even years later, especially for chronic conditions that develop slowly and for mobility limitations, while depressive symptoms are more reflective of current marital status (Hughes and Waite 2009). More specifically, women who experience a divorce, whether they remarry or not, are at higher risk for cardiovascular disease in late middle age (Zhang and Hayward 2006), and widowed men are at higher risk for Type 2 diabetes (Cornelis et al. 2014).

Social support. When an individual feels better after talking over a problem with a supportive friend or family member, this is positive social support. Sharing positive events with others increases well-being (Gable et al. 2004). When others react in a positive manner to sharing, the effects are enhanced; marital satisfaction increases with

positive sharing and positive responses (Gable et al. 2004). On the other hand, the listener may be critical, which may negatively impact health outcomes.

Social support in marriage improves health in several ways (Ross, Mirowsky and Goldsteen 1990). The first way is by providing emotional and instrumental support—having someone to share joys and concerns, as well as household chores. The second way is by reinforcing protective behaviors, or alternatively reducing risky health behaviors. A third way that social support in marriage benefits health is by providing help during recovery from illness (Ross, Mirowsky and Goldsteen 1990). Unmarried patients were more likely to die following cardiac surgery, being 233 percent more likely to die in the three months after surgery than married patients, and 71 percent more likely to die in the 5 years after surgery than married patients (Idler, Boulifard and Contrada 2012). Conversely, loss of social support from a spouse can negatively impact health. The hospitalization or death of a spouse is associated with a higher risk of death for men and women; the authors relate this to initial stress and delayed reaction to loss of social support (Christakis and Allison 2006).

Social support can come from friends or other family members, but positive support from a co-resident spouse or partner may be especially important. Part of the recommended treatment for the three chronic diseases is eating healthfully and engaging in physical activity. However, these health behaviors are also recommended to prevent the diseases. This study looks at whether marital disruption is associated with developing chronic diseases, not treating them. One aspect of social support in marriage is reinforcing protective behaviors, or alternatively reducing risky behaviors. Married people are less likely to smoke, drink heavily, and engage in other behaviors harmful to

health compared to the non-married (Ross, Mirowsky and Goldsteen 1990). People who are beginning to show symptoms of heart failure may have difficulty maintaining a healthy diet and engaging in physical activity due to the shortness of breath and fatigue that are symptomatic of the disease. A supportive spouse or partner could help with shopping and preparing fresh foods, and be an exercise partner. Similarly, someone diagnosed with prediabetes or prehypertension could delay or prevent the disease through health behaviors. This type of support is more likely from a spouse or partner who lives in the same residence than a friend or family member not living in the same residence.

To summarize, marital status is associated with various aspects of health. In this study, I look at marital disruption and its association with three specific conditions: diabetes, heart failure, and hypertension. Treatments for each of these chronic health conditions includes eating healthfully and engaging in physical activity. Furthermore, failure to engage in these health behaviors increases the risk of getting the disease. Social support benefits within marriage can help protect married individuals from developing chronic disease by means of social control of health behaviors. Experiencing divorce or widowhood not only has short-term stress impacts on health, but also has reduced protective benefits of marriage through social control of health behaviors.

Hypotheses

For the three aspects of my dissertation research, I look at the impact of marital disruption measured at Wave 1 on chronic disease status at Wave 2. Specific chronic diseases are diabetes, heart failure, and hypertension, with separate analyses for each condition. Although these diseases are different, the mechanisms of social support and

health behaviors impact them in similar ways, so I predict the outcomes will be the same for all three chronic conditions.

Hypothesis 1: Individuals with a previous history of marital disruption at Wave 1 will have higher odds of having chronic disease at Wave 2.

Hypothesis 2: Individuals who have higher levels of positive social support at Wave 1 will have lower odds of having chronic disease at Wave 2.

Hypothesis 3: Women with a previous history of marital disruption at Wave 1 will have higher odds of having chronic disease at Wave 2 compared to men.

CHAPTER 3

METHODOLOGY

This research uses data from the National Social Life, Health, and Aging Project (NSHAP), collected by the National Opinion Research Center (NORC) at the University of Chicago. NSHAP is a longitudinal study on older community-dwelling adults in the United States, focusing on health, social factors, and relationships. Respondents were interviewed in two waves five years apart. The following sections include descriptions of the sampling, data collection, sample population, statistical plan, and variables used in the analyses.

Sampling

NSHAP uses a complex sampling design. The Health and Retirement Survey (HRS) was screening for a new panel, and to share costs, the NSHAP screening process was combined and conducted by HRS in 2004. There was no overlap in age between HRS and NSHAP sampling frames. Potential NSHAP respondents were recruited from the resulting sampling frame (O'Muircheartaigh, Eckman and Smith 2009).

In Wave 1, a multistage area probability sample used two geographic area stages (large and then small), a household stage, and individual stage to select respondents for a nationally representative sample of adults age 57-85 years living in the community. The sample was balanced by sex and three age groups; African Americans and Latinos were oversampled. Sample size for Wave 1 was 3,005 with an overall response rate of 75.5 percent (O'Muircheartaigh, Eckman and Smith 2009). Wave 1 interviewed only one person from each household. The age restriction (born in 1920-1947) for the Wave 1 sample was not maintained for the spouses or partners recruited in Wave 2; partners had

to be over age 18. Along with returning respondents from Wave 1, 3337 interviews were conducted for Wave 2, with an unconditional response rate of 74 percent (NORC n.d.).

Data Collection

Trained NORC interviewers visited the homes of respondents and administered questionnaires (including computer-assisted personal interview [CAPI] items), collected biospecimens, took measures such as weight, height, and blood pressure, and left behind a mail-in questionnaire. Interviews were conducted in English and Spanish. The weighted sample response rate for the in-home interview was 75.5 percent (Waite et al. 2014b). For Wave 1, respondents were randomly selected to follow one of six interview paths, designed to administer some, but not all, of the interview questions and biomeasures to each respondent. All respondents were asked a core group of questions: demographic characteristics, social network roster, social support from spouse/partner, romantic partnerships, physical health, mental health, employment and finances, religious preference, and medications. Data about sexual activity were collected in a self-administered questionnaire. A core group of biomarker data was also collected at home interviews: weight, height, waist circumference, blood pressure, saliva, vaginal swab for females, and sensory function (Waite et al. 2014b).

Some items were administered in the in-home interview to some respondents, but asked of other respondents in the leave-behind questionnaire. For example, while all respondents were asked about social support from *partners* in the in-home interview, only those in paths 1-4 were asked about social support from *family and friends* in the in-home interview. Paths 5 and 6 were asked about support from family and friends in the leave-behind questionnaire. Items such as these were clearly marked in the codebook.

Results from the in-home interview and the leave-behind questionnaire were combined in the dataset.

Other items were only asked in the leave-behind questionnaire, including social activities, bereavement, caregiving, neighborhood context, sexual attitudes, military service, jail time, HIV, alcoholism, health insurance, and political affiliation. These items were included on all leave-behind questionnaires. Response rate for the leave-behind questionnaire was 84 percent (Waite et al. 2014b).

In Wave 2, items were asked either during the in-home interview *or* the leave-behind questionnaire. That is, none of the items were administered partly in the in-home interview/partly in the leave-behind questionnaire (Waite et al. 2014a).

Sample Population

The sample population includes the 2,261 respondents who participated in the survey in both waves. The size of the sample population varies for each analysis, based on two methodological considerations. First, I dropped cases with missing data for the dependent variables. For example, eight respondents who were missing data for diabetes status in either wave were dropped from that analysis. In addition, only respondents who had *not* been told they had diabetes at Wave 1 were retained for that analysis; likewise, respondents who had never been married were removed from the analysis because they are not at risk for experiencing marital disruption. I used listwise deletion for regression analyses. To maintain the same sample size for all analyses for a particular dependent variable, I removed all cases that had missing values on any of the variables. The same conditions were applied to the analyses for heart failure and hypertension. The smaller samples for the three analyses are described in the respective results chapters.

Demographic characteristics of the sample population are shown in Table 1. The average age is 68 years, ranging from 57 to 85 years. Over half (52.4 percent) of the sample is female. Most are white (70.9 percent), and 16.6 percent are black, 10.3 percent are non-black Hispanic, and 2.3 percent are another race. More than half of the sample has at least some college education, one-fourth graduated from high school or equivalent, and 20.2 percent had less than high school. Household income from the year prior to Wave 1 had the most respondents reporting less than $25,000 (29.3 percent), followed by more than $25,000 to less than $50,000 (27.3 percent), $50,000 to $100,000 (23.4 percent), and more than $100,000 reported by 11.5 percent. About 8 percent of the respondents did not give any information about household income.

One-third of respondents had experienced divorce at Wave 1, and one-fourth had experienced death of a spouse. Just over half of respondents had ever experienced either divorce or widowhood (51.8 percent); some had experienced both divorce and widowhood. Current marital status at Wave 1 showed most respondents married (63.4 percent), followed by widowed (18.8 percent), divorced (10.8 percent), never married (3.1 percent), cohabiting (2.1 percent), and separated (1.6 percent).

At Wave 1, 19.7% of respondents had been told by a doctor that they have diabetes; at Wave 2, this had increased to 23.9 percent. At Wave 1, 6.9% of respondents had been told by a doctor that they have heart failure; at Wave 2, this had decreased to 4.9 percent. At Wave 1, 56.7% of respondents had been told by a doctor that they have hypertension; at Wave 2, this had increased to 60.7 percent.

Table 1. Descriptive Statistics for Sample Population (N = 2261)

Variable	Percentage	Mean	Range
Age at W1		68	57-85
Female	52.1		
Ever divorced at W1	33.4		
Ever widowed at W1	24.1		
Ever divorced/widowed at W1	51.8		
Total positive social support		13.7	6-18
Marital status at W1*			
Married	63.4		
Cohabiting	2.1		
Separated	1.6		
Divorced	10.8		
Widowed	18.8		
Never married	3.1		
Race			
White	70.9		
Black	16.6		
Hispanic, non-black	10.3		
Other race	2.3		
Education			
Less than high school	20.2		
High school or equivalent	25.1		
Some college, vocational, assoc.	30.5		
Bachelor's or higher	24.2		
Household income previous year*			
Less than $25K	29.3		
>= $25K and < 50K	27.3		
$50K to 100K	23.4		
More than $100K	11.5		
Missing	7.9		
Family average/well off age 6-16	44.7		
Family life happy age 6-16	63.3		
Diabetes status W1	19.7		
Diabetes status W2	23.9		
Heart failure status W1	6.9		
Heart failure status W2	4.9		
Hypertension status W1	56.7		
Hypertension status W2	60.7		

Statistical Plan

To examine the effects of marital disruption on health status changes between waves 1 and 2, I used logistic regression. Details for all recoding are presented in the following section.

I used SAS 9.3 for all analyses. The sample population includes only respondents who participated in both wave 1 and wave 2. Wave 1 interviewed only one person from each household. In the second wave, partners of wave 1 respondents living in the same household were recruited, and an effort was made to recruit people who were eligible for wave 1 but did not participate. Thus, wave 2 had more respondents than wave 1, so I chose to use the weights from wave 1 because it is closer to my sample population (Waite et al. 2014a).

Before beginning this study, I obtained expedited approval for research using secondary data from the Institutional Review Board (IRB) at Arizona State University (ASU). Appendix A is the approval letter. Next I submitted the IRB approval letter, a data protection plan, and the signed data use agreement to the National Archive of Computerized Data on Aging at the Inter-university Consortium for Political and Social Research (ICPSR) at the University of Michigan. Appendix B is the data protection plan. After receiving approval to securely download the data files, I made arrangements for a VPN connection to a secure folder at ASU. I received the Wave 1 data files in May 2013 and the Wave 2 data files in February 2015.

Variables

I control for social variables in the model. Female is coded 1 for female and 0 for male. Race has four dummy variables: black, Hispanic (non-black), and other race, with

white as the reference. Educational attainment at Wave 1 has four dummy variables: less than high school, some college/vocational certificate/associate's degree, bachelor's degree or higher, with high school or equivalent as the reference. Age at Wave 1 is a continuous variable included to control for the age of the respondent, which is a factor related to health in older age groups. Household income at Wave 1 is created by combining responses to the questions asked n the Wave 1 questionnaire. Respondents were first asked to report actual household income from the previous year in dollars from all sources, excluding interest, dividends, and gifts. Given the sensitivity of the question, if respondents reported that they did not know or refused to answer, they were asked if their income was more than $50K, about $50K, or less than $50K. Respondents who answered less than $50K were next asked if their income was more than $25K, about $25K, or less than $25K. Respondents who answered more than $50K were next asked if their income was more than $100K, about $100K, or less than $100K. Respondents who refused to answer or didn't know whether their income was more or less than $50K were not asked further questions. Using data from these four variables, I recoded household income into four dummy variables: less than $25K, $25K-49K, and $50K-99K with $100K and above as the reference. The number of missing values for household income was substantially reduced.

Based on the CAD theory, I include two variables to account for effects of childhood economic conditions and happiness of family life in childhood. These two family background questions were included in the leave-behind questionnaire in Wave 2. Although they were not measured at Wave 1, they are retrospective and precede Wave 1. The first item asks "During the time from about age 6 to age 16, would you say your

family was very well off financially, fairly well off, about average, not so well off, or not well off at all?" Answer categories were collapsed to create a dichotomous variable indicating family average or well off from age 6-16. A value of 1 = average, fairly well off, or very well off. A value of 0 = not so well off or not well off at all. The second item asked respondents "How much do you agree with the statement: 'When I was growing up, my family life was always happy'" (Waite et al. 2014a). I collapsed the six answer categories so that a value of 1 indicates a happy family life (I agree a little, I agree pretty much, I agree very much). A value of 0 was assigned to respondents who disagreed with the statement a little, pretty much, or very much.

Even though respondents may have experienced marital disruption, they could have remarried, so marital status at Wave 1 is included in the models to control for its effect on health status. I created a set of dummy variables with Married as the reference category. I coded the remaining categories as follows: Divorced, Widowed, and Other, which includes cohabiting and separated marital statuses that make up a small proportion of the sample population.

I am primarily interested in the effect of marital disruption on health in later life. NSHAP collected a wealth of data about marital history, so I created a marital disruption variable which allows me to look at the effect of experiencing marital disruption before Wave 1.

Ever Widowed is a dichotomous variable indicating whether a respondent has ever experienced death of a spouse at wave 1. Ever Divorced is a dichotomous variable indicating whether a respondent has ever experienced divorce at wave 1. A value of 1 indicates the respondent has been divorced or widowed, while a value of 0 indicates the

respondent has not been divorced or widowed. These variables were combined to create a variable indicating Ever Divorced/Widowed at Wave 1.

NSHAP collects information about social support from respondents about three different types of people: spouse or intimate partner, family, and friends. I want to capture the total amount of positive support respondents received from spouse/partner, family, and friends. Some respondents did not have a spouse or partner, which means that they do not have support of any kind from a spouse or partner. The situation is similar for respondents who do not have family or friends; they are lacking support (positive or negative) from family or from friends.

The questionnaire asks four questions ask about different types of support the respondent receives from a specific partner:

How often can you open up to [name] if you need to talk about your worries?

Would you say hardly ever, some of the time, or often?

How often can you rely on [name] for help if you have a problem?

How often does [name] make too many demands on you?

How often does [name] criticize you?

The four questions are repeated for family members and friends. In Wave 1, the answer categories for all questions were hardly ever (or never) (coded as 1), some of the time (coded as 2), and often (coded as 3). When applicable, the question was clear that family member does not include spouse.

When asked how often they could open up to spouse/partner, family, or friends, if the respondent volunteered that they had no spouse/partner, family, or friends, the

subsequent questions about social support for that source of support were skipped. For those cases, I coded responses for those items as 1 (hardly ever or never).

The first two questions, opening up to another person to talk about worries and relying on another person when one has a problem, indicate positive social support. The last two questions, making too many demands and criticizing, indicate negative social support. However, reverse coding the negative items does not necessarily increase positive support. For example, when respondents say that family members criticize them hardly ever/never, it means just that—no criticism. It does not mean that family members compliment them on hosting a great family dinner or thank them for taking out the trash. With the wording of the questions, I can't infer positive social support from reverse coding negative support. Positive and negative social support as measured here are qualitatively different, so it is not appropriate to combine them quantitatively. Thus, I chose not to use the negative social support variables.

To create a score for total positive social support from all three sources, I summed the two positive support variables together for spouse/partner, the two positive support variables for family, and the two positive support variables for friends. I did not average positive support across all three potential sources of support. Adding them together gives a better indication of the total level of support by taking into consideration that not all respondents are married, have family, or have friends. The range for total positive social support is 6-18.

The response category indicating the lowest level of social support measured at Wave 1 is "hardly ever (or never)" (coded as 1). The coding reflects the fact that the lowest category is a combination of two answers and not a true zero. It's not entirely

"never" and not entirely "hardly ever". In Wave 2, this is replaced by never (coded as 0) and hardly ever (coded as 1). However, for Wave 1, I decided to code the lowest category as 1. Although for some respondents it would be more accurate to have the option to indicate "never" with a value of zero, these data were not available in Wave 1.

The three analyses use the same independent variables and three different dependent variables: diabetes status at wave 2, heart failure status at wave 2, and hypertension status at wave 2. Respondents with missing values for dependent variables were dropped from that particular analysis.

The dependent variable in the first analysis is a self-report item asking whether respondents have ever been told by a doctor that they have diabetes or high blood sugar. The variable is coded so that 1 means respondents have been told they have diabetes and 0 means that the respondents have not been told they have diabetes.

For the second analysis, the dependent variable is a dichotomous variable indicating whether respondents have ever been told by a doctor that they have congestive heart failure. The variable is coded so that 1 means respondents have been told they have heart failure and 0 means that the respondents have not been told they have congestive heart failure. The wording of the questions was slightly different in wave 2 compared to wave 1. The wave 1 question was "Have you ever been treated for heart failure? (PROMPT: You may have been short of breath and the doctor may have told you that you had fluid in your lungs or that your heart was not pumping well.)" In wave 2, respondents were asked, "Has a doctor ever told you that you had congestive heart failure or CHF?" While the wording is not identical, the congestive heart failure variable is more symptom-specific in wave 1 and depends more on the named diagnosis in wave 2. The

wave 2 codebook references the variable in wave 1 for comparison. However, 6.9 percent of respondents reported having been treated for heart failure at Wave 1, while at Wave 2 only 4.9 percent of respondents reported that a doctor told them they have CHF. This unexpected reduction in the percentage of respondents who have heart failure may be explained in part by the different wording of the questions at Wave 1 and Wave 2. The only cure for heart failure is a heart transplant. The NSHAP survey does not ask about transplants, although it is unlikely that the 98 respondents who had heart failure at Wave 1 but not at Wave 2 also underwent heart transplants. It is possible that some respondents who said they had heart failure at Wave 1 did not actually have it. The symptoms specified in the questionnaire could have led some respondents to answer in the affirmative even if they actually had another type of heart disease. Although this anomaly reduces the number of cases in the analysis, these cases would not affect the outcome because they did not have heart failure at Wave 2, which is the dependent variable.

In the third analysis, the dependent variable is a self-report item asking whether respondents have ever been told by a doctor that they have high blood pressure or hypertension. The variable is coded so that 1 means respondents have been told they have hypertension and 0 means that respondents have not been told they have hypertension.

Summary

This dissertation looks at three specific chronic medical conditions—diabetes, heart failure, and hypertension—and asks if previous marital disruption affects the odds of having any of those diseases in later life. This chapter presented information about the data, decisions about how to use the data, and the statistical techniques used for the analyses. The next three chapters present the results.

CHAPTER 4

MARITAL DISRUPTION AND DIABETES IN OLDER ADULTS

This chapter presents the results of the analysis of marital disruption and diabetes status. I used two waves of data from the National Social Life, Health, and Aging Project (NSHAP), collected in 2005-6 and 2010-11. For this analysis, I look at the impact of marital disruption measured at Wave 1 on diabetes status at Wave 2. Using the cumulative (dis)advantage framework, I predict that the disadvantages experienced after divorce will continue to accumulate over time and have negative consequences for diabetes status in later life. I include a second important explanatory variable in the models, positive social support, which I predict will have a protective effect on respondents; those with higher levels of positive social support at Wave 1 will have lower odds of having diabetes at Wave 2.

Hypothesis 1: Individuals with a previous history of marital disruption at Wave 1 will have higher odds of having diabetes at Wave 2.

Hypothesis 2: Individuals who have higher levels of positive social support at Wave 1 will have lower odds of having diabetes at Wave 2.

Hypothesis 3: Women with a previous history of marital disruption at Wave 1 will have higher odds of having diabetes at Wave 2 compared to men.

I used a subset of the sample population, respondents who stated at Wave 1 that a doctor had never told they had diabetes. I further narrowed the sample by excluding respondents who had never married, because my interest is in respondents who had ever experienced a divorce or the death of a spouse; individuals who never married have never been at risk of divorce or widowhood. Finally, I removed all cases which had missing

data for any dependent or independent variables. The final sample size for the diabetes analysis is 1287. Descriptive statistics are shown in Table 2.

Slightly over half of the population is female (51.1 percent). The majority is white (77.4 percent), 11.0 percent are black, 9.1 percent non-black Hispanic, and 2.5 percent other race. The average age at wave 1 is 68 years and ranges from 57 to 85. More than half of the sample has at least some college education. Household income is fairly evenly distributed across the three lowest quartiles, with 27.5 percent making less than $25,000 in the year prior to Wave 1. Thirty percent made $25,000 to less than $50,000, and 28.1 percent made $50,000 to $100,000. In the highest income category, 14.4 percent made over $100,000. Just over half (54.4 percent) of respondents reported their family was average or well off from age 6 to 16, and three-quarters of respondents said they had a happy family life from age 6 to 16. Of the respondents who reported not having been told by a doctor they have diabetes at Wave 1, 7.5 percent had been told by a doctor they have diabetes at Wave 2.

Statistical Plan

I used logistic regression with a binary logit model to determine the log-odds of respondents who have experienced marital disruption having diabetes at Wave 2. Explanatory variables are either measured at Wave 1 or provide retrospective information. A brief description of the variables follows; full details of all variable recoding are presented in Chapter 3: Methods. I used SAS 9.3 for all analyses.

Table 2. Descriptive Statistics Diabetes Analysis (N = 1287)

Variable	Percentage	Mean	Range
Age at W1		68	57-85
Female	51.1		
Ever divorced at W1	35.3		
Ever widowed at W1	24.2		
Ever divorced/widowed at W1	53.5		
Total positive social support		13.9	6-18
Marital status at W1*			
Married	67.7		
Cohabiting	2.0		
Separated	1.2		
Divorced	11.0		
Widowed	18.1		
Race			
White	77.4		
Black	11.0		
Hispanic, non-black	9.1		
Other race	2.5		
Education			
Less than high school	15.5		
High school or equivalent	24.9		
Some college, vocational, associate	31.6		
Bachelor's or higher	28.0		
Household income previous year			
Less than $25K	27.5		
>= $25K and < 50K	30.0		
$50K to 100K	28.1		
More than $100K	14.4		
Family average/well off age 6-16	54.5		
Family life happy age 6-16	75.4		
Diabetes status W1**	0		
Diabetes status W2	7.5		

* Never married respondents were dropped from this analysis

** People with diabetes at W1 were dropped from the analysis

Variables

The dependent variable is a self-report item measured at Wave 2 asking whether respondents have ever been told by a doctor that they have diabetes or high blood sugar. The variable is coded so that 1 means the respondents have been told they have diabetes and 0 means that the respondents have not been told they have diabetes.

I include two important explanatory variables in the models, marital disruption and positive social support. Ever Divorce/Widowed indicates whether respondents have ever been divorced or widowed at Wave 1. A value of 1 indicates the respondents have experienced either divorce or widowhood (or both) and a value of 0 indicates the respondents have not experienced marital disruption. A complete marital biography was collected from respondents in the Wave 1 interview. Total positive social support is the sum of the respondents' rankings of support from three groups: spouse or partner, family, and friends. Two characteristics were measured—how helpful/reliable are partner/family/friends and whether they can talk to partner/family/friends. The range of total social support from all three sources is 6-18.

I control for social variables in the model. Female is coded 1 for female and 0 for male. Race has four dummy variables: black, Hispanic (non-black), and other race with white as the reference. Educational attainment at Wave 1 has four dummy variables: less than high school, some college/vocational certificate/associate's degree, bachelor's degree or higher and high school or equivalent (reference). Age at Wave 1 is a continuous variable included to control for the age of the respondent, which is a factor related to health in older age groups. Household income at Wave 1 has four dummy variables: less than $25,000; greater than or equal to $25,000 but less than $50,000; $50,000 to 100,000;

and greater than $100,000. Two childhood family variables were collected at Wave 2, but represent the respondent's recall of how happy their family life was and how well off their family was from age 6-16; these variables were not collected with the Wave 1 data. Marital status at Wave 1 is included in the models to control for its effect on health status. I created a set of dummy variables with Married as the reference category. I coded the remaining three categories as follows: Divorced, Widowed, and Other. Never Married respondents were excluded from the analysis.

Results

I estimated a logistic regression model (binary logit) for having diabetes at Wave 2 with marital disruption, social support, marital status at Wave 1, education, household income, race/ethnicity, sex, and indicators of childhood family life as predictor variables. Of the 1287 cases in the logistic regression who did not have diabetes at Wave 1, 97 had diabetes at Wave 2. The results are presented as odds ratios (exponentiated regression coefficients). Odds ratios greater than one indicate that odds are greater. The results for the logistic regressions are shown in Table 3.

Model 1 contains age, female, marital status at Wave 1, race/ethnicity, educational attainment, household, and two indicators of the respondent's home life from age 6 to 16. One indicator is whether their family was well off or average, compared to not well off. The other indicator is whether family life was happy, compared to not happy. Model 1 has one significant predictor, female. The odds that a female has diabetes at Wave 2 are .585 that of a male, or 41.5 percent lower for females compared to males (p=.022). Female was significant in all five models.

In model 2, the marital disruption variable indicating whether the respondent had ever been divorced or widowed at Wave 1 is added. While the coefficient was not significant at the .05 level, the odds ratio was less than one, indicating that experiencing marital disruption is negatively associated with diabetes status at Wave 2. In model 3, an interaction term for female and ever divorced or widowed was added. The interaction term was not significant in model 3 or model 4. Total positive social support from spouse or partner, family, and friends made its appearance in model 4 and was significant (p=.027). With an odds ratio of .902, for every unit increase in social support, the odds of having diabetes at Wave 2 decreases by 9.8 percent. In
model 5, the interaction term was removed; the odds ratios for female and social support were about the same as previous models. The AIC statistic can be used to determine the best model fit, with the lowest AIC indicating the best model fit. Model 5 has the lowest AIC, and contains all the variables except the interaction term.

The first hypothesis, that individuals who had ever experienced marital disruption would have higher odds of developing diabetes than those who hadn't experienced marital disruption, was not supported. The second hypothesis was supported; for every unit increase in social support, the odds of having diabetes at Wave 2 decreases by nearly 10 percent. Model 5 had the best fit, and included all the predictors variables less the interaction term. The odds ratios for female were similar across all the models, and the odds ratios for social support were the same in models 4 and 5. The third hypothesis, that women with a previous history of marital disruption at Wave 1 will have higher odds of having diabetes at Wave 2 compared to men, was not supported. The interaction term was not significant in models 3 or 4.

Table 3. Odd Ratios for Logit Models Predicting Wave 2 Diabetes Status

	Model 1	Model 2	Model 3	Model 4	Model 5
Independent Variable	Odds Ratio	Odds Ratio	Odds Ratio	Odds Ratio	Odds Ratio
Age, years	1.010	1.010	1.010	1.005	1.005
Female	.585 *	.570 *	.520 *	.555 *	.599 *
Marital status at W1[a]					
Other	.565	.662	.664	.588	.586
Divorced	1.462	2.006	1.952	1.571	1.610
Widowed	.891	1.231	1.172	.945	.988
Race/ethnicity[b]					
Black	1.246	1.274	1.273	1.228	1.228
Hispanic, non-black	1.323	1.276	1.273	1.230	1.231
Other race	1.369	1.344	1.341	1.272	1.272
Educational attainment[c]					
< high school	1.383	1.398	1.395	1.327	1.329
High school/equiv.	1.627	1.696	1.702	1.682	1.676
Some college	1.330	1.374	1.373	1.344	1.345
Household income[d]					
< $25,000	1.151	1.139	1.135	1.088	1.090
$26,000-49,000	.752	.740	.742	.733	.732
$50,000-100,000	1.041	1.034	1.038	1.045	1.041
Family avg/well off age 6-16	.759	.760	.761	.754	.753
Family life happy age 6-16	1.533	1.554	1.561	1.612	1.605
Ever Divorced/Widowed at W1		.642	.604	.583	.611
Female*Ever D/W			1.214	1.179	
Total positive social support				.902 *	.902 *
N	1287	1287	1287	1287	1287
-2 Log L	669.019	666.586	666.414	661.559	661.681
AIC	703.019	702.586	704.414	701.559	699.681

*p<.05, **p<.01, ***p<.001 a. ref: Married b. ref. White c. ref. Bachelor's or higher d. ref. >$100K

Discussion

Two predictor variables were significantly associated with diabetes status at Wave 2—female and positive social support. Women are often perceived as being more emotional and concerned about others' feelings, while men are perceived as more likely to give practical help when needed. The two questions used to assess positive social support address both those perceptions. The question, "How often can you open up to [name] if you need to talk about your worries? Would you say hardly ever, some of the time, or often?" reflects emotional support. The other question, "How often can you rely on [name] for help if you have a problem?" can be interpreted as the type of support men are more comfortable with, such as instrumental support.

Although I cannot make a causal connection between social support and diabetes, there is an association between them, and improving the support one gets from others may help improve chronic health. The one-unit change in positive social support can be achieved two ways—the three sources of support and the frequency of support. The two questions are asked of spouse/partner, family members, and friends. If an individual wants to increase their level of positive social support, one way to do that is to cultivate supportive relationships with people that are easy to talk to about problems or who will help if you have a problem. Of course, being a supportive friend to others helps facilitate reciprocal relationships.

The frequency of support is seen in the answer categories for all the questions: hardly ever or never (1), some of the time (2), and often (3). One way to increase the frequency of support is fill in any gaps in the sources of support. If an individual is

divorced or widowed, an important source of social support may be missing. While it is not appropriate to suggest a person become married quickly to increase levels of social support, there are other ways to broaden one's chances of improving levels of social support. For instance, joining a support group for recently widowed people is one way to meet new people and connect with people who understand your situation better than most. Relying on friends or family could shift a source of support from partner/spouse to a good friend.

Increasing positive social support by cultivating reciprocally supportive relationships with others and filling in gaps created by marital disruption or other losses can have a big impact on future diabetes status. In this study, the odds of having diabetes at Wave 2 decrease by nearly 10 percent with every unit of increase.

NSHAP provides a rich source of data on many aspects of the lives of older adults in the United States. I barely scratched the surface on the many types of information related to diabetes available from NSHAP. In future research, biomeasures such as HbA1C could be incorporated into the model. Measures of height, weight, and calculated BMI, along with comorbid conditions can be included in future analyses. NSHAP also collects information on medications respondents take, and frequency of physical activity. Measures such as these could shed light on the differences in comorbid conditions, medications, and physical activity between different marital statuses. Do married people have more risk factors for Type 2 diabetes? Is there a difference by marital status in controlling diabetes through lifestyle changes or health behaviors?

CHAPTER 5

MARITAL DISRUPTION AND HEART FAILURE IN OLDER ADULTS

This chapter presents the results of the analysis of marital disruption and heart failure status. I used two waves of data from the National Social Life, Health, and Aging Project (NSHAP), collected in 2005-6 and 2010-11. For this analysis, I looked at the impact of marital disruption measured at Wave 1 on heart failure status at Wave 2. Using the cumulative (dis)advantage framework, I predict that the disadvantages experienced after divorce or widowhood will continue to accumulate over time and have negative consequences for heart failure status in later life. I include a second important explanatory variable in the models, positive social support, which I predict will have a protective effect on respondents; those with higher levels of positive social support at Wave 1 will have lower odds of having heart failure at Wave 2.

> Hypothesis 1: Individuals with a previous history of marital disruption at Wave 1 will have higher odds of having heart failure at Wave 2.
>
> Hypothesis 2: Individuals who have higher levels of positive social support at Wave 1 will have lower odds of having heart failure at Wave 2.
>
> Hypothesis 3: Women with a previous history of marital disruption at Wave 1 will have higher odds of having heart failure at Wave 2 compared to men.

I used a subset of the sample population, respondents who stated at Wave 1 that a doctor had never told them they had heart failure. I further narrowed the sample by excluding respondents who had never married, because my interest is in respondents who had experienced a divorce or the death of a spouse; individuals who never married have

never been at risk of divorce or widowhood. Finally, I removed all cases which had missing data for any dependent or independent variables. The final sample size for the heart failure analysis is 1,460. Descriptive statistics are shown in Table 4.

Slightly over half of the population is female (51.2 percent). The majority is white (75.6 percent), 12.4 percent are black, 9.5 percent non-black Hispanic, and 2.5 percent other. The average age at wave 1 is 68 years and ranges from 57 to 85. Over 58 percent of the sample has at least some college education. Household income is fairly evenly distributed across the three lowest quartiles, with 27.7 percent making less than $25,000 in the year prior to Wave 1. Thirty percent made $25,000 to less than $50,000, and 28.4 percent made $50,000 to $100,000. In the highest income category, 13.4 percent made over $100,000. Just over half (54.4 percent) of respondents reported their family was average or well off from age 6 to 16, and three-quarters of respondents said they had a happy family life from age 6 to 16. Of the respondents who reported not having been told by a doctor they have diabetes at Wave 1, 2.7 percent had been told by a doctor they have diabetes at Wave 2.

Statistical Plan

I used logistic regression with a binary logit model to determine the log-odds of respondents who experienced marital disruption prior to Wave 1 having heart failure at Wave 2. Explanatory variables are either measured at Wave 1 or provide retrospective information. A brief description of the variables follows; full details of all variable recoding are presented in Chapter 3: Methods. I used SAS 9.3 for all analyses.

Table 4. Descriptive Statistics, Heart Failure Analysis (N = 1,460)

Variable	Percentage	Mean	Range
Age at W1		68	57-85
Female	51.2		
Ever divorced at W1	33.8		
Ever widowed at W1	24.6		
Ever divorced/widowed at W1	52.7		
Total positive social support		13.9	6-18
Marital status at W1*			
Married	67.3		
Cohabiting	1.9		
Separated	1.2		
Divorced	10.9		
Widowed	18.8		
Race			
White	75.6		
Black	12.4		
Hispanic, non-black	9.5		
Other race	2.5		
Education			
Less than high school	16.0		
High school or equivalent	25.6		
Some college, vocational, associate	31.9		
Bachelor's or higher	26.6		
Household income previous year			
Less than $25K	27.7		
>= $25K and < 50K	30.2		
$50K to 100K	28.4		
More than $100K	13.4		
Family average/well off age 6-16	54.4		
Family life happy age 6-16	76.4		
Heart failure status W1**	0		
Heart failure status W2	2.7		

* Never married respondents were dropped from this analysis

** Respondents with heart failure at W1 were dropped from the analysis

Variables

The dependent variable is a self-report item measured at Wave 2 asking whether respondents have ever been told by a doctor that they have heart failure. The variable is coded so that 1 means the respondents have been told they have heart failure and 0 means that the respondents have not been told they have heart failure. See Chapter 3: Methodology for full details.

I include two important explanatory variables in the models, marital disruption and positive social support. A complete marital biography was collected from respondents during the Wave 1 interview. Ever Divorced/Widowed indicates whether respondents have ever been divorced or widowed at Wave 1. A value of 1 indicates respondents have experienced either divorce or widowhood (or both) and a value of 0 indicates they have not experienced either type of marital disruption. Total positive social support is the sum of the respondents' rankings of support from three groups: spouse or partner, family, and friends. Two characteristics were measured—how helpful/reliable are partner/family/friends and whether respondents can talk to partner/family/friends. The range of total social support from all three sources is 6-18.

I control for social variables in the model. Female is coded 1 for female and 0 for male. Race has four dummy variables: black, Hispanic (non-black), and other race with white as the reference. Educational attainment at Wave 1 has four dummy variables: less than high school, some college/vocational certificate/associate's degree, bachelor's degree or higher and high school or equivalent (reference). Age at Wave 1 is a continuous variable included to control for the age of the respondent, which is a factor related to

health in older age groups. Household income at Wave 1 has four dummy variables: less than $25,000; greater than or equal to $25,000 but less than $50,000; $50,000 to 100,000; and greater than $100,000. Two childhood family variables were collected at Wave 2, but represent the respondent's recall of how happy their family life was and how well off their family was from age 6-16; these variables were not collected in the first wave. Marital status at Wave 1 is included in the models to control for its effect on health status. I created a set of dummy variables with Married as the reference category. I coded the remaining three categories as follows: Divorced, Widowed, and Other. Never Married respondents were excluded from the analysis.

Results

I estimated a logistic regression model (binary logit) for having heart failure at Wave 2 with marital disruption, social support, marital status at Wave 1, education, household income, race/ethnicity, sex, and indicators of childhood family life as predictor variables. Of the 1,460 respondents in the logistic regression who did not have heart failure at the first wave, 40 had heart failure at Wave 2. The results are presented as odds ratios (exponentiated regression coefficients). Odds ratios greater than one indicate that odds are greater that respondents will have heart failure. For independent variables coded as dummy variables, this means that the dummy variables in the model have higher odds than the reference variable. An odds ratio less than one indicates that odds are lower. Continuous variables are interpreted like this: the odds increase (by the amount of the odds ratio) for every one-unit increase in the continuous independent variable. The results for the logistic regressions are shown in Table 5.

Model 1 contains age at Wave 1, female, marital status at Wave 1, race/ethnicity, educational attainment, household income, and two indicators of the respondent's home life from age 6 to 16. Age at Wave 1 is the one significant predictor in the first model. The odds ratio of 1.066 means that for every one-year increase in age at Wave 1, the odds of having heart failure at Wave 2 increases by 6.6 percent. (p=.0058 in model 1). Age at Wave 1 was significant in all five models, with p values increasing to around .01 in models 4 and 5.

In model 2, I add the marital disruption variable indicating whether the respondent had ever been divorced or widowed at Wave 1. While the coefficient was not significant (p=.6176), the odds ratio was greater than one, indicating that experiencing marital disruption is positively associated with heart failure status at Wave 2. In model 3, an interaction term for female and ever divorced or widowed was added. The interaction term was not significant in model 3 or model 4. Total positive social support from spouse or partner, family, and friends was included in models 4 and 5 and was not significant in either model.

Usually a comparison of the AIC statistic can be used to determine the best model fit, with the lowest AIC indicating the best model fit. However, in all models, SAS indicated regarding model convergence that "Quasi-complete separation of data points detected" and delivered two warnings:

> Warning: The maximum likelihood estimate may not exist.
> Warning: The LOGISTIC procedure continues in spite of the above warning. Results shown are based on the last maximum likelihood iteration. Validity of the model fit is questionable.

In quasi-complete separation of data points, one or more independent variables are "separated" into two groups by their association with the dependent variable. For example, it could be that variable X has lower values associated with a value of 1 for the dependent variable, and higher values associated with a value of 1 for the dependent variable. An overlap between those lower and higher values for the independent variable make it a quasi-complete separation; if there was a clear line of separation between high and low values there would be a complete separation. In my model, it seems that Other race is the relevant predictor variable because odds ratios are less than .001. Experts at UCLA recommend doing nothing about the quasi-complete separation because other predictor variables still have a valid maximum likelihood estimate.

The first hypothesis, that respondents who had ever experienced marital disruption would have higher odds of developing heart failure than those who hadn't experienced marital disruption, was not supported. The second hypothesis, that individuals who had higher levels of positive social support at Wave 1 would have lower odds of having heart failure at Wave 2, was also not supported. Neither marital disruption nor social support variables were significant in any of the models for heart failure at Wave 2. The odds ratio for the significant predictor, age at Wave 1, was similar across all the models. The third hypothesis, that women with a previous history of marital disruption at Wave 1 will have higher odds of having heart failure at Wave 2 compared to men, was not supported. The interaction term was not significant in models 3 or 4.

Discussion

One predictor variable was significantly associated with heart failure status at Wave 2—respondent's age at Wave 1. This is the only analysis in which age at Wave 1 is a significant predictor. The number of respondents who had heart failure at Wave 2 was smaller than in the analyses for diabetes and hypertension. Neither of the main predictor variables, marital disruption and total positive social support, were significantly associated with heart failure status at Wave 2. The third hypothesis, that women with a previous history of marital disruption at Wave 1 will have higher odds of having heart failure at Wave 2 compared to men, was not supported.

Table 5. Odd Ratios for Logit Models Predicting Wave 2 Heart Failure Status

	Model 1	Model 2	Model 3	Model 4	Model 5
Independent Variable	Odds Ratio	Odds Ratio	Odds Ratio	Odds Ratio	Odds Ratio
Age, years	1.066 **	1.066 **	1.066 **	1.062 ***	1.062 **
Female	0.546	0.553	.666	.700	0.567
Marital status at W1[a]					
Other	0.982	0.917	0.922	0.827	0.821
Divorced	1.535	1.328	1.370	1.137	1.100
Widowed	1.459	1.259	1.330	1.133	1.064
Race/ethnicity[b]					
Black	0.903	0.904	0.908	0.900	0.897
Hispanic, non-black	0.164	0.167	0.169	0.163	0.162
Other race	<0.001	<0.001	<0.001	<0.001	<0.001
Educational attainment[c]					
< high school	1.958	1.955	1.957	1.886	1.885
High school/equiv.	1.224	1.216	1.212	1.213	1.218
Some college	1.036	1.026	1.025	1.022	1.022
Household income[d]					
< $25,000	1.589	1.587	1.583	1.579	1.586
$26,000-49,000	1.179	1.182	1.170	1.211	1.225
$50,000-100,000	1.215	1.217	1.202	1.199	1.218
Family average/well off age 6-16	1.347	1.347	1.344	1.348	1.351
Family life happy age 6-16	1.518	1.513	1.504	1.544	1.556
Ever Divorced/Widowed at W1		1.247	1.364	1.333	1.206
Female*Ever D/W			.740	.710	
Total positive social support				0.923	0.925
N	1460	1460	1460	1460	1460
-2 Log L	339.666	339.421	339.251	338.049	338.266
AIC	373.666	375.421	377.251	378.049	376.266

*p<.05, **p<.01, ***p<.001 a. ref: Married b. ref. White c. ref. Bachelor's or higher d. ref. >$100K

CHAPTER 6

MARITAL DISRUPTION AND HYPERTENSION IN OLDER ADULTS

This chapter presents the results of the analysis of marital disruption and hypertension status. I used two waves of data from the National Social Life, Health, and Aging Project (NSHAP), collected in 2005-6 and 2010-11. For this analysis, I look at the impact of marital disruption measured at Wave 1 on hypertension status at Wave 2. Using the cumulative (dis)advantage framework, I predict that the disadvantages experienced after divorce will continue to accumulate over time and have negative consequences for hypertension status in later life. I include a second important explanatory variable in the models, positive social support, which I predict will have a protective effect on respondents; those with higher levels of positive social support at Wave 1 will have lower odds of having hypertension at Wave 2.

Hypothesis 1: Individuals with a previous history of marital disruption at Wave 1 will have higher odds of having hypertension at Wave 2.

Hypothesis 2: Individuals who have higher levels of positive social support at Wave 1 will have lower odds of having hypertension at Wave 2.

Hypothesis 3: Women with a previous history of marital disruption at Wave 1 will have higher odds of having hypertension at Wave 2 compared to men.

I used a subset of the sample population, respondents who stated at Wave 1 that a doctor had never told them they had hypertension. I further narrowed the sample by excluding respondents who had never married, because my interest is in respondents who had ever experienced a divorce or the death of a spouse; individuals who never married

have never been at risk of divorce or widowhood. Finally, I removed all cases which had missing data for any dependent or independent variables. The final sample size for the hypertension analysis is 711. Descriptive statistics are shown in Table 6.

Slightly over half of the population is female (50.3percent). The majority is white (79.5 percent), 8.4 percent are black, 9.9 percent non-black Hispanic, and 2.2 percent other. The average age at wave 1 is 67 years and ranges from 57 to 85. Over 60 percent of the sample has at least some college education. Compared to the diabetes sample, the average age of the hypertension sample is one year less, indicating that more older members of the sample were dropped from the analysis because they already had been told by a doctor that they have hypertension. Indeed, the sample for the hypertension sample is smaller, with just 711 respondents compared to 1287 in the diabetes sample. The marital status distribution for hypertension at Wave 1 is slightly different from the diabetes sample, with the hypertension sample having more married respondents and fewer divorced and widowed respondents. The percentage of black respondents in the hypertension sample is lower than in the diabetes sample. More respondents had ever experienced marital disruption in the hypertension sample. The percentage of respondents having hypertension at Wave 2 is much higher than the percentage of respondents who have diabetes at Wave 2. Household income is slightly higher than the diabetes sample, with 24.1 percent making less than $25,000 in the year prior to Wave 1, and 28.9 percent made $25,000 to less than $50,000, and 29.5 percent made $50,000 to $100,000. In the highest income category, 17.6 percent made over $100,000. Over half (56.9 percent) of

Table 6. Descriptive Statistics, Hypertension Analysis (N = 711)

Variable	Percentage	Mean	Range
Age at W1		67	57-85
Female	50.3		
Ever divorced at W1	37.3		
Ever widowed at W1	20.1		
Ever divorced/widowed at W1	51.3		
Total positive social support		13.9	6-18
Marital status at W1*			
Married	70.5		
Cohabiting	2.1		
Separated	.8		
Divorced	12.2		
Widowed	14.3		
Race			
White	79.5		
Black	8.4		
Hispanic, non-black	9.9		
Other race	2.2		
Education			
Less than high school	13.4		
High school or equivalent	24.9		
Some college, vocational, associate	31.9		
Bachelor's or higher	29.8		
Household income previous year			
Less than $25K	24.1		
>= $25K and < 50K	28.9		
$50K to 100K	29.5		
More than $100K	17.6		
Family average/well off age 6-16	56.9		
Family life happy age 6-16	74.7		
Hypertension status W1**	0		
Hypertension status W2	26.6		

* Never married respondents were dropped from this analysis

** People with hypertension at W1 were dropped from the analysis

respondents reported their family was average or well off from age 6 to 16, and three-quarters of respondents said they had a happy family life from age 6 to 16. Of the respondents who reported not having been told by a doctor they have hypertension at Wave 1, 26.6 percent had been told by a doctor they have diabetes at Wave 2.

Statistical Plan

I used logistic regression with a binary logit model to determine the log-odds of respondents who have experienced marital disruption having hypertension at Wave 2. Explanatory variables are either measured at Wave 1 or provide retrospective information. A brief description of the variables follows; full details of all variable recoding are presented in Chapter 3: Methods. I used SAS 9.3 for all analyses.

Variables

The dependent variable is a self-report item measured at Wave 2 asking whether respondents have ever been told by a doctor that they have hypertension or high blood pressure. The variable is coded so that 1 means the respondents have been told they have hypertension and 0 means that the respondents have not been told they have hypertension.

I include two important explanatory variables in the models, marital disruption and positive social support. Ever Divorce/Widowed indicates whether respondents have ever been divorced or widowed at Wave 1. A value of 1 indicates respondents have experienced either divorce or widowhood (or both) and a value of 0 indicates they have not experienced marital disruption. A complete marital biography was collected from respondents in the Wave 1 interview. Total positive social support is the sum of the

respondents' rankings of support from three groups: spouse or partner, family, and friends. Two characteristics were measured—how helpful/reliable are partner/family/friends and whether they can talk to partner/family/friends. The range of total social support from all three sources is 6-18.

I control for social variables in the model. Female is coded 1 for female and 0 for male. Race has four dummy variables: black, Hispanic (non-black), and other race with white as the reference. Educational attainment at Wave 1 has four dummy variables: less than high school, some college/vocational certificate/associate's degree, bachelor's degree or higher and high school or equivalent (reference). Age at Wave 1 is a continuous variable included to control for the age of the respondent, which is a factor related to health in older age groups. Household income at Wave 1 has four dummy variables: less than $25,000; greater than or equal to $25,000 but less than $50,000; $50,000 to 100,000; and greater than $100,000. Two childhood family variables were collected at Wave 2, but represent the respondent's recall of how happy their family life was and how well off their family was from age 6-16; these variables were not available in the Wave 1 data. Marital status at Wave 1 is included in the models to control for its effect on health status. I created a set of dummy variables with Married as the reference category. I coded the remaining three categories as follows: Divorced, Widowed, and Other. Never Married respondents were excluded from the analysis.

Results

I estimated a logistic regression model (binary logit) for having diabetes at Wave 2 with marital disruption, social support, marital status at Wave 1, education, household

income, race/ethnicity, sex, and indicators of childhood family life as predictor variables. Of the 711 cases in the logistic regression who did not have hypertension at Wave 1, 189 had hypertension at Wave 2. The results are presented as odds ratios (exponentiated regression coefficients). Odds ratios greater than one indicate that odds are greater. The results for the logistic regressions are shown in Table 7.

Model 1 contains age, female, marital status at Wave 1, race/ethnicity, educational attainment, household, and two indicators of the respondent's home life from age 6 to 16. Model 1 has two significant predictors, black and happy family life in childhood. The odds that blacks have diabetes at Wave 2 are 3.105 that of whites, or 210.5 percent higher for blacks compared to whites (p=.0001 in model 1). The odds ratio of 1.775 for happy childhood means that having a happy family life in childhood increases the odds of having diabetes at Wave 2 by 177.5 percent (p=.0094 in model 1). Both of these variables were significant in all five models. In model 2, I add the marital disruption variable indicating whether the respondent had ever been divorced or widowed at Wave 1. While the coefficient was not significant at the .05 level, the odds ratio was greater than one, indicating that experiencing marital disruption is positively associated with hypertension status at Wave 2. In model 3, an interaction term for female and ever divorced or widowed was added. The interaction term was not significant in model 3 or model 4. Total positive social support from spouse or partner, family, and friends was included in models 4 and 5 and was not significant in either model. Comparison of the AIC statistic can be used to determine the best model fit, with the lowest AIC indicating

Table 7. Odd Ratios for Logit Models Predicting Wave 2 Hypertension Status

	Model 1	Model 2	Model 3	Model 4	Model 5
Independent Variable	Odds Ratio	Odds Ratio	Odds Ratio	Odds Ratio	Odds Ratio
Age, years	1.007	1.008	1.008	1.008	1.007
Female	0.870	0.886	.733	.739	0.893
Marital status at W1[a]					
Other	0.488	0.437	0.434	0.432	0.434
Divorced	0.899	0.749	0.705	0.694	0.734
Widowed	1.103	0.911	0.837	0.822	0.889
Race/ethnicity[b]					
Black	3.105 ***	3.104 ***	3.155 ***	3.149 ***	3.096 ***
Hispanic, non-black	1.426	1.472	1.477	1.468	1.461
Other race	1.313	1.325	1.295	1.300	1.331
Educational attainment[c]					
< high school	1.757	1.723	1.709	1.707	1.720
High school/equiv.	1.612	1.584	1.595	1.592	1.581
Some college	1.341	1.307	1.308	1.305	1.304
Household income[d]					
< $25,000	1.252	1.270	1.282	1.280	1.269
$26,000-49,000	0.876	0.888	0.898	0.896	0.885
$50,000-100,000	1.286	1.298	1.320	1.319	1.297
Family average/well off age 6-16	0.927	0.922	0.925	0.925	0.921
Family life happy age 6-16	1.775 *	1.765 *	1.775 **	1.782 **	1.773 **
Ever Divorced/Widowed at W1		1.304	1.122	1.121	1.299
Female*Ever D/W			1.465	1.460	
Total positive social support				0.992	0.991
N	711	711	711	711	711
-2 Log L	783.482	782.031	780.978	780.940	781.971
AIC	817.482	818.031	818.978	820.940	819.971

*p<.05, **p<.01, ***p<.001 a. ref: Married b. ref. White c. ref. Bachelor's or higher d. ref. >$100K

the best model fit. Model 1 has the lowest AIC, and contains all the variables except the main predictor variables (marital disruption and social support) and the interaction term.

The first hypothesis, that individuals who had ever experienced marital disruption would have higher odds of developing hypertension than those who hadn't experienced marital disruption, was not supported. The second hypothesis, that individuals who had higher levels of positive social support at Wave 1 would have lower odds of having hypertension at Wave 2, was also not supported. Neither marital disruption nor social support variables were significant in any of the models for hypertension at Wave 2. The third hypothesis, that women with a previous history of marital disruption at Wave 1 will have higher odds of having hypertension at Wave 2 compared to men, was not supported. The interaction term was not significant in models 3 or 4. Model 1 had the best fit, with just age, sex, marital status at Wave 1, race/ethnicity, education, household income, and childhood family life. The odds ratios for the significant predictors, black and total positive social support, were similar across all the models in which they were included.

Discussion

Two predictor variables were significantly associated with hypertension status at Wave 2—black and having a happy family life in childhood. The odds that blacks have hypertension at Wave 2 are 200 percent higher for blacks compared to whites. This is not surprising; in 2009-2010, there were significant differences in prevalence of hypertension by race/ethnicity in the United States; prevalence was 40 percent for non-Hispanic blacks, compared to 27.4 percent for non-Hispanic whites, 26.1 percent for Hispanics, and 28.6 percent overall (Yoon et al. 2012). Blacks were more aware of their hypertension and more likely to take medication for hypertension (Yoon et al. 2012).

An unexpected finding is that having a happy family life from age 6-16 was significant in all models. Having a happy family life in childhood increases the odds of having hypertension at Wave 2 by roughly 177 percent across all the models. Based on the cumulative (dis)advantage theory, having a happy family life in childhood should *decrease* the odds of having hypertension at Wave 2. The other childhood indicator, family being well off or average from age 6 to 16, while not significant, had odds ratios around .92, indicating the expected direction for this variable, that childhood family's family having an average or more favorable financial situation reduces the odds of having hypertension at Wave 2. This is an area for further exploration. NSHAP includes other retrospective childhood variables: whether respondents lived with both parents from age 6 to 16, health status from 6 to 16, experienced a violent event from 6 to 16, witnessed a violent event from 6 to 16, and educational attainment of father and mother. Future studies could use some of these variables to predict health status in later life.

CHAPTER 7

DISCUSSION

This dissertation explored the connection between marital biography, in particular marital disruption, and its impact on health. Using a cumulative (dis)advantage theoretical framework, I predicted that the negative impacts of divorce or death of a spouse would increase the odds of having a chronic health condition in later life. The three outcome variables were diabetes, heart failure, and hypertension, measured as whether the respondent had ever been told by a doctor that they had the condition. Only respondents who did not have the condition at the time of the first interview were included in the analyses and the dependent variable was measured at the second interview five years later. Social support was included in the model as a secondary predictor variable. The three chronic health conditions used as outcomes are fairly common, and indeed, are related to each other. Hypertension was the most prevalent in the sample at Wave 1, and thus had the smallest sample for analysis. Heart failure was the least prevalent in the sample at Wave 1, and thus had the largest sample for analysis; however, heart failure had the fewest numbers of respondents with new incidence of disease at Wave 2.

The significant predictor variables differ across the three analyses. For diabetes, being female and having more positive social support reduced the odds of having diabetes at Wave 2. The only significant predictor for having heart failure at Wave 2 was age at Wave 1, which was significant at *p*-levels less than .01 across all the models. Every year older increased the odds of having heart failure by 6.7 percent. The significant predictors of hypertension at Wave 2 were being black and having a happy family life

from age 6 to 16. Being black increased the odds of having hypertension at Wave 2 by over 200 percent. Having a happy family life in childhood increased the odds of having hypertension at Wave 2 by between 70 to 80 percent. Both variables were present in all models with similar odds ratios for each variable. The interaction term of marital disruption and gender was not significant in any of the analyses.

Interestingly, no variable reached significance in more than one model. One reason for this is that race, gender, and age are associated with certain diseases, some with stronger associations than others. Likewise, social relationships are important for health and I found that having more positive social support reduced the odds of having diabetes at Wave 2 by nearly 10 percent for each unit change in positive social support. However, one significant predictor variable had unexpected findings in the direction of its effects, having a happy family life from age 6 to 16. Contrary to my expectations, having a happy family life in childhood *increased* the odds of having hypertension at Wave 2 by 75 to 80 percent.

The second hypothesis, that individuals who have higher levels of positive social support at Wave 1 will have lower odds of having chronic disease at Wave 2, was supported for diabetes, but not heart failure nor hypertension. The first hypothesis, that individuals with a previous history of marital disruption at Wave 1 will have higher odds of having chronic disease at Wave 2, was not supported for any of the dependent variables. Likewise, the third hypothesis, that women with a previous history of marital disruption at Wave 1 will have higher odds of having chronic disease at Wave 2 compared to men, was not supported for any of the dependent variables. There are several possible explanations for this.

For the marital disruption hypotheses, it is possible that the effects of marital disruption have already occurred before Wave 1. That is, the people who are going to get diabetes already have it at Wave 1. One way to account for this possibility is to include the time since the most recent marital disruption in the model. Another way is to use a fixed effects model to look only at marital disruption occurring between waves.

Another possibility related to the length of time since marital disruption is that with longer periods, individuals may have rebounded from the negative consequences of divorce or widowhood. Remarriage is one way that this might occur, or developing supportive relationships with friends or other family members. This is inconsistent with CAD theory, but Zimmermann *et al.* found that recent advantages seemed to compensate for disadvantages earlier in life (2006).

My decision to use three separate chronic health conditions for the dependent variables may have impacted the results. In other studies of the effects of marital status or marital disruption on health, groups of conditions were used as outcome variables. Hughes and Waite (2009) used the total number of chronic conditions reported by the respondent (diabetes, heart disease, lung disease, cancer, hypertension, or stroke) and found that marital disruption is associated with total number of chronic conditions. Zhang and Hayward (2006) combined stroke with heart disease (heart attack, coronary heart disease, angina, congestive heart failure, or other heart problems) to create a cardiovascular disease dependent variable. In their analysis of biological risk and marital biography, McFarland, Hayward, and Brown (2013) combined three measures (systolic blood pressure, diastolic blood pressure, and resting heart rate) to create a cardiovascular

risk variable. For metabolic risk, they combined waist circumference and glycosylated hemoglobin (McFarland, Hayward and Brown 2013).

For the second hypothesis, that higher levels of positive social support will have lower odds of chronic disease, the results were significant only for diabetes. Widowed men are at higher risk than married, divorced, or never married men for Type 2 diabetes (Cornelis et al. 2014). Adopting better eating habits and engaging in physical activity can result in noticeable improvements in blood glucose levels for prediabetic patients, preventing or delaying the onset of diabetes. The support provided by a spouse may be especially beneficial for men with prediabetes, as wives attempt to improve eating habits and schedule medical checkups for their husbands. It follows that the loss of a supportive spouse has a negative impact on diabetes status.

While gender differences seem like a logical expectation, given the gender differences in both consequences of marital disruption and health outcomes, my analyses found no significant results by gender. Other studies have found gender differences in some aspects of their analyses, but not others (McFarland, Hayward and Brown 2013, Zhang and Hayward 2006).

This research had some limitations. I used listwise deletion for the logistic regression analyses, which reduced the number of cases. Many of the missing values, including some of the social support variables, were due to respondents not returning the leave-behind questionnaires. Respondents were randomly assigned to one of six interview paths to reduce the length of time needed to complete the interview. Some data for the social support variables were only collected in the leave-behind questionnaires, which had a lower response rate than the in-home interviews. Future studies could use

more sophisticated methods for replacing missing values and retain more cases. Limitations in the dataset meant that I could not include all the variables I wanted to. For example, stress is commonly mentioned in the literature as a consequence of marital disruption, is associated with health outcomes, and fits into the CAD framework. The four-item version of the Perceived Stress Scale (PSS-4) was available in both waves and is a good measure of global stress rather than a count of stressful events experienced by the respondent. However, the PSS-4 has a narrow time focus—questions asked respondents how often they experienced certain feelings in the past week. To use this scale as a predictor of long-term effects of stress on health did not seem appropriate. In addition, I would like to have more information about income before and after marital disruption. However, the dataset includes income for the year preceding the interviews at Wave 1 and Wave 2, and many respondents experienced marital disruption years before the first interview. Including perceived stress and household income in the models would have provided a more comprehensive exploration of the cumulative (dis)advantage theory. One possibility is to look at changes between waves using a fixed effects regression analysis, which uses differences scores for critical independent variables that change over time. Fixed effects analysis would look at changes in income before and after marital disruption that occurred between Waves 1 and 2, but perceived stress would still not be an appropriate measure with a one-week recall period.

One feature of this research is that I examine three chronic physical health conditions, rather than self-rated physical health, mental health, or mortality. Looking at specific outcomes may provide valuable insights for groups providing support to older populations. For example, health education efforts can be targeted to specific disease

populations. The analysis of hypertension confirmed existing knowledge that hypertension is more prevalent among blacks. Also, being male increased odds of having diabetes at Wave 2. Education on preventing and treating diabetes or hypertension can be targeted toward these two groups.

The older generation is retiring in larger numbers than ever, which, coupled with the increased divorce rate among older adults, means that there will be more single older adults than ever before beginning to consider living arrangements and long-term care needs as they age. Regardless of the lack of statistically significant findings in this research, there will be more single people among the elderly. The three chronic health conditions studied here increase in prevalence with age, so it is likely that many of the elderly will have one or more of these conditions. Diabetes, heart failure, and hypertension can have serious implications for disability and daily living activities. Community leaders can begin to look at alternatives to traditional nursing homes and retirement communities, as well as other services for the elderly that will be needed in increasing numbers.

The third wave of NSHAP was collected recently. Three waves increase the possibilities for longitudinal research—I would like to do an event history analysis with NSHAP data. Also, new in Wave 2, respondents were asked *when* they had been diagnosed with diabetes. Information on timing and three or more waves of data are needed for an event history analysis. Marital biography can be explored in different ways. Experiencing widowhood or divorce more than once may have a more severe impact on chronic disease than experiencing marital disruption just once. The timing of marital disruption could be explored. This could be done by considering the duration of time

since the disruption, or it could be measured by the age at first marital disruption, allowing different types of comparison.

Another way to explore marital biography is to look at the sequences and timings of marriages, divorces, spousal deaths. Does it make a difference if someone experiences marital disruption in their 20s and remains single? Compared to someone who marries again within a year or two, the consequences of divorce or widowhood might be more severe when one remains single. Alternatively, one might rebound and make up for the disadvantageous consequences of divorce or widowhood. In future analyses, I can compare respondents who remarried after a marital disruption to respondents who remained divorced or widowed.

Finally, I would like to explore questions that came up as I conducted this research. NSHAP collects some information on health behaviors, which impact disease development and are associated with marital status; this area deserves further exploration. The two types of marital disruption, divorce and widowhood, can be explored separately. While they are similar in some respects, there are qualitative differences. While there is often an element of grief after a divorce, this is likely to be more severe and longer lasting after the death of a spouse. However, the grief is normative after death, but may be unexpected after a divorce. People who have divorced may be less willing to reach out to others for emotional support for their grief compared to people who are widowed. Furthermore, in the NSHAP sample of older adults, there are likely to be more respondents who have experienced both divorce and widowhood, or experienced divorce or widowhood more than once. Finally, I would like to examine more closely the impact of social support. The experience of marital disruption is stressful and some effects are

long-lasting; the loss of social support on top of that throws salt on the wound. Future analyses could include an interaction term to look at the combined effects of marital disruption and social support. In addition, positive *versus* negative social support, source of social support (spouse/partner, family, friends), and gender differences are all areas for further exploration of social support.

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APPENDIX A

IRB APPROVAL

ASU Knowledge Enterprise Development

Office of Research Integrity and Assurance

To:	Jennie Kronenfeld COWDN
From:	Carol Johnston, Chair Biosci IRB
Date:	04/17/2013
Committee Action:	**Expedited Approval**
Approval Date:	04/17/2013
Review Type:	Expedited F7
IRB Protocol #:	1304009063
Study Title:	Marital Biography and Chronic Disease in Older Adults
Expiration Date:	04/16/2014

The above-referenced protocol was approved following expedited review by the Institutional Review Board.

It is the Principal Investigator's responsibility to obtain review and continued approval before the expiration date. You may not continue any research activity beyond the expiration date without approval by the Institutional Review Board.

Adverse Reactions: If any untoward incidents or severe reactions should develop as a result of this study, you are required to notify the Biosci IRB immediately. If necessary a member of the IRB will be assigned to look into the matter. If the problem is serious, approval may be withdrawn pending IRB review.

Amendments: If you wish to change any aspect of this study, such as the procedures, the consent forms, or the investigators, please communicate your requested changes to the Biosci IRB. The new procedure is not to be initiated until the IRB approval has been given.

Please retain a copy of this letter with your approved protocol.

APPENDIX B

DATA PROTECTION PLAN

NSHAP Data Protection Plan

Title of Research Project: Marital Biography and Chronic Disease in Older Adults
Principal Investigator: Jennie J. Kronenfeld
Data Storage Location: The original data received from ICPSR will be stored in a locked drawer in the Center for Population Dynamics lab in the Social Sciences building at Arizona State University. No copies of the data will be made.
Computing Environment: The data will be stored in a folder on the network drive for my academic unit (T. Denny Sanford School of Social and Family Dynamics). Only Dr. Kronenfeld and I will have access to the folder, although IT will be able to access the folder as well. I will use PCs in graduate student labs at ASU or via remote access from my home PC.
Output: Computer output of direct data listings (i.e. case summaries) will not be printed, but stored only in electronic form. Computer output of statistical tests such as regression or descriptive statistics may be printed. No output will be emailed.