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UNDERSTANDING THE RELATIONSHIPS BETWEEN STATES OF MARITAL DISSOLUTION, DIABETES, AND DIABETES MANAGEMENT IN MIDDLE-AGED AND OLDER ADULTS

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Biobehavioral Health

by

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Abstract

The growing number of people in the U.S. with type 2 diabetes and the high cost of diabetes-related health care point to a need to better understand who is at risk of diabetes and what factors are associated with better diabetes management. Diabetes is most common in middle-aged and older adults; and marital dissolution (i.e., divorce and widowhood) is also increasingly common in middle-aged and older adults. Divorce and widowhood have been linked to more limited financial and social resources, poorer health behaviors, and worse mental and physical health, compared to those who remain married. Often there are differences in how divorce and widowhood affect resources and health, with further differences by gender. However, the links between states of marital dissolution and diabetes and its management have not been studied, particularly by gender with a focus on the implications for protection, crisis, and selection theories identified to explain those relationships within lifespan developmental and life course perspectives.

The aims of this dissertation research included: 1) examining the relationship between state of marital dissolution and diabetes, how correlates of diabetes vary by state of dissolution, and whether there are differences by gender; 2) exploring how diabetes management differs by state of marital dissolution and gender; 3) determining whether aspects of marital history are associated with diabetes management; and 4) identifying marriage-related, potentially modifiable factors associated with diabetes management for each state of dissolution-gender category in adults over age 50 living with diabetes. These aims were met by analyzing cross-sectional data that were pooled from the 2010 and 2012 waves of the nationally representative Health and Retirement Study from participants who were eligible for and participated in the Enhanced-Face-to-Face and blood-based biomarker components. All analyses were weighted to account for the complex design of the survey. Sequential, binary logistic regression was used to examine odds of diabetes, and sequential OLS regression was used to understand diabetes management, as measured by glycosylated hemoglobin (HbA1c).
Diabetes prevalence was significantly higher in those who were widowed, compared to those who were married or divorced, and in men, compared to women. The literature suggested that divorced women may be particularly “at risk”; and they did, in fact, tend to have fewer social and financial resources and poorer health behaviors, compared to widowed and married women. However, these differences did not translate into higher odds of diabetes in divorced women. There were fewer consistent patterns in the characteristics of men, compared by state of dissolution. Those who were widowed did have higher odds of diabetes, compared to those who were married, but only before controlling for ascribed factors such as age and race/ethnicity.

Diabetes management was not significantly associated with state of dissolution, nor were there differences by gender. However, there were differences in the theoretically-based risk and protection factors associated with HbA1c by state of dissolution and gender. Length of longest marriage served as a proxy for protection and was associated with lower HbA1c in men. Marital transitions (dissolutions and marriages) served as a proxy for crisis and provided more support for the selection of healthier women into and out of marriages than for crisis. Modifiable factors tended to be associated with HbA1c, with some variation by state of dissolution and gender. However, these relationships, like the relationships between state of dissolution and diabetes and HbA1c, tended to be attenuated by ascribed factors. These findings highlight the importance of social position, beyond state of dissolution, for understanding diabetes prevalence and management.
# Table of Contents

List of Tables ................................................................................................................................. viii  
List of Figures ................................................................................................................................. ix  
Acknowledgements ......................................................................................................................... x  

1. Chapter One: Introduction ......................................................................................................... 1  
   1.1. Purpose ................................................................................................................................. 3  
   1.2. Theoretical Framework ......................................................................................................... 4  
      1.2.1. Models of Marriage ......................................................................................................... 4  
      1.2.2. Lifespan Developmental Perspective (LSP) and Life Course Perspective (LCP) ........ 8  
      1.2.3. Summary of Theoretical Framework .............................................................................. 9  
   1.3. Conceptual Model .................................................................................................................. 10  
   1.4. Aims, Research Questions, and Hypotheses ...................................................................... 12  
   1.5. Innovation, Significance, and Implications ........................................................................ 18  
   1.6. Organization ....................................................................................................................... 19  

2. Chapter Two: Literature Review ................................................................................................. 20  
   2.1. Diabetes ............................................................................................................................... 20  
      2.1.1. Biology of and Risk Factors for Diabetes ........................................................................ 21  
      2.1.2. Diabetes Diagnosis, Management, Complications, and Costs in Middle-Aged and Older  
            Adults ................................................................................................................................. 23  
      2.1.3. Measuring Blood Glucose Levels/Diabetes Management .............................................. 24  
      2.1.4. Risk Factors for Poor Management ............................................................................... 25  
      2.1.5. Summary of Diabetes and Its Management .................................................................. 28  
   2.2. Marriage and Dissolution in Middle-Aged and Older Adults in the U.S. ............................ 28  
      2.2.1. Defining Marriage-Related Terms ................................................................................ 29  
      2.2.2. Characteristics and Well-Being of Those Who are Married, Divorced, and Widowed ...... 30  
      2.2.3. Aspects of Marital History and Well-Being .................................................................. 35  
      2.2.4. Summary of Marriage and Dissolution in Middle-Aged and Older Adults in the U.S. ...... 36  
   2.3. Marital States, Dissolution, and Diabetes .......................................................................... 36  
   2.4. Marital States, Dissolution, and Diabetes Management ...................................................... 39  
   2.5. Summary and Gaps in the Literature ................................................................................... 41  

3. Chapter Three: Methods .............................................................................................................. 43  
   3.1. Data Source .......................................................................................................................... 43
3.2. Data and Sample Selection ........................................................................................................ 46
3.3. Measures ................................................................................................................................... 49
3.4. Procedures and Analyses .......................................................................................................... 59
3.5. Summary of Methods ................................................................................................................. 65
4. Chapter Four: Results for Aim 1 and Aim 2 .............................................................................. 66
4.1. Descriptions of the Samples ....................................................................................................... 66
4.1.1. Full Sample Used in Aim 1 ................................................................................................. 66
4.1.2. Sample of Those Diagnosed with Diabetes Used for Aims 2-4 ......................................... 71
4.2. Aim 1 Findings on State of Marital Dissolution and Gender Links to Diabetes Prevalence and Risk and Protection Factors .................................................................................. 76
4.2.1. State of Marital Dissolution and Odds of Diabetes ............................................................. 77
4.2.2. Gender and State of Dissolution Differences in Odds of Diabetes .................................... 79
4.2.3. Factors Associated with Diabetes for Each State of Dissolution-Gender Category .......... 82
4.2.4. Summary of Aim 1 Findings ............................................................................................... 88
4.3. Aim 2 Findings on Associations between State of Marital Dissolution, Gender, and Diabetes Management ...................................................................................................................... 89
4.4. Summary of Aim 1 and Aim 2 Findings .................................................................................. 94
5. Chapter Five: Results for Aim 3 and Aim 4 .............................................................................. 97
5.1. Aim 3 Findings for Marital History and HbA1c ........................................................................ 97
5.1.1. Length of Longest Marriage ............................................................................................... 97
5.1.2. Marital Transitions ............................................................................................................. 99
5.1.3. Length of Longest Marriage and Marital Transitions ....................................................... 100
5.1.4. Summary of the Effects of Marital History Factors ......................................................... 100
5.2. Aim 4 Findings on the Relationships between Modifiable Factors and HbA1c by State of Marital Dissolution, Gender, and State of Dissolution within Gender ........................................... 101
5.2.1. Accessible Savings ............................................................................................................. 101
5.2.2. Health Insurance Coverage ............................................................................................. 102
5.2.3. Depressive Symptoms ....................................................................................................... 103
5.2.4. Positive and Negative Social Support ............................................................................... 104
5.2.5. Economic versus Social Resources .................................................................................. 106
5.2.6. Summary of the Effects of Modifiable Factors ................................................................. 108
5.3. Summary of Aim 3 and Aim 4 Findings .................................................................................. 108
6. Chapter Six: Discussion ............................................................................................................... 110
6.1. Summary of Findings and Links to Existing Literature .......................................................... 110
6.2. Integration of Findings across Aims and Insights from Lifespan Developmental and Life Course Perspectives .................................................................................................................. 122

6.3. Implications .......................................................................................................................... 124

6.4. Strengths and Limitations .................................................................................................... 126

6.5. Future Directions .................................................................................................................. 129

6.6. Conclusions .......................................................................................................................... 131

References .................................................................................................................................. 132

Appendix A: Definitions for key terms .......................................................................................... 134

Appendix B: Descriptive statistics for the sample of interest with complete data versus missing
 data ........................................................................................................................................... 154

Appendix C: Coefficients for the effects of state of dissolution, marital history, ascribed, achieved,
 social, and health-related factors on diabetes management (HbA1c), by gender ......................... 157

Appendix D: Coefficients for the effects of length of longest marriage and other covariates on
diabetes management (HbA1c), overall ......................................................................................... 158

Appendix E: Coefficients for the effects of length of longest marriage and other covariates on
diabetes management (HbA1c), by gender .................................................................................... 159

Appendix F: Coefficients for the effects marital transitions on diabetes management (HbA1c),
overall ......................................................................................................................................... 160

Appendix G: Coefficients for the effects of savings and other covariates on diabetes management
(HbA1c), overall ............................................................................................................................ 161

Appendix H: Coefficients for the effects of savings and covariates on diabetes management (HbA1c),
by gender ................................................................................................................................... 162

Appendix I: Coefficients for the effects of depressive symptoms and covariates on diabetes
management (HbA1c), overall ......................................................................................................... 163
List of Tables

Table 1: Descriptive statistics for Aim 1 sample overall, by gender, and by state of marital dissolution .................................................................................................................67

Table 2: Descriptive statistics for Aim 1 sample with comparisons by state of marital dissolution within gender and by gender within state of marital dissolution .................................70

Table 3: Descriptive statistics for Aims 2-4 sample overall, by gender, and by state of marital dissolution .................................................................................................................................73

Table 4: Descriptive statistics for Aims 2-4 sample with comparisons by state of dissolution within gender and by gender within state of dissolution ........................................75

Table 5: Odds ratios for the effects of state of marital dissolution, marital history, modifiable, ascribed, achieved and social, and health-related factors on diabetes prevalence, overall ............................................................................................................78

Table 6: Odds ratios for the effects of state of marital dissolution, marital history, modifiable, ascribed, achieved and social, and health-related factors on diabetes prevalence, by gender ............................................................................................................................................81

Table 7: Odds ratios for the effects of state of marital dissolution, marital history, modifiable, ascribed, achieved and social, and health-related factors on diabetes prevalence, by state of dissolution within gender ........................................................................................................85

Table 8: Coefficients for the effects of state of dissolution, marital history, ascribed, achieved, social, and health-related factors on diabetes management (HbA1c), overall ..........91

Table 9: Coefficients for the effects of state of dissolution, marital history, ascribed, achieved, social, and health-related factors on diabetes management (HbA1c), by state dissolution within gender .................................................................................................................93
List of Figures

Figure 1.1. Conceptual model for the relationship between state of dissolution and diabetes management .............................................................. 12

Figure 3.1 Sample selection criteria and sample size at each stage of inclusions/exclusion ................................................................. 48
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1. **Chapter One: Introduction**

Type 2 diabetes affects approximately 12% of the United States (U.S.) population over the age of 20, and the prevalence is nearly double at 25% in middle-aged and older adults—that is, those over the age of 50 (ADA, 2016a). The risk of diabetes increases with age because of both biology (e.g., changes in physiological processes such as metabolism) and behavior (e.g., the cumulative effects of unhealthy diet and lack of physical activity over many years) (M.B. Davidson, 1979; Kalyani & Egan, 2013; Barzilai, Huffman, Muzumdar, & Bartke, 2012; Tuomilehto et al., 2001; CDC, 2015a). Diabetes can be challenging to manage as it requires changing long-standing health behaviors and, for some, overcoming structural barriers to behavior changes (e.g., limited access to affordable, healthy foods, medications and care providers, and safe places to exercise) (Gaskin et al., 2014; Krishnan, Cozier, Rosenberg, & Palmer, 2010; Odegard & Gray, 2008; Fitzpatrick, Powe, Cooper, Ives & Robbins, 2004; Jerant, von Friederichs-Fitzwater, & Moore, 2005; Siordia, Saenz, & Tom, 2012). It can be especially challenging to manage for those with limited financial and social resources (Zgibor & Simmons, 2002; Nam, Chesla, Stotts, Kroon, & Janson, 2011; Gallant, 2003). Poor diabetes management can result in high blood glucose levels and complications, such as eye, nerve, and kidney disease (ADA, 2016a). A one point reduction in glycosylated hemoglobin (HbA1c)—an indicator of glycemic control/metabolism over the past 2 to 3 months—can reduce risk of these diseases by 20% and can reduce the risk of micro and macrovascular complications by 37% and 14%, respectively (Stratton et al., 2000). As a leading cause of death and at a cost of $245 billion a year in the U.S., it is important to understand who is at risk for diabetes and what factors influence management (ADA, 2016a). Identifying sociodemographic risk factors, particularly those that are modifiable, may be helpful for targeting diabetes prevention and management efforts.

Marriage is a key source of financial and social resources, and it is generally associated with better health, including lower prevalence of diabetes (Choi & Marks, 2011; Goldman, 1993; Wood, Goesling, & Avellar, 2007; Umberson, 1992; Pienta, Hayward, & Jenkins, 2000; Schwandt, Coresh, &
Hindin, 2010). This is the idea of “protection.” Marital dissolutions (i.e., the end of a marriage due to either divorce or widowhood/death of a spouse) are thought to be harmful to health due to both the decreased financial and social resources and the increased stress that often result from the dissolution of a marriage. This is the idea of “crisis.” Importantly, the mode of dissolution in combination with gender and stage of life can have very different impacts on health and well-being (Wood et al., 2007; Liu, 2012). For example, divorce, compared to widowhood, is often more detrimental to wealth and mental health, especially for women (Booth & Amato, 1991; Williams & Umberson, 2004). Divorce also increases risk of suicide, but only in men (Kposowa, 2000). Widowhood, but not divorce, is detrimental to self-rated health and increases risk of mortality, specifically in older men (Williams & Umberson, 2004; Lillard & Panis, 1996), but, in other studies, increased mortality has also been found in older divorced men (Sbarra, Law, & Portley, 2011).

These studies highlight the value in examining a given measure of health by not only state of dissolution, but also by gender and age. In research on diabetes prevalence, incidence, and management, those who are divorced and those who are widowed—in addition to those who have never been married—are sometimes grouped together as “unmarried,” due to small sample sizes and/or a focus on social support, rather than marital status (Chiu & Wray, 2010; Wray, Alwin, McCammon, Manning, & Best, 2006; Diabetes Prevention Program Research Group, 2004; August & Sorkin, 2010). Studies that focused on how marital status, including discrete states of dissolution, influences diabetes have not included any measure of diabetes management, nor have they examined differences by gender (Pienta et al., 2000; Das, 2013; Rote, 2016). As a result, little is known about if/how states of marital dissolution (i.e., divorced, widowed) and gender affect diabetes and its management, particularly in adults over age 50 when risk of both diabetes and having experienced a marital dissolution increase (Brown & Lin, 2012; Lin & Brown, 2012).
Research is needed on the relationship between state of marital dissolution and risk of diabetes and diabetes management in middle-aged and older adults. In the coming decades the prevalence of diabetes is expected to double or even triple in middle and older aged adults, due to increases in diabetes incidence and prevalence, despite the recent leveling off of life expectancy (CDC, 2012; Xu, Murphy, Kochanek, & Arias, 2016). Marital dissolution has become more common, with an increase from 25% in 1960 to 43% in 2013 (Livingston, 2014). There are clear differences in health and well-being between those who are married, divorced, and widowed for many measures of health, but limited research on whether there are differences in diabetes and its management due to state of dissolution. It is unclear whether middle and older aged adults who are in states of marital dissolution are able to manage their diabetes as effectively as those who are married and whether potential differences in financial and social resources are related to management.

1.1. Purpose

The purpose of this dissertation is to explore the relationship between states of marital dissolution (divorced, widowed, and, as a reference group, married), self-reported diabetes, and diabetes management, as measured by HbA1c, in middle-aged and older adults. I will also identify any differences by gender, as men and women tend to bring different resources into a marriage and lose different resources when they enter into states of marital dissolution. Then, I will examine how two aspects of marital history—length of longest marriage and marital transitions—influence HbA1c in those with diabetes in order to better understand if protection and/or crisis related factors influence HbA1c. Finally, I will assess whether there are differences in the relationships between five marriage-related, potentially modifiable factors (i.e., accessible savings, health insurance, depression, and negative and positive social support) and diabetes management by state of marital dissolution and gender. This research will provide a clearer picture of how state of marital dissolution, gender, aspects of marital history, and marriage-related modifiable factors influence diabetes and its management in a growing
portion of the population. It may also provide some insights into whether selection, protection, and crisis affect diabetes and management. This information on risk factors for diabetes and poor management by specific sociodemographic groups can guide future research aimed at informing policy and practice aimed at helping at-risk populations better manage their diabetes.

1.2. Theoretical Framework

This research on the relationships between states of marital dissolution, diabetes, and management in middle-aged and older adults is guided by three prominent theories (selection, protection, and crisis) on the relationship between marriage and health. In addition, it is viewed through the lens of the Lifespan Developmental Perspective (LSP) and the Life Course Perspective (LCP). Brief descriptions of each theory and framework and their influence on this dissertation are provided below.

1.2.1. Models of Marriage

The relationship between marriage and health is well established, dating back over 50 years (Hu & Goldman, 1990; Gove, 1973; Lillard & Panis, 1996; Manzoli, Villari, Pirone, & Boccia, 2007; LaHorgue, 1960; Zalokar, 1960). During that time, three theories for why this relationship exists have emerged: selection, resources/protection, and crisis (Williams & Umberson, 2004; Waite, 2009). Each of these theories helps provide some context for understanding the relationship between state of marital dissolution and diabetes management.

Selection: Marital selection is the idea that marriage is positively associated with health due to the selection of healthier, “more desirable” individuals into marriage (Waldron, Hughes, Brooks, 1996; Goldman, 1993; Coombs, 1991). Many studies have found evidence of selection; however, most of these studies found that protection and/or crisis also played a role in the relationship between marriage and various measures of health (e.g., health behaviors, chronic conditions, self-reported health, mortality) (Williams & Umberson, 2004; Wood et al., 2007; Murray, 2000). Although selection is not the focus of this dissertation, it does influence the design and interpretation of the findings. For example, those who
become married were likely to be healthier prior to entry into marriage than their never married counterparts (Murray, 2000; Waldron et al., 1996; Goldman, 1993). Those who become divorced may be less healthy than those who remain married (Joung, Van De Mheen, Stronks, Van Poppel, & Mackenbach, 1998; Waldron et al., 1996; Zhang & Hayward, 2006). As a result, this dissertation aims to explore differences in diabetes and its managements by state of marital dissolution using those who are married as a benchmark, rather than using those who are never married as a benchmark or looking for differences between those who are married and those who are not. Given that health prior to current marital state will not be controlled for in this research, the results will need to be interpreted with caution. The consideration given to other aspects of selection in the design and interpretation of this research is discussed below.

*Resources/Protection:* The marital resources/protection model, referred to as protection from this point forward, states that marriage is a unique institution that provides benefits to health. Specifically, those who marry also tend to have access to more financial and social resources that benefit health, with important differences in these resources by gender elaborated on below (Wood et al., 2007; Stolzenberg & Waite, 2005; Umberson, 1992). Those who are married tend to have higher incomes, benefit from economies of scale, and have more opportunities for and consistency in health insurance coverage over their lifespan (Berk & Taylor, 1984; Waite, 1995; Wilmoth & Koso, 2002), although, historically, men, particularly younger men, do well financially even after a divorce (Holden & Smock, 1991). Married individuals may also be protected against poor health due to lower engagement in risky activities because of an increased sense of responsibility to provide for their families and/or due to the social control their spouses exert on their health behaviors (Wood et al., 2007; Umberson, 1992; Seidel, Franks, Stephens, & Rook, 2012). In addition, those who are married tend to benefit from social support provided by a spouse (Holt-Lunstad, Birmingham, & Jones, 2008; Cutrona, 1996). These financial
and social resources accumulate over time resulting in “stock” in or the “protection” of health, sometimes even after a marital dissolution (Lillard & Waite, 1995).

Marital protection is thought to be the mechanism behind the negative association between marriage and slow-to-develop chronic conditions (Waite, 2009; Dupre, Beck, & Meadows, 2009). Some research suggests that the longer an individual is in one enduring marriage, the more health protections or “enhancements” they receive, due to increased stability and resources (Lillard & Waite, 1995; Hughes & Waite, 2009). First marriages tend to provide the greatest benefits to health and well-being (Williams & Umberson, 2004; Wood et al., 2007). Older adults who are remarried often report high quality marriages and better health compared to those who remain divorced or widowed (Bograd & Spilka, 1996); however, remarriage does not provide middle-aged and older adults the same benefits to health behaviors and health outcomes as does a first marriage (Williams & Umberson, 2004; Wood et al., 2007). Those who are remarried report more loneliness and poorer mental health, particularly if they have experienced several marital dissolutions, compared to those who are still in their first marriage (Peters & Liefbroer, 1997; Barrett, 2000). In addition, the dissolution that takes place between a first marriage and a potential remarriage comes with many stressors that can deplete one’s stock in health. As a result, one long marriage is thought to provide more stock than numerous short marriages (Lillard & Waite, 1995). The benefits of a longer marriage can then buffer against the negative effects of hardships, such as a transition out of marriage (Waite, 2009; Dupre & Meadows, 2007; Dupre et al., 2009).

The literature suggests that marital protection operates differently for women and men (Williams & Umberson, 2004). Women are more likely to benefit from the financial advantages offered by marriage, while men are more likely to benefit from the increased access to social support offered by marriage (Williams & Umberson, 2004; Berk & Taylor, 1984). In states of divorce and widowhood, women generally experience greater losses of financial resources and men tend to experience greater
losses of social resources. Understanding the role of protection in diabetes and its management overall and by gender is one focus of this dissertation.

Protection is examined in Aims 3 and 4 of this dissertation (as described in greater detail in section 1.4 of this chapter). In Aim 3, length of longest marriage is used as a proxy for protection to see if it is associated with HbA1c, regardless of current marital status. In Aim 4, the influences of four potentially modifiable factors—accessible savings, health insurance, positive social support, and negative social support—that are considered resources and often vary by marital status are tested to see if they are associated with HbA1c and whether there are differences in the relationship by state of dissolution and gender.

_Crisis:_ The crisis theory states that marriage is related to health, not because of the benefits marriage provides, but rather because of the stress experienced during, or resulting from, a marital transition. Transitions into marriage can be stressful due to changes in living arrangements, habits, and patterns of interaction; transitions out of marriage are thought to be especially stressful and harmful to health (Johnson & Wu, 2002; Lillard & Waite, 1995). Divorce is often preceded by marital conflict; widowhood is often preceded by the poor health of one’s spouse and sometimes the strains of caregiving. In addition, dissolution often involves a change in living arrangements, habits, patterns of interaction, and the loss of financial and social resources (Williams & Umberson, 2004). Several studies have found evidence that both protection and crisis [and selection] help to explain why those who are married are healthier than those who are previously married. Some of these studies show that the effects of marital crisis are stronger than the effects of marital protection (Williams & Umberson, 2004; Hughes & Waite, 2009).

The current research will explore crisis in Aims 3 and 4, which are detailed in section 1.4. In Aim 3, the relationship between marital transitions (≤ 2 transitions based on number of times married, divorced, widowed, and/or marriage ended for unknown reason, compared to more than two
transitions) is examined, with marital transitions serving as a proxy for crisis. An association between more than two transitions and higher HbA1c, regardless of current marital state, would provide support for crisis. In Aim 4, the relationship between depressive symptoms and HbA1c is examined, with depressive symptoms serving as a potentially modifiable factor that might be suggestive of stress/crisis. The goal of these analyses is not to determine which of these three theories best explains diabetes and its management, but rather to determine whether protection- or crisis-related factors are more relevant to diabetes management for certain portions of the population, while acknowledging the likely influence of selection on the sample being analyzed and the findings.

1.2.2. Lifespan Developmental Perspective (LSP) and Life Course Perspective (LCP)

The Lifespan Developmental Perspective (LSP), in addition to concepts from the Life Course Perspective (LCP), provides a helpful framework for understanding the relationship between states of marital dissolution and diabetes and its management. The LSP takes a primarily intrapersonal approach to aging. It suggests that human development is a lifelong, normative, age-graded process driven by ontogenesis; individual differences arise primarily from differences in age, historical location or cohort, and from human agency (Alwin, 2012; Baltes, 1987). While the focus is on the individual, the perspective increasingly acknowledges the role of the environment in shaping how individuals progress through life. Importantly, it highlights multidimensionality, multidirectionality, gains and losses, plasticity, and contextualism as important characteristics of development (Baltes, 1987; Alwin, 2010). In other words, individuals can experience gains or losses at any point in life, and various aspects of health (e.g., physical and mental) and life (e.g., education and marriage) can influence each other. Human agency or choice is limited by one’s resources and opportunities.

This framework helps us to understand why, for example, risk of diabetes increases with age and, to some extent, how risk of diabetes has increased over time (i.e., historical location and environment). Concepts such as multidirectionality, multidimensionality, and contextualism also provide
a basis for understanding differences in risk of diabetes and poor management by state of dissolution and gender and why risk factors for diabetes and management may also vary by state of dissolution and gender.

The LCP is a newer perspective that was developed from observations of the aging U.S. population. Although very similar to the LSP, it differs in that it takes a more interpersonal approach, stating that sociogenesis is the driving force behind how people progress through life (Elder, Johnson, Crosnoe, 2003; Settersten, 2003; Dannefer, 1984). An individual’s experiences have cumulative and lasting effects on progression (Alwin, 2012). Life course events, roles, and social ties—particularly the idea of linked lives—are important in determining or interrupting an individual’s trajectory through life (Alwin, 2012; Elder et al., 2003). The timing and sequencing of life events is critical in determining one’s trajectory through life. While these concepts (i.e., sociogenesis/institutional regulation, linked lives, timing, sequence, cumulative advantage and disadvantage) will not be looked at directly in this research due to data limitations (i.e., limited sample size and waves containing), consideration of these concepts will be given in the interpretation of the findings and future research directions.

1.2.3. Summary of Theoretical Framework

The LSP, concepts from the LCP, and the three theories on the marriage-health relationship influence the design of this dissertation, as well as the inclusion and development of the variables. This dissertation takes a more interdisciplinary approach to understanding the relationship between states of marital dissolution and health by pulling from both the LSP and the LCP to frame the research. In this research, aging is considered a normative, biological part of a lifespan (i.e., the period between birth and death). However, differences in aging and health increase with age due primarily to differences in experiences (i.e., context and historical location), resources, and roles. Each individual is seen as unique and has the ability/freedom to make choices that shape their experiences, but those choices are constrained by their environment. This highlights the value in looking at differences in diabetes and its
management between those who are divorced and those who are widowed, particularly by gender. Risk of diabetes and poor management are influenced by both genetics and social factors such as resources. Midlife and older age are periods during which risk of diabetes is highest and most heavily influenced, but not determined, by both age-graded processes (e.g., menopause) and earlier life events and transitions (e.g., educational attainment, marriage). These events and transitions may have negative or positive effects on those who experience them. Those effects are likely to be influenced by the circumstances surrounding them, such as resources and timing. Thus, background factors are controlled for and/or included as covariates in models of HbA1c. These factors are grouped into categories: ascribed, achieved, social, and health. Ascribed factors are the most basic and are with an individual from birth through death. Achieved factors are those that a person accrues often beginning in early adulthood, such as socioeconomic status (SES) and marital status. Social and health factors such as social support and health behaviors are often influenced by ascribed and achieved factors but also influence health outcomes such as diabetes management. The protection and crisis theories and related literature provide a basis for the study hypotheses. Historical setting/location is also important and will be taken into consideration in the operationalization of variables and interpretation of results.

1.3. Conceptual Model

The conceptual model presented in Figure 1.1 was developed based on the protection and crisis models, lifespan and life course perspectives, and review of the literature. State of marital dissolution (i.e., divorced, widowed, and—as a reference group—married) is thought to be associated with both diabetes—as measured by self-report of doctor diagnosed diabetes—and diabetes management—as measured by HbA1c from a dried blood spot. Since all analyses in this dissertation are cross-sectional, it is important to note that there is also the potential for diabetes and HbA1c to influence the state of marital dissolution, marital history, and risk and protection factors such as savings, social support, and health status. The relationship between state of marital dissolution and diabetes management is
thought to work through both marital history and several potentially modifiable factors. The two aspects of marital history explored in this research are length of longest marriage and marital transitions, with the former potentially providing support for marital protection and the latter potentially providing support for crisis. Length of longest marriage is included because the longer a marriage lasts, the more benefits an individual gains due to stability and access to financial and social resources. These benefits are thought to provide protection, possibly even after the individual is no longer married (Brockmann & Klein, 2004). Therefore, length of longest marriage may influence diabetes and its management, even in those who are widowed or divorced. A measure of marital transitions is included because transitions are considered stressful and provide insight on crisis. Modifiable factors often related to marital status included in this research include accessible savings, health insurance, positive and negative social support, and depressive symptoms. These factors are included to determine whether risk and protection factors for diabetes prevalence and management differ by state of marital dissolution and gender.

A number of control variables are included in the analyses because of their influence on diabetes and its management. These variables include ascribed, achieved, social, and health characteristics. Ascribed characteristics are those that are determined at birth and not easily modified, such as race/ethnicity. Achieved characteristics are those that an individual works toward/achieves, such as educational attainment. Social characteristics include factors like contact with children. Health characteristics include factors such as smoking and chronic conditions. While these factors serve as control variables, they also provide insight into how risk of diabetes and poor management vary in sociodemographic groups. All analyses will be run overall, by state of dissolution, by gender, and by state of dissolution within gender. This is because the effects of state of marital dissolution on diabetes management might be suppressed if some relationships are opposite in men and women and the relationships are not analyzed separately for men and women. This will show whether specific subgroups are behind any significant associations in the less stratified analyses. Again, many of these
relationships can be bidirectional, as noted by the arrows in the figure below. The cross-sectional analyses will show relationships rather than causation.

Figure 1.1. Conceptual model for the relationship between state of dissolution and diabetes management

1.4. Aims, Research Questions, and Hypotheses

The literature on marriage and health, which is discussed in greater depth in Chapter Two, shows there can be important differences in how divorce and widowhood affect health (Wood et al., 2007; Williams & Umberson, 2004; Pinquart, 2003; Stolzenberg & Waite, 2005). Similarly, literature on marital status and diabetes suggests that those who are married have a lower risk of diabetes and better diabetes management, compared to those who are divorced or widowed. There is limited research,
however, on links between discrete states of marital dissolution, such as divorced and widowed, and diabetes management. Many studies either focus on diabetes incidence or prevalence rather than management or group those who are separated, divorced, widowed, and/or never married together. Theories of marriage, as well as the lifespan developmental and life course perspectives, highlight the affects different events can have on one’s life; divorce and widowhood often have different effects on an individual’s financial and social resources (Waite; 1995; Holden & Kuo, 1996; Holden & Smock, 1991; Uhlenberg, Cooney, & Boyd, 1990; Lillard & Waite, 1995; Waite, 2009). There are also important differences by gender and age (Holden & Smock, 1991; Uhlenberg et al., 1990; Lillard & Waite, 1995).

The following aims, research questions, and hypotheses are based on the existing literature and theory. The literature on which the hypotheses below are based is discussed in more depth in the next chapter.

1.4.1. **Aim 1:** To explore differences in diabetes prevalence and its correlates by state of marital dissolution and gender in middle-aged and older adults

   **A1.R1:** Are there differences in the prevalence of self-report of doctor-diagnosed diabetes by state of marital dissolution?

   **A1.H1:** Diabetes will be most common in those who are widowed, followed by those who are divorced. It will be least common in those who are married. Social and financial resources and sociodemographic characteristics such as age will attenuate these differences. These hypotheses are based on the literature suggesting that diabetes is less common in those who are married (Wray et al., 2006), the idea that marriage offers protection against poor health, and the idea that divorce and widowhood are stressful events that come with a loss of financial and social resources. Those who are divorced tend to have shorter marriages and fewer financial and social resources compared to those who are widowed, but those who are widowed tend to be older and still have more limited social and financial resources than those who are married (Wood et al., 2007; Williams & Umberson, 2004).
A1.R2: Are there differences in the prevalence of self-reported, doctor-diagnosed diabetes by gender and state of marital dissolution?

A1.H2: There will be a difference in diabetes prevalence by gender. Diabetes will be more common in men than in women. In women, diabetes will be most common in those who are divorced. In men, diabetes will be most common in those who are widowed. These hypotheses are based on the finding that the prevalence of diabetes tends to be slightly higher in men, compared to women in middle and older age (Wray et al., 2006) and that divorced men tend to fair better than widowed men or divorced women, while widowed women tend to fair better than divorced women or widowed men (Pienta et al., 2000).

A1.R3: Are there differences in the marital history, modifiable, ascribed, achieved, social, and health-related risk and protective factors associated with diabetes by gender and state of marital?

A1.H3: Diabetes will be more common in those who are older, not as well-off financially, obese, inactive, and have more health conditions across state of dissolution-gender categories. In married women, obesity and negative social support are likely to be positively associated with diabetes. In divorced women, accessible savings and depressive symptoms are likely to be negatively and positively associated with diabetes, respectively. In widowed women, accessible savings and inactivity are likely to be negatively and positively associated with diabetes, respectively. Positive social support and obesity are expected to respectively be negatively and positively associated with diabetes in married men; less positive social support and poor health behaviors are expected to be associated with diabetes in divorced men, and low positive social support is hypothesized to be associated with higher diabetes prevalence in widowed men. These hypotheses are based on literature on the risk factors for diabetes (Wray, et al., 2006) and on the resources and health habits associated with various marital statuses and transitions (Goldman, Korenman, & Weinstein, 1995; Wood et al., 2007), which are discussed in the next chapter.
1.4.2. **Aim 2:** To explore differences in HbA1c by state of marital dissolution and gender in middle-aged and older adults with self-reported diabetes

* A2.R1: Are there differences in HbA1c by state of marital dissolution?

* A2.H1: HbA1c is hypothesized to be highest in those who are divorced, followed by those who are widowed, and lowest in those who are married. This hypothesis is based on literature suggesting that marriage is beneficial to financial resources, a number of health behaviors, health care access and usage, and health outcomes because of increased stability and financial and social support (Wood et al., 2006). These resources are more limited in those who are widowed and especially in those who are divorced. In addition, depression tends to be higher in those who are divorced (Wood et al., 2006), and divorce is thought to be especially harmful to health in middle and older aged adults where widowhood is an expected part of life and divorce still carries a stigma (Waite, 2009). Finally, those who are widowed tend to have longer marriages than those who are divorced, providing more years of “protection.”

* A2.R2: Are there differences in the relationship between HbA1c and state of marital dissolution by gender?

* A2.H2: Men will have slightly higher HbA1c levels than women, based on the literature that shows they tend to have a higher prevalence of diabetes and that HbA1c tends to be higher in men (Wray et al., 2006; Rote, 2016; Das, 2013). In women, those who are widowed will have the lowest HbA1c, followed by those who are married; those who are divorced will have the highest HbA1c. This hypothesis is based on literature showing that women experience more limited health gains from marriage compared to men and becoming widowed can actually improve some measures of health in women. Also, widowhood does not impact resources to the same extent divorce does; divorced women do poorer on almost all measures of health and resources, compared to married women (Holden & Smock, 1991; Uhlenberg et al., 1990; Lillard & Waite, 1995; Brown & Lin, 2012). In men, those who are
married will have the lowest HbA1c, followed by those who are divorced; it will be highest in men who are widowed. This hypothesis is based on the benefits men generally receive from being married, and the more negative effects of widowhood, compared to divorce, on men’s health (Dupre & Meadows, 2007).

1.4.3. **Aim 3**: To examine whether two aspects of marital history—length of longest marriage and marital transitions—influence HbA1c, indicating support for protection and/or crisis, and whether there are differences by state of marital dissolution and gender in a sample of middle-aged and older adults with self-reported diabetes

**A3.R1**: Does length of longest marriage influence HbA1c overall and for each state of marital dissolution, and are there differences by gender?

**A3.H1**: Longer longest marriage will be negatively associated with HbA1c, overall and for each state of marital dissolution. This hypothesis is based on the marital protection model: marriage provides resources that help to maintain or improve health and these benefits accumulate over time, potentially lasting into states of dissolution (Lillard & Waite, 1995). Both men and women, regardless of state of dissolution, are hypothesized to benefit from longer marriages (Dupre & Meadows, 2007). However, if significant, social resources may be more likely to attenuate the relationship in men, while financial resources may reduce the relationship in women (Lillard & Waite, 1995; Umberson, 1992).

**A3.R2**: Are fewer marital transitions (based on number of times married, divorced, and/or widowed) associated with lower HbA1c overall and for each state of marital dissolution, and are there differences by gender?

**A3.H2**: Those with fewer marital transitions are hypothesized to have lower HbA1c levels overall and for each state of marital dissolution. The relationship between transitions and HbA1c is expected to be stronger for women. These hypotheses are based on the crisis model (transitions into and out of any marital status are stressful and can negatively affect health behaviors, status, and outcomes through
interruption to routine) and research suggesting that there might be more stress related to transitions for women due to more stigma around divorce and greater loss of financial resources (Johnson & Wu, 2002; Lillard & Waite, 1995; Dupre & Meadows, 2007; Addo & Lichter, 2013).

1.4.4. **Aim 4:** To identify any of the potentially modifiable marriage-related factors, including accessible savings, health insurance coverage, positive and negative social support, and depressive symptoms, that influence HbA1c in middle-aged and older adults with diabetes overall and by state of marital dissolution, gender, and state of dissolution within gender

   **A4.R1:** Are accessible savings associated with HbA1c? Are there differences by state of dissolution, gender, and state of dissolution within gender?

   **A4.H1:** Accessible savings will be negatively associated with HbA1c across states of marital dissolutions and genders, and may be particularly relevant for divorced women. These hypotheses are based on literature linking lower socioeconomic status to poorer glycemic control (Grintsova, Maier, & Mielck, 2014) and divorce to more limited financial resources in women (Brown & Lin, 2012).

   **A4.R2:** Is health insurance associated with HbA1c? Are there differences by state of dissolution, gender, and state of dissolution within gender?

   **A4.H2:** Health insurance coverage will be negatively associated with HbA1c overall for each state of dissolution-gender category. This hypothesis is based on the idea that those with health insurance may have better access to diabetes management resources, and, thus, better management (Nelson, Chapko, Reiber, & Boyko, 2005; Wilper et al., 2009).

   **A4.R3:** Is positive social support associated with HbA1c? Are there differences by state of dissolution, gender, and state of dissolution within gender?

   **A4.H3:** Positive social support is hypothesized to be associated with lower HbA1c, especially in widowed and divorced men among whom there may be more variability in access to positive social support (Kalmijn, 2007; Umberson, 1992).
A4.R4: Is negative social support associated with HbA1c? Are there differences by state of dissolution, gender, and state of dissolution within gender?

A4.H4: Negative social support will be associated with higher HbA1c overall. It may be especially relevant in those who are divorced and to men. It may also be significantly associated with HbA1c in married women, given the literature suggesting they are less likely to receive social support from their spouse than are married men (Kalmijn, 2007; Umberson, 1992).

A4.R5: Are depressive symptoms associated with HbA1c? Are there differences by state of dissolution, gender, and state of dissolution within gender?

A4.H5: More depressive symptoms are hypothesized to be associated with higher HbA1c, particularly for widowed men and divorced women based on literature suggesting that these two groups have more depression and poorer health than other groups (Chiu, Wray, Beverly, & Dominic, 2010; Stolzenberg & Waite, 2005; Wood et al., 2007).

A4.R6: Are there differences in whether financial or social factors better estimate HbA1c by state of dissolution within gender?

A4.H6: Social factors will better estimate HbA1c for men, particularly widowed men, and financial factors will better estimate HbA1c for women, particularly widowed women (Lillard & Waite, 1995; Umberson, 1992).

1.5. Innovation, Significance, and Implications

Although there is a positive relationship between marriage and many measures of health, including diabetes, it is unclear what diabetes and its management look like among middle-aged and older adults in specific states of marital dissolution. This dissertation will be the first study to examine differences in diabetes risk and management by state of marital dissolution and gender in middle-aged and older adults using a large, nationally representative data set. It will also test whether two aspects of marital history influence management, and whether their influence varies by state of dissolution and
gender. Finally, it will identify significant correlates of diabetes management for each state of marital dissolution-gender category, with a focus on modifiable factors. The work will be framed by the lifespan and life course perspectives and will provide insights as to whether protection and/or crisis are behind any relationship between state of marital dissolution, gender, and HbA1c.

Identifying which population(s) have the greatest risk of diabetes and poor diabetes management provides a basis for understanding which populations might benefit from more targeted research and interventions and which variables to further investigate in predictive research. Significant relationships between modifiable factors and HbA1c by state of marital dissolution and gender would also warrant further research and consideration in policy and practice decisions.

1.6. Organization

The dissertation will be presented in the traditional format and will address the study aims in six chapters. The next chapter, Chapter Two, provides a detailed review of the literature on diabetes and its management, marriage and dissolution, and links between the two in an aging population. Chapter Three describes the data, measures, and analyses used to address the aims. Chapter Four describes the samples and findings for Aims 1 and 2. Chapter Five presents the findings for Aims 3 and 4. Chapter Six summarizes all the findings in relation to the aims and hypotheses, discusses how the findings fit into the existing literature, notes the strengths and limitations of the research, provides implications of this work, and proposes future directions for this line of research. Additional figures and tables—providing greater detail than what is included in the main text of this dissertation—will be presented as appendices.
2. Chapter Two: Literature Review

This chapter provides a brief overview of the literature on diabetes, its management, states of marital dissolution, links between the three, and factors that are likely to influence those links in four sections. In the first section, the increasing prevalence of diabetes, particularly in middle and older ages is discussed. In addition, risk factors for diabetes, the importance of management, indicators of management effectiveness, and risk factors for poor management are detailed. In the second section, patterns of marriage and dissolution in middle-aged and older U.S. adults are discussed, as are key marriage-related terms and the sociodemographic and health characteristics of those who are married, divorced, and widowed. Several aspects of marital history are also discussed. In the third section, the existing literature on the relationship between states of marital dissolution and risk of diabetes is synthesized and critiqued. In the fourth section, the same is done on the relationship between states of marital dissolution and diabetes management. In each of these sections, relevant risk factors for diabetes and/or poor management are also discussed. The chapter concludes with a summary, gaps in the literature, and the need for the current research.

2.1. Diabetes

Diabetes is the 7th leading cause of death and affects approximately 29 million people in the United States (CDC, 2015a; CDC, 2015b); the prevalence is expected to rise to nearly 44 million, or one in every three to five people, by 2050 (Boyle, Thompson, Gregg, Barker, & Williamson, 2010; Huang, 2009; CDC, 2015a). There are three basic types of diabetes: type 1, type 2, and gestational. Type 2 diabetes comprises 95% of cases of all cases of diabetes and drives any statistics on trends in “diabetes” (CDC, 2015a). The large increases are the result of a combination of the nature of diabetes and demographic trends. Diabetes, specifically type 2 diabetes, is a chronic condition that can only be managed, not cured, which results in a higher prevalence particularly if people are able to successfully manage their diabetes and, thus, delay or prevent premature death. In addition, diabetes is common among middle-
aged and older adults; the proportion and number of middle-aged and older adults in the population is increasing due to increased survivorship (Ortman, Velkoff, & Hogan, 2014). Also, the proportion of overweight and particularly obese people in the population has increased over the past several decades, and increases in diabetes have followed (Nguyen, Nguyen, Lane, & Wang, 2011). Management is very complicated and proves challenging for many people living with diabetes. Given the growing numbers of middle-aged and older adults living with and at risk for diabetes in the coming decades, understanding as much as possible about diabetes management is critical. What follows is a summary of what is known about diabetes and its management and the implications of that knowledge for this research.

2.1.1. Biology of and Risk Factors for Diabetes

Type 2 diabetes is a metabolic disorder in which the body is resistant to insulin and/or cannot produce enough insulin to adequately process glucose in the blood. As a result, blood glucose levels remain high, causing damage to blood vessels. Both biological and environmental factors can increase one’s risk of diabetes.

Biological or ascribed risk factors for type 2 diabetes include genetics, race/ethnicity, and age. More than one copy of a variant of the TCF7L2 gene—present in approximately 17% of the population—can increase risk of diabetes by 80% (Tong et al., 2009; NIDDK, 2014a), with replication studies confirming the findings in a variety of racial/ethnic and national groups including Northern Europeans, Indians, Japanese, Mexican-Americans, and West Africans (Hattersley, 2007). Risk of diabetes is also higher in the U.S. in the following racial/ethnic groups: African Americans, Native Americans, Alaska Natives, Hispanics/Latinos, Native Hawaiians, and Pacific Islander Americans (NIDDKa, 2014). Aging can also increase risk of diabetes, as wear and tear, dysfunction, and dysregulation of various systems, such as reduced production of beta cells in the pancreas, become more common (Gunasekaran & Gannon, 2011). It is important to note that race/ethnicity and age can be considered biological or socio-environmental risk factors, depending on one’s theoretical perspective. Each is discussed in a
socioenvironmental context below. While each of these three biological factors can increase risk of diabetes, socioenvironmental and behavioral factors are often seen as more important risk factors because they can amplify biological risks and because they are modifiable, meaning they can be changed in an effort to prevent or delay onset of diabetes (Murea, Ma, & Freedman, 2012).

Socioenvironmental and behavioral risk factors are considered the initiators of diabetes, as biological factors alone do not cause diabetes (Franks, 2011; Hu, 2011). They include numerous factors, but some of the key factors include family history of diabetes, low socioeconomic status, lack of physical activity, poor diet, obesity (particularly abdominal obesity), and not being married (NIDDK, 2014a; Wray et al., 2006). As noted above, age and race/ethnicity can be looked at as socioenvironmental or ascribed factors. Aging is not only a process of ontogenesis, but also the culmination of opportunities and experiences determined by one’s environment. In the U.S., race/ethnicity is associated with factors like SES, cultural norms, and dietary preferences (Caprio et al., 2008; Kumanyika, 2008; Thackeray, Merrill, & Neiger, 2004). A key achieved factor is socioeconomic status, which has widespread implications for health behaviors and risk of diabetes (Everson, Maty, Lynch, & Kaplan, 2002; Wray et al., 2006; Robbins, Vaccarino, Zhang, & Kasl, 2005). It is associated with health literacy, health care, and access to safe places to exercise and healthy foods (Brown et al., 2004; Schillinger, Barton, Karter, Wang, & Adler, 2006). Family tends to influence factors like SES and dietary and exercise habits, resulting in a positive association between having a close relative with diabetes and the development of diabetes—in other words, a family history of diabetes due to learned behaviors and shared environment rather than genetics (Lynch, Kaplan, & Salonen, 1997; Valdez, Yoon, Liu, & Khoury, 2007). Health-related factors include health behaviors such as a lack of physical activity, poor diet, and related statuses such as obesity. Inactivity hinders the body’s ability to regulate blood glucose levels, increasing risk of diabetes (Mikus et al., 2012; WHO, 2015). Poor diet can lead to high loads of glucose forcing the body to work harder to process the excess glucose. Both lack of physical activity and poor diet can also increase risk of
obesity, which in turn increases risk of diabetes (Tuomilehto et al., 2001; Boulé, Haddad, Kenny, Wells, & Sigal, 2001; Sigal Kenny, Wasserman, Castaneda-Sceppa, & White, 2006; Hu et al., 2001). Being unmarried has also been linked to increased risk of diabetes, (Wray et al., 2006; Cornelis et al., 2014). Based on the above risk factors, it is important to take both biological/ascribed and socioenvironmental/achieved and health-related factors into account when researching diabetes and its management.

2.1.2. Diabetes Diagnosis, Management, Complications, and Costs in Middle-Aged and Older Adults

Diabetes diagnosis is based on one or more tests of blood glucose levels, as diabetes is a condition denoted by high blood glucose levels (NIDDK, 2014b). It is diagnosed based on a glycosylated hemoglobin (HbA1c) test of 6.5% or above, a fasting plasma glucose (FPG) test of 125mg/dL or above, an oral glucose tolerance test (OGTT) of 200mg/dL or above, and/or a random plasma glucose (RPG) test of 200mg/dL or above (NIDDK, 2014b). These tests can also be used to assess management of diabetes. There are advantages and disadvantages to each type of test, but HbA1c is frequently used in survey research because it does not require fasting, can be done using participant-procured dried blood spots, and provides a more average measure of glucose levels over the past two to three months (McDade, Williams, & Snodgrass, 2007; McDade, 2011; Crimmins et al., 2013; Weir, 2008).

Unfortunately, about one in four people with diabetes has not been diagnosed and may not know they have the disease (CDC, 2015a). Diagnosis is a critical step in preventing complications (Harris, 1993). When an individual is diagnosed with diabetes, his/her doctor often prescribes engaging in regular exercise, maintaining a healthier diet, taking medications as prescribed, monitoring blood glucose levels, watching for signs of neuropathy, and visiting the doctor regularly in an attempt to keep blood glucose levels in a low, healthy range (Inzucchi et al., 2012; ADA, 2016b).

The management behaviors prescribed to those diagnosed with diabetes can be expensive physically, financially, and socially. Time is needed to engage in these behaviors, most of which need to
be repeated several times each day. Health insurance can be helpful to those living with diabetes, as routine doctor visits, tests to measure blood glucose levels, and medications can be expensive. Even with insurance, there are often out-of-pocket costs (Piette, Heisler, & Wagner, 2004; Piette, Wagner, Potter, & Schillinger, 2004). Financial resources that are easy to access make it possible to absorb these costs and any additional costs for eating healthfully and exercising regularly. In addition to financial resources, social resources aid in the management of diabetes. Activities such as eating healthfully, monitoring blood glucose, and exercising regularly are positively correlated with social support (Gallant, 2013).

Poorly managed and unmanaged diabetes, as indicated by high, chronically fluctuating blood glucose levels, can lead to dental disease, kidney disease, heart disease, stroke, neuropathy, blindness, infections, amputations, limited activities of daily living (ADLs) and instrumental activities of daily living (IADLs), and increased risk of premature death (CDC, 2015a). Proper management of diabetes can keep blood glucose levels within a lower risk range, delaying or preventing these health issues (CDC, 2015a).

2.1.3. Measuring Blood Glucose Levels/Diabetes Management

Ensuring that diabetes is effectively managed often requires a blood glucose test. HbA1c is the gold standard for assessing long-term/average glycemic control because it shows the average level over the past two to three months, rather than day-to-day fluctuations (McDade et al., 2007; McDade, 2011). In addition to being a good indicator of management, no fasting is required, and it has high validity and reliability (McDade et al., 2007; McDade, 2011).

The American Diabetes Association has laid out target HbA1c levels, based on individual characteristics. For most adults the target level is ≤7.0% (ADA, 2015). For healthy adults with a long life expectancy and no/low risk of hypoglycemia, ≤6.5% is recommended (ADA, 2015). On the other hand, a less aggressive target of <8.0% is recommended for older adults with a limited life expectancy, numerous comorbidities, risk of hypoglycemia, and/or a long history of diabetes (ADA, 2015).
There are several limitations of HbA1c as an indicator of diabetes management that should be noted. One limitation is that, as with all blood glucose tests, the results are not valid if the test was not administered properly. A second is that it is not accurate in people with higher (underestimates) or lower (overestimates) than average rates of red blood cell turnover (ADA, 2015; National Glycohemoglobin Standardization Program (NGSP), 2016). Conditions/events such as genetic variations (HbS trait, HbC trait), renal failure, blood transfusions, and anemia can lead to over or under estimation of blood glucose levels (NGSP, 2016). A third limitation is that there are racial/ethnic differences in the relationship between HbA1c and blood glucose levels with non-Hispanic blacks having higher HbA1c levels than non-Hispanic whites in those with and without diabetes, despite there being no evidence of higher risk of complications or death for those with higher levels (Herman & Cohen, 2012; ADA, 2015). A fourth is that it does not measure variability in blood glucose levels, and rapid fluctuations are especially harmful to health (ADA, 2015). Finally, dried blood spots, compared to whole blood spots, are less accurate, despite being much more cost effective (McDade, 2011; Weir, 2008). When using HbA1c as an outcome, it is important that the 1) tests were administered properly, 2) test results be carefully reviewed, 3) research questions be appropriate to the outcome given its limitations (e.g., not aimed at identifying differences by race ethnicity), and 4) relationships found be critically interpreted by the researcher. In this dissertation, the first two were addressed by the Health and Retirement Study researchers, and the second two are addressed by the researcher.

2.1.4. Risk Factors for Poor Management

Many studies have identified risk factors for poor diabetes management, and, like risks for diabetes, these risks can be grouped into ascribed, achieved, social, and health, and social factors. Ascribed risk factors for poor management include younger age and being non-Hispanic black or Hispanic (Benoit, Fleming, Philis-Tsimikas, & Ji, 2005; Chiu & Wray, 2010; Nichols, Hillier, Javor, & Brown, 2000); the findings as to whether or not gender is related to management are more complex (Chiu &
Chiu and Wray (2010) found that HbA1c was not significantly different in middle-aged and older men and women. However, women are generally at greater risk of complications and poor outcomes (Chiu & Wray, 2011; Legato et al., 2006).

Achieved risk factors for poor diabetes management include lower income, lower educational attainment, and being uninsured (Nam et al., 2011; Benoit et al., 2005; Chiu & Wray, 2010; Nichols et al., 2000). As with risk of diabetes, lower SES (e.g., income, wealth, education) is associated with poor management, often as a result of more barriers to management. In addition, being uninsured is associated with greater risk of diabetes and poor management (Nelson, Chapko, Reiber, & Boyko, 2005; Wilper et al., 2009). Sometimes the relationship between insurance and diabetes is complicated by other factors. For example, diabetes is more likely to be undiagnosed in those without insurance and those with chronic conditions may prioritize having health insurance (Harris, 1995). These factors might help to explain sometimes contradictory findings in relationships between insurance and diabetes management.

Health-related correlates of poorer management include longer duration of diabetes, being on insulin or diabetes medications, more comorbid conditions, obesity, smoking, drinking, and depression (Benoit et al., 2005; Chiu & Wray, 2010; Nichols et al., 2000; Lustman & Clouse, 2005; Katon, 2008). These relationships are complicated, often being bidirectional. Risk of higher blood glucose levels and complications increase with years lived with diabetes. However, younger patients tend to have poorer control because they have less experience managing their diabetes. Medications and insulin are used to bring blood glucose levels under control, but are prescribed to those with high, poorly controlled blood glucose levels. These relationships make factors like duration of diabetes and medications important to control for, but, without detailed, longitudinal measures, one should not read too much into the relationships. Obesity and comorbidities are strong, consistent risk factors for diabetes, poorer diabetes management, and complications (Steppan et al., 2001; Nguyen et al., 2011; Lin, Kent, Winn, Cohen, &
Neumann, 2015; Chiu & Wray, 2010). Smoking is a risk factor for diabetes; smoking also greatly increases risk of premature death in those with diabetes (Eliasson, 2003; Haire-Joshu, Glasgow, & Tibbs, 1999). Research suggests that alcohol consumption tends to have an inverse or U-shaped relationship with blood glucose levels (Ahmed, Karter, Warton, Doan, & Weisner, 2008; Howard, Arnsten, & Gourevitch, 2004; Koppes, Dekker, Hendriks, Bouter, & Heine, 2005). Moderate drinkers are less likely to have diabetes; among those with diabetes, they are less likely to have high blood glucose levels (Koppes et al., 2005; Pietraszek, Gregersen, & Hermansen, 2010). Those diagnosed with diabetes are normally instructed not to drink, especially given that alcohol combined with certain medications may actually increase risk of hypoglycemia (Pietraszek, Gregersen, & Hermansen, 2010). Drinking also increases the risk of poor adherence to management guidelines (Ahmed, Karter, & Liu, 2006). Depressive symptoms are more common in those with diabetes than in the general population, and these symptoms are positively associated with blood glucose levels due to lower participation in protective self-management behaviors (Anderson, Freedland, Clouse, & Lustman, 2001; Gonzalez et al., 2008; Chiu et al., 2010).

Finally, a social factor related to poor diabetes management is low social support (Stopford, Winkley, & Ismail, 2013; van Dam et al., 2005; Strom & Egede, 2012). It is worth noting that the samples and the measures of both social support and diabetes management vary widely across most studies. Examples of measures of social support include marital status, diabetes-specific scales of social support, network size, and scales of support for chronic disease management. Measures of diabetes management ranged from various measures of health behaviors to adherence to guidelines to HbA1c. There is generally strong support for the link between social support and more proximal measures of management such as behaviors. While there was limited support for the relationship between social support and HbA1c in a review by Stopford et al (2013), the link between social support and HbA1c was well supported in a review by Strom and Egede (2012). Overall, social support is a theoretically
important variable for understanding diabetes management, particularly potential differences in HbA1c by state of marital dissolution.

Because of the link between being unmarried and risk of diabetes, but the dearth of research on how states of dissolution/unmarried influence risk of diabetes and diabetes management, this dissertation will explore the relationship between states of marital dissolution, diabetes, and diabetes management. It will also examine whether the potentially modifiable factors above such as accessible savings, health insurance coverage, social support, and depressive symptoms vary by state of marital dissolution and reduce any relationship between state of marital dissolution and diabetes management.

2.1.5. Summary of Diabetes and Its Management

The preceding information on diabetes risks, diagnosis, and management has implications for this research. Both biological/ascribed and socioenvironmental factors should be considered when researching diabetes and its management. Ascribed risk factors that need to be controlled for when exploring differences in diabetes prevalence by state of marital dissolution in this research include age, gender, and race/ethnicity. Socioenvironmental factors can be broken down into achieved, health-related, and social factors. Achieved factors that need to be considered are socioeconomic status and health insurance. Health-related factors to include are comorbidities, obesity, and health behaviors such as inactivity, smoking, and drinking. Social factors such as social support are also important to include in models of management. HbA1c is a good indicator of diabetes management, as it may reflect changes in life circumstances due to stress and changes in management behaviors. It is also a valuable indicator of risk of complications.

2.2. Marriage and Dissolution in Middle-Aged and Older Adults in the U.S.

Approximately 85% of older adults in the U.S. marry at some point in their lives; however, risk of marital dissolution due to divorce or widowhood increases with each year of marriage (Stevenson & Wolfers, 2007). Almost half of all marriages end before their 25th anniversary (Cohn, 2010). Also,
although divorce rates overall are lower than they were ten years ago, the rate of divorce in those over 50 years of age has doubled over the past 25 years (Brown & Lin, 2012). Longer life expectancies have also contributed to a rise in states of marital dissolution/previous married, as people are realizing they have more relatively healthy years after retirement and may want to spend that time in a satisfying relationship (Livingston, 2014; Wu & Schimmele, 2007; Fries, Bruce, & Chakravarty, 2011). These increases in life expectancy are thought to be behind the decreases seen in widowhood among women over the past thirty years (Manning & Brown, 2011). However, the rate of widowhood among men has remained relatively stable. As a result, many of people over the age of 46 have experienced a marital dissolution (Stevenson & Wolfers, 2007). At any given time, approximately 23% of men and 50% of women over age 65 are in states of marital dissolution (The Administration on Aging (AoA), 2014). More specifically, 12% men are divorced or separated and 11% are widowed. In contrast, 15% of women are divorced or separated, and 35% are widowed (AoA, 2014).

2.2.1. Defining Marriage-Related Terms

There are many terms related to marriage, dissolution, and the sequences of these events.

Marital status indicates legal partnership status. While marital status options vary by survey, the U.S. Census distinguishes between/recognizes six marital statuses: married, married spouse absent, separated, divorced, widowed, and never married (Kreider & Ellis, 2011). Partnered/cohabiting is becoming a more common option on questionnaires, but is not currently included as an option on the U.S. Census. These statuses can be categorized in several ways. They may fall under married (married or married with a spouse absent) or unmarried (separated (although still legally married), divorced, widowed, or never married). Sometimes people who are partnered may also be categorized as married.

Another way to categorize statuses is married or previously married/in a state of marital dissolution (separated, divorced, or widowed). Marital statuses are generally treated as static and can be contrasted with marital transitions—a change from one marital status to another. The term marital history is used
in reference to the complexities of marriages and dissolutions. *Marital history* can include characteristics such as marital status; number of marriages, divorces, and widowhoods; durations in marital statuses; sequence and timing of statuses and transitions; and even marital quality.

In this research, the focus will be on states of marital dissolution. *States of marital dissolution* include divorced or widowed, with married as the reference group. Each of these states contains only the status/state noted. In other words, those who are separated are not included with those who are divorced; those who are partnered/cohabiting are not included with those who are married. From a theoretical perspective, these groups are distinct, even if they share some similarities. For example, those who are separated may not experience all the losses that someone who is divorced has (e.g., loss of health insurance coverage from spouse’s insurance); those who are partnered/cohabiting may not receive the same benefits as those who are married (e.g., emotional security, health insurance) (Brown, Lee, & Bulanda, 2006). The current study attempts to explore relationships between diabetes management and characteristics of two states of marital dissolution that are often grouped together because of their similarities, necessitating rigid definitions of these states. The sociodemographic and health characteristics of being married, divorced, and widowed are discussed below. Appendix A contains more detailed definitions for the above italicized terms.

2.2.2. **Characteristics and Well-Being of Those Who are Married, Divorced, and Widowed**

A wealth of research exists on the characteristics of those in various marital statuses and how they compare on a number of measures of well-being. Key areas of difference are financial security, social support, mental health, and physical health. Many of these differences also vary within marital status by ascribed characteristics such as gender, age, and race/ethnicity. Those who are divorced or widowed are more likely to be women, non-Hispanic black or Hispanic, older, less educated, and worse off financially, compared to those who are married (Haider, Jacknowitz, & Schoeni, 2003). These relationships are due to selection rather than protection or crisis and may partially explain differences in
health. There are also important differences between those who are widowed and those who are divorced. Differences in these four areas of well-being between those who are married, divorced, and widowed are detailed below with attention to variations in these areas by ascribed factors within a given state of dissolution.

Financial security is important to health and well-being, (Lynch et al., 1997; Deaton, 2002; Pinquart & Sörensen, 2000; Demakakos, Nazroo, Breeze, & Marmot, 2008). Those who are married are more likely to have financial security than those who have experienced a marital dissolution (Ulker, 2009). Marriage brings many financial benefits or “resources,” often starting early in the marriage, such as higher pay for married, compared with unmarried, men (Berk & Taylor, 1984; Waite, 1995; Wilmoth & Koso, 2002). Economies of scale, more consistent health insurance coverage, and tax incentives also help those who are married (Waite, 1995; Wood et al., 2007), and married people tend to have more money in savings (Lillard & Waite, 1995). There are key differences in financial security by state of marital dissolution. Those who are widowed tend to fare better financially than those who are divorced. For example, wealth is approximately 200% higher in those who are widowed, compared to those who are divorced because of inheritance rather than division of assets (Brown & Lin, 2012).

There are also important differences in the relationship between financial well-being and state of dissolution by age, gender, and race/ethnic (Holden & Smock, 1991; Uhlenberg, Cooney, & Boyd, 1990; Lillard & Waite, 1995; Angel, Jimenez, & Angel, 2006). Older adults who experience a marital dissolution, particularly a divorce, are less likely to be able to financially recover than are people who experience a marital dissolution at earlier ages. In contrast with men, women, especially older women, are less likely to regain financial security after a marital dissolution, again, particularly a divorce (Holden & Kuo, 1996; Holden & Smock, 1991; Uhlenberg et al., 1990; Lillard & Waite, 1995). This makes older, divorced women a vulnerable group, especially given that they are less likely to remarry than men and they tend to outlive men but do so with more chronic, disabling comorbidities and fewer financial
resources (Oksuzyan, Juel, Vaupel, & Christensen, 2008). Non-Hispanic black and Hispanic people who are widowed or divorced tend to fare even poorer financially, compared to their non-Hispanic white counterparts (Angel et al., 2006). These financial differences have been shown to influence other measures of well-being.

Social support is another measure of well-being that has implications for overall health (DiMatteo, 2004), and social support can vary by state of marital dissolution and gender. People who are widowed or divorced are thought to have less support than those who are married, in large part because support from one’s spouse is assumed to be a basic component of marriage (House, 1981). When one loses a spouse, there may be a gap in social support. Sometimes a divorce can also reduce or eliminate social support from children (Kalmijn, 2007). In contrast, becoming widowed can increase social support from alternative sources (Brown & Lin, 2012). This suggests that while both widowed and divorced individuals lose social support from a spouse, those who are widowed are less likely to experience an actual loss of social support; instead the experience more of a change in source of support.

The most notable differences in social support are related to gender (Umberson, 1992). Women of all marital statuses report higher levels of social support compared to men (Turner & Marino, 1994). Women are more likely to serve as the primary source of social support to their husbands and to have their own social support network, separate from their spouse, from whom they receive social support (Antonucci & Akiyama, 1987). As a result, men are more likely to experience a loss of or gap in social support after widowhood or divorce. Women are also more likely than men to maintain close relationships with and receive social support from their children after a divorce (Kalmijn, 2007). Research on a related concept, loneliness, suggests that widowed men may be most lacking in social resources (Pinquart, 2003). In summary, men tend to count on their wives for social support, while women tend to maintain wider social support networks which benefit them in instances of marital
dissolution. Social resources, as is the case with financial resources, have implications for mental and physical health.

Mental health is generally better in those who are married, compared to those who are divorced or widowed. Those who are married report higher levels of happiness, fewer depressive symptoms, and less loneliness (Stolzenberg & Waite, 2005; Wood et al., 2007). Many studies have focused on depressive symptoms as a measure of mental health because it is sensitive to life events, a good indicator of mental health, and correlated with physical health (Wood et al., 2007). Depressive symptoms are lower in those who are married than in those who have experienced a marital dissolution, and the higher levels of symptoms for those who are divorced are often long lasting, if not permanent (Wood et al., 2007). Those who are widowed have high levels of depressive symptoms, but these tended to decrease within approximately two years. This suggests that depressive symptoms may be lower in those who are widowed.

Gender and age affect these patterns. Married men tend to report fewer depressive symptoms than do married women, even though women tend to have higher levels of social support (Wood et al., 2007). Men and women who transition to widowhood report similar levels of depression, suggesting that widowhood is harder on men (Lee, DeMaris, Bavin, & Sullivan, 2001). Some research suggests that widowed women may cope better with widowhood than do men because women are often the caregivers in the family and report a sense of freedom while men tend to report loneliness (K. Davidson, 2001). Age also influences the relationship between marital status and depressive symptoms, with middle-aged adults, compared to younger adults, showing fewer increases after a transition to a state of dissolution (Marks & Lambert, 1998). The lifespan developmental and life course perspectives suggest that this is due to dissolution being a more common experience in middle and older age, compared to younger adulthood.
Physical health also tends to be better in those who are married, compared to those who are widowed or divorced. Those who are married tend to engage in more preventative and healthy behaviors, report better self-rated health, experience fewer chronic health conditions, and have lower rates of mortality (Lee, et al., 2005; Schone & Weinick, 1998; Wood et al., 2007). On most measures of health, those who are widowed fair more poorly than do those who are divorced, even after controlling for factors such as age (Wood et al., 2007; Liu & Umberson, 2008). As with the other measures of well-being, there are differences by gender. Self-rated health is generally higher among married men, and lower among older divorced or widowed men. In contrast to the relationship in older men, younger divorced men actually report better self-rated health than married men (Wood et al., 2007). Self-rated health in women was not related to age, marital status, or marital transitions (Wood et al., 2007). Risk of heart disease was not associated with marital status in men according to a study by Zhang and Hayward (2009), but divorced and particularly widowed women had higher risk of heart disease compared to married women, and their risk increased over time; such risks did not vary by marital status in men.

Although the benefits of marriage are found on most measures of health, there are some measures of health on which those who are widowed and/or divorced may fare better than those who are married. Rates of overweight and obesity tend to be higher in those who are married than in those who fall into any other marital status category (Sobal, Rauschenbach, & Frongillo, 2003). Overweight and obesity generally increase risk of cardiovascular and metabolic conditions in younger age, but overweight can be protective in older ages. However, it is also worth noting that weight loss often accompanies depression. Risk of disability may also be higher in those who are married than in those who are divorced, but it was highest in those who are widowed (Goldman et al., 1995). Differences in well-being as measured by these aspects of health highlight the value in examining conditions such as diabetes that have received little attention in the research on marriage and health.
The literature on the above measures of well-being suggests that those who are in states of marital dissolution are generally at a disadvantage, compared to those who remain married. However, there are differences between those who are divorced and those who are widowed, particularly by gender and age/stage. Some of the studies above looked at marital transitions, while others focused on marital status. There is some evidence that mental health is more highly associated with mental health and more transient measures of health, while marital status is more highly associated with physical health, especially chronic conditions. Some also included other aspects of marital history in the models, which had implications for health.

2.2.3. Aspects of Marital History and Well-Being

Several researchers have found that in addition to the importance of marital status, other aspects of marital history also influence well-being. Marriage duration, number of transitions or dissolutions, and timing have all been linked to health. Longer length of marriage has been shown to provide more stability during which a couple can accumulate wealth, and health can be protected via social support and/or control (Ulker, 2009; Umberson, 1992; Waite, 2009). In a study by Lillard and Waite (1995), longer marriage duration was linked to lower risk of mortality, particularly for women, regardless of current marital status. Dupre and Meadows (2007) found that longer marriage duration was associated with lower rates of disease for both men and women, but divorce duration was key for men. Another found that marriage duration was associated with cardiovascular risk for women but not men (McFarland, Hayward, & Brown, 2013). Hughes and Waite (2009) found that marriage duration was a significant predictor of health, but worked through age at first marriage.

Number of marital transitions and/or dissolutions is a related concept in terms of interruption versus continuity, but has a more direct link to crisis theory. Higher numbers of transitions/interruptions are detrimental to health, in part due to reduced financial well-being in women (Addo & Lichter, 2013). The same study by Dupre and Meadow (2007) noted above also examined the effect of number of
transitions (divorces and widowhoods) on health and found that more transitions were associated with higher incidence of disease. For women, divorce transitions were linked to health, while widowhood transitions were in men. They also noted that age at first marriage was related to disease incidence in women. Hughes and Waite (2009) found that having multiple marriage dissolutions was associated with lower self-rated health and more chronic conditions, mobility limitations, and depression.

2.2.4. Summary of Marriage and Dissolution in Middle-Aged and Older Adults in the U.S.

Marital dissolution is becoming increasingly common in middle and older age. Although widowhood once made up the majority of cases of dissolution in middle and older age, divorce has become increasingly common. Given differences between those who are divorced and those who are widowhood on measures of health behaviors and health outcomes, due in part to differences in marital history, financial resources, and social support, it is important to determine whether these patterns are present in diabetes management. It is also important to explore differences by gender based on the literature showing differences in health outcomes and the mechanisms behind those differences by gender and to limit the sample to one age category, rather than to examine the relationship in adults of all ages.

2.3. Marital States, Dissolution, and Diabetes

Studies on the relationship between various marriage-related measures and diabetes are discussed below. The studies are organized in two sections: diabetes and HbA1c. The studies categorized under “diabetes” are focused on risk of diabetes. The studies under “HbA1c” do not focus on diabetes but rather on blood glucose levels as an indicator of metabolic disease or other health outcomes such as diabetes management. The latter studies indicate whether blood glucose levels tend to be higher or lower for those in various marital statuses, and thus provide insight into the relationship between marital status—with a focus on states of dissolution—and risk of diabetes.
Diabetes. A relationship between marital status and diabetes has been found in several studies. The effect of marital status on the onset of type 2 diabetes was noted in a nationally representative study of the U.S. population over age 50 on the influence of social status on diabetes in aging adults (Wray et al., 2006). Odds of diabetes onset trended toward being lower in both middle-aged and older adults who were married than in those who were unmarried (widowed, divorced, separated, never married), but the relationship was not statistically significant. This null finding might be due to differences in risk factors for and poor health by type of unmarried. Information on differences by gender or race/ethnicity was not presented (Wray et al., 2006). Another study using a different subset of the same nationally representative data set—the HRS—found risk of diabetes was higher in women who were divorced than in those who were married and highest in those who were widowed (Pienta et al., 2000). Widowed, but not divorced, men had higher risk of diabetes compared to those who were married. These differences were even greater in non-Hispanic blacks and Hispanics (2000).

Other research has focused on more specific portions of the population. One study that focused specifically on African Americans found that marriage (versus unmarried) protects African American women, but not African American men, against diabetes (Schwandt et al., 2010). This study is important in that many other studies lack the sample size to examine patterns in African Americans. A study by Cornelis et al., (2014) focusing on men found that unmarried men had a higher risk of diabetes than did married men. More specifically, widowers had higher risk of diabetes compared to those who were married due to BMI and lifestyle factors; divorced men had slightly higher risk of diabetes compared to those who were married, only after adjusting for lifestyle factors. The strengths of the Cornelis et al., (2014) study were validation of disease diagnosis using medical records, very detailed lifestyle factors as explanatory variables, and large sample size. Two major limitations are that all the men were highly educated medical professionals, and 95% were non-Hispanic whites, leaving other racial/ethnic groups severely underrepresented.
These studies on the relationship between marital status and risk of diabetes suggest that risk is higher in those who are unmarried than in those who are married. More specifically, being divorced or widowed increases risk and there are differences by gender. Divorced men generally have the same risk as married men, while divorced women tend to have higher risk than married women but lower risk than widowed women. The studies above also highlight the importance of a variety of other factors in this relationship, such as race/ethnicity, health, and lifestyle factors.

HbA1c. Two studies included HbA1c as an outcome in their examination of the effects of marital status on health, but were not specifically focused on diabetes. The first study focused on the effects of spousal loss on health in older adults aged 57 to 85 and found that logged HbA1c was slightly higher in women who were widowed, compared to married (Das, 2013). Longer time since loss was associated with higher HbA1c. One limitation of this study was small cell size in those who are divorced or separated. Another is that those who were separated were grouped with those who were divorced, which might weaken the potential effects of divorce despite adding cases/power. A similar study by Rote (2016) looked at allostatic load and also found that those who were widowed were likely to have higher HbA1c levels, compared to those who were married. Again, time in status was positively correlated with risk of high HbA1c. Both the Das and Rote studies used National Social Life, Health, and Aging Project data and noted small cell size as a limitation. Neither study focuses on diabetes specifically, but both provide insight into the relationship between states of marital dissolution, marital history, and HbA1c. Unfortunately, other studies in which some indicator of possible risk of diabetes and marital status are even included in the same model do not present their results in a way that would allow the reader to identify differences by state of marital dissolution and/or gender (e.g., Saydah & Lochner, 2010)

In summary, more research is needed on how state of marital dissolution influences risk of diabetes. The existing literature is limited by one or more of the following: limited generalizability,
heterogeneous categories of unmarried, or not looking at differences by gender, despite the overwhelming amount of literature showing most differences in well-being due to marital status vary by gender. This dissertation research aims to fill these gaps.

2.4. Marital States, Dissolution, and Diabetes Management

There is also limited literature on the relationship between marital status and diabetes management. Many of the studies focus on characteristics of married adults (e.g., social control, marital quality, social support) that influence management, as opposed to if marital status influences management. While the former literature serves a valid purpose given the percentage of people who marry and are married at any one point in time, it is also important to identify any differences in management among those in states of marital dissolution, given the high prevalence of dissolution and higher risk of poor health. The studies described below provide some insight into the relationship between various marriage-related factors and various measures of diabetes management.

Ruggiero and colleagues (1997) assessed, among other things, what diabetes management looked like in various subgroups in a sample age 18 and over. They included self-report of diabetes management-related glucose testing, diet, and exercise. They found that marital status (i.e., married, divorced/widowed, never married, cohabiting) was not a significant predictor of any of the three indicators of management.

A study by Chiu and Wray (2010) aimed to identify factors predicting glycemic control in middle-aged and older adults with diabetes and included married versus unmarried as a predictor. They also did not find a statistically significant difference in HbA1c between the two groups. One explanation for this besides the null hypothesis is that there may be differences in HbA1c that are masked by opposing effects by type of unmarried and/or by gender. In their analyses, married included those who were married and those who were cohabiting; unmarried included those who were widowed, divorced, separated, and never married. Several studies have shown important differences in health outcomes
between those who are never married, widowed, and divorced (Avellar & Smock, 2005; Pudrovska, Schieman, & Carr, 2006).

One study that focused on marital status and chronic disease included a measure of diabetes severity in patients of physicians in three metropolitan areas in the U.S. (Sherbourne & Hays, 1990). The authors found that diabetes severity was higher in those who were married, but there were no significant differences compared to those who were unmarried after adjusting for background characteristics (1990).

A study by Jacobson, De Groot, & Samson (1994) focused on diabetes-related quality of life and health-related quality of life in people with diabetes. They found that marital status (i.e., married, never married, divorced/separated, widowed) influenced health related diabetes-related quality of life in people with diabetes. Those who were divorced/separated experienced the lowest levels of quality of life. While the sample size was small (n = 240), the study findings provide support for a line of research on differences in diabetes management by state of marital dissolution.

There is a dearth of research on the relationship between diabetes management and specific marital statuses. Of the four studies identified that touched on marriage and diabetes management, two (Ruggiero et al., 1997 and Jacobson et al., 1994) included relatively specific measures of marital statuses. The study by Jacobson and colleagues (1994) suggests there might be a relationship in management by state of marital dissolution. The work by Sherbourne & Hays (1990) also suggested there might be a relationship, but lacked detail on the factors that might explain the relationship. The remaining papers did not assess discrete states of unmarried. Theoretically informed work on the link between marital histories and other measures of health suggests the need for discrete measures of status due to differences in financial, social, mental, and physical well-being by marital status and gender. Work that takes these findings into account and that uses HbA1c—a measure of management that has shown sensitivity to states of dissolution and that is associated with complications—is needed.
2.5. Summary and Gaps in the Literature

In summary, the existing literature shows significant differences in health outcomes between those who are married, divorced, and widowed. Comparing those who are divorced and widowed to those who are married—rather than those who are never married—is important because a large portion of the U.S. population experiences divorce or widowhood at some point in life. Also, the experience of marriage might have lasting, protective effects on health, particularly for those with longer marriages. On the other hand, numerous disruptions to status in the form of marriages, divorces, and widowhoods might be detrimental to health, particularly aspects of health that require very consistent, careful self-management such as diabetes.

A focus on specific states of marital dissolution is important because of the differences in acceptability of divorce versus widowhood in middle-aged and older adults. Also, there are differences in the consequences of a divorce versus widowhood on financial and social well-being. Given that both financial and social well-being are correlated with health and vary heavily by state of dissolution and marital history, they are likely to have different relationships with diabetes management in different gender-state of dissolution categories. State of marital dissolution is also associated with mental health and insurance coverage, either of which might help to explain a state of dissolution-diabetes management relationship. To get a clear picture of these relationships, analyses will be run by gender and potential explanatory factors will be added in blocks.

Currently, there is limited literature on states of marital dissolution and diabetes management in middle-aged and older adults. Those who are socially and financially disadvantaged generally have poorer health, and those who are divorced or widowed are generally socially and financially disadvantaged. However, it is not clear what these characteristics look like in those who are both living with diabetes and either divorced or widowed, nor is it clear how marital history-related factors influence diabetes management. This dissertation explores differences in diabetes and HbA1c by state
of marital dissolution and gender; in addition, it provides insight into whether protection and/or crisis influence the relationship between HbA1c and state of marital dissolution and whether risk factors for higher HbA1c levels vary by potentially modifiable factors. The next chapter will detail the data and steps taken to analyze said data to address the aims.
3. Chapter Three: Methods

The aims of this dissertation were to explore differences in diabetes prevalence and its correlates by state of marital dissolution and gender in a nationally representative sample of middle-aged and older adults, to determine whether diabetes management, as measured by HbA1c, differed by state of marital dissolution and gender, to examine whether marital history influenced diabetes management, and to identify modifiable correlates of HbA1c in each state of marital dissolution-gender category. To address these aims, cross-sectional data from the nationally representative Health and Retirement Study were used. This chapter provides details on the data source, in addition to why and how the data, sample, and variables were selected and modified for use in this research. It also details the analyses employed to address the aims and research questions of this dissertation research.

3.1. Data Source

Data for this research were drawn from the Health and Retirement Study (HRS). The HRS is a longitudinal, continually nationally representative, multi-stage, area clustered, stratified probability sample of non-institutionalized middle-aged and older adults who over 50 years of age in the U.S. (Health and Retirement Study (HRS), 2011). It was designed to allow researchers to study the relationships among retirement, financial well-being, physical and mental health, and family in a diverse sample of aging adults (Karp, 2007). Data are collected on indicators of participants’ current and childhood demographic characteristics, educational and employment history, financial well-being, insurance coverage, self-reported and measured physical and mental health, social support systems, decision making, and retirement situation, among other indicators.

HRS data collection began in 1992 with 12,652 adults aged 51–61 and their spouses/partners, children, and caregivers of any age (Hauser & Willis, 2004; HRS, 2011; Juster & Suzman, 1995); parallel data collection for the Asset and Health Dynamics (AHEAD Among the Oldest Old study began in 1993 on 8,222 adults over age 70 and their spouses/partners of any age (HRS, 2011). Participants from both
studies were reinterviewed every two years until the two surveys were integrated in 1998. The new sample of all respondents from both the HRS and the AHEAD were reinterviewed in the newly merged survey in 1998. Additional cohorts of adults over age 50 have been added to the initial sample at regular intervals (every 6 years beginning in 1998), bringing the sample since 1998 to over 20,000 participants who are (re)interviewed every two years (Karp, 2007).

As a multi (four)-stage area, probability sample, the HRS oversamples non-Hispanic blacks, Hispanics, and Floridians; the “oldest old” (i.e., those over age 80) are also a target population (HRS, 2011). This effort is made to enable researchers to analyze these subgroups. To facilitate researchers in making generalizations to the U.S. population, the HRS provides survey weight, strata, and cluster variables for each wave and subsample within each wave. These variables can be applied or modified and applied to analyses to make findings nationally representative and, therefore, generalizable to the U.S. population (Ofstedal, Weir, Chen, & Wagner, 2011).

The HRS is administered to participants in person, by telephone, by mail, and/or online. Beginning in 2006, half of the sample was assigned to the Enhanced Face-to-Face Interviews (EFTF), which included additional questionnaires, physical measures, and the collection of biomarkers (HRS, 2015). This half sample completed the majority of the survey items including the core questionnaires in a face-to-face interview, in addition to completing physical tasks and providing anthropometric measurements, a saliva sample, and a blood spot. They also responded to a psychosocial leave-behind questionnaire, which they were to return by mail (2015). The other half of the sample completed just the core questionnaires in 2006. In 2008, the latter half sample participated in the EFTF; the former half sample completed just the core questionnaires. Every fourth year (i.e., every other wave), participants again complete the EFTF. Participants from new cohorts are randomly assigned to either the first or second half sample. To date, half of the sample completed the EFTF in 2006, 2010, and 2014 (biomarkers not yet available for 2014) and the other half completed it in 2008 and 2012.
The blood-based biomarker component of the EFTF consists of a dried blood spot. All EFTF eligible participants who do not need a proxy, do not reside in a nursing home, and are interviewed face-to-face are asked to participate in this component by providing informed consent, as described in an HRS documentation report prepared by Crimmins, Faul, Kim, and Weir (2015). This report indicates that those who consent are asked to provide a [dried] blood spot (i.e., have their finger pricked and place a drop of blood onto up to six pieces of filter paper). This process results in dried blood spots that are frozen then sent to a lab to be processed for HbA1c, HDL cholesterol, C-reactive protein, and Cystatin C levels. Before data are released, they are thoroughly cleaned by HRS researchers. Because dried blood spots are processed by multiple labs and are less reliable than whole blood spots, the HRS researchers strongly recommend using NHANES (whole blood spot) equivalent measures that they create for each biomarker (Crimmins et al., 2015). In addition, they provide post survey weights for the biomarker data (Crimmins et al., 2015).

The RAND Corporation’s (a nonprofit that “helps improve policy and decision making through research and analysis” (RAND, n.d.a)) Center for the Study of Aging provides a RAND-HRS data file containing longitudinal data. It is an easy-to-use dataset for which values for many financial well-being items have been imputed. The dataset also reconciles differences in responses across waves and provides several composite variables.

The HRS is sponsored by the National Institute on Aging (grant number NIA U01 AG009740) and is administered out of and housed by the University of Michigan (RAND Center for the Study of Aging, 2016). The University of Michigan’s Institutional Review Board (IRB) has approved the study. The HRS Core files and RAND HRS are publically available with a brief application for access. The biomarker data are considered sensitive data and require an additional application. More information on the HRS history, structure, sample, and measures can be found at http://hrsonline.isr.umich.edu.
3.2. Data and Sample Selection

Data used for this dissertation included pooled HRS data from the 2010 and 2012 EFTF eligible half samples. The dataset drew from the 2010 and 2012 HRS Core files (pre-load, coverscreen, demographics, physical health, and leave behind), tracker file, corresponding RAND (Version O) file, and the 2010 and the 2012 biomarker file. Data from the 1992-2008 HRS Core Interviews were used to check the 2010 and 2012 marital history variables.

Pooling the 2010—a year in which the sample was replenished with the addition of a new cohort—and 2012 data on those who were EFTF eligible and participated in the blood-based biomarker component provided a larger sample size than would be achieved using just one wave of the data or longitudinal data. These pooled data allowed for the examination of the odds of diagnosed diabetes and levels of HbA1c by state of marital dissolution and gender. They also allowed for the examination of differences in the associations between marital history and modifiable factors and diabetes management by state of dissolution and gender. However, the cross-sectional data selected for this research do not allow for any causal inferences to be drawn from the results.

Alternative sources of data that were considered for this research included the HRS 2003 Diabetes Mail Survey in combination with data from preceding and proceeding wave, the National Social Life, Health and Aging Project (NSHAP), the National Health and Nutrition Examination Survey (NHANES), and the Americans Changing Lives Study (ACL). The 2003 Diabetes Mail Survey had a wealth of data on diabetes management in addition to HbA1c; however, use of that survey would have resulted in a sample size of less than half of the sample size available using pooled 2010|2012 data and the data are over 10 years old. In addition, the focus of this dissertation depends more on measures of marital state and history than on detailed measures of diabetes management. The NSLHAP is focused on older adults and contains a number of biomarkers, but the sample size is significantly smaller than that of the HRS and has a smaller number of people with diabetes. The NHANES also has a wealth of biomarkers and a
large sample size, but its focus on all ages limits the size of the sample over 50 years of age. The ACL does not improve the sample size of middle-aged and older adults with diabetes, lacks a measure of diabetes management, and data are collected less frequently (i.e., every three to ten years). In summary, the HRS provided the best balance of relevant measures and sample size on the population of interest.

The sample used to address the aims of this dissertation consisted of HRS participants who 1) completed the 2010 (n = 22,034) or 2012 (n = 20,554) Core Interview (n = 42,588); 2) were EFTF eligible (n = 21,292); 3) were eligible to complete the Leave Behind Questionnaire (n = 21,292) and completed it (n = 15,721); 4) participated in the blood based biomarker component (n = 12,098); 5) were over 50 years of age (n = 12,098); and 6) were in a marital status of interest (i.e., married, divorced, or widowed) (n = 10,667). Participants who reported a race/ethnicity other than non-Hispanic white, non-Hispanic black, or Hispanic, were excluded (n = 319), leaving n = 10,388 participants. There were 148 participants with non-positive survey weights, bringing the sample size to 10,240. In order to allow for clearer comparison of results across analyses and groups, listwise deletion was used on a total of 616 cases containing missing data—6.02% missingness. The final sample for Aim 1 comprises 9,624 participants.

For Aims 2, 3, and 4, the sample was restricted further to individuals who self-reported doctor diagnosed diabetes, resulting in a sample of 2,235 participants. Figure 3.1 details where cases were lost.

The resulting sample with complete data (N = 9,624) was significantly different than those with missing data (n = 619). Odds of being in the sample were higher among those who were insured, had more years of education, had slightly longer longest marriages, and were in contact with their children. Odds of sample participation were lower in those who reported diagnosed diabetes, were non-Hispanic black or Hispanic, and had more depressive symptoms. Overall, sample participants could be considered more advantaged or a lower risk group, compared to cases excluded due to missingness. Appendix B provides more detailed information on characteristics of analytic sample cases compared to cases with
Figure 3.1 Sample selection criteria and sample size at each stage of inclusions/exclusion

Note. *Does not sum to total value of ns in noted for each variable due to overlapping missingness.
missing data. Detailed descriptive statistics by state of marital dissolution and gender are presented in the next chapter.

3.3. Measures

The following variables were included in the analyses for one or more aims of this dissertation. These variables are based on HRS and/or RAND-HRS items. For all categorical variables, “0” serves as the reference group.

Dependent Variables

The dependent variables include self-report of doctor diagnosed diabetes and diabetes management, as measured by HbA1c. The former is the dependent variable for Aim 1. The latter is the dependent variable for Aims 2, 3, and 4.

Self-reported (SR) diabetes. SR diabetes was measured using a RAND-HRS variable based on report of diabetes at “this” wave. The variable was based on participants’ responses to the question: “Has a doctor ever told you that you have diabetes or high blood sugar?” or, for participants who have reported diabetes at a previous wave, dispute or confirmation of having been diagnosed. Responses of “yes” or “disputes previous record and has” were recoded 1, and responses of “no” or “disputes previous record and no” were recoded 0. All other responses (e.g., refuse to answer, missing, don’t know) were considered missing. (yes, diagnosed diabetes = 1, no diagnosed diabetes = 0).

HbA1c. Glycosylated hemoglobin (HbA1c) was based on dried blood spots from participants who were eligible and consented to provide a blood spot. The blood spot completion rate was 84% in 2010 and 86% in 2012. Dried blood spots were analyzed by Heritage Laboratory in 2010 and the University of Washington in 2012. A validation study that assessed the correlation between whole blood and dried blood spots and between labs found that both were moderately to highly correlated (r = .84 to .97) (Crimmins et al., 2014). Due to the potential for variability between labs and in dried blood spots compared to whole blood spots, the HRS researchers created, released, and advocated the use of an
adjusted HbA1c variable that was based on the distribution of assays in the whole blood spots collected in the NHANES (Crimmins et al., 2015). This adjusted HbA1c variable ranged from 3.01% to 17.17% in the full sample and 4.26% to 13.84% in the sample of those with diabetes.

**Independent and Stratifying Variables**

The focus of this dissertation is on how specific states of marital dissolution and gender influence diabetes and its management. It is important to consider gender when looking at how state of marital dissolution influences health, especially in older adult because of the more rigid roles each gender tends to fill. State of dissolution and gender are the key independent variables and are detailed below. Marital history and modifiable factors are included in the Covariates section, even though they are technically independent variables in some analyses.

*State of marital dissolution.* The state of marital dissolution variable was created using the RAND-HRS marital status with partnership variable because it contained very specific marital statuses. Participants with a status of partnered, separated, separated/divorced, married with an absent spouse, or never married was excluded from the sample on a theoretical basis: Those who are married generally have greater access to financial and social resources because living with spouse provides economies of scale and frequent contact. Those who are partnered may benefit from some but not all the benefits of marriage; they are less likely to share finances with or be covered by a significant other’s health insurance (Brown et al., 2006). Those in any of the other four categories do not benefit from economies of scale. Those who are separated or have an absent spouse may suffer from some but not all of the potential effects of a marital dissolution (e.g., joint finances and, in the latter, social support). Combining any of these statuses with any of the three groups of interest (i.e., married, divorced, widowed) might dilute any relationship between state of marital dissolution and diabetes and its management. Consequences of excluding them were a smaller sample size within each state of dissolution-gender category and less generalizable results. State of marital dissolution consisted of three categories
(married = 0, divorced = 1, widowed = 2); married served as the reference group because there tends to be more literature on those who are married and because the literature suggests that those who are widowed and divorced might be more “at risk” groups. The state of marital dissolution variable was also used to create dichotomous variables (i.e., married vs other, divorced vs other, widowed vs other) that were used in some tests of statistical significance and regression analyses.

Gender. This variable was created from the RAND-HRS sex variable. In the HRS, the interviewer assigned sex (i.e., male, female) for each participant based on name, voice, and/or appearance and can update sex at any wave. The RAND-HRS sex variable is a cleaned version of the HRS variable. For this research, the RAND-HRS variable was relabeled gender and female and male were recoded as follows: woman = 0, man = 1.

State of dissolution and gender were also used to make a new six level variable with the following categories: married woman = 0, divorced woman = 1, widowed woman = 2, married man = 3, divorced man = 4, widowed man = 5. This variable was used in some analyses, and the reference group changed based on the preliminary analyses for that portion of the research.

Covariates

A theoretically informed review of the literature identified a number of factors with the potential to attenuate any relationship between state of marital dissolution and diabetes management or, in the event that state of dissolution is not significantly associated with HbA1c, to be correlated with HbA1c but with differences by state of dissolution and gender. These factors were grouped into two categories: marital history-related factors and modifiable factors. Both groups of variables are considered independent variables in some analyses, but as covariates in others. Other factors identified in the review of the literature as relevant predictors of diabetes were grouped into ascribed, achieved, social, and health factors and are also detailed below.
Marital History

Two variables, length of longest marriage and marital transitions were included as measures of marital history. These variables were included in order to gain insight into whether stable marriage (protection) and/or transitions into/out of marriage (crisis) influence diabetes management—the focus of Aim 3. In Aim 3, these two variables are the independent variables.

Length of longest marriage. Length of longest marriage was based on a RAND-HRS provided variable that uses the start and end dates of all reported marriages to determine which one was the longest. This variable was based on research linking longer length of longest marriage to higher Social Security benefit levels (Lin, Brown, & Hammersmith, 2015) and lower risk of death after a heart attack (Durpre & Nelson, 2016). The range for this variable was 0 - 72.7 years.

Marital Transitions (≤ 2). This variable is the sum of the number of times an individual has been married, divorced, and/or widowed, if the individual has been married. The measure is similar to one used by Dupre and Nelson (2016), but their measure did not include a count of marriages. The measure for this dissertation research included marriages because research suggests that marriages can be stressful, and including (re)marriages also helps to take into account that remarriages tend to be less beneficial to health, as noted in the review of the literature. The variable is based on four RAND-HRS provided measures: number of times married, number of times divorced, and number of times marriage ended for an unknown reason. RAND created each of those measures using marriage, divorce, and spouse death dates from all waves of the Core and Exit interview files. Some participants reported being “widowed” but had a zero for RAND-HRS’s number of times widowed variable. These participants became divorced first; when their ex-spouse died, they reported being widowed. There were also participants who reported being widowed or married who had a zero for number of widowed or married, respectively. All cases with conflicting reports were excluded from the sample. The number of marriages participants were asked about was capped at four in the more recent waves of the HRS,
allowing for up to eight transitions, but the HRS allowed for unlimited transitions to be reported in past waves, resulting in a min of 1 and a max of 15. Because this variable was not truly continuous and was heavily skewed, it was made binary \( (1 = \leq 2 \text{ transitions}, 0 = >2 \text{ transitions}) \).

**Modifiable Factors**

Modifiable factors in this research included financial well-being (as measured by accessible savings), health insurance, social support (both positive and negative), and depression. These constructs are highly associated with marital history and have the potential to influence diabetes management in addition to the potential to be modified through public policy or programs, making them worth exploring more closely as independent variables in Aim 4 of this dissertation research. Each variable is detailed below.

**Accessible savings.** Financial well-being can be measured in many ways. In this dissertation, it was measured using accessible/liquid savings. Unlike retirement accounts or assets (e.g., properties), accessible savings can be used for day to day and unexpected expenses. Having access to financial resources makes managing diabetes easier. For example, it makes it easier to purchase necessary medications and glucose monitoring supplies. In addition, accessible savings is thought to be a better indicator of one’s more immediate circumstances. Accessible savings was created using RAND-HRS’s “value of checking, savings, or money market accounts” variable, which is based on the following HRS question: “What is the present value of your checking or savings accounts or money market accounts? (If you added up all such accounts, about how much would they amount to right now?).” RAND’s variable contains imputed values for missing or incomplete data. The accessible savings variable created for this research was a continuous variable (range, $0-4,000,000) and it had several outliers, a heavy positive skew, and many legitimate zero values. A value of one was added to eliminate zero values before it was log transformed \((\text{range}, 0 - 6.6)\).
Health insurance. Health insurance coverage can mean more access to resources for prevention, early diagnosis, and management (Nelson et al., 2005). Not all U.S. residents have health insurance, but marriage and older age increase access. In this research, the health insurance variable was created using RAND-HRS variables based on self-report of current health insurance coverage by a government program (e.g., Medicare, Medicaid, VA), employer, spouse’s employer, an ex-spouse, or an “other” source. These variables were used to create a binary variable (health insurance = 1, no health insurance/uninsured = 0).

Positive and negative social support. Social support benefits health, including diabetes management. Marriage is often a key source of support, particularly in diabetes management. The broader health literature suggests women may be better about finding alternative sources of support compared to men. Positive social support and negative social support were included in the analyses to determine whether they were associated with diabetes management and whether that relationship differed by state of dissolution and gender. Positive social support and negative social support were based on four sets of seven items, each assessing perceived social support/relationship quality. Each set of items focused on a different source of social support: spouse, child(ren), other family, and friends. Three items for each set measured positive social support from that source and the other four items measured negative support from that source. The positive items included 1) “How much do they really understand the way you feel about things?,” 2) “How much can you rely on them if you have a serious problem?,” and 3) “How much can you open up to them if you need to talk about your worries?.” The negative items included 1) “How often do they make too many demands on you?,” 2) “How much do they criticize you?,” 3) “How much do they let you down when you are counting on them?,” and 4) “How much do they get on your nerves.” Response options were “1 = a lot,” “2 = some,” “3 = a little,” “4 = not at all.” These items were reverse coded to create an index of positive support and an index of negative support, with higher numbers indicating more positive support or more negative support from
a given source. Each index was then averaged across sources to create one scale of positive social support (range, 1.0 - 4.0) and one scale of negative social support (range, 1.0 - 4.0). Cronbach’s alpha for overall positive social support was 0.59. Alphas for specific sources of positive social support ranged from 0.80 to 0.85. The overall negative social support measure had an alpha of 0.71. Specific source of negative social support items had alphas ranging from 0.75 to 0.79.

*Depressive symptoms.* The HRS uses an eight-item short form of the Center for Epidemiological Studies Depression (CES-D) scale to measure depressive symptoms in participants. This eight-item short form is well validated for use in middle-aged and older adults (Radloff, 1977; Turvey, Wallace, & Herzog, 1999; Steffick, 2000), with high reliability scores (α > 0.85). The scale can be dichotomized to assess level of clinical depression or used in its count form to assess symptoms of depression. The latter is preferable for this research as it has been linked to diabetes management, as noted by Chiu and colleagues (2010; Fisher et al., 2007). The scale asks about whether or not the participant felt the following much of the time in the past week: depressed, everything was an effort, sleep was restless, happy, lonely, enjoyment for life, sad, and could not get going. RAND provides a count of these variables in which “enjoyed life” and “was happy” were reverse coded to create a count of depressive symptoms (*range*, 0 - 8).

*Ascribed Status*

Ascribed status variables—those that are not generally modifiable—include gender, age, and race/ethnicity. Gender was discussed above as an independent/stratifying variable. Age is important to include as a control or explanatory variable because widowhood and poorer health are much more common in older age. Non-Hispanic blacks and Hispanics are at higher risk of diabetes, divorce, and widowhood, so race/ethnicity is included as a control/explanatory variable.

*Age.* Age was based on a RAND-HRS variable that provided participants’ age in years at the end of the interview for each wave (*range*, 50 - 101 years).
Race/Ethnicity. RAND-HRS’s race and whether or not Hispanic variables were used to create a race/ethnicity variable: non-Hispanic white = 0 (reference group), non-Hispanic black = 1, Hispanic = 2. This variable was used to create three binary variables: non-Hispanic white ( = 1, other = 0), non-Hispanic black ( = 1, other = 0), and Hispanic ( = 1, other = 0).

Achieved Status

Achieved status variables—those that are potentially modifiable—include factors such as education, financial well-being, and health insurance. Health insurance and financial well-being were discussed above and included as modifiable factors in this research. Education will be included in some models as a control/explanatory variable given its relationship to both diabetes management and marital history.

Education. This variable is based on the number of years of education participants report having completed at the time of their first interview. Education is generally stable in middle-aged and older adults, with the highest level of education typically having been completed in young adulthood (Ross, & Wu, 1996). The education variable used in the current research was recoded from a RAND-HRS variable and had a range of 0 (no formal education) to 17 years (post college education).

Social

In addition to scales measuring social support, adult children—particularly daughters—may serve as a source of social support and care (Hill, 2015; Stoller, 1983; Silverstein & Bengtson, 1994). Contact with children can vary by marital status, with those who are divorced generally having the lowest rates of being in contact with children (Pinquart, 2003). In this dissertation research, being in contact with children was included as a potential explanatory variable.

In contact with children. Participants’ report of the number of their children they are in contact with was used to create a variable indicating whether or not they are in contact with their children (in contact = 1, not in contact = 0).
Several health-related measures were included as covariates or controls in this research. These measures included count of chronic conditions; more behavior oriented measures such as being obese, inactive, a smoker, and a heavy drinker; and diabetes-specific measures including medications/insulin for diabetes and years with diabetes. Each variable is discussed below.

**Chronic conditions.** Count of chronic conditions other than diabetes was based on the question “Has a doctor ever told you that you have [x]?” for each of six possible conditions: arthritis, cancer, lung disease, heart disease, hypertension, and stroke. Participants could respond yes or no when answering the question for the first time, or confirm or dispute having reported the condition at a previous wave/interview. Each of these conditions was recoded (yes, has condition x = 1, does not have condition = 0), then summed to form a count of chronic conditions (range, 0 - 6).

**Obese.** Among older adults, some excess weight can be protective against mortality (Auyeung et al., 2010). As a result, obesity, rather than overweight, is included as a covariate. RAND used self-reported height and weight variables to create a measure of body mass index (BMI = kg/m²) (CDC, 2015c). Using this item, a measure of obesity was created by coding a BMI of 30.0 kg/m² or greater as obese (obese = 1, not obese = 0).

**Inactive.** Inactivity is a risk factor for diabetes, and activity is recommended for diabetes management. An inactivity variable was created using three separate measures of activity: engagement in vigorous, moderate, and/or light activity. Response options ranged from more than once per week to hardly ever/never for each of these three levels of activity questions. These items were used to create a measure of inactivity: engagement in any level of these activities less than two times per week was considered inactive ( = 1); engagement in one or more of these activities at least two times per week was considered not inactive ( = 0).
Smoker. Smoking increases risk of diabetes and complications (Eliasson, 2003). Two questions were used to determine whether or not participants were current smokers: “Have you ever smoked cigarettes?” and, if so, “Do you smoke cigarettes now?.” These items were recoded to form a current smoker variable (1 = current smoker, 0 = not currently a smoker).

Heavy drinker. The ADA (2014) advises against having more than one drink per day for women and two drinks a day for men. Heavy drinking is having more than one drink per day (or 8 or more drinks per week) for women and more than two drinks per day (or 15 or more drinks per week) for men (USDHHS, 2015). A heavy drinker variable was created based on gender and the question: “In the last three months, on the days you drink, about how many drinks do you have?.” Women who consumed more than one drink per day and men who consumed more than two drinks per day when they drank were considered heavy drinkers (heavy drinker = 1, non-heavy drinker = 0).

Diabetes medications or insulin. Two items were used to create a measure of medication/insulin use to manage diabetes. The first item assessed oral medication using the question, “In order to treat or control your diabetes, are you now taking medication that you swallow?” The second item was a measure of insulin use, based on the question “Are you now using insulin shots or a pump?.” Only participants who self-reported having diabetes were asked these questions, and response options were “yes” or “no” to each question. These items were used to create a new variable for which participants who were not diagnosed with diabetes and those who were diagnosed and responded “no” to both questions were assigned a 0 = not taking medications or insulin to treat diabetes. Those who had diabetes and responded “yes” to both questions were assigned a 1 = taking medications and/or insulin for diabetes.

Years with diabetes. Participants who self-report having been diagnosed with diabetes were also asked: “In what year was your diabetes first diagnosed?.” The year they reported was subtracted from the interview year to get a continuous measure of years with diabetes (range, 1 - 80 years).
3.4. Procedures and Analyses

All analyses for this dissertation research were conducted using SAS 9.4 survey procedures and included weights, strata (n = 56), and clusters (n = 112) to account for the complex sample design of the HRS. The post-survey biomarker weights were the weights selected for use in this research because 1) the biomarker subsample was the smallest subsample used and 2) the post-survey weight accounts for non-response. The domain statement—rather than a(n) “by,” “if,” or “where” command typically used to stratify a sample—was used to run inferential analyses for each subsample of interest (e.g., sample of interest, sample with diabetes, each state of dissolution-gender category) to properly estimate variances. Tests of statistical significance were two-tailed with a significance level of $p < 0.05$.

All relevant data were merged, and variables of interest were recoded and cleaned. Merging consisted of keeping all variables of interest, as determined by a review of the literature, from each of the relevant data wave and topic files, then merging the resulting datasets on person and household identification number for 2010 and for 2012. The next step was recoding the variables, including the post-survey biomarker weight to allow the 2010 weight to be applied to the 2010 cases and the 2012 weight to be applied to the 2012 cases. Once the variables were recoded, the file for 2010 and the file for 2012 were merged on person and household identification number and on EFTF status. As noted above, the sample was narrowed to the population of interest for this research. Cleaning consisted of identifying and removing any remaining invalid values; legitimate outliers were further examined and dealt with as noted in the measures section. The remaining OLS regression assumptions were also checked and generally met: Accessible savings was heavily skewed to the left, so it was transformed as noted in the measures section; as detailed below, there were some correlated variables based on the correlation matrix of all study variables, but the variance inflation factors (VIF) were within an acceptable range.
Preliminary analyses consisted of checking the reliability of some variables and checking relationships among study variables overall and by subgroup. Cronbach’s alpha was calculated for negative and positive social support as noted in the measures section. Pearson correlations were run with all study variables in their continuous or binary form to determine which theoretically relevant control variables could be excluded and to check for collinearity. The relationship between age and length of longest marriage in years were positively associated ($r = 0.574$). However, the VIF was within an acceptable tolerance range. Pearson correlations were the only analyses not run in the survey procedures noted above because as a survey procedure is not available. Marginal correlations between state of dissolution and HbA1c prompted the focus on marital history and modifiable factors as independent variables of HbA1c that might be different depending on state of dissolution and gender, rather than as mediators in the relationship between state of dissolution and HbA1c.

Once the sample was finalized, a variable was created to identify those in the analytic sample and those with missing data to determine potential bias. Differences between the cases with missing data and the analytic sample were assessed using binary logistic regression. Significant differences were noted above and detailed in Appendix B. A second variable was created to identify participants in the sample of interest on one level and all other participants in the biomarker subsample on the other level to use in domain statements.

Descriptive characteristics were assessed using univariate and bivariate analyses and contrast statements. This included frequencies of each level of categorical variable overall, by state of marital dissolution, by gender, and by state of dissolution within gender. To test for significant differences in categorical variables by gender, Rao-Scott Chi-Square—a more conservative version of a Pearson Chi-Square that was designed for use with complex survey data—tests were used. Means and standard errors were used to describe continuous variables by each of the subdomains of interest. Independent samples t-tests were used to test for mean differences on continuous variables between men and
women. Contrast statements within survey regression procedures were used to test for differences in each variable within and between states of dissolution and gender.

The aims of this dissertation were addressed using multivariate analyses, with the type of analysis being determined by the form of the outcome variable. Binary logistic regression was used to test the relationships between state of dissolution and diabetes prevalence and to examine how correlates of diabetes vary by state of marital dissolution and gender (Aim 1). Ordinary least squares (OLS) regression was used to assess the relationship between state of marital dissolution and diabetes management, as measured by HbA1c (Aim 2), and to determine whether any other marriage-related factors were associated with management (Aims 3 and 4). More detail on the analyses specific to each aim are discussed below.

**Aim 1: To explore differences in diabetes prevalence and its correlates by state of marital dissolution and gender in middle-aged and older adults**

This aim was addressed using descriptive and inferential statistics. Descriptive statistics (i.e., percentages, means and standard errors) were used to assess differences in the prevalence of diabetes by state of dissolution and gender using a sample of 9,624 middle and older aged adults with and without diabetes. Then, tests of statistical significance appropriate to the level of measure were used to determine whether there were differences between groups of interest. Rao-Scott Chi-square tests were used to test for significant differences in diabetes and other categorical risk and protective characteristics by gender and t-tests were used to check for differences in continuous variables by gender. Contrasts within regression procedures were used to test for significant differences in descriptive characteristics between those who were married, divorced, and widowed (e.g., married vs. widowed, divorced vs married, and widowed vs. divorced). The same was done to test for differences in states of dissolution within gender.
In addition, sequential binary logistic regression models were run to see whether there were
differences in odds of diabetes when controlling for other factors and whether the factors associated
with odds of diabetes were different depending on state of dissolution and gender. Binary logistic
regression was used because the outcome variable consisted of two levels: has diabetes, does not have
diabetes. It is a common technique for assessing correlates of a health condition making it easy to
interpret the results within the wider literature. The resulting estimates presented include odds ratios,
95% confidence limits, standardized estimates, and significance levels. Odds ratios will be interpreted as
the amount of change in odds of diabetes for a one unit increase in a continuous independent variable
or how much higher the odds of diabetes are in one group compared to the reference group in a binary
independent variable, holding all other independent variables in the model constant. The standardized
estimates are interpreted in the same way, except that the units of measure have been standardized
across variables to allow for the relative contribution of each independent variable to be assessed. For
each one standard deviation increase in an independent variable, one would expect a one standard
deviation increase in the dependent variable. It is worth noting that caution must be used when
interpreting the standardized estimates because the distribution of each variable influences the
meaning of a “one standard deviation change.”

Differences in diabetes by state of dissolution were assessed by using the state of marital
dissolution variable as the independent variable with diabetes as the dependent variable in a binary
logistic regression model (1). Blocks of covariates were added in subsequent models to determine how
each block of covariates influenced the relationship between state of dissolution and diabetes. Marital
history factors were added in Model 2; modifiable factors were added in Model 3; ascribed factors were
added in Model 4; achieved and social factors were added in Model 5, and health factors were added in
Model 6. This process was repeated, stratifying by gender to determine how correlates of diabetes
differed for men and women. The fully adjusted model was also stratified by state of dissolution within
gender to see whether correlates of diabetes differed for women and men in various states of dissolution. In addition, models with a two-way interaction term for state of dissolution and gender were run to determine if there were differences in the relationship between state of dissolution and odds of diabetes for men and women.

**Aim 2:** To explore differences in HbA1c by state of marital dissolution and gender in middle-aged and older adults with self-reported diabetes

To address this aim, the sample was limited to those with diabetes (n = 2,235). Again, percentages, means and standard deviations, and tests of statistical significance were used to assess differences in diabetes management (i.e., HbA1c) and other descriptive characteristics in participants with diagnosed diabetes overall and between and within states of dissolution and gender. Then, because HbA1c is a continuous outcome variable, sequential OLS regression was used to determine whether state of marital dissolution was associated with Hba1c. The beta coefficients, standard errors, standardized coefficients, and significance levels resulting from these analyses are presented in tables. The beta coefficients were interpreted very much the same way as the odds ratios. For each one unit change in a continuous independent variable, holding all covariates constant, a change equal to the beta coefficient is expected in HbA1c. The beta coefficient of a binary independent variable indicates how much higher or lower HbA1c is on average in that category of the binary variable compared to the reference category, again, holding all other variables in the model constant. The standardized coefficients are interpreted the same way, except that the “units” have been standardized to standard deviations. Again, caution must be taken when interpreting these standardized estimates, as the standard deviation for any given variable is dependent on the distribution of that variable.

Changes in the relationship between state of dissolution and HbA1c were assessed as covariates were sequentially added to the model based on the lifespan and life course perspectives: marital history (Model 2), ascribed factors (Model 3), achieved factors (Model 4), social factors (Model 5), and health
factors (Model 6). These models were run for the full sample with diabetes, by state of dissolution, and by gender. The fully adjusted model was also stratified by state of dissolution within gender to see whether correlates of diabetes management (i.e., HbA1c) differed for women and men in various states of dissolution. To determine if there were statistically significant differences in the effect of marital status on HbA1c in men and women, a model was also run with a two-way interaction term for marital dissolution by gender.

**Aim 3:** To examine whether two aspects of marital history—length of longest marriage and marital transitions—influence HbA1c, indicating support for protection and/or crisis, and whether there are differences by state of marital dissolution and gender in a sample of middle-aged and older adults with self-reported diabetes.

Sequential OLS regression was also used to address this aim. First, the relationship between length of longest marriage and HbA1c was modeled. Next the relationship between marital transitions and HbA1c was modeled. Blocks of covariates were added sequentially (ascribed, achieved, social, and health) to each model in order to determine whether other factors attenuated any relationship between marital history and HbA1c. Both sets of models were run overall (with state of dissolution as another independent variable), by state of dissolution, by gender, and by state of marital dissolution within gender.

**Aim 4:** To identify any of the potentially modifiable marriage-related factors, including accessible savings, health insurance coverage, positive and negative social support, and depressive symptoms, that influence HbA1c in middle-aged and older adults with diabetes overall and by state of marital dissolution, gender, and state of dissolution within gender.

The research questions in Aim 4 were answered using several series of sequential OLS regression models. The relationship between each of the five modifiable factors (savings, health insurance, negative and positive social support, and depression) and HbA1c were modeled individually and with
potential explanatory variables added sequentially in blocks: state of dissolution (Model 2), marital history (Model 3), ascribed (Model 4), achieved (Model 5), social (Model 6), and health factors (Model 7). Each model was run for the full sample, by state of marital dissolution, by gender, and by state of marital dissolution within gender. In addition, a three-way interaction term for state of dissolution, gender, and each modifiable factor was added to Model 1 for the overall sample. Last, the amount of variance in diabetes management explained by financial (savings and insurance) versus social (positive social support and negative social support) factors were assessed by state of dissolution-gender category.

3.5. Summary of Methods

In summary, the aims of this dissertation were met with pooled, cross-sectional data from the 2010 and 2012 waves of the Health and Retirement Study. While these cross-sectional data do not allow for causal inferences to be drawn, the sample size and wealth of data on marital history, demographics, and health were sufficient for answering the research questions of this dissertation in a nationally representative sample. All analyses were weighted and run in SAS 9.4 survey procedures to account for the complex survey design. The sample for Aim 1 consisted of both participants with and without diabetes (N = 9,624). The dependent variable for this aim was diabetes and binary logistic regression was used to test hypotheses. For Aims 2 through 4, the sample was limited to only those with diabetes (n = 2,235). The dependent variable was HbA1c, and hierarchical OLS regression was used to test the hypotheses of these aims. The next chapter describes the sample and contains the findings for Aim 1 and Aim 2. The findings for Aim 3 and Aim 4 are presented in Chapter Five.
4. Chapter Four: Results for Aim 1 and Aim 2

This chapter describes the samples used in this research and presents the findings for Aims 1 and 2. The sample for Aim 1 and the sample for Aims 2-4 are both described below. Each sample is detailed overall, by gender, by state of marital dissolution, and by state of marital dissolution within gender. Next, the findings for Aims 1 and 2 are presented. The findings for Aims 3 and 4 are presented in Chapter Five. All statistics are weighted unless otherwise noted and account for the complex design of the HRS, as described in Chapter Three.

4.1. Descriptions of the Samples

Two samples were used to address the aims of this dissertation. The first aim was addressed using a sample of adults over 50 years of age (N = 9,624). The purpose of Aim 1 was to understand how the odds of diabetes vary by state of marital dissolution and gender and what the risk factors are for each of those states. Aims 2-4 were addressed by narrowing the first sample to only cases in which the participant self-reported doctor diagnosed diabetes (n = 2,235). The purpose of Aim 2 was to explore whether there were differences in diabetes management, as measured by HbA1c, by state of marital dissolution and gender.

4.1.1. Full Sample Used in Aim 1

Table 1 details the sample for Aim 1, overall, by gender, and by state of marital dissolution. This sample consisted of 9,624 adults over 50 years of age with an average age of 66 years (range: 50-101). Men made up 44% of the sample. Approximately 71% of the sample was currently married, 14% was currently divorced, and 15% was currently widowed; most (66%) had experienced two or fewer transitions into and/or out of marriage and the average length of participants’ longest marriage was 33 years (range: 0-73). Non-Hispanic whites, non-Hispanic blacks, and Hispanics represented 87%, 7%, and 6% of the sample, respectively. The average years of education was 13, and the average amount of savings participants had in easily accessible accounts (i.e., checking, savings, and money market)
Table 1: Descriptive statistics for Aim 1 sample overall, by gender, and by state of marital dissolution

<table>
<thead>
<tr>
<th>Variable</th>
<th>All</th>
<th>Women</th>
<th>Men</th>
<th>Married</th>
<th>Divorced</th>
<th>Widowed</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>n=6,479</td>
<td>n=1,281</td>
<td>n=1,864</td>
</tr>
<tr>
<td>Diabetes</td>
<td>20.32(0.59)</td>
<td>18.79(0.69)</td>
<td>22.25(0.77)</td>
<td>19.26(0.65)</td>
<td>20.44(1.26)</td>
<td>25.17(1.17)</td>
</tr>
<tr>
<td>State of Dissolution</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Married</td>
<td>70.68(0.60)</td>
<td>61.64(0.68)</td>
<td>82.08(0.65)</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Divorced</td>
<td>14.14(0.55)</td>
<td>15.93(0.68)</td>
<td>11.89(0.74)</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Widowed</td>
<td>15.17(0.44)</td>
<td>22.43(0.69)</td>
<td>6.03(0.33)</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Men</td>
<td>44.25(0.41)</td>
<td>-</td>
<td>-</td>
<td>51.39(0.41)</td>
<td>37.21(1.77)</td>
<td>17.58(0.87)</td>
</tr>
<tr>
<td>s2 Marital Transitions</td>
<td>66.22(0.85)</td>
<td>67(1.03)</td>
<td>65.25(0.92)</td>
<td>66.46(0.91)</td>
<td>59.23(1.85)</td>
<td>71.63(1.33)</td>
</tr>
<tr>
<td>Health Insurance</td>
<td>94.21(0.44)</td>
<td>94.06(0.49)</td>
<td>94.40(0.56)</td>
<td>94.73(0.49)</td>
<td>87.94(1.05)</td>
<td>97.63(0.34)</td>
</tr>
<tr>
<td>Race/Ethnicity</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Non-Hispanic White</td>
<td>86.56(1.09)</td>
<td>85.79(1.08)</td>
<td>87.52(1.20)</td>
<td>88.47(1.20)</td>
<td>79.08(1.76)</td>
<td>84.60(1.16)</td>
</tr>
<tr>
<td>Non-Hispanic Black</td>
<td>7.13(0.42)</td>
<td>7.89(0.47)</td>
<td>6.19(0.45)</td>
<td>5.22(0.46)</td>
<td>13.46(1.07)</td>
<td>10.17(0.79)</td>
</tr>
<tr>
<td>Hispanic</td>
<td>6.31(0.92)</td>
<td>6.32(0.89)</td>
<td>6.29(1.02)</td>
<td>6.31(1.03)</td>
<td>7.47(1.28)</td>
<td>5.23(0.85)</td>
</tr>
<tr>
<td>Obese</td>
<td>34.88(0.70)</td>
<td>35.55(0.93)</td>
<td>34.03(0.88)</td>
<td>35.22(0.88)</td>
<td>36.94(1.37)</td>
<td>31.37(1.27)</td>
</tr>
<tr>
<td>Inactive</td>
<td>27.13(0.75)</td>
<td>29.59(0.83)</td>
<td>24.03(0.94)</td>
<td>24.31(0.88)</td>
<td>27.58(1.46)</td>
<td>39.86(1.52)</td>
</tr>
<tr>
<td>Smoker</td>
<td>11.94(0.53)</td>
<td>11.01(0.58)</td>
<td>13.12(0.76)</td>
<td>10.18(0.61)</td>
<td>23.00(1.55)</td>
<td>9.84(0.92)</td>
</tr>
<tr>
<td>Heavy Drinker</td>
<td>15.69(0.59)</td>
<td>16.19(0.68)</td>
<td>15.06(0.75)</td>
<td>16.12(0.69)</td>
<td>20.30(1.26)</td>
<td>9.39(1.00)</td>
</tr>
<tr>
<td>In Contact w/Child(ren)</td>
<td>95.04(0.36)</td>
<td>94.81(0.38)</td>
<td>95.33(0.48)</td>
<td>96.36(0.41)</td>
<td>89.30(1.28)</td>
<td>94.24(0.72)</td>
</tr>
<tr>
<td>Medication/Insulin</td>
<td>16.38(0.54)</td>
<td>15.14(0.64)</td>
<td>17.95(0.78)</td>
<td>82.10(1.07)</td>
<td>73.64(3.26)</td>
<td>80.57(2.66)</td>
</tr>
<tr>
<td>HbA1c</td>
<td>5.78(0.01)</td>
<td>5.74(0.01)</td>
<td>5.82(0.02)</td>
<td>5.76(0.01)</td>
<td>5.81(0.03)</td>
<td>5.83(0.02)</td>
</tr>
<tr>
<td>Longest Marriage, yrs</td>
<td>33.24(0.42)</td>
<td>33.14(0.48)</td>
<td>33.37(0.44)</td>
<td>35.94(0.43)</td>
<td>15.89(0.36)</td>
<td>36.84(0.72)</td>
</tr>
<tr>
<td>Accessible Savings</td>
<td>35.187(1,706)</td>
<td>33.413(2,220)</td>
<td>37.421(1841)</td>
<td>39.440(2,254)</td>
<td>15.727(1,711)</td>
<td>33.508(2,853)</td>
</tr>
<tr>
<td>Accessible Savings, logged</td>
<td>3.41(0.04)</td>
<td>3.37(0.05)</td>
<td>3.46(0.05)</td>
<td>3.58(0.05)</td>
<td>2.80(0.06)</td>
<td>3.21(0.05)</td>
</tr>
<tr>
<td>CES-D</td>
<td>1.25(0.03)</td>
<td>1.37(0.04)</td>
<td>1.10(0.03)</td>
<td>1.02(0.03)</td>
<td>1.85(0.08)</td>
<td>1.76(0.06)</td>
</tr>
<tr>
<td>Positive Soc Support</td>
<td>3.14(0.01)</td>
<td>3.21(0.01)</td>
<td>3.05(0.01)</td>
<td>3.14(0.01)</td>
<td>3.07(0.02)</td>
<td>3.20(0.01)</td>
</tr>
<tr>
<td>Negative Soc Support</td>
<td>1.64(0.01)</td>
<td>1.65(0.01)</td>
<td>1.64(0.01)</td>
<td>1.67(0.01)</td>
<td>1.68(0.02)</td>
<td>1.49(0.01)</td>
</tr>
<tr>
<td>Age</td>
<td>66.35(0.29)</td>
<td>66.67(0.33)</td>
<td>65.95(0.29)</td>
<td>64.76(0.28)</td>
<td>63.27(0.3)</td>
<td>76.64(0.46)</td>
</tr>
<tr>
<td>Education, yrs</td>
<td>13.32(0.07)</td>
<td>13.17(0.07)</td>
<td>13.51(0.07)</td>
<td>13.55(0.08)</td>
<td>13.26(0.09)</td>
<td>12.30(0.09)</td>
</tr>
<tr>
<td>Health Conditions</td>
<td>1.69(0.02)</td>
<td>1.71(0.02)</td>
<td>1.67(0.02)</td>
<td>1.59(0.02)</td>
<td>1.69(0.04)</td>
<td>2.20(0.04)</td>
</tr>
<tr>
<td>Years w/Diabetes</td>
<td>2.28(0.08)</td>
<td>2.17(0.10)</td>
<td>2.41(0.11)</td>
<td>2.11(0.09)</td>
<td>2.19(0.18)</td>
<td>3.13(0.20)</td>
</tr>
</tbody>
</table>

Notes. Weighted descriptives using pooled 2010-2012 data from the Health and Retirement Study
Superscripts indicate significant differences at p < 0.05
G  Significant difference between men and women within a given marital status
D  Significantly different from Married
W  Significantly different from Divorced
M  Significantly different from Widowed
was $35,187 (range: $0-4,000,000; median: $5,951). Nearly all participants had health insurance (94%) and reported being in contact with their children, if they had them (95%). Participants reported higher levels of positive social support \((M = 3.14)\) than negative social support \((M = 1.64)\), with each being measured on a separate scale \((range; 1-4, with 4 representing highest support)\). The average number of CES-D measured depressive symptoms was 1.25 \((range: 0-8)\). Nearly all participants reported having health insurance coverage (94%). The average number of chronic health conditions was 1.69. Nearly 35% of participants were obese, 27% were inactive, 16% were heavy drinkers, and 12% were current smokers. Approximately 20% of the sample reported doctor diagnosed diabetes, and the average HbA1c level was 5.78%.

The sample differed on a number of characteristics by gender. Compared to men, women were older \((M_w = 66.67, M_m = 65.95)\), more likely to be divorced \((W: 16\% M: 12\%)\) or widowed \((W: 22\% M: 6\%)\), and have less education \((M_w = 13.17\text{yrs}, M_m = 13.51\text{yrs})\) and accessible savings \((M_w = $33,413, M_m = $37,421)\). Women reported higher levels of positive social support \((M_w = 3.21, M_m = 3.05)\), but they also reported higher levels of depressive symptoms \((M_w = 1.37, M_m = 1.10)\). More women than men were physically inactive \((W: 30\%, M: 24\%)\); however, more men were current smokers \((W: 11.01, M: 13.12)\), self-reported doctor diagnosed diabetes \((W: 19\%, M: 22\%)\), and had higher levels of HbA1c \((M_w = 5.74\%, M_m = 5.82\%)\).

There were also numerous differences by state of marital dissolution. Those who were widowed were significantly older \((M = 76.64)\) than those who were married and divorced; those who were married were significantly older \((M = 64.76)\) than those who were divorced \((M = 63.27)\). Those who were divorced had significantly less in accessible savings \((M = $15,727)\) than did those who were married \((M = $39,440)\) or widowed \((M = $33,508)\), while there were no significant differences in savings between those widowed and married. Those who were divorced were also less likely to have health insurance (88%) than those who were married (95%) or widowed (98%). Those who were divorced also
tended to have riskier health behaviors, more depressive symptoms, less positive social support than those who were married or widowed, although levels of inactivity were highest in those who were widowed. Those who were divorced had more chronic health conditions than those who were married but less than those who were widowed, despite being the youngest group. Health insurance coverage and being in contact with their children were less common in those who were divorced than in those who were married or widowed. More widowed adults were inactive, older, and insured; diabetes, chronic health conditions, and positive social support were also more common/higher in those who were widowed compared to those who were married or divorced. Interestingly, levels of positive social support for those who were widowed tended to be similar to levels of those who were married, while those who were divorced had lower levels of positive social support. On the other hand, levels of negative social support for those who were divorced tended to be similar to levels of those who were married, while those who were widowed had lower levels of negative social support. There were also differences in diabetes, with prevalence being highest in those who were widowed but not significantly different between those who were married and those who were divorced. HbA1c was significantly higher in those who were widowed compared to those who were married, but there were no significant differences between those who were divorced and those who were widowed or between those who were married and those who were divorced.

As seen in Table 2, there were also differences in the Aim 1 participants’ characteristics by state of dissolution within gender and by gender within state of dissolution. The disadvantages noted above within those who were divorced were also seen in women who were divorced compared to married women and widowed women. Divorced women had less in savings, higher HbA1c, less positive social support, and more chronic health conditions than married women despite being about the same age. Diabetes, obesity, and inactivity were also more common in divorced women than married women. Diabetes and inactivity were most common in widowed women; they also had the most health
<table>
<thead>
<tr>
<th>Variable</th>
<th>Women</th>
<th>Men</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Married (n = 3,218)</td>
<td>Married (n = 3,261)</td>
</tr>
<tr>
<td></td>
<td>%/M(SE)</td>
<td>%/M(SE)</td>
</tr>
<tr>
<td>Diabetes</td>
<td>16.42(0.73)</td>
<td>19.87(1.49)</td>
</tr>
<tr>
<td>≤2 Marital Transitions</td>
<td>68.15(1.13)</td>
<td>57.13(2.21)</td>
</tr>
<tr>
<td>Health Insurance</td>
<td>94.19(0.58)</td>
<td>88.77(1.19)</td>
</tr>
<tr>
<td>Race/Ethnicity</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Non-Hispanic White</td>
<td>88.58(1.16)</td>
<td>77.28(1.88)</td>
</tr>
<tr>
<td>Non-Hispanic Black</td>
<td>5.26(0.48)</td>
<td>14.54(1.39)</td>
</tr>
<tr>
<td>Hispanic</td>
<td>6.16(0.96)</td>
<td>8.18(1.31)</td>
</tr>
<tr>
<td>Obese</td>
<td>35.74(1.31)</td>
<td>41.67(1.87)</td>
</tr>
<tr>
<td>Inactive</td>
<td>25.32(1.05)</td>
<td>30.73(1.91)</td>
</tr>
<tr>
<td>Smoker</td>
<td>9.10(0.64)</td>
<td>21.29(1.61)</td>
</tr>
<tr>
<td>Heavy Drinker</td>
<td>18.45(0.89)</td>
<td>17.66(1.65)</td>
</tr>
<tr>
<td>In Contact w/Child(ren)</td>
<td>96.22(0.48)</td>
<td>89.54(1.37)</td>
</tr>
<tr>
<td>Medication/Insulin</td>
<td>13.50(0.74)</td>
<td>15.16(1.24)</td>
</tr>
<tr>
<td>HbA1c</td>
<td>5.70(0.02)</td>
<td>5.80(0.04)</td>
</tr>
<tr>
<td>Longest Marriage, yrs</td>
<td>36.47(0.52)</td>
<td>15.67(0.40)</td>
</tr>
<tr>
<td>Accessible Savings</td>
<td>40,702(3,403)</td>
<td>11,819(1,622)</td>
</tr>
<tr>
<td>Accessible Savings, logged</td>
<td>3.61(0.05)</td>
<td>2.78(0.07)</td>
</tr>
<tr>
<td>CES-D</td>
<td>1.10(0.04)</td>
<td>1.87(0.09)</td>
</tr>
<tr>
<td>Positive Soc Support</td>
<td>3.22(0.01)</td>
<td>3.15(0.02)</td>
</tr>
<tr>
<td>Negative Soc Support</td>
<td>1.68(0.01)</td>
<td>1.71(0.02)</td>
</tr>
<tr>
<td>Age</td>
<td>63.85(0.60)</td>
<td>63.62(0.38)</td>
</tr>
<tr>
<td>Education, yrs</td>
<td>13.46(0.09)</td>
<td>13.34(1.00)</td>
</tr>
<tr>
<td>Health Conditions</td>
<td>1.53(0.03)</td>
<td>1.76(0.05)</td>
</tr>
<tr>
<td>Years w/Diabetes</td>
<td>1.82(0.11)</td>
<td>2.31(0.22)</td>
</tr>
</tbody>
</table>

Notes. Weighted descriptive using pooled 2010/2012 data from the Health and Retirement Study. Superscripts indicate significant differences at p < 0.05

- g: Significantly different between men and women within a given marital status
- d: Significantly different from Married
- W: Significantly different from Divorced
- D: Significantly different from Widowed
conditions. However, widowed women were older than married or divorced women and fell in between the other two groups of women in accumulated accessible savings.

Divorced men followed the same pattern in some respects. They had the lowest in accessible savings of the groups of men. Smoking, drinking, and depressive symptoms were higher in divorced men than in married or widowed men. They were similar to married men with regard to activity, HbA1c, diabetes prevalence, negative social support, and health conditions. Widowed men were the oldest and divorced men were the youngest. Widowed men had the highest levels of HbA1c, inactivity, health conditions, and health insurance, but were not significantly different from married men in savings, obesity, drinking, and smoking. Married men had the lowest levels of depressive symptoms and were most likely to be in contact with their children.

In summary, the characteristics of the weighted sample looked much like the U.S. population over age 50. There were more women than men; and women tended to be older and have higher levels of social support, negative support, and depressive symptoms. Men tended to be married, have more in savings, and be more likely to be smokers. Those who were divorced were more likely to use substances and have less in savings. Those who were widowed tended to be oldest, have the most health conditions, including diabetes, but they also had high social support and insurance coverage. Men tended to have more chronic conditions, except for in those who were divorced. Some of the key demographic differences between groups, such as the significantly older age of those who were widowed, highlight the need for multivariate analyses to determine what the odds of diabetes are in this sample by state of marital dissolution, controlling for other characteristics.

4.1.2. Sample of Those Diagnosed with Diabetes Used for Aims 2-4

Table 3 details the participants in the Aim 2-4 sample, overall, by gender, and by state of dissolution. Of the 9,624 participants in the full sample for Aim 1, 2,235 (20%) reported having been diagnosed with diabetes by a doctor and, thus, became the sample for Aims 2 through 4. Of those with
diabetes, 48% were men. Most participants were married (67%); 14% were divorced and 19% were widowed. Almost 79% were non-Hispanic white, 11% were non-Hispanic black, and 10% were Hispanic. The average number of years of education was 12.67, and the average amount in accessible savings was $26,738. Nearly all participants had health insurance (95%). The average number of chronic conditions was 2.24, and the average number of depressive symptoms was 1.67. Positive social support and negative social support were 3.08 and 1.70, respectively. Over 95% of the sample with children was in contact with them; the average length of longest marriage 34 years. Approximately 55% of the sample was obese, 40% was inactive 11% smoked, and 9% were heavy drinkers. The mean HbA1c was 6.78%; nearly 81% of the participants were on medications or insulin to treat their diabetes; the average years lived with diabetes was 10.45.

In comparison to the full sample for Aim 1 (not presented in tables), the sample of those with diabetes for Aim 2-4 contained more participants who were obese and inactive. They also had more depressive symptoms and health conditions. In addition to having poorer health, they were more socially and economically disadvantaged. Those in the diabetic sample were more likely to have less positive social support and more negative social support, be widowed, be non-Hispanic black or Hispanic, have less education, be older, be a man, and report substantially lower accessible savings.

As with the full sample, there were significant differences in participants’ characteristics by gender (see Table 3). More of the women than men in the sample were divorced (W: 17%, M: 11%) or widowed (W: 29%, M: 8%). There were also more non-Hispanic black (W: 13%, M: 9%) women than men. More women were obese (W: 58%, M: 48%) and/or inactive (W: 45%, M: 35%) than men, but more men were heavy drinkers (W: 7%, M: 11%). Women had less in accessible savings ($M_W = 26,046, $M_M = 27,475) and less education ($M_W = 12yrs, $M_M = 13yrs), and more depressive symptoms ($M_W = 1.84, $M_M = 1.50) and chronic health conditions ($M_W = 2.31, $M_M = 2.16). They also had more positive social support ($M_W = 3.15, $M_M = 3.00).
Table 3: Descriptive statistics for Aims 2-4 sample overall, by gender, and by state of marital dissolution

<table>
<thead>
<tr>
<th>Variable</th>
<th>Full Sample</th>
<th>Gender</th>
<th>State of Marital Dissolution</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>All n = 2,235</td>
<td>Women n = 1,223</td>
<td>Men n = 1,012</td>
</tr>
<tr>
<td>State of Dissolution</td>
<td>%/M(SE)</td>
<td>%/M(SE)</td>
<td>%/M(SE)</td>
</tr>
<tr>
<td>Married</td>
<td>66.98(1.21)</td>
<td>53.87(1.57)</td>
<td>80.93(1.46)</td>
</tr>
<tr>
<td>Divorced</td>
<td>14.22(0.98)</td>
<td>16.84(1.34)</td>
<td>11.44(1.25)</td>
</tr>
<tr>
<td>Widowed</td>
<td>18.79(0.85)</td>
<td>29.28(1.34)</td>
<td>7.63(0.81)</td>
</tr>
<tr>
<td>Men</td>
<td>48.46(1.03)</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>≤2 Marital Transitions</td>
<td>65.39(1.46)</td>
<td>67.54(1.73)</td>
<td>63.11(1.93)</td>
</tr>
<tr>
<td>Health Insurance</td>
<td>94.93(0.76)</td>
<td>94.26(1.05)</td>
<td>95.65(0.82)</td>
</tr>
<tr>
<td>Race/Ethnicity</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Non-Hispanic White</td>
<td>78.68(1.86)</td>
<td>76.11(1.83)</td>
<td>81.42(2.13)</td>
</tr>
<tr>
<td>Non-Hispanic Black</td>
<td>11.27(0.78)</td>
<td>13.43(0.95)</td>
<td>8.97(0.92)</td>
</tr>
<tr>
<td>Hispanic</td>
<td>10.04(1.59)</td>
<td>10.45(1.58)</td>
<td>9.61(1.79)</td>
</tr>
<tr>
<td>Obese</td>
<td>54.85(1.29)</td>
<td>57.55(1.81)</td>
<td>48.03(1.84) (^G)</td>
</tr>
<tr>
<td>Inactive</td>
<td>39.88(1.13)</td>
<td>44.55(1.62)</td>
<td>34.93(1.81) (^G)</td>
</tr>
<tr>
<td>Smoker</td>
<td>10.87(0.90)</td>
<td>10.68(0.96)</td>
<td>11.07(1.73)</td>
</tr>
<tr>
<td>Heavy Drinker</td>
<td>8.89(0.69)</td>
<td>7.01(1.13)</td>
<td>10.89(1.02) (^G)</td>
</tr>
<tr>
<td>In Contact w/Child(ren)</td>
<td>95.53(0.62)</td>
<td>94.99(0.90)</td>
<td>96.11(0.73)</td>
</tr>
<tr>
<td>Medication/insulin</td>
<td>80.61(1.02)</td>
<td>80.57(1.49)</td>
<td>80.64(1.44)</td>
</tr>
<tr>
<td>HbA1c</td>
<td>6.78(0.03)</td>
<td>6.72(0.04)</td>
<td>6.84(0.05)</td>
</tr>
<tr>
<td>Longest Marriage, yrs</td>
<td>34.01(0.55)</td>
<td>33.45(0.71)</td>
<td>34.60(0.58)</td>
</tr>
<tr>
<td>Accessible Savings</td>
<td>26,736(3,831)</td>
<td>26,046(7,204)</td>
<td>27,475(3,312)</td>
</tr>
<tr>
<td>Accessible Savings, logged</td>
<td>3.05(0.06)</td>
<td>2.87(0.07)</td>
<td>3.25(0.06) (^G)</td>
</tr>
<tr>
<td>CES-D</td>
<td>1.67(0.06)</td>
<td>1.84(0.09)</td>
<td>1.50(0.09) (^G)</td>
</tr>
<tr>
<td>Positive Soc Support</td>
<td>3.08(0.02)</td>
<td>3.15(0.02)</td>
<td>3.00(0.02) (^G)</td>
</tr>
<tr>
<td>Negative Soc Support</td>
<td>1.70(0.01)</td>
<td>1.69(0.02)</td>
<td>1.70(0.02)</td>
</tr>
<tr>
<td>Age</td>
<td>67.82(0.35)</td>
<td>68.16(0.39)</td>
<td>67.46(0.40)</td>
</tr>
<tr>
<td>Education, yrs</td>
<td>12.67(0.10)</td>
<td>12.30(0.12)</td>
<td>13.06(0.13) (^G)</td>
</tr>
<tr>
<td>Health Conditions</td>
<td>2.24(0.03)</td>
<td>2.31(0.04)</td>
<td>2.16(0.04) (^G)</td>
</tr>
<tr>
<td>Years w/Diabetes</td>
<td>10.45(0.23)</td>
<td>10.61(0.27)</td>
<td>10.28(0.35)</td>
</tr>
</tbody>
</table>

Notes. Weighted descriptive using pooled 2010|2012 data from the Health and Retirement Study.
Superscripts indicate significant differences at \(p < 0.05\).

\(^G\) Significant difference between men and women within a given marital status.

\(^M\) Significantly different from Married.

\(^D\) Significantly different from Divorced.

\(^W\) Significantly different from Widowed.
Significant differences in characteristics by state of marital dissolution were also notable (see Table 3). Those who were married were much more likely to be men (59%), while those who were divorced or widowed were much more likely to be women (D: 61%, W: 80%, respectively). Smoking and obesity were more common in those who are divorced. Those who were divorced were less likely to be on medications for diabetes than those who were married, but not less likely than those who were widowed. Also, those who were widowed had the lowest HbA1c levels, despite having the highest average age and most inactivity and chronic conditions. Those who were married had the most in savings, highest depressive symptoms, and fewest health conditions. HbA1c was not significantly different in those who were married and divorced, but it was significantly higher in those who were married than those who were widowed. It was not significant different between those who were divorced and widowed.

Table 4 details the Aim 2-4 sample by state of marital dissolution within gender and by gender within state of dissolution. Obesity was highest in married and divorced women but there were not significant differences between states of dissolution in men. There was also less difference in accessible savings and education between states of dissolution in men compared to women. However, divorced men were younger on average than other men and widowed men were older on average than other men. Women who were divorced were again the lowest savings, highest smoking, and highest CES-D group of women. However, they were not significantly different from married women on age, insurance, obesity, drinking, age, education, or years with diabetes. They were not significantly different from widowed women on inactivity, smoking, CES-D, health conditions, or years with diabetes. There were no significant differences in HbA1c by state of dissolution within either gender.

The Aim 2-4 sample of those with diabetes tended to be more disadvantaged on most measures of wellbeing than the overall sample. There were also fewer gender and state of dissolution differences, compared to the overall sample, suggesting that the sample of those with diabetes is more
Table 4: Descriptive statistics for Aims 2-4 sample with comparisons by state of dissolution within gender and by gender within state of dissolution

<table>
<thead>
<tr>
<th>Variable</th>
<th>Women</th>
<th>Men</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Married</td>
<td>Divorced</td>
</tr>
<tr>
<td></td>
<td>n = 612</td>
<td>n = 201</td>
</tr>
<tr>
<td></td>
<td>%/M(SE) p</td>
<td>%/M(SE) p</td>
</tr>
<tr>
<td>≤2 Marital Transitions</td>
<td>71.28(2.40)</td>
<td>65.24(4.38)</td>
</tr>
<tr>
<td>Health Insurance</td>
<td>93.92(1.51)</td>
<td>94.15(2.30)</td>
</tr>
<tr>
<td>Race/Ethnicity</td>
<td>Non-Hispanic White</td>
<td>79.67(2.77)</td>
</tr>
<tr>
<td></td>
<td>Non-Hispanic Black</td>
<td>8.73(1.16)</td>
</tr>
<tr>
<td></td>
<td>Hispanic</td>
<td>11.60(2.34)</td>
</tr>
<tr>
<td>Obese</td>
<td>61.76(2.71)</td>
<td>61.09(3.60)</td>
</tr>
<tr>
<td>Inactive</td>
<td>39.56(2.82)</td>
<td>46.62(4.66)</td>
</tr>
<tr>
<td>Smoker</td>
<td>8.11(1.44)</td>
<td>16.04(2.81)</td>
</tr>
<tr>
<td>Heavy Drinker</td>
<td>9.12(1.94)</td>
<td>7.07(1.81)</td>
</tr>
<tr>
<td>In Contact w/Child(ren)</td>
<td>96.70(0.86)</td>
<td>86.83(3.16)</td>
</tr>
<tr>
<td>Medication/Insulin</td>
<td>82.24(1.83)</td>
<td>76.30(3.44)</td>
</tr>
<tr>
<td>HbA1c</td>
<td>6.75(0.06)</td>
<td>6.87(0.15)</td>
</tr>
<tr>
<td>Longest Marriage, yrs</td>
<td>39.27(0.70)</td>
<td>15.92(0.94)</td>
</tr>
<tr>
<td>Accessible Savings</td>
<td>37,548(13,398)</td>
<td>7,765(1,565)</td>
</tr>
<tr>
<td>Accessible Savings, logged</td>
<td>3.19(0.10)</td>
<td>2.23(0.11)</td>
</tr>
<tr>
<td>CES-D</td>
<td>1.44(0.09)</td>
<td>2.52(0.22)</td>
</tr>
<tr>
<td>Positive Soc Support</td>
<td>3.16(0.03)</td>
<td>3.05(0.06)</td>
</tr>
<tr>
<td>Negative Soc Support</td>
<td>1.71(0.02)</td>
<td>1.85(0.06)</td>
</tr>
<tr>
<td>Age</td>
<td>65.38(0.39)</td>
<td>65.25(0.69)</td>
</tr>
<tr>
<td>Education, yrs</td>
<td>12.59(0.17)</td>
<td>12.65(0.20)</td>
</tr>
<tr>
<td>Health Conditions</td>
<td>2.11(0.05)</td>
<td>2.46(0.13)</td>
</tr>
<tr>
<td>Years w/Diabetes</td>
<td>9.99(0.39)</td>
<td>10.84(0.80)</td>
</tr>
</tbody>
</table>

Notes. Weighted descriptives using pooled 2010|2012 data from the Health and Retirement Study.
Superscripts indicate significant differences at p < 0.05.

- G: Significant difference between men and women within a given marital status
- M: Significantly different from Married
- D: Significantly different from Divorced
- W: Significantly different from Widowed
homogeneous. Still, there were a number of differences within and between gender and state of dissolution, particularly on ascribed, marital history, social, and health factors.

4.2. Aim 1 Findings on State of Marital Dissolution and Gender Links to Diabetes Prevalence and Risk and Protection Factors

Aim 1: To explore differences in diabetes prevalence and its correlates by state of marital dissolution and gender in middle-aged and older adults

In order to test the hypotheses associated with this aim, the proportions and the odds ratios and corresponding 95% confidence intervals of diabetes were calculated for the sample overall, by state of marital dissolution, gender, and state of dissolution within gender. Those who were widowed were hypothesized to have higher odds of diabetes than those who were married. Those who were divorced were also expected to have higher odds than those who were divorced, but not to have higher odds than those who were widowed.

As noted above and in Table 1, the overall, unadjusted prevalence of diabetes was 20.32%. It was highest in those who were widowed (25.17%), followed by those who were divorced (20.44%); and it was lowest in those who were married (19.26%). Differences were significant between those who were widowed and divorced and widowed and married, but not between divorced and married. The proportion of men with diabetes (22.25%) was higher than the proportion of women with diabetes (18.79%). As noted in Table 2, in women, diabetes was least common in those who were married (16.42%); and most common in those who were married (24.52%). It was significantly more common in divorced women than in married women and in widowed women than in divorced women. Also noted in Table 2, in men, those who were divorced and those who were married had nearly the same prevalence of diabetes (21.41% and 21.94%, respectively); diabetes was significantly more common in widowed men (28.18%). Given significant differences on ascribed, achieved, and health characteristics between those who were married, divorced, and widowed and men compared to women, a series of
binary logistic regression models were run to determine which categories had the highest odds of diabetes, after controlling for those characteristics.

4.2.1. State of Marital Dissolution and Odds of Diabetes

Table 5 presents odds of diabetes for the overall sample. Again, those who were widowed were hypothesized to have higher odds of diabetes and that this would be due to social and financial resources (modifiable factors) and ascribed factors. As seen in Model 1 of Table 5, compared to those who were married, those who were widowed had significantly higher (41%) odds of diabetes ($OR = 1.410$, $CI = 1.231-1.615$, $p < 0.001$). Those who were divorced did not differ significantly from those who were married in their odds of diabetes ($OR = 1.077$, $CI = 0.910-1.275$, $p = NS$). In Model 2 (not shown), odds of diabetes remained significantly higher (41%) in those who were widowed compared to those who were married when controlling for marital history (length of longest marriage and two or fewer marital transitions). In four additional models, more controls were added in sequential blocks: Modifiable factors (Model 3); ascribed factors (Model 4); achieved and social factors (Model 5, not presented); then health factors with this final model (6) controlling for all study variables except years with diabetes and medication/insulin to treat diabetes. The inclusion of modifiable factors reduced the strength of the relationship between widowed and diabetes, but did not fully reduce it ($OR = 1.280$, $CI = 1.120-1.462$, $p < 0.01$). The addition of ascribed factors, namely age, fully attenuated the significance of the relationship ($OR = 1.184$, $CI = 0.996-1.407$, $p < 0.10$). In all subsequent models, being a man remained a significant risk factor for diabetes as were some of the factors that varied heavily by gender and state of dissolution in preliminary analyses. These patterns were followed up on in below.

In another set of models (not shown in tables), those who were widowed, compared to those who were divorced, had significantly higher odds (31%) of diabetes before controlling for other factors ($OR = 1.309$, $CI = 1.103-1.554$, $p < 0.01$). This relationship was not significant in subsequent models controlling for the above blocks of covariates.
Table 5: Odds ratios for the effects of state of marital dissolution, marital history, modifiable, ascribed, achieved and social, and health-related factors on diabetes prevalence, overall

<table>
<thead>
<tr>
<th></th>
<th>All Participants n = 9,624</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Model 1</td>
</tr>
<tr>
<td>Divorced</td>
<td>1.077</td>
</tr>
<tr>
<td>Widowed</td>
<td>1.410</td>
</tr>
<tr>
<td>52 Marital Transitions</td>
<td>0.853</td>
</tr>
<tr>
<td>Longest Marriage</td>
<td>1.007</td>
</tr>
<tr>
<td>Savings (logged)</td>
<td>0.850</td>
</tr>
<tr>
<td>Health Insurance</td>
<td>1.533</td>
</tr>
<tr>
<td>CES-D</td>
<td>1.091</td>
</tr>
<tr>
<td>Positive Soc Support</td>
<td>0.847</td>
</tr>
<tr>
<td>Negative Soc Support</td>
<td>1.208</td>
</tr>
<tr>
<td>Male</td>
<td>1.016</td>
</tr>
<tr>
<td>Age</td>
<td>1.393</td>
</tr>
<tr>
<td>Non-Hispanic Black</td>
<td>1.785</td>
</tr>
<tr>
<td>Hispanic</td>
<td>1.785</td>
</tr>
<tr>
<td>Education, yrs</td>
<td>0.899</td>
</tr>
<tr>
<td>In Contact w/Child(ren)</td>
<td>1.395</td>
</tr>
<tr>
<td>Health Conditions</td>
<td>0.874</td>
</tr>
<tr>
<td>Obese</td>
<td>1.395</td>
</tr>
<tr>
<td>Inactive</td>
<td>1.395</td>
</tr>
<tr>
<td>Smoker</td>
<td>0.874</td>
</tr>
<tr>
<td>Heavy Drinker</td>
<td>0.874</td>
</tr>
</tbody>
</table>

Notes. Based on weighted, pooled 2010-2012 data from the Health and Retirement Study.
*p < 0.05; ** p < 0.01; *** p < 0.001
Model 5 omitted but available upon request.
4.2.2. Gender and State of Dissolution Differences in Odds of Diabetes

To test for gender differences in odds of diabetes overall and by state of dissolution several sets of analyses were conducted. First, the relationship between gender and the odds of diabetes was assessed. Next, an interaction term was tested to determine whether gender was a modifier in the relationship between state of marital dissolution and odds of diabetes. Then, the relationship between state of dissolution and odds of diabetes was assessed, stratified by gender to examine if there were differences in which factors attenuated any relationship between state of dissolution and diabetes. Finally, the odds of diabetes were compared for each state of dissolution-gender category to examine which groups had the higher and lower odds of diabetes, compared to married women.

A series of models (not presented in tables) were run to assess differences in risk of diabetes between men and women. Men were hypothesized to have higher odds of diabetes. Compared to women, men did have significantly higher odds of diabetes before controlling for other factors \( (OR = 1.237, CI = 1.110-1.379, p < 0.001) \). Men’s odds were also significantly higher in each subsequent model as marital history, modifiable factors, ascribed, achieved and social, and health factors were added until all study variables were included \( (OR = 1.430, CI = 1.275-1.604, p < 0.001) \).

Next, to determine if gender modifies the relationship between state of dissolution and odds of diabetes, diabetes was regressed on gender, state of dissolution, and their interaction term. Contrary to what was hypothesized, state of marital dissolution did not affect odds of diabetes differently for men and women \( (F(2, 55) = 1.45, p = NS) \). While the interaction term was not significant, subsequent analyses are presented below in order to examine whether or not there were gender differences in the variables that attenuated the relationship between state of dissolution and odds of diabetes.

Table 6 presents the odds of diabetes stratified by gender to determine whether there were differences in odds of diabetes and “explanatory” factors by state of dissolution within gender. In women, diabetes was hypothesized to be most common in those who were divorced. As shown in
Model 1, being divorced and being widowed, compared to being married, were associated with significantly higher odds of diabetes in women before accounting for other factors (D: \( OR = 1.262, CI = 1.025-1.553, p < 0.05 \) and W: \( OR = 1.654, CI = 1.392-1.966, p < 0.001 \), respectively). In other words, odds of diabetes were 26% higher in divorced women and 65% higher in widowed women, compared to married women before controlling for other factors. The relationships remained significant after controlling for marital history (Model 2). Modifiable factors such as savings and social support reduced the relationship between divorce and diabetes (\( OR = 1.133, CI = 0.902-1.423, p = NS \)), with both accessible savings and CES-D being significantly associated with diabetes—two factors that were significantly lower and higher, respectively in divorced women compared to married women. Once ascribed factors—again, namely age—were added to the model, odds of diabetes were not significantly higher for those who were widowed compared to those who were married (\( OR = 1.220, CI = 0.977-1.522, p < 0.10 \)). In a separate set of models (not presented in tables), women who were widowed also had significantly higher odds of diabetes when compared to women who were divorced (\( OR = 1.264, CI = 1.012-1.579, p < 0.05 \)). Although modifiable factors did not reduce this relationship, age fully attenuated it.

In men, it was hypothesized that diabetes would be most common in those who were widowed. As shown in Model 1 for men in Table 6, being widowed, but not divorced, compared to being married, was significantly associated with odds of diabetes before controlling for other factors (\( OR = 1.396, CI = 1.033-1.885, p < 0.05 \)). As with women, the higher odds of diabetes in widowed, compared to married men was not attenuated by modifiable factors, but the subsequent inclusion of ascribed factors did attenuate the relationship. In a separate set of models not presented in tables, men who were widowed also had significantly higher odds of diabetes when compared to men who were divorced (\( OR = 1.441, CI = 1.041-1.993, p < 0.05 \)). As with women, modifiable factors did not attenuate the relationship between being widowed, compared to divorced, and odds of diabetes, but age fully attenuated it.
Table 6: Odds ratios for the effects of state of marital dissolution, marital history, modifiable, ascribed, achieved and social, and health-related factors on diabetes prevalence, by gender

<table>
<thead>
<tr>
<th></th>
<th>Model 1</th>
<th>Model 2</th>
<th>Model 3</th>
<th>Model 4</th>
<th>Model 5</th>
<th>Model 6</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>OR (95%CI)</td>
<td>Std Err p</td>
<td>OR (95%CI)</td>
<td>Std Err p</td>
<td>OR (95%CI)</td>
<td>Std Err p</td>
</tr>
<tr>
<td>Divorced</td>
<td>1.263 (1.025 - 1.553)</td>
<td>2.687 **</td>
<td>1.355 (1.067 - 1.719)</td>
<td>3.16 **</td>
<td>1.133 (0.902 - 1.421)</td>
<td>1.449</td>
</tr>
<tr>
<td>Widowed</td>
<td>1.654 (1.392 - 1.966)</td>
<td>6.603 ***</td>
<td>1.655 (1.394 - 1.966)</td>
<td>6.604 ***</td>
<td>1.444 (1.214 - 1.717)</td>
<td>4.864 ***</td>
</tr>
<tr>
<td>S2 Marital Transitions</td>
<td>0.978 (0.812 - 1.178)</td>
<td>0.331</td>
<td>1.004 (0.832 - 1.211)</td>
<td>0.056</td>
<td>1.006 (0.812 - 1.217)</td>
<td>0.095</td>
</tr>
<tr>
<td>Longest Marriage</td>
<td>1.004 (0.997 - 1.001)</td>
<td>1.771</td>
<td>1.001 (1.001 - 1.033)</td>
<td>3.309</td>
<td>0.987 (0.981 - 0.987)</td>
<td>0.006</td>
</tr>
<tr>
<td>Savings (Logged)</td>
<td>0.807 (0.775 - 0.841)</td>
<td>-10.807 ***</td>
<td>0.842 (0.803 - 0.883)</td>
<td>-6.836 ***</td>
<td>0.847 (0.807 - 0.887)</td>
<td>-6.954 ***</td>
</tr>
<tr>
<td>Health Insurance</td>
<td>1.430 (0.974 - 2.069)</td>
<td>2.681</td>
<td>1.459 (0.978 - 2.176)</td>
<td>2.871</td>
<td>1.508 (1.038 - 2.176)</td>
<td>2.930</td>
</tr>
<tr>
<td>CES-D</td>
<td>0.981 (0.771 - 1.011)</td>
<td>-1.817</td>
<td>0.980 (0.752 - 1.010)</td>
<td>-2.136</td>
<td>0.980 (0.752 - 1.015)</td>
<td>-2.138</td>
</tr>
<tr>
<td>Positive Soc Support</td>
<td>1.135 (0.959 - 1.342)</td>
<td>1.869</td>
<td>1.013 (0.902 - 1.124)</td>
<td>2.437</td>
<td>1.013 (0.799 - 1.273)</td>
<td>1.504</td>
</tr>
<tr>
<td>Hispanic</td>
<td>1.469 (1.405 - 2.332)</td>
<td>5.239***</td>
<td>1.849 (1.467 - 2.332)</td>
<td>5.239***</td>
<td>1.794 (1.427 - 2.154)</td>
<td>5.075***</td>
</tr>
<tr>
<td>Non-Hispanic Black</td>
<td>1.480 (1.414 - 2.291)</td>
<td>4.601 ***</td>
<td>1.480 (1.414 - 2.291)</td>
<td>4.601 ***</td>
<td>1.444 (1.316 - 1.602)</td>
<td>2.690 ***</td>
</tr>
<tr>
<td>Years of Education</td>
<td>1.137 (1.067 - 1.211)</td>
<td>1.437</td>
<td>1.137 (1.067 - 1.211)</td>
<td>1.437</td>
<td>1.137 (1.067 - 1.211)</td>
<td>1.437</td>
</tr>
<tr>
<td>In Contact w/ Children</td>
<td>0.007 (0.001 - 0.031)</td>
<td>0.011</td>
<td>0.007 (0.001 - 0.031)</td>
<td>0.011</td>
<td>0.005 (0.001 - 0.025)</td>
<td>0.056</td>
</tr>
<tr>
<td>Health Conditions</td>
<td>2.77 (2.55)</td>
<td>6.44 (4.53) ***</td>
<td>10.64 (9.48) ***</td>
<td>11.03 (12.45) ***</td>
<td>11.62 (12.45) ***</td>
<td>10.21 (12.45) ***</td>
</tr>
<tr>
<td>P*(Pseudo, Max Rescued)</td>
<td>0.003 (0.003)</td>
<td>0.009</td>
<td>0.0332 (0.004)</td>
<td>0.044</td>
<td>0.035 (0.007)</td>
<td>0.056</td>
</tr>
</tbody>
</table>

* p < 0.05; ** p < 0.01; *** p < 0.001

Notes: Based on weighted, pooled 2010-2012 data from the Health and Retirement Study.
Another set of analyses (not presented in tables) compared the odds of diabetes in each of the six state of dissolution-gender categories, with married women serving as the reference group because they had the lowest frequency of diabetes. Compared to married women, divorced women, widowed women, married men, divorced men, and widowed men all had higher odds of diabetes, before controlling for other factors. Odds of diabetes were higher by nearly 100% in widowed men (OR = 1.998, CI = 1.484-2.690, p <0.001), 65% in widowed women’s (OR = 1.654, CI = 1.392-1.965, p <0.001), 43% in married men (OR = 1.431, CI = 1.266-1.616, p <0.001), 39% in divorced men (OR = 1.387, CI = 1.056-1.821, p < 0.05), and 26% in divorced women (OR = 1.262, CI = 1.025-1.553, p < 0.05). After age was added to the model, each group remained at significantly higher odds of diabetes compared to married women. The relationships largely held when controlling for race/ethnicity, although divorced women were no longer being significantly different from married women in their odds of diabetes. Once achieved factors were controlled for, odds of diabetes were not significantly higher in divorced women (OR = 1.084, CI = 0.883-1.330, p = NS) or widowed women (OR = 1.180, CI = 0.985-1.413, p < 0.10), compared to married women. Men (married men [OR = 1.428, CI = 1.262 1.616, p <0.0001], divorced men [OR = 1.440, CI = 1.050-1.975, p < 0.05], and widowed men [OR = 1.488, CI = 1.098-2.016, p < 0.05] remained at significantly higher odds of diabetes, compared to married women even after controlling for all factors.

4.2.3. Factors Associated with Diabetes for Each State of Dissolution-Gender Category

Theoretically relevant risk and protection factors for diabetes for each of six state of marital dissolution-gender category (i.e., married women, divorced women, widowed women, married men, divorced men, and widowed men) were tested in a series of seven binary logistic regression models. In Model 1, marital history variables (≤2 marital transitions and length of longest marriage) were used to estimate diabetes. Modifiable factors were then added in Model 2, ascribed factors were added in
Model 3, achieved and social factors in Model 4, and health factors in Model 5. This was done for each of the six categories. The fully adjusted model (i.e., Model 5) for each group is presented in Table 7.

Married women. In Model 1, length of longest marriage was positively associated with odds of diabetes ($OR = 1.021, CI = 1.012-1.029, p < 0.001$). However, as noted in Chapter Three, there was a moderate positive relationship between age and length of longest marriage ($r = .574, p < 0.001$). In Model 2, length of longest marriage ($OR = 1.022, CI = 1.013-1.031, p < 0.001$) and depressive symptoms ($OR = 1.073, CI = 1.014-1.134, p < 0.05$) were positively associated with odds of diabetes, while accessible savings ($OR = 0.803, CI = 0.757-0.852, p < 0.001$) and positive social support ($OR = 0.785, CI = 0.617-0.999, p < 0.05$) were negatively associated with odds of diabetes. These four factors remained significant when ascribed factors were added in Model 3. Being non-Hispanic black ($OR = 1.990, CI = 1.364-2.904, p < 0.001$) and Hispanic ($OR = 2.306, CI = 1.703-3.123, p < 0.001$) were positively associated with odds of diabetes in this model, with non-Hispanic black married women and Hispanic married women, respectively, having two and almost two and a half times higher odds of diabetes than non-Hispanic white married women. The addition of social and achieved factors in Model 4 attenuated some of these relationships slightly—and eliminated the relationship between CES-D and odds of diabetes—likely through education which was negatively associated with odds of diabetes ($OR = 0.915, CI = 0.878-0.955, p < 0.001$) especially for Hispanic women ($OR = 1.830, CI = 1.340-2.499, p < 0.001$). In the final model (5), health-related factors were added, which eliminated the relationship between length of longest marriage and odds of diabetes and between being non-Hispanic black and odds of diabetes ($OR = 1.468, CI = 0.966-2.232, p < 0.10$). The odds of diabetes in Hispanic married women increased, compared to non-Hispanic white married women ($OR = 2.409, CI = 1.681-3.452, p < 0.001$). The health factors significantly associated with diabetes in this model included count of health conditions ($OR = 1.478, CI = 1.331-1.640, p < 0.001$), being obese ($OR = 2.949, CI = 2.265-3.841, p < 0.001$), and being inactive ($OR = 1.359, CI = 1.017-1.816, p < 0.05$).
Divorced women. In Model 1, neither marital history variable was significantly associated with odds of diabetes for divorced women. In Model 2, accessible savings was associated with lower odds of diabetes \((OR = 0.790, CI = 0.706-0.883, p < 0.001)\), while health insurance was associated with much higher odds \((OR = 2.743, CI = 1.120-6.713, p < 0.05)\). In Model 3, ascribed factors were added. Both older \((OR = 1.025, CI = 1.005-1.046, p < 0.05)\) and non-Hispanic black divorced women \((OR = 1.865, CI = 1.162-2.992, p < 0.05)\) had higher odds of diabetes, and the relationships between savings and insurance and diabetes persisted. Achieved and social factors were added in Model 4, and being in contact with one’s child(ren) was negatively associated with odds of diabetes \((OR = 0.479, CI = 0.266-0.861, p < 0.05)\). All the relationships noted for Model 3 held steady in Model 4. In Model 5, health-related factors were added, bringing the relationship between savings and insurance and diabetes to non-significance. In this model, odds of diabetes were significantly higher in those who were non-Hispanic black \((OR = 1.948, CI = 1.111-3.417, p < 0.05)\), had more health conditions \((OR = 0.392, CI = 0.228-0.676, p < 0.01)\), and were obese \((OR = 1.923, CI = 1.301-2.842, p < 0.01)\). Odds were significantly lower in those who were in contact with their child(ren) \((OR = 0.392, CI = 0.228-0.676, p < 0.01)\) and who were smokers \((OR = 0.516, CI = 0.295-0.902, p < 0.05)\).

Widowed women. In Model 1, length longest marriage in years was negatively associated with odds of diabetes \((OR = 0.984, CI = 0.977-0.992, p < 0.001)\). Modifiable factors were added in Model 2, slightly decreasing the relationship between length of longest marriage and odds of diabetes \((OR = 0.990, CI = 0.981-0.998, p < 0.05)\). Accessible savings were negatively associated with odds of diabetes \((OR = 0.846, CI = 0.784-0.913, p < 0.001)\), and CES-D was positively associated with odds of diabetes \((OR = 1.092, CI = 1.033-1.155, p < 0.01)\). In Model 3, these relationships persisted with the addition of ascribed factors, none of which were significant. In Model 4, achieved and social factors were added, and years of education was negatively associated with diabetes \((OR = 0.926, CI = 0.867-0.988, p < 0.05)\).
Table 7: Odds ratios for the effects of state of marital dissolution, marital history, modifiable, ascribed, achieved and social, and health-related factors on diabetes prevalence, by state of dissolution within gender

<table>
<thead>
<tr>
<th></th>
<th>Married Women</th>
<th>Divorced Women</th>
<th>Widowed Women</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>n = 3,218</td>
<td>n = 874</td>
<td>n = 1,537</td>
</tr>
<tr>
<td>s2 Marital Transitions</td>
<td>1.00</td>
<td>1.00</td>
<td>1.00</td>
</tr>
<tr>
<td>Longest Marriage</td>
<td>0.98</td>
<td>0.98</td>
<td>0.98</td>
</tr>
<tr>
<td>Savings (logged)</td>
<td>0.96</td>
<td>0.96</td>
<td>0.96</td>
</tr>
<tr>
<td>Health Insurance</td>
<td>0.96</td>
<td>0.96</td>
<td>0.96</td>
</tr>
<tr>
<td>CES-D</td>
<td>0.94</td>
<td>0.94</td>
<td>0.94</td>
</tr>
<tr>
<td>Positive Soc Support</td>
<td>0.91</td>
<td>0.91</td>
<td>0.91</td>
</tr>
<tr>
<td>Negative Soc Support</td>
<td>0.90</td>
<td>0.90</td>
<td>0.90</td>
</tr>
<tr>
<td>Age</td>
<td>1.00</td>
<td>1.00</td>
<td>1.00</td>
</tr>
<tr>
<td>Non-Hispanic Black</td>
<td>1.00</td>
<td>1.00</td>
<td>1.00</td>
</tr>
<tr>
<td>Hispanic</td>
<td>0.89</td>
<td>0.89</td>
<td>0.89</td>
</tr>
<tr>
<td>Years of Education</td>
<td>0.95</td>
<td>0.95</td>
<td>0.95</td>
</tr>
<tr>
<td>In Contact w/ Children</td>
<td>0.99</td>
<td>0.99</td>
<td>0.99</td>
</tr>
<tr>
<td>Health Conditions</td>
<td>1.00</td>
<td>1.00</td>
<td>1.00</td>
</tr>
<tr>
<td>Obese</td>
<td>0.96</td>
<td>0.96</td>
<td>0.96</td>
</tr>
<tr>
<td>Inactive</td>
<td>0.95</td>
<td>0.95</td>
<td>0.95</td>
</tr>
<tr>
<td>Smoker</td>
<td>0.96</td>
<td>0.96</td>
<td>0.96</td>
</tr>
<tr>
<td>Heavy Drinker</td>
<td>0.96</td>
<td>0.96</td>
<td>0.96</td>
</tr>
</tbody>
</table>

Notes. Based on weighted, pooled 2010-2012 data from the Health and Retirement Study.

* p < 0.05; ** p < 0.01; *** p < 0.001
Again, the other factors—savings and CES-D—remained significantly associated with diabetes. The addition of health-related factors in Model 5 brought the other factors to non-significance. Count of health conditions ($OR = 1.457, CI = 1.285-1.652, p < 0.001$), obesity ($OR = 2.100, CI = 1.467-3.007, p < 0.001$), and inactivity ($OR = 1.439, CI = 1.045-1.981, p < 0.05$) were associated with higher odds of diabetes. Heavy drinking was associated with lower odds of diabetes ($OR = 0.243, CI = 0.117-0.506, p < 0.01$).

**Married men.** In Model 1, the relationship between marital history factors and diabetes was assessed. Married men with two or fewer marital transitions had significantly lower odds of diabetes ($OR = 0.769, CI = 0.616-0.960, p < 0.05$), compared with married men with more than two marital transitions (i.e., marriages, divorces, widowhoods, and marriages that ended for an unknown reason). Modifiable factors were added in Model 2. Two or fewer marital transitions remained significant ($OR = 0.775, CI = 0.625-0.963, p < 0.05$); savings was negatively associated with odds of diabetes ($OR = 0.893, CI = 0.847-0.941, p < 0.001$), while CES-D ($OR = 1.129, CI = 1.063-1.198, p < 0.001$) and negative social support ($OR = 1.534, CI = 1.213-1.940, p < 0.001$) were positively associated with diabetes. In Model 3, ascribed factors were added, with positive associations between diabetes and age ($OR = 1.023, CI = 1.005-1.041, p < 0.05$), non-Hispanic black ($OR = 1.746, CI = 1.226-2.487, p < 0.01$), and Hispanic ($OR = 2.003, CI = 1.494-2.685, p < 0.001$). Marital history was no longer significant in this model, but savings, CES-D, and negative social support remained significantly associated with diabetes. In Model 4, ascribed and social factors were added but were not significant, and savings were reduced to non-significance. The other relationships remained relatively constant and significant. In the final model, health factors were added, reducing the strength of most of the previous relationships, but not fully attenuating them. In this final model, CES-D ($OR = 1.067, CI = 1.008-1.129, p < 0.05$), negative social support ($OR = 1.428, CI = 1.127-1.811, p < 0.01$), being non-Hispanic black ($OR = 1.684, CI = 1.173-2.416, p < 0.01$), being Hispanic ($OR = 2.437, CI = 1.711-3.473, p < 0.001$), count of health conditions ($OR = 1.331, CI = 1.197-
1.479, \( p < 0.001 \), obesity (\( OR = 2.405, CI = 1.956-2.956, p < 0.001 \)), and inactivity (\( OR = 1.369, CI = 1.122-1.671, p < 0.01 \)) were positively associated with odds of diabetes, while heavy drinking was negatively associated with odds of diabetes (\( OR = 0.675, CI = 0.515-0.884, p < 0.01 \)).

Divorced men. Marital history factors are included in Model 1, with two or fewer marital transitions being associated with lower odds of diabetes (\( OR = 0.486, CI = 0.309-0.764, p < 0.01 \)). In Model 2, modifiable factors are added: Having health insurance was associated with much higher odds of diabetes (\( OR = 4.459, CI = 1.879-10.586, p < 0.01 \)), and marital transitions remained significantly and stably associated with diabetes (\( OR = 0.511, CI = 0.309-0.844, p < 0.01 \)). Ascribed and achieved factors were not significant associated with odds of diabetes when added to Model 3 and Model 4, respectively, but transitions and insurance remained significant. In Model 5, health factors were added; count of health conditions (\( OR = 1.669, CI = 1.287-2.165, p < 0.001 \)) and obesity (\( OR = 3.156, CI = 1.587-6.275, p < 0.01 \)) were positively associated with odds of diabetes. Number of transitions and health insurance again remained significantly associated with odds of diabetes (\( OR = 0.565, CI = 0.320-1.000, p < 0.05 \) and \( OR = 4.088, CI = 1.455-11.481, p < 0.01 \), respectively), but had very large confidence intervals suggesting the sample size was too small for the variability in the sample.

Widowed men. In Model 1, marital history factors were not significantly associated with odds of diabetes. In Model 2, positive social support was the only modifiable factor associated with odds of diabetes (\( OR = 0.532, CI = 0.332-0.851, p < 0.01 \)). Ascribed factors and achieved factors were not associated with odds of diabetes in Model 3 or 4, but positive social support continued to be negatively associated with odds of diabetes. In Model 5, positive social support remained significant when health factors were added (\( OR = 0.517, CI = 0.327-0.816, p < 0.01 \)). The only health-related factor that was significant was being a current smoker, which was negatively associated with odds of diabetes (\( OR = 0.180, CI = 0.065-0.501, p < 0.01 \)).
In summary, in the fully adjusted models, health-related factors tended to be significant across groups; marital history factors were not significant for any group. However, marital history factors were significant in many early models, as marital history is thought to be influential through the effects it has on material and social resources. In married women, odds of diabetes were significantly higher for those who were obese, had more health conditions, were Hispanic, were physically inactive, had fewer years of education, had less in accessible savings, and had less positive social support. In divorced women, count of health conditions, obesity, and being non-Hispanic black were positively associated with diabetes, while having contact with kids and being a smoker were negatively associated with odds of diabetes. In widowed women, odds of diabetes were significantly higher in those with more health conditions, were obese, were physically inactive, and were not heavy drinkers. In married men, odds of diabetes were higher in those who were obese, had more health conditions, were Hispanic, had more negative social support, were not heavy drinkers, were inactive, were non-Hispanic black, and had higher CES-D scores. In divorced men, count of health conditions, obesity, and health insurance were positively associated with diabetes. Being a smoker and positive social support were the only significant correlates of diabetes in widowed men. When significant, smoking and heavy drinking were negatively associated with odds of diabetes. While this runs counter to what one might expect, it is likely due to those with diagnosed diabetes being told to limit or eliminate these habits.

4.2.4. Summary of Aim 1 Findings

In summary, there were differences in diabetes prevalence by state of dissolution and gender. The prevalence of diabetes was higher in those in states of dissolution, particularly widowhood. While diabetes was more common in men, there was no difference in the pattern of odds of diabetes by gender and state of dissolution. In other words, both widowed men and widowed women had higher odds of diabetes than did divorced men or divorced women, respectively; this was counter to the
hypothesis that widowed men and divorced women would have the highest odds of diabetes in their respective state of dissolutions categories within gender.

Both modifiable and ascribed factors contributed to these differences, with savings being a key modifiable factor and age and race/ethnicity being key ascribed factors in attenuating relationships between state of dissolution and diabetes overall and by gender. In women, the only modifiable factors that were significant in the fully adjusted models were savings and negative social support in married women. Depressive symptoms and negative social support were the only modifiable factors significant in the fully adjusted model for married men. In divorced men, health insurance was the only significant modifiable factor; while positive social support was the only significant modifiable factor in widowed men in the fully adjusted model. This ran counter to hypotheses and the general literature on the importance of financial modifiable factors for women and social modifiable factors for men, particularly among those divorced.

4.3. Aim 2 Findings on Associations between State of Marital Dissolution, Gender, and Diabetes Management

Aim 2: To explore differences in HbA1c by state of marital dissolution and gender in middle-aged and older adults with self-reported diabetes

Given the relationships between diabetes and states of marital dissolution and some limited literature on the relationship between marital status and diabetes management in the literature, HbA1c, used as a proxy for diabetes management, was hypothesized to vary by state marital of dissolution and gender. Those who were divorced and those who were men were hypothesized to have the poorest management. The influence of state of marital dissolution and gender on HbA1c was modeled using a series of OLS regression models (as shown in Table 8 and Appendix C) with a sample of 2,235 middle-aged and older adults with diagnosed diabetes.
In Model 1 of Table 8, divorced and widowed, compared to married, were included to determine their influence on HbA1c. Being widowed was significantly associated with HbA1c, with HbA1c being lower in those who were widowed compared to those who were married \((b = -0.187, SE = 0.072, p < 0.05)\). This finding is what one would expect based on the descriptive statistics, but counter to what was hypothesized based on the literature. It remained significantly associated with higher HbA1c when marital history was included in Model 2. However, in subsequent models (3-6) adjusting for ascribed, achieved, social, and health factors, the relationship between widowed and HbA1c failed to reach significance (Model 3: \(b = -0.003, SE = 0.097, p = NS\)). Being divorced compared to married was not significantly associated with HbA1c (Model 1: \(b = 0.055, SE = 0.109, p = NS\)). In a separate set of analyses (not presented in tables), widowed, rather than married, was used as the reference group. Here, being divorced, compared to widowed, was not significantly associated with HbA1c \((b = 0.242, SE = 0.130, p < 0.10)\).

Further investigation of gender differences in HbA1c revealed few statistically significant relationships. As can be seen in Table 8, gender was not significantly associated with HbA1c before or after controlling for other factors \((b = 0.118, SE = 0.070 \ p < 0.10\) and \(b = 0.141 \ SE = 0.074 \ p < 0.10\), respectively).

To determine if gender modified the relationship between state of dissolution and HbA1c, HbA1c was regressed on gender, state of dissolution, and their interaction term. As with odds of diabetes, there was no significant interaction between gender and state of marital dissolution on HbA1c \((F (2, 56) = 0.13, p = NS)\). Subsequent analyses are presented below in order to examine whether there were gender differences in variables attenuating the relationship between state of dissolution and odds of diabetes.
Table 8: Coefficients for the effects of state of dissolution, marital history, ascribed, achieved, social, and health-related factors on diabetes management (HbA1c), overall

<table>
<thead>
<tr>
<th></th>
<th>Model 1</th>
<th>Model 2</th>
<th>Model 3</th>
<th>Model 4</th>
<th>Model 5</th>
<th>Model 6</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>B</td>
<td>SE</td>
<td>B</td>
<td>SE</td>
<td>B</td>
<td>SE</td>
</tr>
<tr>
<td>Divorced</td>
<td>-0.124</td>
<td>0.125</td>
<td>-0.034</td>
<td>0.104</td>
<td>0.019</td>
<td>0.134</td>
</tr>
<tr>
<td>Widowed</td>
<td>-0.225</td>
<td>0.080</td>
<td>-0.069**</td>
<td>0.097</td>
<td>-0.006</td>
<td>0.101</td>
</tr>
<tr>
<td>s2 Marital Transitions</td>
<td>0.167</td>
<td>0.084</td>
<td>0.062**</td>
<td>0.086</td>
<td>0.026**</td>
<td>0.085</td>
</tr>
<tr>
<td>Longest Marriage</td>
<td>-0.009</td>
<td>0.003**</td>
<td>-0.113**</td>
<td>0.004</td>
<td>-0.003**</td>
<td>0.004</td>
</tr>
<tr>
<td>Male</td>
<td>0.126</td>
<td>0.074</td>
<td>0.049**</td>
<td>0.134</td>
<td>0.053**</td>
<td>0.141</td>
</tr>
<tr>
<td>Age</td>
<td>-0.017</td>
<td>0.005</td>
<td>-0.127**</td>
<td>-0.016</td>
<td>0.005</td>
<td>-0.124**</td>
</tr>
<tr>
<td>Non-Hispanic Black</td>
<td>0.269</td>
<td>0.094</td>
<td>0.067**</td>
<td>0.230</td>
<td>0.093</td>
<td>0.057*</td>
</tr>
<tr>
<td>Hispanic</td>
<td>0.368</td>
<td>0.131</td>
<td>0.087**</td>
<td>0.295</td>
<td>0.148</td>
<td>0.070</td>
</tr>
<tr>
<td>Years of Education</td>
<td>-0.002</td>
<td>0.011</td>
<td>-0.006</td>
<td>-0.031</td>
<td>0.027</td>
<td>0.041</td>
</tr>
<tr>
<td>Savings (logged)</td>
<td>-0.056</td>
<td>0.205</td>
<td>-0.010</td>
<td>-0.056</td>
<td>0.205</td>
<td>0.000</td>
</tr>
<tr>
<td>Health Insurance</td>
<td>-0.027</td>
<td>0.070</td>
<td>0.011</td>
<td>-0.027</td>
<td>0.070</td>
<td>0.011</td>
</tr>
<tr>
<td>Positive Soc Support</td>
<td>0.026</td>
<td>0.019</td>
<td>0.044</td>
<td>0.026</td>
<td>0.019</td>
<td>0.044</td>
</tr>
<tr>
<td>Negative Soc Support</td>
<td>-0.177</td>
<td>0.055</td>
<td>0.069**</td>
<td>-0.064</td>
<td>0.029</td>
<td>0.061*</td>
</tr>
<tr>
<td>In Contact w/ Children</td>
<td>0.039</td>
<td>0.069</td>
<td>0.015</td>
<td>0.039</td>
<td>0.069</td>
<td>0.015</td>
</tr>
<tr>
<td>CES-D</td>
<td>0.026</td>
<td>0.003</td>
<td>0.190***</td>
<td>0.026</td>
<td>0.003</td>
<td>0.190***</td>
</tr>
<tr>
<td>Health Conditions</td>
<td>-0.072</td>
<td>0.121</td>
<td>0.016</td>
<td>-0.072</td>
<td>0.121</td>
<td>0.016</td>
</tr>
<tr>
<td>Obese</td>
<td>0.660</td>
<td>0.083</td>
<td>0.205***</td>
<td>0.660</td>
<td>0.083</td>
<td>0.205***</td>
</tr>
<tr>
<td>Inactive</td>
<td>0.004</td>
<td>0.004</td>
<td>0.004</td>
<td>0.004</td>
<td>0.004</td>
<td>0.004</td>
</tr>
<tr>
<td>Smoker</td>
<td>0.012</td>
<td>0.012</td>
<td>0.012</td>
<td>0.012</td>
<td>0.012</td>
<td>0.012</td>
</tr>
<tr>
<td>Heavy Drinker</td>
<td>0.032</td>
<td>0.032</td>
<td>0.032</td>
<td>0.032</td>
<td>0.032</td>
<td>0.032</td>
</tr>
<tr>
<td>Years with Diabetes</td>
<td>0.034</td>
<td>0.033</td>
<td>0.034</td>
<td>0.034</td>
<td>0.033</td>
<td>0.034</td>
</tr>
<tr>
<td>Medication/Insulin</td>
<td>0.136</td>
<td>0.134</td>
<td>0.136</td>
<td>0.136</td>
<td>0.134</td>
<td>0.134</td>
</tr>
</tbody>
</table>

Notes. Based on weighted, pooled 2010|2012 data from the Health and Retirement Study
* p < 0.05; ** p < 0.01; *** p < 0.001
Model 5 omitted but available upon request
As shown in the Appendix C table, there were also no differences in when odds of diabetes for states of marital dissolution were examine by gender before (women: divorced \([b = 0.126, SE = 0.168, p = NS]\), widowed \([b = -0.150, SE = 0.091, p = NS]\); men: divorced \([b = -0.003, SE = 0.190, p = NS]\); widowed \([b = -0.129, SE = 0.151, p = NS]\)), or after adjusting for other variables (women: divorced \([b = 0.089, SE = 0.172, p = NS]\); widowed \([b = -0.091, SE = 0.122, p = NS]\); men: divorced \([b = -0.072, SE = 0.210, p = NS]\); widowed \([b = 0.078, SE = 0.143, p = NS]\)), with those married serving as the reference group. In a separate set of models not presented in tables, those who were widowed served as the reference group. In these analyses, those who were divorced did not have significantly different HbA1c levels, compared to those who were widowed, in women (unadjusted: \(b = 0.276, SE = 0.173, p = NS\); adjusted: \(b = 0.182, SE = 0.149, p = NS\)) or in men (unadjusted: \(b = 0.127, SE = 0.231, p = NS\); adjusted: \(b = -0.071, SE = 0.235, p = NS\)). These findings ran counter to the hypothesis that those divorced women and widowed men would have higher levels of HbA1c.

Next, in a set of models (not presented in tables), each state of dissolution-gender category group was included in the same model, with married women once again serving as the reference group, to compare levels of HbA1c. Before and after controlling for other factors, there were no statistically significant differences in HbA1c levels in divorced women, widowed women, married men, divorced men, or widowed men, compared to married women. The same models were run again but widowed women were used as the reference group because they had the lowest unadjusted mean levels of HbA1c. In these models, only married men had significantly different (higher) levels of HbA1c, compared to widowed women before \((b = 0.255, SE = 0.098, p < 0.01)\), but not after adjusting for all other factors \((b = 0.153, SE = 0.116, p = NS)\).

Table 9 presents the risk and protection factors for diabetes management for each state of dissolution-gender category (i.e., by state of dissolution within gender). This table will be referred back
Table 9: Coefficients for the effects of state of dissolution, marital history, ascribed, achieved, social, and health-related factors on diabetes management (HbA1c), by state dissolution within gender

<table>
<thead>
<tr>
<th></th>
<th>Married Women n = 612</th>
<th>Divorced Women n = 294</th>
<th>Widowed Women n = 410</th>
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</thead>
<tbody>
<tr>
<td></td>
<td>Model 6</td>
<td></td>
<td>Model 6</td>
</tr>
<tr>
<td></td>
<td>B</td>
<td>SE B</td>
<td>B</td>
</tr>
<tr>
<td>≤2 S Marital Transitions</td>
<td>0.142</td>
<td>0.210</td>
<td>0.055</td>
</tr>
<tr>
<td>Longest Marriage</td>
<td>0.009</td>
<td>0.008</td>
<td>0.105</td>
</tr>
<tr>
<td>Age</td>
<td>-0.019</td>
<td>0.008</td>
<td>-0.137</td>
</tr>
<tr>
<td>Non-Hispanic Black</td>
<td>0.259</td>
<td>0.162</td>
<td>0.065</td>
</tr>
<tr>
<td>Hispanic</td>
<td>-0.144</td>
<td>0.250</td>
<td>-0.039</td>
</tr>
<tr>
<td>Years of Education</td>
<td>0.000</td>
<td>0.022</td>
<td>-0.001</td>
</tr>
<tr>
<td>Savings (logged)</td>
<td>-0.065</td>
<td>0.038</td>
<td>-0.088</td>
</tr>
<tr>
<td>Health Insurance</td>
<td>-0.116</td>
<td>0.262</td>
<td>-0.024</td>
</tr>
<tr>
<td>Positive Soc Support</td>
<td>-0.042</td>
<td>0.114</td>
<td>-0.018</td>
</tr>
<tr>
<td>Negative Soc Support</td>
<td>-0.095</td>
<td>0.120</td>
<td>-0.038</td>
</tr>
<tr>
<td>In Contact w/ Children</td>
<td>-0.315</td>
<td>0.299</td>
<td>-0.048</td>
</tr>
<tr>
<td>CES-D</td>
<td>0.058</td>
<td>0.033</td>
<td>0.099</td>
</tr>
<tr>
<td>Health Conditions</td>
<td>-0.129</td>
<td>0.057</td>
<td>-0.121</td>
</tr>
<tr>
<td>Obese</td>
<td>0.186</td>
<td>0.107</td>
<td>0.077</td>
</tr>
<tr>
<td>Inactive</td>
<td>0.002</td>
<td>0.125</td>
<td>0.001</td>
</tr>
<tr>
<td>Smoker</td>
<td>0.498</td>
<td>0.227</td>
<td>0.116</td>
</tr>
<tr>
<td>Heavy Drinker</td>
<td>0.303</td>
<td>0.203</td>
<td>0.074</td>
</tr>
<tr>
<td>Year with Diabetes</td>
<td>0.023</td>
<td>0.005</td>
<td>0.174</td>
</tr>
<tr>
<td>Medication/Insulin</td>
<td>0.669</td>
<td>0.142</td>
<td>0.218</td>
</tr>
<tr>
<td>Constant B, SE</td>
<td>7.629</td>
<td>6.771</td>
<td>5.739</td>
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<table>
<thead>
<tr>
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<th>Married Men n = 829</th>
<th>Divorced Men n = 93</th>
<th>Widowed Men n = 90</th>
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</thead>
<tbody>
<tr>
<td></td>
<td>Model 6</td>
<td></td>
<td>Model 6</td>
</tr>
<tr>
<td></td>
<td>B</td>
<td>SE B</td>
<td>B</td>
</tr>
<tr>
<td>≤2 S Marital Transitions</td>
<td>-0.083</td>
<td>-0.134</td>
<td>0.036</td>
</tr>
<tr>
<td>Longest Marriage</td>
<td>-0.002</td>
<td>-0.008</td>
<td>-0.019</td>
</tr>
<tr>
<td>Age</td>
<td>-0.031</td>
<td>0.008</td>
<td>-0.214</td>
</tr>
<tr>
<td>Non-Hispanic Black</td>
<td>0.026</td>
<td>0.167</td>
<td>0.005</td>
</tr>
<tr>
<td>Hispanic</td>
<td>0.482</td>
<td>0.235</td>
<td>0.112</td>
</tr>
<tr>
<td>Years of Education</td>
<td>0.009</td>
<td>0.020</td>
<td>0.002</td>
</tr>
<tr>
<td>Savings (logged)</td>
<td>0.027</td>
<td>0.038</td>
<td>0.032</td>
</tr>
<tr>
<td>Health Insurance</td>
<td>-0.158</td>
<td>0.403</td>
<td>-0.031</td>
</tr>
<tr>
<td>Positive Soc Support</td>
<td>0.049</td>
<td>0.102</td>
<td>0.019</td>
</tr>
<tr>
<td>Negative Soc Support</td>
<td>0.028</td>
<td>0.100</td>
<td>0.001</td>
</tr>
<tr>
<td>In Contact w/ Children</td>
<td>0.519</td>
<td>0.242</td>
<td>0.072</td>
</tr>
<tr>
<td>CES-D</td>
<td>0.073</td>
<td>0.045</td>
<td>0.104</td>
</tr>
<tr>
<td>Health Conditions</td>
<td>0.025</td>
<td>0.046</td>
<td>-0.024</td>
</tr>
<tr>
<td>Obese</td>
<td>0.009</td>
<td>0.102</td>
<td>0.002</td>
</tr>
<tr>
<td>Inactive</td>
<td>0.148</td>
<td>0.112</td>
<td>0.053</td>
</tr>
<tr>
<td>Smoker</td>
<td>-0.251</td>
<td>0.170</td>
<td>-0.059</td>
</tr>
<tr>
<td>Heavy Drinker</td>
<td>-0.198</td>
<td>0.164</td>
<td>-0.045</td>
</tr>
<tr>
<td>Year with Diabetes</td>
<td>0.030</td>
<td>0.007</td>
<td>0.219</td>
</tr>
<tr>
<td>Medication/Insulin</td>
<td>0.579</td>
<td>0.125</td>
<td>0.167</td>
</tr>
<tr>
<td>Constant B, SE</td>
<td>7.465</td>
<td>0.905</td>
<td>9.364</td>
</tr>
</tbody>
</table>

Notes: Based on weighted, pooled 2010-2012 data from the Health and Retirement Study
* p < 0.05; ** p < 0.01; *** p < 0.001
to in Chapter Five when the fully adjusted relationship between marital history and modifiable factors are discussed for each state of dissolution-gender category.

In summary, there were few differences in HbA1c by state of dissolution and/or gender, unlike with diabetes prevalence in Aim 1. In Aim 2 focused on diabetes management, the only significant differences in HbA1c on state of marital dissolution and/or gender were 1) between those who were widowed and those who were married, before controlling for ascribed characteristics such as age and 2) between widowed women and married men, again, before controlling for other characteristics. An interaction term for state of marital dissolution and gender was not significantly associated with HbA1c, suggesting there are no differences in HbA1c by state of dissolution within gender.

4.4. Summary of Aim 1 and Aim 2 Findings

The sample for Aim 1 parallels the U.S. population over age 50, and it was used to explore the effects of state of marital dissolution and gender on the odds of diabetes. In the overall sample (N = 9,624), those who were widowed had higher odds of diabetes than did those who were married; modifiable factors (i.e., savings, insurance, CES-D, positive social support, and negative social support) fully attenuated the relationship. Being divorced, compared to being married or widowed, was not significantly related to the odds of diabetes in the overall sample or in men; however, women who were divorced had higher odds of diabetes than did married women. The relationship was attenuated by modifiable factors (e.g., savings, CES-D). The higher odds of diabetes in widowed women, compared to married women, were explained by modifiable and ascribed factors (i.e., age, race/ethnicity). In men, there were no significant differences between divorced and married men’s odds of diabetes, but widowed men had higher odds of diabetes until modifiable factors were included in the model.

Factors consistently associated with diabetes in most state of dissolution-gender categories were obesity and health conditions. Marital history factors were also significantly associated with diabetes, but these relationships tended to be attenuated by ascribed and achieved factors. Some
notable differences in factors associated with diabetes by state of dissolution-gender category were higher odds of diabetes for those with insurance, but only in divorced women and divorced men; and lower odds of diabetes for those with more in accessible savings, but only in married women. Interestingly, married women were the only group of women who averaged more in accessible savings than men of the same state of dissolution. Another difference was the lower odds of diabetes with more positive social support in married women and widowed men but not in other groups. Counter to hypotheses, smoking and drinking were negatively associated with diabetes. This is likely due to those with diabetes following management guidelines that discourage these behaviors.

Aim 2 took these findings a step further to explore the effects of state of marital dissolution on diabetes management. HbA1c, average blood glucose level over the last two months, was used as an indicator of management. The sample for Aim 2 (and Aims 3 and 4) consisted of those with diagnosed diabetes (n = 2,235), approximately 20% of the full sample used for Aim 1. A comparison of the sample for Aim 1 and for Aims 2 through 4 revealed that the sample of individuals with diabetes was more disadvantaged than the full sample. In Aim 2, those widowed had lower HbA1c levels than those married or divorced, but only before controlling for ascribed factors. Gender was not significantly associated with HbA1c, nor was state of dissolution within gender. Chapter Five presents findings for Aim 3, which focuses on whether marital history is related to diabetes management and for Aim 4, which explores whether social and financial resources are associated with diabetes management and whether there are differences by state of marital dissolution and gender.

Overall, state of marital dissolution was not significantly associated with diabetes or HbA1c after controlling for modifiable and ascribed factors. Although this is what one might expect given that the modifiable factors were selected because of their link to marital history, the importance of other sociodemographic factors such as age and race/ethnicity attenuated relationships between state of dissolution and diabetes and HbA1c and sometimes between modifiable factors and HbA1c. This
suggests that those characteristics may be more important for understanding diabetes prevalence and management, than state of marital dissolution. In the next chapter, marital history and modifiable factors are explored in greater detail.
5. Chapter Five: Results for Aim 3 and Aim 4

This chapter contains findings for Aim 3 and Aim 4. These findings expand on those of Aim 2 (presented in Chapter Four) to explore whether aspects of marital history are associated with HbA1c differently by state of marital dissolution and gender (Aim 3). In addition, this chapter explores whether five potentially modifiable factors (i.e., savings, insurance, positive and negative social support, and depressive symptoms)—noted in the literature to be linked to marital history and health—are associated with HbA1c and whether there are differences in their relationships with HbA1c by state of marital dissolution and gender.

5.1. Aim 3 Findings for Marital History and HbA1c

The following sections provide the findings for analyses conducted to investigate Aim 3:

To examine whether two aspects of marital history—length of longest marriage and marital transitions—influence HbA1c, indicating support for protection and/or crisis, and whether there are differences by state of marital dissolution and gender in a sample of middle-aged and older adults with self-reported diabetes.

5.1.1. Length of Longest Marriage

Length of longest marriage was hypothesized to be negatively associated with HbA1c, regardless of state of marital dissolution. This hypothesis was based on the marriage protection model, which suggests that being married provides benefits that may outlast the marriage. A series of OLS regression models was used to test this hypothesis.

As seen in Model 1 of Appendix D, length of longest marriage was weakly, negatively associated with HbA1c ($b = -0.006, SE = 0.002, p < 0.05$) in this sample of middle-aged and older adults with diabetes ($n = 2,235$). This relationship remained stable and significant when adding state of marital dissolution in Model 2, but ascribed factors (specifically age) reduced the relationship to non-significance ($b = 0.001, SE = 0.003, p = NS$) in Model 3.
There were differences in the relationship between length of longest marriage and HbA1c by state of dissolution, gender, and gender within state of dissolution. When the relationship between length of longest marriage and HbA1c was examined by state of marital dissolution (results not presented in tables), there was a weak but significant negative association between length of longest marriage and HbA1c \((b = -0.009, SE = 0.003, p < 0.01)\) in those who were married, only before adding ascribed factors to the model. The relationship was not significant in those who were divorced \((b = -0.013, SE = 0.011, p = NS)\) or widowed \((b = 0.001, SE = 0.003, p = NS)\).

Appendix E presents a table on analyses testing the relationship between length of longest marriage and HbA1c when examined by gender. For women, length of longest marriage was not significantly associated with HbA1c. However, for men, there was a 0.010 decrease in HbA1c for each additional year of one’s longest marriage, (Model 1: \(b = -0.010, SE = 0.004, p < 0.05)\). As can be seen in Appendix E, the relationship in men was also attenuated by age in Model 3 \((b = -0.002, SE = 0.006, p = NS)\).

When tested by state of dissolution within gender (results not presented in tables), the relationship between length of longest marriage and HbA1c was significant in married men and in divorced men. In both married and divorced men, there was a negative relationship between longest marriage and HbA1c \((b = -0.012, SE = 0.005, p < 0.01 \text{ and } b = -0.037, SE = 0.012, p < 0.01, \text{ respectively})\). In married men, this relationship was not significant after controlling for ascribed factors; in divorced men \((n = 93)\), it was marginally significant even after controlling for all other factors \((b = -0.027, SE = 0.015, p < 0.10)\) (see Table 9). The relationship was not significant in the other groups.

The hypothesis that length of longest marriage and HbA1c would be negatively associated was partially supported by these findings. In particular, this relationship was supported in men, and, more specifically, in married and divorced men. In contrast, the hypothesis was not supported in women. This finding might provide some support for the marriage protection model in men. Each additional year of
divorced and married men’s longest marriage was associated with a very modest decrease in HbA1c. Although the relationship was not significant in married men after adding ascribed factors, it did remain significant in divorced men, even after adjusting for the types of factors one would expect length of marriage to work though, such as savings.

5.1.2. Marital Transitions

Having fewer marital transitions (i.e., two or fewer = 1; more than two = 0) was hypothesized to be negatively associated with HbA1c. This hypothesis was based on the crisis model: Transitions into or out of any marital status are stressful because they disrupt many aspects of life and can negatively affect health behaviors, status, and outcomes. To test this hypothesis, the relationship between marital transitions and HbA1c was examined in the sample of those with diabetes overall, by state of marital dissolution, by gender, and by state of dissolution within gender.

As shown in Appendix F, HbA1c was not associated with number of transitions in the full sample of those with diabetes in this research ($b = 0.037, SE = 0.065, p = NS$). There were also no differences within any state of marital dissolution category, nor by gender or state of dissolution within gender (not presented in tables).

In light of these unexpected findings, crisis—through marital transitions—was explored in more detail (results not presented in tables). Two new variables were created: The first was number of dissolutions (for any reason) and the second was number of marriages. Both more marriages and more dissolutions were associated with lower HbA1c, but only in women (Dissolutions: $b = -0.087, SE = 0.038, p < 0.05$; Marriages: $b = -0.114, SE = 0.051, p < 0.05$), and specifically in married women (Dissolutions: $b = -0.157, SE = 0.070, p < 0.05$ and Marriages: $b = -0.157, SE = 0.070, p < 0.05$). Dissolutions were then categorized into zero or one dissolutions, two dissolutions, and more than two dissolutions. Compared to married women with zero or one dissolutions, married women with two dissolutions and married women with more than two dissolutions had lower HbA1c ($b = -0.341, SE = 0.156, p = 0.034$ and
The relationships became stronger when controlling for ascribed factors and remained significant in each model as achieved, social, and health factors were added (Full adjusted model: $b = -0.493$, $SE = 0.150$, $p < 0.01$ and $b = -0.814$, $SE = 0.321$, $p < 0.05$, respectively).

These findings run counter to the hypothesis that more transitions would be associated with higher HbA1c. Women who had more than two marriages or dissolutions made up a very small portion of the sample ($n = 119$ and $n = 72$, respectively). Also, preliminary analyses indicated a very high number of marital transitions for some participants and a non-linear relationship between number of transitions and HbA1c, which is why marital transitions was dichotomized. These findings do not align with crisis or protection, and instead suggest selection: High transition women are healthier and, thus, able to select into and out of marriages more freely.

### 5.1.3. Length of Longest Marriage and Marital Transitions

When length of longest marriage (as a proxy for the marriage protection theory) and marital transitions (as a proxy for the crisis theory) were compared to each other to see which adds more value to the models of HbA1c, neither one out performs the other. Instead, each was only significant for specific subgroups. Length of longest marriage tended to be significant for men—particularly married and divorced men; marital of transitions (and marriages and dissolutions, specifically) were only associated with HbA1c in married women. These finding provide some support for protection in men and some support for selection in women.

### 5.1.4. Summary of the Effects of Marital History Factors

In summary, both length of longest marriage and marital transitions add value to models estimating HbA1c, but are more relevant to some groups than to others. For men, particularly married and divorced men, length of longest marriage is negatively associated with HbA1c. For married women,
the relationship between numerous marital transitions of any type and HbA1c aligns better with selection than with crisis.

5.2. Aim 4 Findings on the Relationships between Modifiable Factors and HbA1c by State of Marital Dissolution, Gender, and State of Dissolution within Gender

These next sections provide the findings for analyses conducted to investigate Aim 4:

To identify any of the potentially modifiable marriage-related factors, including accessible savings, health insurance coverage, positive and negative social support, and depressive symptoms, that influence HbA1c in middle-aged and older adults with diabetes overall and by state of marital dissolution, gender, and state of dissolution within gender

5.2.1. Accessible Savings

To examine the relationship between accessible savings and HbA1c, and potential differences by state of dissolution and gender, analyses assessed the relationship overall, by state of dissolution, by gender, and by state of dissolution within gender. Accessible savings was hypothesized to be negatively associated with HbA1c for all groups, but particularly for women and those in states of dissolution because of the literature showing that dissolution negatively affects savings for women and that more financial resources are associated with better health.

Appendix G presents a table of the models for the relationship in the overall sample of those with diabetes. As shown in that table, there was a negative association between accessible savings and HbA1c before controlling for other variables (Model 1: $b = -0.064, SE = 0.022, p < 0.01$), and remained significant after controlling for state of dissolution (Model 2: $b = -0.068, SE = 0.024, p < 0.01$) and marital history (Model 3: $b = -0.060, SE = 0.024, p < 0.05$). However, ascribed factors including age and race/ethnicity fully attenuated the significance of the relationship (Model 4: $b = -0.033, SE = 0.026, p = NS$).
When examined by state of dissolution (not presented in tables), savings was negatively associated with HbA1c in those who were married in Model 1 ($b = -0.063, SE = 0.024, p < 0.01$), but ascribed factors reduced the relationship. The relationship was marginally significant in those who were widowed ($b = -0.076, SE = 0.040, p < 0.10$). It was not significant in those who were divorced.

As shown in the Appendix H table, there was no relationship between savings and HbA1c in men (Model 1: $b = -0.040, SE = 0.035, p = NS$); however, the relationship was significant in women ($b = -0.093, SE = 0.031, p < 0.01$) in Model 1 before controlling for other factors. The inclusion of state of dissolution in Model 2 and marital history in Model 3 did not affect the relationship, but the inclusion of ascribed factors in Model 4 attenuated the relationship completely between savings and HbA1c in women.

When the relationship was examined by state of dissolution within gender (not shown in tables), it became clear that the relationship between savings and HbA1c in those who were married and in women was driven by the married women category for whom the relationship was negative ($b = -0.088, SE = 0.036, p < 0.001$). Again, ascribed factors attenuated the relationship ($b = -0.063, SE = 0.038, p = NS$). Savings was not significantly associated with HbA1c in any other state of dissolution-gender category.

These findings partially support the hypotheses related to savings. Accessible savings was significantly, negatively associated with HbA1c in women. Counter to hypotheses, this relationship was driven by the married women, as opposed to divorced and widowed women; and the relationship was attenuated by ascribed factors, namely age and race/ethnicity.

5.2.2. Health Insurance Coverage

Next, the relationship between health insurance and HbA1c was examined overall, by state of dissolution, by gender, and by state of dissolution within gender because of the literature suggesting that one reason for health differences by marital status are due to lack of insurance in those who are
divorced. Health insurance was hypothesized to be negatively associated with diabetes. The descriptive statistics presented in Chapter Four showed there was little variability in health insurance coverage by state of dissolution or gender in the sample of those with diabetes. When the influence of insurance on HbA1c was tested using OLS regression (results not presented in tables), insurance was not significantly associated with HbA1c overall, by state of dissolution, or by gender. However, in married women, having insurance was significantly associated with lower HbA1c before controlling for ascribed factors ($b = -0.429, SE = 0.205, p < 0.05$). The inclusion of ascribed factors such as age and being non-Hispanic black attenuated the relationship ($b = -0.222, SE = 0.262, p = NS$).

Counter to what was hypothesized, health insurance was not associated with diabetes for most groups. The exceptions were married women and widowed men. The relationship in married women was attenuated by age and race/ethnicity. In widowed men, the positive association between health insurance and HbA1c was ignored due to the insufficient sample size and highly limited variability in health insurance in widowed men (coverage = 99%). Given that most adults over age 65 in the United States receive government-provided health care if they do not already have their own, the relationships were run stratified by age (under age 65, or age 65 and over). This resulted in even smaller subgroups, meaning more limited power. None of the relationships between health insurance and HbA1c were significant when stratified by age category.

5.2.3. Depressive Symptoms

Given that the literature suggests that depressive symptoms are highly associated with marital status and transitions in addition to diabetes management, depressive symptoms were included as a potentially modifiable factor that might be associated with HbA1c and vary by state of dissolution and gender. Depressive symptoms were hypothesized to be positively associated with HbA1c, especially in divorced women and widowed men. This hypothesis was based on literature showing higher rates of
depression in these groups, possibly because they are considered less normative statuses than say widowhood for women or divorce in younger women.

OLS regression analyses assess the relationship between CES-D and HbA1c, and models were run for the overall sample of those with diabetes, by state of dissolution, by gender, and by state of dissolution within gender. As shown in Appendix I, CES-D was positively associated with HbA1c in the overall sample of middle and older aged adults with diabetes (Model 1: \( b = 0.044, SE = 0.019, p < 0.05 \)), but only before adjusting for ascribed factors. When examined by state of dissolution (results not presented in tables), it was only significant in those who were married (\( b = 0.079, SE = 0.030, p < 0.05 \)). It remained significant but slightly weaker after controlling for marital history, ascribed factors, achieved factors, social factors, and health factors (\( b = 0.064, SE = 0.030, p < 0.05 \)). It was not significantly associated with HbA1c in those who were widowed or divorced, suggesting that the relationship in the overall sample was driving by those who were married. When examined by gender (results not presented in tables), CES-D was not significantly associated with HbA1c in men or in women. When the relationship was examined by state of dissolution within gender (results not presented in tables), CES-D was marginally significant in married women before and after controlling for other factors (\( b = 0.056, SE = 0.032, p < 0.10 \) and \( b = 0.058, SE = 0.032, p < 0.10 \), respectively). It was also significant in married men, but only before controlling for ascribed factors (\( b = 0.097, SE = 0.045, p < 0.05 \)).

In summary, CES-D was positively associated with HbA1c as hypothesized. However, it did not provide a unique significant contribution to HbA1c once other factors such as age were included in the models. Also, it was only significant in those who were married, and it was not significant in widowed men or divorced women as hypothesized.

**5.2.4. Positive and Negative Social Support**

Positive social support and negative social support were examined as potentially modifiable social resources that might be associated with HbA1c due to the lack of social support many newly
divorced or widowed adults report and the positive relationship between social support and engagement in diabetes management behaviors. Positive social support was hypothesized to be negatively associated with HbA1c overall and specifically for those who were married. Negative social support was hypothesized to be positively associated with HbA1c overall and for each state of dissolution, particularly those who were divorced. Both were hypothesized to be more significant in men than in women, given literature that suggests that men are more likely to rely on a significant other for social support and therefore miss that support if they do not have it and to experience more social control of health behaviors (Umberson, 1992; Seidel et al., 2012). The relationships between negative and positive social support and HbA1c are not presented in tables.

Positive social support was not associated with HbA1c overall, by state of dissolution, by gender, or by gender within state of dissolution before or after adjusting for other variables. It is possible that this is because the measure of social support was a general measure, rather than a measure of diabetes- or health-related social support. It is also possible that the relationship was insignificant because the alpha was lower than ideal ($\alpha = .59$).

Negative social support was not associated with HbA1c overall ($b = 0.141, SE = 0.077, p < 0.10$). It was also not associated with HbA1c in either gender. However, it was associated with HbA1c in widowed men ($b = 0.700, SE = 0.314, p < 0.05$) and marginally associated with it in married men ($b = 0.240, SE = 0.122, p < 0.05$). The relationship persisted in widowed men with the addition of marital history, ascribed, and achieved factors, but was no longer significant when health factors were included in the model.

Because neither positive nor negative social support performed as well as expected in estimating diabetes prevalence and the Cronbach’s alpha for each was lower than ideal, each was broken down into source of social support. The eight new variables included positive support from one’s spouse, children, other family members, and friends and negative support from one’s spouse, children,
other family, and friends. Their alphas ranged from .75 to .85. For men, negative social support from one’s children was associated with higher HbA1c ($b = 0.187, SE = 0.084, p < 0.05$). For women, positive social support from one’s spouse was marginally associated with lower HbA1c ($b = -0.138, SE = 0.069, p < 0.05$).

When these more detailed sources of social support were examined by state of marital dissolution within gender, positive support from one’s spouse was a marginally associated with lower HbA1c for married women ($b = -0.157, SE = 0.088, p < 0.10$). In widowed women, positive social support from friends was associated with lower HbA1c ($b = -0.237, SE = 0.092, p < 0.05$). Each additional unit of positive support from a friend was associated with a 0.237 unit decrease in HbA1c. In widowed men, negative social support from one’s child and from one’s other family members were positively associated with higher HbA1c ($b = 0.418, SE = 0.186, p < 0.05$ and $b = 0.595, SE = 0.171, p < 0.01$, respectively). In widowed men, both relationships remained significant after adjusting for all other non-social support factors ($b = 0.47, SE = 0.176, p < 0.01$ and $b = 0.382, SE = 0.183, p < 0.05$, respectively).

In summary, the overall measures of negative and positive social support were rarely significantly associated with HbA1c; however, more specific measures based on source of social support were significantly associated with HbA1c in two state of dissolution within gender categories: widowed men and widowed women. Positive social support from friends was associated with lower HbA1c in widowed women; negative social support from children and other family members were associated with higher HbA1c in widowed men.

5.2.5. Economic versus Social Resources

Based on the protection theory of the relationship between marriage and health and the expected differences by gender, the value of economic and social resources was compared by state of marital dissolution within gender. Economic resources were hypothesized to better explain the variance in women’s HbA1c levels, particularly divorced women’s, compared to men’s. In contrast, social
resources were hypothesized to be better in men, particularly divorced and widowed men, compared to women. In order to test these hypotheses, the adjusted $R^2$ values within each state of dissolution-gender category resulting from models including various sequences and combinations of independent variables were compared. The models included just economic variables (savings and insurance); just social variables (positive and negative social support); all variables except economic and social variables; all variables plus economic variables; all variables plus social variables, and, finally, all variables, including both economic and social variables. These results are discussed below, but are not presented in table format.

As hypothesized, economic resources explained more of the variance in HbA1c in women, while social resources explained more of the variance in HbA1c in men, each compared to the variance explained by the other type of resource within a given gender. In married women, economic factors explained more of the variance in HbA1c than did social factors both when social then economic factors were the only independent variables (i.e., their unique contribution) and when they were the last variables added to the model (i.e., what they contributed above and beyond other factors). In divorced women, the same pattern was seen. Less difference in the value of economic versus social factors was seen for widowed women. Similarly, for married, divorced, and widowed men there were no noteworthy differences in how well social and economic factors explained HbA1c, but both did add explanatory value. For all groups, health factors contributed most to the amount of explained variance within a given group, with both economic and social factors contributing only modestly to the explained variance in HbA1c. The amount of explained variance in HbA1c was not compared by group because the differences in the sample sizes, rather than in the relevance of covariates, is likely to be the cause for differences in the amount of variance explained for each group.
5.2.6. Summary of the Effects of Modifiable Factors

Marriage-related and potentially modifiable factors—including accessible savings, health insurance coverage, positive and negative social support, and depressive symptoms—were generally associated with HbA1c levels. There were differences by state of marital dissolution, gender, and state of marital dissolution within gender. However, most of these relationships were marginally significant and/or not very strong. For most variables, the relationships became more consistent and significant when looked at by gender within state of dissolution, despite the reduced power available in these models. Also, the value of these modifiable and even ascribed factors is limited in comparison to health-related measures across state of dissolution-gender categories as can be seen in Table 9.

5.3. Summary of Aim 3 and Aim 4 Findings

The purpose of Aim 3 and Aim 4 was to better understand whether marriage related factors were associated with HbA1c and whether there were differences by state of marital dissolution, gender, and state of marital dissolution within gender due to protection and/or crisis related factors. Aim 3 focused on marital history-related factors: length of longest marriage and number of marital transitions. In women, marital transitions tended to be negatively associated with HbA1c even after controlling for all other factors. This finding provides more support for selection than for either protection or crisis. In men who were married and men who were divorced, length of longest marriage tended to be negatively associated with HbA1c but age fully attenuated the relationship. Focusing only on those who were married, the relationship might be attributed to selection, given that age and length of longest marriage are moderately associated. However, the relationship in divorced men provides some support for protection.

Aim 4 focused on how factors that tend to vary with marital status and changes in marital status influenced HbA1c and whether there were differences in the relationship between these factors and HbA1c by state of dissolution, gender, and state of dissolution within gender in a sample of middle-aged
and older adults with diabetes. Most of these factors contributed little to estimating the variance in HbA1c, but, again, these variables were more helpful when used to estimate HbA1c within specific gender and marital states. However, contrary to expectations, there were no three-way interactions between these variables, gender, and state of dissolution in estimating HbA1c. Also, while economic factors tended to explain more of the variance in HbA1c in women and social factors tended to explain more of the variance in men, it is likely other factors such as age and race/ethnicity might be behind the differences by state of dissolution. The findings from this chapter (Aim 3 and Aim 4) and Chapter Four (Aim 1 and Aim 2) are summarized and discussed in relation to the wider body of literature in Chapter Six. Strengths and limitations of this research, in addition to future research directions, are also discussed in Chapter Six.
6. Chapter Six: Discussion

This chapter provides a summary of the aims, research questions, and hypotheses of this dissertation, in addition to a discussion of the findings in the context of the lifespan and life course perspectives and in relation to the existing literature on diabetes management and on selection, protection, and crisis. Implications and the limitations and strengths of this research are also discussed, as are future research directions.

6.1. Summary of Findings and Links to Existing Literature

There is a wealth of literature on the relationships between marital history, health behaviors, and health outcomes, which has led to three theories proposed to explain those relationships. The first theory is the marital protection model: Marriage benefits health through increased financial and social resources, stability, and perceptions of roles and responsibilities within the marriage, with potentially lasting benefits of those protections into states of dissolution. The second theory is the crisis model: Marriage does not so much provide benefits to health as transitions out of marriage deteriorate health through the stress of disruption. The third theory is selection: Marriage and dissolution do not affect health; instead, healthier people are selected into marriage and less healthy people are selected out of marriage. There is little published research on the relationships between marital status, particularly states of marital dissolution, and diabetes and its management, particularly in the context of protection, crisis, and selection. The purpose of this dissertation was to identify and understand these potential relationships through four aims: 1) to identify any differences in diabetes prevalence by state of dissolution and gender and to explore the risk factors for diabetes for each state of dissolution-gender category; 2) to examine potential differences in diabetes management, as measured by HbA1c, by state of dissolution and gender; 3) to determine whether aspects of marital history influence diabetes management; and 4) to identify significant potentially modifiable factors associated with diabetes.
management for each state of dissolution-gender category and whether there are differences in those patterns by state of dissolution and gender.

6.1.1. **Aim 1: To explore differences in diabetes prevalence and its correlates by state of marital dissolution and gender in middle-aged and older adults**

This aim was broken down further into three research questions: 1) Does prevalence of diabetes differ by state of dissolution? 2) Does prevalence of diabetes differ by gender and state of dissolution? 3) What risk factors are associated with each state of dissolution-gender category? In response to those questions, diabetes prevalence was hypothesized to be lowest in those who were married and highest in those who were widowed. Men were hypothesized to have a higher prevalence of diabetes than women, with divorced men having lower odds of diabetes than widowed or married men; in contrast, divorced women were hypothesized to have higher odds of diabetes than married or widowed women.

Study analyses revealed that diabetes prevalence overall was highest in those who were widowed, providing partial support for the first hypothesis; it was not significantly different between those who were married and those who were divorced. The differences between those who were widowed compared to married were attenuated by a combination of modifiable, marriage-related factors, such as savings and social support, and by ascribed factors such as age. The difference between those who were divorced and those who were widowed was attenuated by any one additional factor whether modifiable or ascribed. These findings are in line with those of Pienta and colleagues (2000).

Men had higher odds of diabetes than women both before and after controlling for other factors, as hypothesized. This finding is consistent with the existing body of literature on gender differences in risk of diabetes (Gale & Gillespie, 2001; Wray et al., 2006). Among men, there were no significant differences in odds of diabetes by state of dissolution, controlling for age and/or modifiable factors. In contrast, both divorced and widowed women had higher odds of diabetes than married women. The difference was completely explained by age for widowed women and by either
race/ethnicity or savings for divorced women. While these subgroup analyses revealed some differences in the odds of diabetes by state of dissolution within gender, the interaction term for state of dissolution and gender was not significant. These patterns are also similar to those found by Pienta and colleagues (2000), despite the much younger average age of their sample. They found that diabetes prevalence in divorced and widowed women was more similar, while prevalence in married and divorced men was more similar.

When state of dissolution-gender categories were compared (married women serving as the reference group), each group had significantly higher odds of diabetes after controlling for age. Married men, divorced men, and widowed men continued to have higher odds than married women, even after controlling for all modifiable, ascribed, achieved, social, and health factors. Given that men have been shown to benefit more from marriage according to the literature, but that they had higher odds of diabetes, there is a need for longitudinal research that can assess within person change in health due to marital transitions in men versus women. These cross-sectional analyses were limited to differences in health between men and women in a given marital status and to associations between diabetes prevalence and potential risk factors.

Correlates of diabetes—viewed as potential risk or protection factors for this research—varied by state of marital dissolution-gender category. Two of the more consistent correlates across groups were obesity and health conditions. The only categories for whom obesity and count of health conditions was not associated with higher odds of diabetes was widowed men. Somewhat counterintuitively, heavy drinking in widowed women and married men and being a current smoker in divorced women and widowed men were associated with lower odds of diabetes. Given that people diagnosed with diabetes are advised not to drink heavily or smoke (ADA, 2016b), this finding is likely due to the cross-sectional design of this study and the tendency for people to heed their doctor’s advice to stop smoking and drinking if they are diagnosed with serious, chronic conditions such as diabetes.
Ascribed factors were also significantly associated with odds of diabetes, but differences due to age tended to be explained or masked by health factors.

Achieved factors—both savings and years of education—were negatively associated with diabetes in most groups before including health-related factors to the models. Only in married women were these two achieved variables significantly associated with diabetes in the fully adjusted model. The finding that savings tended to be significantly associated with diabetes in women but not as much so in men adds to the existing literature on the gendered nature of the relationship between financial resources and health (Goldman et al., 1995; Joung et al., 1998). It also adds to the diabetes literature on the link between socioeconomic status and diabetes, specifically for women (Insaf, Strogatz, Yucel, Chasan-Taber, & Shaw, 2013).

Positive social support tended to be similar in those who were widowed and married and negative social support tended to be similar in those who were married and divorced. Positive social support was negatively associated with diabetes for married women and widowed men, while negative social support was associated with higher odds of diabetes in married men. Although these findings did not show patterns consistent with the marriage-health literature, they do support the literature on social support stating that positive social support generally benefits health.

In the fully adjusted models for women, there were few notable differences in the risk factors for diabetes between divorced women and widowed women. In the fully adjusted models for men, there was little overlap in significant risk factors between those who were married, widowed, and divorced.

In summary, while divorced women were “disadvantaged” on most measures of well-being compared to married women, that disadvantage did not translate to higher odds of diabetes. Instead, the difference was fully attenuated by race/ethnicity (i.e., the higher prevalence of divorce and diabetes in non-Hispanic blacks); savings was also able to attenuate the relationship. Compared to divorced
women, widowed women had more savings and positive social support, as well as less depression and negative social support. The patterns were less consistent in men. On some measures, divorced men were more disadvantaged while widowed men were on others, but there were no significant differences in odds of diabetes after adjusting for other factors. It is worth noting that the process of adding ascribed sociodemographic characteristics to the models tended to attenuate the relationship between state of marital dissolution and diabetes, and it also sometimes attenuated the relationship between modifiable factors and diabetes, when holding state of dissolution constant. This suggests that differences in the age and racial/ethnic composition of state of dissolution categories might be driving the relationship between state of dissolution and diabetes. In other words, more general social position may be behind the differences seen in odds of diabetes before adjusting for diabetes, rather than state of marital dissolution specifically.

6.1.2. **Aim 2: To explore differences in HbA1c by state of marital dissolution and gender in middle-aged and older adults with self-reported diabetes**

Two research questions were answered to address this aim: 1) Do HbA1c levels differ by state of dissolution? 2) Are there differences by gender? In response to those questions, married adults were hypothesized to have the lowest levels of HbA1c and those who were divorced were hypothesized to have the highest levels. Men’s HbA1c levels were also expected to be higher than women’s. These hypotheses were based on literature suggesting divorce may be more harmful for women and for older men both in terms of social and material resources and mental and physical health (Waite, 2009; Wood et al., 2006).

HbA1c was significantly lower in those who were widowed compared with those who were married, but only before controlling for any marital history, ascribed, achieved, social, and health factors. Those who were divorced did not have significantly different HbA1c levels than those who were married or widowed. These results are in line with those found by Das: Those who are widowed have
higher HbA1c levels compared to those who are married, but that those who are divorced do not have significantly different HbA1c levels compared to those who are married (2013). HbA1c levels were not significantly different in men compared to women, or by state of dissolution within gender, as confirmed by a test for interaction between state of dissolution and gender in estimating HbA1c. The finding that there were no differences in HbA1c by gender in a sample of people with diagnosed diabetes is in line with those in Chiu and Wray (2010). The finding that there were no differences by state of dissolution within gender was in contrast to Das’ finding that HbA1c was higher in widowed women compared to married women (2013). This difference is likely do to the difference in sample—his sample was not limited to those diagnosed with diabetes.

The findings for this aim were both surprising and expected. They were surprising in that other studies have found differences in levels of HbA1c by state of dissolution, although these findings were in the general population, rather than a sample of people with diagnosed diabetes (Rote, 2016; Das, 2013). They are not surprising in that they support the findings of Chiu and Wray (2006) and Ruggiero and colleagues (1997). Chiu and Wray (2006) looked at differences between those who were married and unmarried and found no significant differences in those with diagnosed diabetes. Ruggiero and colleagues (1997) looked at diabetes management in more specific statuses (married, separated/divorced/widowed, single, partnered) and found no significant differences in a sample of adults over age of 18 with any type of diabetes. Also, there were no articles on HbA1c by state of dissolution, and there tends to be a bias toward publishing papers with significant findings (Peplow, 2014; Dwan, Gamble, Williamson, & Kirkham, 2013). The lack of literature on this topic suggested there may not be significant differences. However, the research was conducted based on 1) the literature suggesting there are differences in HbA1c by state of dissolution and possibly gender in the wider population with and without diabetes, 2) the literature suggesting marital history is associated with the health behaviors and management of other chronic conditions (August & Sorkin, 2010), and 3) research
by Bennett (2006) suggesting that transitions to divorce and to widowhood are not the same and that each measure of health responds to them differently.

One explanation for the null findings, aside from the null hypothesis, is that time in current state of dissolution was not taken into account. Those who entered their current status more recently might have higher levels of HbA1c due to the stress of a transition, compared to those who have been in their status longer and have had more time to adjust. Also, as noted by Hughes and Waite (2009), differences in slow to develop conditions like diabetes are more likely to be seen in measures of marital statuses while differences in depression and other similar measures may be more apparent in measures of marital transitions. Another explanation is that quality of marriage was not taken into account. Poor quality marriage is negatively associated with health (Trief, Ploutz-Snyder, Britton, & Weinstock, 2004; Donoho, Crimmins, & Seeman, 2013); as a result, those who are married may look more like those who are divorced. Alternatively, the importance of age and race/ethnicity in addition to modifiable factors in explaining the difference in HbA1c between those who were widowed and those who were married again suggests that selection into and out of marriage based on social position might be the underlying reason for the tenuous relationship between state of dissolution and HbA1c.

6.1.3. **Aim 3: To examine whether two aspects of marital history—length of longest marriage and marital transitions—influence HbA1c, indicating support for protection and/or crisis, and whether there are differences by state of marital dissolution and gender in a sample of middle-aged and older adults with self-reported diabetes**

To examine the relationship between marital history and diabetes management, two aspects of marital history—length of longest marriage and two or fewer marital transitions—were selected based on their links to protection and crisis theories. Literature suggested that the benefits of continuity of marriage accumulate and protect health, even in states of dissolution. However, each transition is thought to carry stressors that can damage health. Length of longest marriage and two or fewer
compared to more than two marital transitions of any type were hypothesized to be negatively associated with HbA1c.

The hypothesis that length of longest marriage would be negatively associated with HbA1c was partially supported. There was a weak negative association between length of longest marriage and HbA1c overall and in men, but only before ascribed factors were controlled for. Age attenuated the relationship in both groups. Looking at state of dissolution within gender, length of longest marriage was significant for both married and divorced men. Age again explained the relationship in married men; however, the relationship remained significant in divorced men even after controlling for all ascribed, achieved, social, and health factors, including age. This finding was in line with the hypotheses. Age and length of longest marriage were correlated with each other and once age was added to the model for the other groups, length of longest marriage did not have an effect on HbA1c, beyond that of age. However, the correlation between age and length of marriage was lower in divorced men and divorced women, which is likely why length of marriage was significant in divorced men.

The hypothesis that two or fewer marital transitions would be positively associated with HbA1c was not supported. There was no significant association between number of transitions and HbA1c overall, by state of dissolution, by gender, or by state of dissolution within gender. This finding was rather surprising, as it runs counter to most literature on transitions and health (Dupre & Meadows, 2007). As a result, the relationship between type of marital transition (i.e., more than two marriages, compared to two or fewer; and more than two dissolutions of any type, compared to two or less) and HbA1c was examined. Married women with more than two dissolutions or more than two marriages had lower odds of diabetes, compared with those with one or two. This study is cross-sectional and was not able to test for selection, but one might speculate that this finding is a result of the selection of younger, healthier women into and out of marriage. Support for this possibility comes from a study that found that those with chronic conditions are more likely to remain married. Also, the excess number of older
women relative to older men generally results in selection of the more “eligible” (i.e., healthier) women into heterosexual marriages.

Although length of longest marriage and marital transitions were not strongly associated with HbA1c overall, length of longest marriage was negatively associated with it in men, and particularly in divorced men. Number of marital dissolutions was negatively associated with HbA1c in women, with married women driving that relationship. This provides some tenuous support for the existing literature showing that men are more responsive to changes in duration, while women’s health is more responsive to number of changes in status (Williams & Umberson, 2004; Dupre & Meadows, 2007). The findings for marital transitions, dissolutions, and marriages provide support for selection, rather than crisis, in the relationship between marital history and HbA1c in middle-aged and older adults with diabetes. The findings on length of longest marriage might provide some preliminary support for protection in the relationship between marital history and diabetes management in middle-aged and older adults with diabetes. Another theory might be at play if protection is supported, rather than crisis. The divorce-stress-adjustment/chronic stress model developed by Amato (2000) suggests that divorce might have long-term effects, unlike the short-term effects predicted by the crisis model (Arcaleni, 2012). Research with longitudinal data is needed to make more definitive conclusions on the roles of selection, protection, and crisis in this particular population.

6.1.4. **Aim 4: To identify any of the potentially modifiable marriage-related factors (i.e., accessible savings, health insurance coverage, positive and negative social support, and depressive symptoms) that influence HbA1c in middle-aged and older adults with diabetes overall and by state of marital dissolution, gender, and state of dissolution within gender**

To address this aim, each of the potentially modifiable marriage-related factors was analyzed separately; then the financial (savings and insurance) versus social (positive and negative social support) resource factors were compared within each state of dissolution-gender category. Savings and positive
social support were hypothesized to be negatively associated with diabetes management across groups, while insurance, negative social support, and CES-D were hypothesized to be positively associated with HbA1c across groups. Social factors were expected to have more influence on estimates of men’s levels of HbA1c, while economic factors were expected to have more influence on women’s.

Accessible savings was negatively associated with HbA1c overall and in women, but it was the relationship in married women that was driving the relationships overall and in women. The addition of ascribed factors (i.e., age, being non-Hispanic Black, and Hispanic) attenuated the relationship between savings and HbA1c in married women. This finding again suggests that overall social position might be driving any state of dissolution differences in HbA1c.

Health insurance was significantly associated with HbA1c in married women and widowed men. The relationship in married women was negative suggesting slightly lower HbA1c in those with insurance, but the relationship was attenuated by the addition of any variable. While the relationship was statistically significant in widowed men before and after controlling for all ascribed, achieved, social, and health factors, these findings should be interpreted with caution. Nearly all participants in the sample with diabetes had health insurance, and the percentage of widowed men with health insurance was particularly high. The distribution of insurance coverage in the sample was in line with those found by Harris (1995). Although there were no singularity warnings, there was not enough variability or power to treat the findings for the relationship between insurance coverage and HbA1c in widowed men as valid.

The number of CES-D depressive symptoms was significantly lower in men and women who were married compared to those who were widowed or divorced. More depressive symptoms were associated with higher (worse) HbA1c, before but not after ascribed and achieved factors were included in the overall sample. Interestingly, it was only among those who were married that more depressive symptoms were associated with higher HbA1c before and after controlling for other factors. In married
men, depressive symptoms and HbA1c were positively associated when controlling for marital history, but not when ascribed factors were added to the model. These findings are in line with literature showing higher levels of depression in those who are divorced and widowed (Wood et al., 2007) and that depression is positively associated with HbA1c (Chiu et al, 2010).

Positive social support was not significantly associated with HbA1c in any group. Negative social support was not significantly related to HbA1c either, except for in widowed men. Because the findings were so unexpected, positive and negative social support were each looked at in more detail based on source of social support. In widowed men negative social support from both children and other family members was positively associated with HbA1c, even after adjusting for all other factors. Widowed women benefited from social support from friends, which is what one would expect based on the existing literature that women tend to rely on sources of support other than their spouses. Counter to other findings in this research pointing toward the importance of social position over state of dissolution, the relationship between source of social support and HbA1c does seem to be specific to state of dissolution-gender category. Overall, negative social support seemed to be a slightly better estimator of HbA1c than positive social support but both were source dependent. The weak relationship between social support and HbA1c runs counter to what one would expect based on the literature. This finding may be due to the global measure of social support used in this research, as opposed to one of the diabetes management specific measures.

The relative value of economic versus social resources in explaining the variance in HbA1c was also compared within each state of marital dissolution-gender category. Social resources explained more of the variance in HbA1c in men, while economic resources explained more of the variance in HbA1c in women. There were no clear patterns by state of dissolution within gender. Again these findings align with the literature on the gendered nature of health and the types of resources each gender has access to, particularly those who are in middle and older age.
Overall, the correlates of HbA1c in each state of dissolution-gender category varied widely. Modifiable factors helped to explain the variance in HbA1c, as did marital history, ascribed, achieved, and social factors. However, health factors, followed by ascribed factors, explained by far the most variance in HbA1c and variables within these two sets of factors were the most consistently and significantly associated with HbA1c in the fully adjusted models. The factors that were significantly associated with diabetes—holding the other factors constant—in the fully adjusted model for each group are discussed below.

In married women, diabetes medications, years with diabetes, being a smoker, health conditions, and age were associated with HbA1c in the fully adjusted models. Each factor, with the exception of health conditions and age, was positively associated with HbA1c. In married men, medications, years with diabetes, contact with kids, and being Hispanic were associated with higher HbA1c, while age was associated with lower HbA1c. The relationships age and contact with children had with HbA1c were counterintuitive and warrant further investigation.

In divorced women, medications, years with diabetes, and obesity were associated with higher HbA1c. Each of these associations is what one would expect, based on the existing literature. In divorced men, medications were associated with higher HbA1c and heavy drinking, length of longest marriage, and age were associated with lower HbA1c. These findings were also counterintuitive. While the relationship between HbA1c and heavy drinking can be explained by literature noting that alcohol consumption can cause hypoglycemia (i.e., low blood glucose levels) (Emanuele, Swade, & Emanuele, 1998), the positive association between savings and HbA1c is puzzling. It is possible there is confounding, but more investigation of this potentially spurious relationship is needed.

In widowed women, the only variables significantly associated with HbA1c were years with medications for diabetes and years with diabetes. Both were positively associated with HbA1c and what one would expect based on the literature. In widowed men, years with diabetes, heavy drinking,
negative social support, and contact with kids were associated with HbA1c. All variables except heavy drinking were positively associated with HbA1c. As noted, the relationship between drinking and HbA1c might be due to the effect of alcohol on glycemic levels. The association with contact with children might be due to adult children being in more frequent contact with a sick parent than a healthy one (Mancini & Blieszner, 1989). However, the more detailed analyses of social support found that children are also a significant source of negative social support for widowed men, which might explain why being in contact with them is positively associated with HbA1c.

In summary, state of dissolution was not significantly associated with diabetes or HbA1c when marital history, ascribed, achieved, social, and health factors were accounted for. This is what one would expect based on the literature suggesting that the relationship between state of dissolution and diabetes and its management would work through these other factors, particularly achieved and social factors. However, ascribed factors such as age and race/ethnicity tended to fully attenuate differences in both the relationships between states of dissolution and diabetes and marriage-related modifiable factors and diabetes. These findings support the selection theory and suggest that it isn’t state of dissolution that matters for diabetes prevalence and management, but rather other aspects of social position such as age and race/ethnicity. This research also adds to the literature on the importance of financial and social resources in the health outcomes, in a sample of people living with diabetes, even if there were minimal differences by state of dissolution and gender. The implications of these findings for research, theory, policy, and practice are discussed in the next sections.

6.2. Integration of Findings across Aims and Insights from Lifespan Developmental and Life Course Perspectives

Taken together, the findings from this dissertation suggest that there are notable differences in diabetes and risk factors for it by state of dissolution and gender in middle-aged and older adults, but only before taking other social position related factors into account. There were even more limited
differences in diabetes management by state of dissolution and gender in middle-aged and older adults with self-reported, doctor-diagnosed diabetes. These patterns have links to the life course and lifespan perspectives. These perspectives state that early life experiences influence opportunities and roles and, in turn, implications for later life health (Alwin & Wray, 2005). Largely unmodifiable ascribed factors, which shape health and opportunity from birth, were strongly associated with diabetes prevalence. In contrast, potentially modifiable achieved factors had less influence on risk of diabetes, and relationships between achieved factors and diabetes were often attenuated by health-related factors. This is likely because health behaviors are more proximal to diabetes and diabetes management, even though achieved factors influence one’s ability to engage in healthful behaviors (Alwin & Wray, 2005). In addition, because this research is cross-sectional and focused on older adults, time in current status or when and why health behaviors developed in relationship to state of dissolution and HbA1c levels cannot be accounted for. The potential effects of state of dissolution and related risks on diabetes and its management may have already influenced other measures of health, resulting in the strong, proximal links between health, diabetes, and management.

Life course events such as becoming divorced or widowed affect individuals’ roles, but these changes also affect their resources (Williams & Umberson, 2004). This research found that divorced women were disadvantaged compared to married women on most measures of well-being, ranging from financial resources to social support to health behaviors. There were fewer differences between those who were widowed and those who were married. One would expect this to translate into differences in odds of diabetes, but diabetes is a “slow to develop” chronic condition that seems to be more resistant to life course events that affect roles and resources than other measures of health, such as heart disease, self-reported health, weight, and mental health (Pienta et al., 2000; Wood et al, 2007). In addition, state of dissolution may be less relevant than other measures of social position and ascribed
factors because age, gender, and race/ethnicity are all associated with financial resources and are much more visible and, therefore, potentially more proximal to everyday interactions that affect health.

There were fewer differences in HbA1c by gender or state of dissolution. Differences were explained by ascribed and health-related factors, rather than achieved or modifiable factors. There were also some differences in the risk factors for high HbA1c by state of dissolution and gender, but, again, these tended to be explained by ascribed factors suggesting other measures of social position are more important in understanding diabetes management than state of marital dissolution. This suggests that the needs of individuals vary based on their life circumstances, including age, race/ethnicity, current health status, access to financial resources, gender, and, to a more limited extent, possibly state of dissolution.

6.3. Implications

This research has implications for research more broadly and for research aimed at informing policy, programming, and practice. Most literature on the relationship between marriage and health suggests that those who are married are healthier than those who are not married. However, there is a dearth of literature on whether there are differences in diabetes and its management by state of marital dissolution and gender. Much of the existing research on diabetes and its management examines those married compared to those who are unmarried, leaving potential differences by state of dissolution (i.e., widowed, divorced) unexplored. This is the first study to explore diabetes prevalence, HbA1c levels, and the risk and protection factors for each in states of widowhood and divorce separately. In this cross-sectional research, limited between and within group differences in odds of diabetes and Hba1c levels were found, and those that were found were explained by modifiable and, more consistently, ascribed factors.

Interestingly, those who were widowed had the highest prevalence of diabetes in the overall sample, but they also had the lowest levels of HbA1c in the sample of those with diabetes. Those who
were widowed also tended to be significantly older than those who were married or divorced. These
differences in HbA1c between those who were widowed and those who were married were explained
by age (and modifiable factors), which was negatively associated with HbA1c. This finding is in line with
those of Chiu and Wray (2010): Age is negatively associated with HbA1c levels in a contemporary,
nationally representative sample of middle-aged and older adults. More research on HbA1c by birth
cohort is needed to see whether older adults who may have had diabetes for longer have more practice
and therefore success at managing their diabetes, whether attrition due to mortality in older ages
results in the negative association or whether the changing historical context and growing prevalence of
obesity and development of type 2 diabetes in younger age groups is influencing this relationship
between age and HbA1c. Longitudinal research is also needed to explore if/how risk of diabetes and
HbA1c levels change with marital transitions, as opposed to current marital status/state of dissolution.

More attention should be given to the various types of social factors that may influence diabetes
management. In this research, general measures of negative and positive social support were poor
estimators of diabetes and HbA1c. However, source of support provided more insight. Research on
diabetes management-specific sources of support by state of dissolution could be helpful in better
understanding why each source of support was related to HbA1c.

This research highlights the importance of specifying why marital status is being included as a
control variable (e.g., difference in health, difference in social resources, and differences in financial
resources) in diabetes research and understating the characteristics of each marital status before
grouping them together. For example, those who are widowed and divorced are often grouped
together. However, in those with diabetes, widowed men’s savings were not significantly different than
those of married men, but divorced men’s were much lower, even adjusting for age. In women with
diabetes, both widowed and divorced women had less in saving than those who were married, adjusting
for age. On the other hand, levels of social support were more similar in women who were married and
widowed than in women who were divorced. Knowing that these differences by state of dissolution-gender exist and vary by construct of interest is critical when deciding whether to include marital statuses and, if so, how to construct the variable for a given purpose.

Finally, given that this study was cross-sectional and exploratory, it does not have direct implications for policy, programming, or practice; however, it does have implications for research aimed at informing these endeavors. First, diabetes prevention is critical and warrants more research to inform interventions. Number of years with diabetes was strongly and stably associated with HbA1c levels across dissolution and gender categories. HbA1c generally increases over time, so the longer health can be maintained, the better health outcomes will be. Second, it is important for researchers—and likely for policy- and program-makers—to take individuals’ life circumstances into account, rather than relying on one-size-fits-all approaches. The risk factors for diabetes and its management varied widely across groups, particularly on aspects of social position such as age, gender, race/ethnicity, and socioeconomic status (e.g., savings). Consideration of the resources to which various populations are likely to have access is important for diabetes management efforts. For example, the knowledge that widowed women who had positive social support from friends had lower levels of HbA1c while widowed men who had negative social support from their children had higher levels of HbA1c warrants further research, as it could have important implications for planning interventions or recommending treatments.

6.4. Strengths and Limitations

This dissertation research expanded on the existing body of research on risk factors for diabetes and its management by exploring differences by state of dissolution and gender. It also supplements the literature on the marital history-health relationship by exploring if state of dissolution and marital history are related to diabetes and its management, two outcomes that are lacking in this body of literature. Strengths of this research included both theory and design. The focus on those divorced and
widowed, rather than combining all states of unmarried together, provides insights into differences by state of dissolution and why those differences exist—even though the factors (i.e., ascribed) were not what was expected (i.e., modifiable). This study discussed risk factors specific to each state of dissolution and gender category, and it did so using nationally representative data from the Health and Retirement Study. The HRS is known not only for its high participation rate, but also for its vast breadth of measures that are well validated in middle-aged and older adults. Finally, pooling the data across two waves provided more power than is available with other data sets, waves, and surveys.

The findings of this research must be considered in the context of its limitations as well. First, the study was cross-sectional in design, thus, causal inferences cannot be drawn. Longitudinal data would allow the researcher to look at change within, rather than just differences between, groups. Specifically, it would allow for the researcher to control for ascribed, social, and health status prior to a marital transition, or, in a shorter term longitudinal design, to at least control for previous wave achieved, social, and health status factors. Although two waves of data are currently available, there are not enough cases in the divorced men and widowed men categories to analyze without pooling the data, let alone to analyze in a longitudinal sample with attrition. This cross-sectional approach provides a very conservative picture of the relationship between state of dissolution and HbA1c, as HbA1c is a rather distal measure of diabetes management; also, without controlling for time in status, crisis is not likely to be a strong factor. Marital status might affect some but not all management behaviors and may or may not be strong enough to impact HbA1c. In addition, the influence of protection, crisis, and selection cannot be disentangled with cross-sectional data.

Second, use of secondary data provided a larger more representative sample than would be possible with primary data collection, but there is less depth in the measures available. For example, the measure of diagnosed diabetes does not specify what type of diabetes (i.e., type 1, gestational, or type 2) is being asked about. As a result, some people in the sample with diagnosed diabetes may have type 1
or women might have had gestational diabetes during pregnancy that resolved after giving birth. Still, the vast majority of cases (90-95%) can be expected to be type 2 diabetes (CDC, 2015a). Also, this subset of HRS data did not contain measures of diabetes management behaviors, making interpretation of reason for any differences in HbA1c difficult. In addition, the measures of social support available in the EFTF questionnaire were global, rather than health- or diabetes-specific. While this information is useful, it has more limited implications for intervention research. It also provides a more constrained view of why/how social support is related to HbA1c, as noted above. Another limitation of the data is that most measures are based on self-report. However, a very strong advantage of using this subset of HRS data was the availability of clinically measured HbA1c for all participants.

Third, it is important to acknowledge the complexities of an unbalanced sample. Having unequal sample sizes for stratifying groups results in a power based on the smallest sample size. In addition, it can make detecting the cause for significant differences in ANOVA challenging. In middle-aged and older adults, women are much more likely to be divorced or widowed than men (AoA, 2014). And both genders are more likely to be married than divorced or widowed (AoA, 2014). However, widowed and divorced older men are not oversampled in the HRS. As a result, there were over nine times as many married men as there were widowed men. The sample sizes and, thus, power with which to test hypotheses about differences in risk factors for diabetes and poor management within state of dissolution-gender categories was severely limited.

Fourth, because the data were pooled from two waves of data covering a four year period, there was potential for bias, particularly in insurance coverage. The Affordable Care Act was signed into law in 2010. Although it had some immediate effects on health insurance coverage, the numbers of newly covered Americans was small until 2013. A comparison of HRS participants with health insurance in 2010 and 2012 showed that approximately 91.58% of participants had health insurance in 2010 and
91.07% had health insurance in 2012, suggesting minimal historical bias in insurance coverage due to pooling.

These limitations require that the findings be interpreted with some caution, and generalizability is limited by the clean categories of dissolution that exclude those who are separated, have an absent spouse, and are cohabiting. Also, approximately 6% of the sample of interest was excluded due to missing data, and those cases were significantly more disadvantaged on measures of resources and health, compared to the analytic sample which limits generalizability to the U.S. married, widowed, and divorced population over age 50. However, the study’s unique contributions to the literature provide a basis for further exploration of the relationship between state of dissolution and diabetes management.

6.5. Future Directions

This research found that diabetes prevalence and correlates varied by social position with age and race/ethnicity attenuating state of dissolution-gender differences, and there were few differences in diabetes management by state of dissolution with aspects of social position being more relevant to our understanding of diabetes management. Given the limitations noted above of this cross-sectional research, it would be worth examining the more short-term impacts of marital transitions on diabetes and management, as the effects might be stronger and indicate a period of need for resources and counseling. It would also be valuable to look at more proximal measures of management such as behaviors and more distal measures such as complications (e.g., neuropathy, retinopathy, nephropathy) shortly after a given dissolution and several years after (or how a given type of dissolution influences trajectories for specific aspects of diabetes management).

Future research should explore whether there are differences in these patterns by age cohorts, by racial/ethnic group, and in same sex couples. These lines of inquiry are based on several observations. First, diabetes is becoming increasingly common at younger ages. HbA1c has historically
been positively associated with age, even in older adults without diagnosed diabetes. However, this
dissertation and other studies have found that age was negatively associated with HbA1c in middle-aged
and older adults in the most recent data available. As a result, cohort might be confounding the
relationships between age, HbA1c, and state of dissolution (Williams & Umberson, 2004). Second,
divorce is much more common in non-Hispanic blacks and in Hispanics than in non-Hispanic whites. In
addition, race/ethnicity partially or fully attenuated many of the relationships between state of
dissolution and odds of diabetes and between modifiable factors and HbA1c. It is possible that risk
factors for diabetes and its management vary not only by state of dissolution and gender, but also by
race/ethnicity. Last, due to differences by gender and literature suggesting that men and women
receive and take different benefits from a heterosexual marriage, it would be interesting to see if same
sex partners give and receive the same benefits or if they fill voids that would be left if they each
fulfilled traditional gender roles.

The literature would also benefit from further investigation of how other aspects of marital
history influence the dissolution-HbA1c relationship. Two aspects that deserve attention are whether
married couples are in their first, second, or third-plus marriage or cohabiting—particularly given
increase in remarriage in middle and older age—and how long individuals have been in their current
marital status (Livingston, 2014). Timing of first marriage has also been linked to health and
socioeconomic status and could have implications for diabetes management. Finally, continued
exploration of the contribution of risk factors suggesting crisis, protection, and/or selection would
provide additional insight into if/why there are between and within group differences by state of
dissolution and gender.
6.6. Conclusions

A theoretically-based approach framed within a lifespan developmental and life course perspective to examine the relationship between state of marital dissolution and diabetes and its management revealed that diabetes prevalence, as measured by self-report of doctor diagnosed diabetes, was highest in those who were widowed, yet mean levels of HbA1c in the diabetic sample were lowest in those who were widowed. Divorced women tended to be more disadvantaged than married and widowed women, but this did not translate to significantly higher odds of diabetes. Diabetes prevalence was instead most consistently associated with ascribed (age, race/ethnicity) and health (health conditions and obesity) factors across state of dissolution-gender categories, suggesting that other aspects of social position matter more for diabetes and its management than state of marital dissolution. HbA1c levels differed little by state of dissolution and gender, but were associated with modifiable marriage related factors. Importantly, significant risk factors for diabetes by group were not necessarily the same as the risk factors for poor management. Ascribed and health factors tended to attenuate these relationships. Future research with heavier focus on the life course perspective and use of longitudinal data to explore how diabetes management trajectories are influenced by marital transitions would benefit understanding the relationship between marriage and diabetes management.
References


Appendix A

Definitions for key terms

Middle-Aged and Older Adults: adults 50 years of age and over

Type 2 Diabetes: a chronic, metabolic condition in which the body is unable to efficiently and effectively process glucose, resulting in high blood glucose levels (HbA1c ≥6.5%, FPG ≥126). Unlike type 1 diabetes, type 2 diabetes is often preventable with healthy diet, regular exercise, and maintenance of a healthy weight. Type 2 diabetes accounts for approximately 95% of cases of diagnosed diabetes in middle-aged and older adults.

Diabetes Management: engagement in doctor recommended behaviors in an effort to bring blood glucose levels into a lower risk range. It typically includes behaviors such as regular engagement in physical activity, maintaining a healthy diet, visiting one’s doctor regularly, taking medications as prescribed, and monitoring blood glucose levels. Effective diabetes management results in stable blood glucose levels of ≤6.5 in adults, and ≤7.0 in older adults without hypoglycemia (i.e., low blood sugar).

Glycosylated Hemoglobin (HbA1c): a measure of the “average” level of glycosylated hemoglobin in the blood over the past two to three months, depending on how long the red blood cells carrying the glycosylated proteins live. An HbA1c of ≤6% is considered healthy, 6 to 6.5% is considered pre-diabetic, and >6.5% indicates diabetes. HbA1c can be used as a method of diagnosing diabetes and/or as an indicator of how well diabetes is being controlled.

Glycemic Control: the typical blood glucose level in a person with diabetes. There are different measures of control and targets for each measure, based on an individual’s age, health, and values and preferences for care. In general, the targets for control, as measured by HbA1c, are 6.5% for people who are living with diabetes, but otherwise healthy, and 7.0% for older adults living with diabetes. Less aggressive targets (~8.0%) are recommended for people who are prone to hypoglycemia, have a limited expected lifespan, or are dealing with other limiting factors.

Marital Status: indicator of legal partnership. The U.S. Bureau of the Census recognizes 6 marital statuses: now married, married spouse absent, separated, divorced, widowed, and never married. Partnered is becoming a more common option on questionnaires, but is not currently included as an option in the U.S. Census.

Unmarried: people who are not (or no longer) legally married (never married, divorced, or widowed).

Married: people who have entered into a legally recognized marriage and whose spouse is present.

Divorced: people who have legally ended their marriage.

Widowed: people whose legal spouse died while they were married.

Never Married: people who have never been legally married or who had a marriage annulled.

Separated: People who are legally married but living with their spouse due to discord.
Partnered: people who are in stable, committed, long-term relationships but who are not legally married. These people may be categorized as widowed, never married, separated, or divorced in surveys that do not assess partnership.

Previously Married: people who were married and who are now widowed or divorced; people who are separated are sometimes included in this category

Marital History: the timing, durations, types, ordering, and, sometimes, quality of marital statuses over an individual’s lifespan

Marital Transition: moving from one marital status to a different marital status due to the gain or loss of a marriage

State of Marital Dissolution: this term will be used throughout this dissertation to refer to the three categories of the independent variable: divorced, widowed, and married, with married serving as the reference group
Appendix B

Descriptive statistics for the sample of interest with complete data versus missing data

<table>
<thead>
<tr>
<th></th>
<th>Cases w/Complete Data</th>
<th>Cases w/Incomplete Data</th>
<th>Missing</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>(N = 9,624)</td>
<td>(n = 616)</td>
<td>n</td>
</tr>
<tr>
<td>%, M(SD)</td>
<td>%, M(SD)</td>
<td>P</td>
<td>n</td>
</tr>
<tr>
<td>State of Dissolution</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Married</td>
<td>70.7, 6.4</td>
<td>68.5, 6.2</td>
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</tr>
<tr>
<td>Divorced (vs M)</td>
<td>14.1, 2.5</td>
<td>13.5, 2.3</td>
<td>-</td>
</tr>
<tr>
<td>Widowed (vs M)</td>
<td>15.2, 2.2</td>
<td>18.0, 2.2</td>
<td>-</td>
</tr>
<tr>
<td>Men</td>
<td>44.3, 12.1</td>
<td>39.9, 11.3</td>
<td>0</td>
</tr>
<tr>
<td># Transitions</td>
<td>66.2, 11.1</td>
<td>64.0, 11.1</td>
<td>58</td>
</tr>
<tr>
<td>Diabetes</td>
<td>20.3, 11.2</td>
<td>31.0, 11.0</td>
<td>*** 4</td>
</tr>
<tr>
<td>Insurance</td>
<td>94.2, 11.0</td>
<td>89.5, 11.0</td>
<td>*** 15</td>
</tr>
<tr>
<td>Race/Ethnicity</td>
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<td></td>
<td></td>
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<tr>
<td>White</td>
<td>86.6, 11.3</td>
<td>73.0, 11.0</td>
<td>-</td>
</tr>
<tr>
<td>Black (vs W)</td>
<td>7.1, 2.0</td>
<td>8.9, 2.0</td>
<td>** -</td>
</tr>
<tr>
<td>Hispanic (vs W)</td>
<td>6.3, 2.0</td>
<td>18.0, 2.0</td>
<td>*** -</td>
</tr>
<tr>
<td>Obese</td>
<td>34.9, 11.2</td>
<td>35.7, 11.2</td>
<td>115</td>
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<tr>
<td>Inactive</td>
<td>27.1, 11.3</td>
<td>29.4, 11.4</td>
<td>0</td>
</tr>
<tr>
<td>Smoker</td>
<td>11.9, 2.0</td>
<td>12.8, 2.1</td>
<td>34</td>
</tr>
<tr>
<td>Heavy Drinker</td>
<td>15.7, 11.2</td>
<td>11.6, 1.0</td>
<td>14</td>
</tr>
<tr>
<td>Medications</td>
<td>16.4, 11.2</td>
<td>18.5, 1.0</td>
<td>59</td>
</tr>
<tr>
<td>Contact with Kids</td>
<td>95.0, 2.0</td>
<td>92.2, 1.0</td>
<td>* 0</td>
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<tr>
<td>HbA1c</td>
<td>5.78, 0.2</td>
<td>5.84, 0.2</td>
<td>247</td>
</tr>
<tr>
<td>Longest Marriage</td>
<td>33.24, 11.2</td>
<td>30.10, 11.0</td>
<td>*** 0</td>
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<tr>
<td>Savings</td>
<td>35,187</td>
<td>28,120</td>
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<td>Depressive Symptoms</td>
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<td>1.72, 0.2</td>
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<td>Positive Social Support</td>
<td>3.14, 1.0</td>
<td>3.12, 1.0</td>
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<tr>
<td>Negative Social Support</td>
<td>1.64, 0.2</td>
<td>1.69, 0.2</td>
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<tr>
<td>Age</td>
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<td>66.00</td>
<td>0</td>
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<tr>
<td>Education</td>
<td>13.32</td>
<td>11.98, 0.2</td>
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<td>Yrs w diabetes</td>
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<td>2.32</td>
<td>56</td>
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Notes. Pooled 2010|2012 data from the Health and Retirement Study N=10,240; sample size for excluded cases varied by missingness on a given variable Significant differences between sample with complete and incomplete cases were determined using binary logistic regression (probability modeled is having complete data/in sample=1) *p<.05, **p<.01, ***p<.001
Appendix C

Coefficients for the effects of state of dissolution, marital history, ascribed, achieved, social, and health-related factors on diabetes management (HbA1c), by gender

<table>
<thead>
<tr>
<th></th>
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<th>Model 2</th>
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<th>Model 4</th>
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<td>s2 Marital Transitions</td>
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<td>Longest Marriage</td>
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<td>Age</td>
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<td>Years of Education</td>
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<td>Savings (logged)</td>
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<td>Health Insurance</td>
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| Constant, b, SE     | 6.745  | 0.062  | ***    | 6.738  | 0.140  | ***    | 7.348  | 0.347  | ***    | 7.629  | 0.349  | 10.502  | 5.140  | 21.233  | ***    |
| R², Adj. R²         | 0.006, 0.006 |         | 0.001, 0.003 |         | 0.031, 0.031 |         | 0.041, 0.039 |         | 0.015, 0.015 |         | 0.159, 0.158 |         | 0.159, 0.158 |         |

Notes. Based on weighted, pooled 2010-2012 data from the Health and Retirement Study.

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

157
Appendix D

Coefficients for the effects of length of longest marriage and other covariates on diabetes management (HbA1c), overall

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<td>$p$</td>
<td>$B$</td>
<td>$SE$</td>
<td>$t$</td>
<td>$p$</td>
<td>$B$</td>
<td>$SE$</td>
<td>$t$</td>
<td>$p$</td>
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<td>-0.069</td>
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<td>-0.080</td>
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<td>0.003</td>
<td>0.015</td>
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<td>0.049</td>
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<td>0.271</td>
<td>0.094</td>
<td>0.067</td>
<td>**</td>
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<td>0.377</td>
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<td>0.089</td>
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<tr>
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<td>0.116</td>
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<td></td>
<td></td>
<td>0.032, 0.031</td>
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</table>

Notes. Based on weighted, pooled 2010-2012 data from the Health and Retirement Study

* $p < 0.05$; ** $p < 0.01$; *** $p < 0.001$
Appendix E

Coefficients for the effects of length of longest marriage and other covariates on diabetes management (HbA1c), by gender

<table>
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<th>Women</th>
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<td>Longest Marriage</td>
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<td>-0.002 0.003 -0.021</td>
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<tr>
<td>Divorced</td>
<td>0.090 0.182 0.028</td>
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<tr>
<td>Widowed</td>
<td>-0.160 0.099 -0.060</td>
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</tr>
<tr>
<td>Age</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Non-Hispanic Black</td>
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<tr>
<td>Hispanic</td>
<td></td>
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<tr>
<td>Constant B, SE</td>
<td>6.631 0.076 ***</td>
<td>6.806 0.141 ***</td>
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<tr>
<td>Df, F</td>
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<td>R², Adj. R²</td>
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<td>0.009, 0.008</td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>Men</th>
<th>Model 1</th>
<th>Model 2</th>
<th>Model 3</th>
<th>Model 4</th>
</tr>
</thead>
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<tr>
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<td>Longest Marriage</td>
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<td>-0.012 0.004 -0.135 **</td>
<td>-0.002 0.006 -0.027</td>
<td>-0.051 0.195 -0.012</td>
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<tr>
<td>Divorced</td>
<td>-0.243 0.213 -0.059</td>
<td>-0.093 0.215 -0.022</td>
<td>0.060 0.152 0.012</td>
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<td>Widowed</td>
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<td>-0.021 0.008 -0.148 **</td>
<td>-0.023 0.006 -0.164 ***</td>
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<td>Age</td>
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<td></td>
<td>0.104 0.134 0.022</td>
<td>0.114 0.129 0.025</td>
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<tr>
<td>Hispanic</td>
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</tr>
<tr>
<td>Constant B, SE</td>
<td>7.172 0.150 ***</td>
<td>7.281 0.186 ***</td>
<td>8.290 0.450 ***</td>
<td>8.350 0.430 ***</td>
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<td>6 4.25 **</td>
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<td>0.015, 0.015</td>
<td>0.039, 0.038</td>
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Notes. Based on weighted, pooled 2010|2012 data from the Health and Retirement Study
* p < 0.05; ** p < 0.01; *** p < 0.001
Appendix F

Coefficients for the effects marital transitions on diabetes management (HbA1c), overall

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<td>0.037 0.065 0.014</td>
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<tr>
<td>Widowed</td>
<td>-0.187 0.072 -0.057 *</td>
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<tr>
<td>Constant B, SE, T, p</td>
<td>6.755 0.049 ***</td>
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<td>F</td>
<td>1 0.33 3 2.73</td>
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<tr>
<td>R², Adj. R²</td>
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Notes. Based on weighted, pooled 2010|2012 data from the Health and Retirement Study
* p < 0.05; ** p < 0.01; *** p < 0.001
Appendix G

Coefficients for the effects of savings and other covariates on diabetes management (HbA1c), overall

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<th>Model 3</th>
<th></th>
<th></th>
<th>Model 4</th>
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<td>-0.068</td>
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<td>-0.089</td>
<td>**</td>
<td>-0.060</td>
<td>0.024</td>
<td>-0.078</td>
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<td>0.000</td>
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<td>**</td>
<td>-0.074</td>
<td>0.085</td>
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<td>0.061</td>
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<td>-0.097</td>
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<td>0.004</td>
<td>0.002</td>
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<td>0.005</td>
<td>-0.125</td>
<td>**</td>
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<td>0.235</td>
<td>0.093</td>
<td>0.058</td>
<td>*</td>
<td>0.235</td>
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<td>7.188</td>
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Notes. Based on weighted, pooled 2010|2012 data from the Health and Retirement Study
* p < 0.05; ** p < 0.01; *** p < 0.001
## Appendix H

### Coefficients for the effects of savings and covariates on diabetes management (HbA1c), by gender

#### Women

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<th>Model</th>
<th>B</th>
<th>SE</th>
<th>p</th>
<th>Model</th>
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<td>0.030</td>
<td>-0.133 **</td>
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<td>0.033</td>
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<td>-0.203</td>
<td>0.100</td>
<td>-0.076 *</td>
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<td>-0.022</td>
<td></td>
<td>-0.059</td>
<td>0.117</td>
<td>-0.022</td>
</tr>
<tr>
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<td>0.070</td>
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<td>0.047</td>
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<td>0.118</td>
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<td>0.122</td>
<td>0.118</td>
<td>0.047</td>
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<td>0.045</td>
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<tr>
<td>Non-Hispanic Black</td>
<td>0.178</td>
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<td>0.045</td>
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<td>0.178</td>
<td>0.185</td>
<td>0.045</td>
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<tr>
<td>Constant B, SE</td>
<td>6.990</td>
<td>0.095</td>
<td>***</td>
<td></td>
<td>7.053</td>
<td>0.108</td>
<td>***</td>
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<td>6.999</td>
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<td>3</td>
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<td>8</td>
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<td>0.027</td>
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<td>0.039, 0.038</td>
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#### Men

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<th>p</th>
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</table>

**Notes.** Based on weighted, pooled 2010|2012 data from the Health and Retirement Study

* *p < 0.05; **p < 0.01; ***p < 0.001
Appendix I

Coefficients for the effects of depressive symptoms and covariates on diabetes management (HbA1c), overall

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<tr>
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<td>0.010, 0.010</td>
<td>0.018, 0.017</td>
<td>0.036, 0.036</td>
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</tbody>
</table>

Notes. Based on weighted, pooled 2010–2012 data from the Health and Retirement Study

* p < 0.05; ** p < 0.01; *** p < 0.001
VITA

CYNTHIA L. LACOE-MANIACI

EDUCATION
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Biobehavioral Health Outstanding Graduate Teaching Award (2011)
National Institute of Aging: Technical Assistance Workshop Admittance and Scholarship (2009)
Bunton-Waller Fellow (2008-2012)

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PUBLICATIONS

SELECT PRESENTATIONS