ADAPTATION TO LATE-LIFE SPOUSAL LOSS: AN EXAMINATION OF LONGITUDINAL TRAJECTORIES

BY

SHUO XU

DISSERTATION

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Doctoral Committee:

Associate Professor Janet M. Liechty, Chair
Professor Teresa Ostler
Assistant Professor Rosalba Hernandez
Assistant Professor Rachel Garthe
Professor Susan Silverberg Koerner
Assistant Professor Ruopeng An, Washington University in St. Louis

ABSTRACT

Spousal loss is one of the most devastating life events in late adulthood, and has substantial negative impact on the well-being of older adults. One impact of spousal loss is the disruption of self-narratives and world views, thus meaning making is an important task for bereaved individuals, and is associated with the development of adaptation. The primary purposes of this study were to respond to a heated debate regarding whether resilience (no change in functioning during adversity) is the most common response to adversity, and to describe trajectories of adaptation in the context of late-life spousal loss. Specifically, this study aimed to examine the influence of spousal loss on the process of aging, to identify person-centered trajectories on six dimensions of adaptation, particularly on two meaning-related dimensions, and to analyze the prevalence of resilience among widowed older adults.

The study used secondary data from 2011-2018 waves of the National Health & Aging Trends Study (NHATS). The NHATS is a nationally representative study of Medicare beneficiaries aged 65 and older living in the United States (n = 8,245). This study included 570 widowed participants who were initially married and lost a spousal during the study. Propensity score matching was conducted to select 464 pairs of widowed and non-widowed participants by matching their characteristics on seven areas including age, gender, race, education, mobility, physical health, and number of chronic illness. To operationalize the multidimensional nature of adaptation, six dimensions— life satisfaction, subjective age, depression, anxiety, positive affect, and negative affect—were examined simultaneously in this study.

Growth Mixture Model (GMM) was applied to identify heterogeneous adaptation trajectories. Specifically, an array of conditional GMM analyses with the predictor of spousal loss were conducted with the entire sample (464 pairs of widowed and non-widowed participants)

to examine the impact of spousal loss on the memberships of trajectories of the six dimensions. Another array of unconditional GMM analyses were conducted only with the widowed subgroups (n=570) to estimate heterogeneous trajectories of the six dimensions. Lastly, logistic regressions were performed to estimate the influence of demographic factors on predicting the memberships of the trajectories among the widowed older adults.

Four key findings resulted. First, widowed older adults were more likely to be in the unfavorable trajectories (e.g. chronic high trajectory) than non-widowed participants with exceptions on life satisfaction and negative affect. Second, among widowed participants, two to three adaptation trajectories emerged for each of the six dimensions of adaptation, but resilient trajectory did not emerge on anxiety. Third, most participants (71% - 100%) exhibited resilience when examining the six dimensions individually. However, when examining the six dimensions collectively, the majority of participants (61%) exhibited resilience only on four dimensions of adaption, and no one was resilient across all six dimensions. Lastly, education was the only significant predictor of resilience.

This study suggests that spousal loss has a longitudinal negative impact on the well-being of older adults. Widowed older adults presented individual pathways on adapting to spousal loss; the majority of widowed older adults experienced challenges on at least two dimensions of adaption, and no individual was resilient across all six dimensions. Additionally, education was the only significant predictor of resilience. Future research is needed to uncover more dimensions of adaptation, examine the association of pre- and post-loss experiences, investigate the influences of special occasions on adaptation, and compare adaptation by age groups.

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CHAPTER 1: INTRODUCTION

1.1 Statement of Problem

In the twenty-first century, population aging has become one of the most influential social transformations. According to the U.S. Census Bureau (2017), in 2017, there were 47.8 million of Americans aged 65 or older, accounting for 14.9% of the total population. By 2030, there will be 78.0 million older adults. Compared to 76.7 million under the age of 18, for the first time in the U.S. history, the older population will outnumber children. By 2060, about 25% of the U.S. population will be aged 65 years or older, and 19.7 million of them will be aged 85 or older. As a result of this swiftly growing older population, there are increasing concerns that the current society, especially the healthcare system, is not well-prepared to meet the needs of this greatly expanded aging population (Dall et al., 2013; Lim, Wong, Leong, Choo, & Pang, 2017). How to sustain and improve the health, wellbeing, and independence of older adults, especially among the disadvantaged, has become a major concern.

Aging is accompanied by a series of biological and psychological changes. Advancing age not only means gray hair, retirement, or decreased physical function, but also increasing opportunities for facing and dealing with death. On one hand, older adults tend to recognize that limited time remains in their own lives. They are more likely to talk about death (De Raedt, Koster, & Ryckewaert, 2013) and are more active in planning for their own death (Lovell & Yates, 2014). On the other hand, losing friends, families, and loved ones becomes common and unavoidable. Processing grief and bereavement becomes one of the major tasks in later adulthood.

Losing a spouse is one of the most devastating life events for older adults, and coping with spousal loss can be challenging. Bereaved spouses are forced to manage the changes to the behavioral, social, and economic environments that were once shared with the deceased spouse (Donnelly & Hinterlong, 2010; Sass, Sun, & Webb, 2013; Utz, Caserta, & Lund, 2012; Williams, 2004). Meanwhile, they also need to deal with many intense emotions, such as loneliness, depressive moods, guilt, sadness, yearning, longing, and anger (Field, Hart, & Horowitz, 1999; Fried et al., 2015; M. Stroebe et al., 2014; W. Stroebe, Abakoumkin, & Stroebe, 2010; van der Houwen et al., 2010). Through all these, bereaved individuals are dealing with re-evaluating, identifying, and transforming their connections to the deceased. E. Becker (1973) stressed that people were eager to think themselves as persons of value and meaning who believe their lives are significant. Meaning provides definition and guidance to a person's life and life path. The death of a spouse can shatter a person's assumptive world view and the established beliefs that an individual holds (Bauer, 2003; Gillies & Neimeyer, 2006; Janoff-Bulman, 1999). Changes in life circumstances make it hard to continue as who they were before the loss (Robert A Neimeyer, 2006).

In the United States, 29.7% of older adults age between 75 and 84, and 57.7% of older adults age 85 or older are widowed (U.S. Census Bureau, 2017). The wellbeing of the widowed elderly represents a significant public health concern given that spousal loss and widowhood have both immediate and longer-term effects on the elderly. Many studies have documented the negative impact of spousal loss on older adults, including increased mortality, major depressive disorders, panic disorder, post-traumatic stress, complicated grief, and negative health behaviors (Eckholdt, Watson, & O'Connor, 2018; Kersting, Brähler, Glaesmer, & Wagner, 2011; Maciejewski, Maercker, Boelen, & Prigerson, 2016; O'Connor, 2010; Onrust & Cuijpers, 2006;

Shor et al., 2012; Stahl & Schulz, 2014). These negative influences linger for years, even to the end of the survivor's life. In fact, grief is not something to "get over". Connections to the deceased spouse do not end, but are transformed and transcended over time (Klass, Silverman, & Nickman, 2014).

In recent decades, especially with the emergence of positive psychology, a growing body of research has focused on exploring resilience, and the contextual, social, and individual factors that prevent older adults from taking unfavorable pathways following adversities, including late-life spousal loss. There is accumulating evidence that resilience has profound positive impacts on various aspects of older adults, including higher quality of life, greater happiness, better mental health and wellbeing, successful aging, lower depression, longevity, and reduced mortality risk (Bonanno et al., 2002; Y. J. Lee, Choi, Hwang, Kim, & Hwang, 2016; MacLeod, Musich, Hawkins, Alsgaard, & Wicker, 2016; Ong, Bergeman, Bisconti, & Wallace, 2006; Rossi, Bisconti, & Bergeman, 2007; Spahni, Bennett, & Perrig-Chiello, 2016). However, there are also continuing debates about resilience, specifically around the questions: Can all traumas be healed? Is resilience common? What is the nature of resilience?

One school of scholars, represented by Bonanno and Galatzer-Levy, investigated adaptation and resilience in multiple traumatic circumstances, including the loss of a loved one, violence, natural disasters, war, and unemployment. They found that among various trajectories of adaptation following adversity, the resilient trajectory was the most common (Bonanno, Brewin, Kaniasty, & La Greca, 2010; Bonanno, Rennicke, & Dekel, 2005; Bonanno et al., 2002; Donoho, Bonanno, Porter, Kearney, & Powell, 2017; Galatzer-Levy, Bonanno, & Mancini, 2010; Mancini, Bonanno, & Clark, 2011). Nonetheless, other research that attempted to replicate some of the works of Bonanno and Galatzer-Levy (specifically, Galatzer-Levy et al., 2010; Mancini et

al., 2011) found that resilience was the *least* common. These scholars argue that the optimistic results in Bonanno and Galatzer-Levy's original studies were due to data analytic choices when applying Growth Mixture Modeling (GMM) and the use of just one or two proxies for adaptation when the nature of adaptation and resilience is actually multidimensional (Infurna & Luthar, 2016a, 2016b, 2018). Additionally, another controversial issue has been whether resilience is an adaptable process that can be cultivated by interacting with the external environment or is a personality trait that remains stable over time. Although each argument has compelling evidence, it remains unclear to what extent and under what circumstances resilience is adaptable. Therefore, assessing the longitudinal trajectories of adaptation and analysis using GMM will make an important contribution and add clarity to these debates.

1.2 Purpose of the Study

My dissertation sheds light on these debates by using growth mixture modeling (GMM) to explore the trajectories of six dimensions of adaptation (and resilience, as one trajectory of adaptation) under a context of late-life spousal loss. Specifically, the proposed study:

1. Investigated the impact of spousal loss on the trajectories of aging.
2. Identified and described different trajectories of adaptation to spousal loss among older adults.
3. Examined the prevalence of resilience among widowed older adults.
4. Highlighted the important role of anticipatory grief on the development of adaptation to late-life spousal loss.
5. Described the characteristics of participants in the resilient trajectory and in the recovery trajectory.

1.3 Contribution to Literature

This study used nationally representative data to track newly widowed older adults for a maximum of seven years and delineate individual adaptation trajectories. The findings of this study make the following contributions to current literature:

First, the findings highlight the longitudinal impact of spousal loss on the trajectories of aging. Although many studies have found that spousal loss had a significant influence on the well-being of older adults, few studies examined the impact of spousal loss on individual aging trajectories; even fewer studies analyzed such impact in a timeframe of eight years. This study not only delineated different trajectories of aging, but also highlighted the longitudinal impact of spousal loss on aging.

Second, the findings provide important empirical evidence to clarify the debates about resilience (as one trajectory of adaptation). This study engaged six proxies of adaptation, identified trajectories for each proxy, and analyzed the prevalence of resilience. These findings respond to the question whether resilience was common. Additionally, this study not only described the prevalence of resilience on each individual proxy, but also described the prevalence of resilience across six outcomes. These analyses respond to another question in the literature that if individuals presented resilience in one dimension of adaptation, did that mean the individual is resilient in other dimensions as well.

Third, this study aimed to uncover multiple dimensions of adaptation (and resilience, as one trajectory of adaption) by employing a multidimensional approach. While it seemed conceptually clear that adaptation (and resilience, as one trajectory of adaption) is multidimensional, few existing studies have operationalized this multi-dimensionality. One study systematically reviewed 77 empirical resilience studies that used GMM and found that (1) life satisfaction, depressive symptoms, and health indices were repeatedly used as proxies for

adaptation when examining marital or family- related traumatic events while (2) few studies engaged more than two proxies (Infurna & Luthar, 2018). Thus, there is a need for future studies to engage multiple and new proxies for adaptation (and resilience, as one trajectory of adaption). This study filled this gap by using six proxies, including several novel proxies, including anxiety, positive affect, and subjective age. On one hand, while the integration of proxies, such as life satisfaction and depression, could replicate the findings from previous studies, the examination of novel proxies could uncover other dimensions of adaptation as well.

Lastly, one overlooked or not sufficiently emphasized area in the literature was the influence of pre-loss experience on the trajectories of post-loss adaptation among surviving spouses. It is clear that approaching death is hard for both dying patients and their loved ones, but how such experiences impact the adaptation to loss among surviving loved ones has not been fully enough investigated. Findings from the current study have important implications for healthcare staff, especially for those working in the field of end-of-life care. Support for the grieved spouses should start as early as possible in order to facilitate a better adaptation after the loss.

CHAPTER 2: LITERATURE REVIEW

This chapter has four sections. The first section provided the theoretical framework linking key constructs in study. The second section thematically reviewed empirical studies related to late-life spousal loss with specific emphases on the debates on adaptation and resilience. The third section identified gaps in the existing literature. Based on these gaps, the last section presented research questions and hypotheses which were examined in this study.

2.1 Theoretical Framework

Spousal loss in late life is a phenomenon with multiple layers. This section of the Literature Review unfolds this phenomenon by introducing four theories that explain different layers of this phenomenon. Specifically, Socioemotional Selectivity Theory (SST) engages a life-course perspective to explain how "running-out of time" influences decision-making across the life span with a specific focus on explaining the importance of finding meaning in later adulthood. Second, the Meaning Reconstruction Model (MRM) demonstrates the significant role of meaning making after loss, and how meaning making influences grief and bereavement. Third, Resilience and Resiliency Theory (RRT) provides a paradigm for exploring human resilience and for understanding the process of adaptation. Lastly, the Socio-Ecological Model (SEM) works as a thread which ties all the three layers together by providing a person-in-environment perspective for analyzing interactions between individuals and their ecologies. Each theory is discussed below.

2.1.1 Socioemotional Selectivity Theory

SST is grounded in a basic human function: the monitoring of time (Carstensen, 1992; Carstensen, Isaacowitz, & Charles, 1999). According to SST, the perception of time plays a central role in the selection of social goals and behaviors. As people move through their life span,

they become increasingly aware that time is "running out." It becomes increasingly important to make right choices. Activities that are unpleasant or lack meaning become less compelling under the conditions of limited perceived time. Instead, activities that foster meaning and pleasant emotions are prioritized.

While it seems obvious that human needs or social goals influence their actions, SST is less concerned with which goals are essential but more emphasizes how social goals direct behaviors. This theory proposed two primary trajectories of social motivation operating throughout life: the emotional trajectory and the knowledge trajectory (Carstensen, 1992; Carstensen et al., 1999). The emotional trajectory is characterized by motivations to achieve emotional satisfaction and meaning. This trajectory is high during infancy and early childhood, declines from middle childhood throughout early adulthood, and rises again from later adulthood into old age. In contrast, the knowledge trajectory is characterized by motivations to gain knowledge and prepare for the future. This trajectory starts high during the earlier years of life and gradually declines over the life course.

Unlike younger people, who tend to expand their social contacts in order to gain important information for enlarging knowledge and preparing for the future, older adults care more about the quality of social interactions than quantity. In other words, although social interactions shrink in later adulthood, emotional closeness to significant others actually increases (Carstensen, 1992). Older adults tent to pursue their life purposes through the interactions with significant others in their lives. Such interactions can further influence older adults' emotional experiences in everyday life. Thus, significant others, such as a spouse, siblings, and friends, may play even more significant roles in late adulthood than any other life stages. However, once negative emotions are aroused, SST makes no claim about the intensity of the experience

(Carstensen et al., 1999). That is to say, this theory cannot be used to predict people's reactions when traumatic events happen and negative emotions are triggered. As such, other theories are needed to explain the experience after traumatic events, such as spousal loss. Therefore, the MRM is introduced to describe the mechanism of grief.

2.1.2 The Meaning Reconstruction Model

Influenced by social constructionism, which posits that reality is constructed through human interpretative activities, MRM strives to explain the importance of meaning making in the face of grief (Gillies & Neimeyer, 2006). Similar to other grief theories, such as continuing bonds, attachment theory, and dual process theories, MRM asserts that the central task of grief is the reconstruction of meaning. After the loss of a significant person, individuals have to re-identify themselves by making new roles or meanings in their lives. However, meaning making following loss is often recognized as twofold: making sense of the death and finding a benefit from one's experience with the loss (Davis & Nolen-Hoeksema, 2001; Davis, Nolen-Hoeksema, & Larson, 1998).

One of the uniquenesses of MRM is that it not only confirms the importance of making sense of the death and finding a benefit from the loss, but also emphasizes the development of narratives around how bereaved individuals view themselves and their lives after the death of a significant person (Neimeyer, 1998). That is, "mourning, in both its private and public moments, draws heavily on the narratives process to establish the meaning of the deceased's life and death, as well as the post-mortem status of the bereaved within the broader community concerned with the loss" (Neimeyer, Klass, & Dennis, 2014a, 2014b).

As such, two major meaning making processes occur: assimilation and accommodation. *Assimilation* indicates how people assimilate the loss experience into their pre-loss narratives or

beliefs in order to maintain their previous identities. The development of a religious explanation for the loss can be typical of such assimilation. *Accommodation*, in contrast, indicates how people develop, reorganize, deepen, or expand their belief system, identity, or self-narrative in order to accept the reality of loss. Roughly speaking, assimilation adds new space for the experience while accommodation adapts existing space for the experience.

The development of these narratives is also influenced by the survivor's social contexts. As such, narrative responses to loss will vary greatly given different social contexts and the belief systems that the surviving engaged. In general, individuals who are successful in the assimilation or accommodation, no matter the approach taken, show better adaptation than those who failed this meaning making process (Gillies & Neimeyer, 2006; Neimeyer, 2006a; Neimeyer, 2006b).

In summary, MRM raises two important points: First, because grief is a very complex process, which can be influenced by many factors, the pathways of individuals may vary greatly. Second, the ways that individuals perceive loss and grieve are built on their experiences before loss. In order to describe the potential pathways of adaptation to spousal loss, the RRT is introduced below.

2.1.3 The Resilience and Resiliency theory

In the field of resilience studies, there is an increasing interest in a generic theory that can be applied across different populations of interest and potential stressors. The Resilience and Resiliency Theory (RRT), proposed by Richardson (Richardson, 2002), offers such a theory and has not only been widely cited in the resilience literature (Fletcher & Sarkar, 2013; Jenkins, Wiklund, & Brundin, 2014; Maatouk et al., 2018; Manne et al., 2015; Woodford, Kulick, & Atteberry, 2015) but also incorporated as a theoretical framework for the development of

resilience measurements and interventions (Connor & Davidson, 2003; Luthans, Avolio, Avey, & Norman, 2007; Mealer et al., 2014). Richardson suggests that RRT provides a paradigm that incorporates postmodern thinking and explained that resilience can be explored in three waves of inquiry (as follows):

1. describe personal and ecological factors that predict social and personal successes for coping with adversity (protective factors)
2. define the process of reintegration after disruption and possible consequences produced by different pathways (reintegration process)
3. identify motivational forces within people and the creation of experience s that foster the activation and utilization of the forces for reintegration (internal resources) (Richardson, 2002).

One of the main contributions of RRT (Richardson, 2002; Richardson, Neiger, Jensen, & Kumpfer, 1990) is the proposed resiliency model (see Figure 1). This conceptual model begins with biopsychospiritual homeostasis, a state of mind, body and spirit at a time-point when a person has adapted to the status quo, whether good or bad. Biopsychospiritual homeostasis routinely interacts with stress or adversity. Disruption will occur when people have insufficient internal or external resources (i.e. protective factors) to offset the influence of adversity. This triggers the process of reintegration.

During reintegration, people attempt to adjust to the new circumstance(s) and re-achieve biopsychospiritual homeostasis. This process can end up with one of the four following outcomes: (a) resilient reintegration, which refers to a state in which people activate additional resources (protective factors) to buffer against future life adversities and reach a higher level of homeostasis than previously; (b) reintegration back to homeostasis, which refers to a state in

which people remain at the previous level of homeostasis and "heal" from the interruption; (c) reintegration with loss, which refers to a state where people lose existing resources from the crisis and achieve a lower level of homeostasis and functioning than before the crisis; and (d) dysfunctional reintegration, which refers to a state in which people resort to destructive behaviors or substances after the crisis. In particular, this resiliency model highlights the dynamic process that proceeds from prior to the disruption, through the reintegration, and to the aftermath, whether as a state of coping with the help of resources and protective factors or dysfunctional reintegration.

Overall, RRT has some plausible features, which can be applied to a range of types of life adversities, including spousal loss and aging. First, it is one of the few metatheories that includes a range of theoretical ideas from philosophy, physics, psychology, medicine, religiosity, and spirituality (Fletcher & Sarkar, 2013). Second, it offers a guideline for resilience research and identifies several areas that are worth exploring in future research. Third, as a response to the debate about whether resilience is a genetic trait or an adaptive behavior, this theory indicates that resilience is driven by personal motivational forces with support from ecological resources.

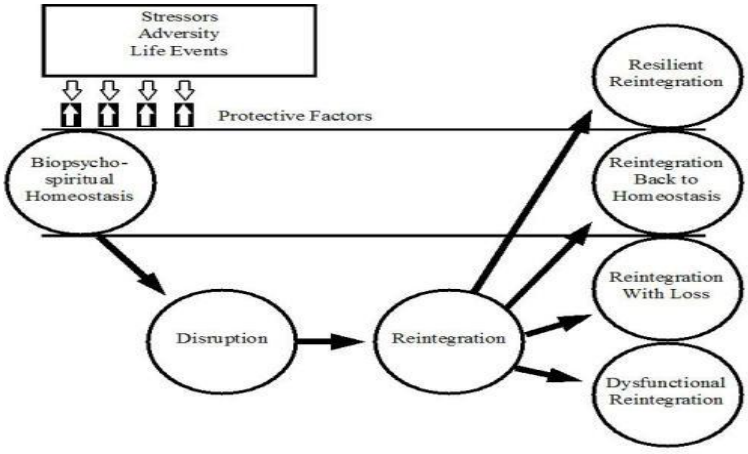

Figure 2.1 Resiliency Model. Reprinted from Richardson (2002**)**

2.1.4 The Social Ecological Model

The SEM has been used as a framework for explaining not only interactions between personal and environmental factors but also the influences of these interactions on human behaviors (Bronfenbrenner, 1977). A person's ecological environment is composed of a set of five systems, one inside another, with a dynamic that runs from the inner levels toward the outer.

1. the microsystem consists of a person's direct, immediate environment. It includes idiosyncratic factors like gender, age, education, income and the people who have direct social interactions with the person, including parents, friends, spouses, and so on
2. the mesosystem contains the relationships and interactions in the microsystems
3. the exosystem is a larger social system in which people do not have direct function, but are influenced by it. Such systems and people may include community, the workplace, prisons or other institutional spaces (like universities), and extended family members
4. the macrosystem is a collection of cultural level factors, including values, beliefs, practices, mores and laws. Sometimes, it also refers to race, religion, and socioeconomic status.
5. Lastly, the chronosystem refers to changes or consistencies over time across large socio-historical contexts, including various policies, war, or economic shifts that can exert influence on people across their lifespan (Bronfenbrenner, 1986; Bronfenbrenner & Evans, 2002).

The SEM is critical for resilience research in that it underscores the interrelationship between individuals, social systems, and the environment (Wister et al., 2016). In order to

illustrate resilience in late life, several models have been proposed using an ecological approach. For example, one study identified three nested levels of resources that contribute to older adults' resilience: (a) individual resources, including human capital like education, personality, income, etc., (b) contextual resources, which refers to the immediate social and built environment, such as community, around people, and (c) sociocultural resources, which include social policies and institutional structures (Aldwin & Igarashi, 2012). Likewise, another study identified three levels of risks (individual level risks, contextual level risks and stressful life event risks) that can prevent older adults from resilience (Jason, Carr, Washington, Hilliard, & Mingo, 2017). Another ecological model suggested six domains indicating that resilience in older adults occurs within overlapping and interrelated scales of household, family, neighborhood, and community resilience as well (Wild, Wiles, & Allen, 2013). Here, each domain contributes to the resilience of others, and these nested domains suggest that resilience in late life is influenced therefore by a complex set of pertinent factors within the system (Wild et al., 2013).

All these models of resilience in late life have underscored that resilience in old age is influenced by the interactions of multiple levels of factors. In fact, in some circumstances, resilience in older adults does not necessarily require individual level resources; external resources alone can effectively facilitate resilience (Bennett & Windle, 2015; Windle & Bennett, 2012)

2.1.5 Resilience to Loss in Later Life: A Combined Model

Although the current study engaged RRT as the fundamental theoretical framework, RRT has several implausible features which may limit its applicability for explaining adaptation to spousal loss in late adulthood. First, while RRT takes individual and environmental factors into consideration, it does not consider person-environment interaction or the sociocultural context in which potential interactions occur. Scholars (Ungar, 2008; Ungar & Liebenberg, 2011) argue

that resilience is less about a personal trait, but more about interactions between people and the quality of the environment and resources. This objection highlights an importance of culture and social context not adequately recognized in the existing studies. As such, researchers have increasingly suggested that resilience studies should shift from a focus solely on personal features towards a broader scope that examines the ecology through which people navigate (Clauss-Ehlers, 2008; Ungar, Ghazinour, & Richter, 2013; Waller, 2010). Second, although RRT considers the influence of protective factors prior to disruption, it does not adequately explain how protective factors influence the process of reintegration at each layer of social ecology, despite numerous studies identifying a wide range of factors (e.g. social support, confidence, religion, family environment, etc.) that can influence the process of reintegration (Afifi & MacMillan, 2011; Luthar, 2015; McClure, Chavez, Agars, Peacock, & Matosian, 2008; Sarkar & Fletcher, 2014; Steinhardt & Dolbier, 2008). Third, because the current study aims to explore resilience in light of the negative impact of spousal loss, the generality of RRT does not adequately account for the significance and particular consequences associated with grief and bereavement after spousal loss. In particular, while it identifies an arc from disruption, reintegration, and aftermath, it assumes that individuals would complete this process, which may not hold true to older adults. Lastly, although it is obvious that people at different developmental stages react differently to adversities, such as loss, the effect of life course is not considered in the SST. Life course may be of enormous significance for people in the last stages of life course. In order to addresses these explanatory gaps, the current study integrated RRT with SST, MRM and SET.

In general, these four theories capture different layers of resilience to spousal loss and serve different functions. SST provides a life span perspective addresses the interactions among

time, meaning, and aging. SST underscores how the sense of "running out of time" can influence personal decision making and selection of goals and actions. It also explains the intentions of prioritize meaningful social connections and interactions than others among older adults. MRM specifically explains the unique role of meaning making in the face of grief and bereavement and also underscores the fact that mourning is not only a process that addresses attachment to the deceased but also prompts a reconsideration of the meaning of the self as well. RRT serves three functions: (1) it lays out three areas (protective factors, reintegration processes, and internal sources) for future studies to explore; (2) it describes four potential pathways and outcomes from the reintegration process; and (3) acknowledges how protective factors can potentially buffer the impact of traumatic life events. Lastly, the SEM provides a framework for identifying protective factors in a logical way and illuminates the mechanism by which persons and their environments interact. Although all four theories are important for the development of the conceptual framework of this study, the present study only tested the resilient and resiliency model, which specifies individual adaptation trajectories and the protective factors on the individual level. Figure 2 presents the theoretical model of current study.

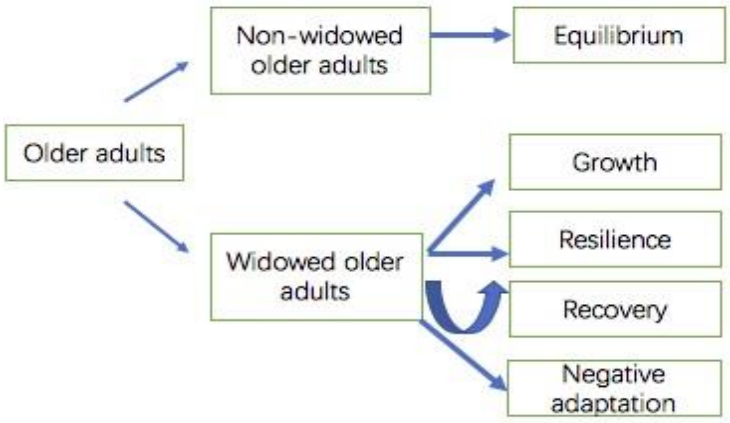

Figure 2.2 Theoretical model of current study

Informed by this new model, the current study responded to three major questions of adaptation to spousal loss within the context of aging. First, how does spousal loss influence the aging process among older adults? Second, how many and what are the different adaptation pathways among widowed older adults in the timeframe of eight years? Lastly, what are the individual characteristics of members in different adaptation trajectories?

2.2 Resilience and late-life spousal loss

2.2.1 Working Definition

Before reviewing the findings of empirical studies, it is important to clarify the definitions of different adaptation trajectories, including resilience, recovery and chronic high/low. In current adaptation literature, although it is clear that there are individual variations in adaptation trajectories, there are disagreements regarding how to define different adaptation trajectories. Many descriptions and conceptualizations of resilience and adaptation across disciplines prevail. Although several systematic reviews have compared differences of definition from both practical and theoretical perspectives, it is still highly recommended for researchers to provide clear definitions in their adaption studies (Aburn, Gott, & Hoare, 2016; Garcia-Dia, DiNapoli, Garcia-Ona, Jakubowski, & O'Flaherty, 2013; van Kessel, 2013; Windle, 2010; Wister et al., 2016).

In this study, the theoretical definition of resilience is adopted from a study by Ungar (2008), who viewed resilience from the social ecological perspective and highlighted the critical role of resources and ecological systems. The definition is presented below:

> In the context of exposure to significant adversity, whether psychological, environmental, or both, resilience is both the capacity of individuals to navigate their way to health-sustaining resources, including opportunities to experience feelings of well-being, and a

condition of the individual's family, community and culture to provide these health resources and experiences in culturally meaningful ways (p.225).

In terms of the operational definitions of adaptation trajectories, the central differences in existing literature involves whether resilience is an ability to "bounce back" after a disruption from adversity or an ability to avoid or resist changes in the first place. While many researchers support the notion of bouncing back (J. H. Lee et al., 2013; Moore & Stratton, 2003; Richardson, 2002; Smith et al., 2008; Sturgeon & Zautra, 2010), others argue that resilience is more than just recovery (bouncing back). These researchers demonstrated that a great number of individuals may not necessarily go through the process of recovery because they may not experience functional changes in the face of traumatic life events in the first place. Therefore, resilience should be the ability to resist changes and to maintain equilibrium (Bonanno et al., 2004).

The current study acknowledges that different definitions have been used in existing studies. Given that this study is informed by the debates between two schools of thoughts (discussed below), and both of them define resilience as *an ability to resist changes and maintain equilibrium,* the current study defined resilience as the ability to resist changes in the face of adversities. The definitions of other trajectories engaged the definitions in Bonanno's studies (Bonanno, 2004). Specifically, the "bouncing back" trajectory was defined as the *recovery trajectory*; the trajectories depicted consistent dysfunctions overtime were defined as chronic high/low trajectories. Appendix A provides the working definitions of all trajectories of this study.

2.2.2 Empirical Studies

The study of resilience began in the field of child development, where scholars attempted to explore individual, family, community resources, and developmental pathways for vulnerable

children and youth (Garmezy, 1976; Rutter, 1982; Werner, 1989). Since then, the term resilience has been widely used and described in the literature. In recent decades, rather than focusing on negative consequences, a growing body of research has focused on exploring resilience among adults along with the contextual, social and personal factors that prevent adults (and even older adults) from taking unfavorable pathways after adversity (Zimmerman, 2013).

More recently, the concept of resilient aging has specifically emerged and been adopted in an increasing number of studies. Some scholars argue that terms like successful, productive, or healthy aging might be upsetting for some older adults as these terms isolate older adults who are chronically ill or disabled from those who are well and healthy. Such terms also give a distorted impression that older adults are supposed to be healthy and productive, while in the real world, a majority of older adults often suffer from various types of illness or disadvantages (Bowling & Dieppe, 2005; Harris, 2008; Hicks & Conner, 2013). In contrast, resilient aging provides a more achievable goal for all older adults, including the frail elderly. The concept of resilient aging recognizes the continuing adversities that older adults are dealing with and the ability to bounce back or resist change to maintain equilibrium after stressful life events.

There is accumulating evidence that resilience has profound positive impact on older adults. A systematic review, defining resilience as the ability to bounce back, overviewed 55 empirical studies on resilience among older adults and highlighted several mental, social, and physical characteristics of high resilience older adults (MacLeod et al., 2016). Characteristics included adaptive coping styles, optimism and hopefulness, positive emotions, social support and community involvement, as well as independent activities and being physically active. This review also synthesized potential optimal outcomes of resilience, including higher quality of life, greater happiness, better mental health and wellbeing, successful aging, lower depression,

longevity, and reduced mortality risk (MacLeod et al., 2016). Additionally, other studies, defining resilience as a personality trait, found that resilience can facilitate better coping and adaptations among bereaved individuals, and specifically a resistance to and recovery from loss-related stress (Bonanno et al., 2002; Y. J. Lee et al., 2016; Ong et al., 2006; Rossi et al., 2007; Spahni et al., 2016).

However, debate continues around resilience, specifically around the questions do people naturally cope with adversity, thus making resilience common, and what is the nature of resilience? Each of these is addressed below.

Is resilience common? The debate regarding whether resilience is common has become especially prominent in recent years with the extensive use of advanced statistical models, such as Growth Mixture Model (GMM), in the field of social science. The debate is mainly between two schools of thought. One school, represented by Bonanno and Galatzer-Levy, demonstrated that resiliencies more common than typically believed. Researchers conducted studies regarding human adaptation and resilience across a range of contexts, including spousal loss, child loss, violence, natural disasters, war, divorce, unemployment and other life-threatening and traumatic events (Bonanno et al., 2010; Bonanno et al., 2005; Bonanno et al., 2002; Donoho et al., 2017; Galatzer-Levy et al., 2010; Mancini et al., 2011)—and found a high prevalence of resilience among participants facing potential traumatic events. For example, among bereaved spouses, resilient people represented 45.9%-58.7% of the population sampled (Bonanno et al., 2002; Mancini et al., 2011). Other findings were 71.8% among the divorced (Mancini et al., 2011), 68.3% among people who had experienced heart attack (Galatzer-Levy & Bonanno, 2014), 72.0% among people with post chronic pain (Zhu, Galatzer-Levy, & Bonanno, 2014), 73.7% among cancer patients (Burton, Galatzer-Levy, & Bonanno, 2015), 65.7% among people following

potential trauma (Galatzer-Levy, Huang, & Bonanno, 2018), and 72% among individuals who experienced job-loss (Galatzer-Levy et al., 2010; Stolove, Galatzer-Levy, & Bonanno, 2017). Researchers concluded that people are able to heal from most traumas and that resilience is the most common response following significant negative life events (Bonanno & Diminich, 2013).

Conversely, another school, represented by Infurna and Luthar, argues that resilience is not a "common place" and that it is wrong to make any definitive assertion about rates of resilience (Infurna & Luthar, 2016a, 2016b, 2018). These scholars sought to replicate two of the preceding studies—which examined the trajectories of life satisfaction before and after three traumatic life events: spousal loss, divorce, and unemployment (Galatzer-Levy et al., 2010; Mancini et al., 2011).—using the same dataset and analytical technique (GMM) from those studies but employing three different analytical strategies: one identical to the prior studies, and two others with different GMM practical analytical assumptions. This approach yielded two distinct findings: (1) that resilient trajectories were the most common when using the identical model and (2) *least* common when using the other two models (Infurna & Luthar, 2016b).

Infurna and Luthar (2018) reviewed 77 studies that have used GMM to examine adaptation (including resilience) to adversities among adults. This review has three major findings. First, it found that most studies employed similar approaches or assumptions in the analyses. For example, 86% of selected studies assumed homogeneity of variance across trajectories, and 68% estimated the slope variances to be zero across trajectories. Second, given that most studies used the same methodological assumptions, the findings could be significantly biased. Third, among the selected studies, 82% used only a single adjustment outcome, even as the conclusions were generalized to resilience in general. Therefore, this review highlights that the positive findings of past studies were relied highly on the authors' decisions on GMM

assumptions. The authors suggested that when using advanced models like GMM, researchers should follow reporting guidelines, including Guidelines for Reporting on Latent Trajectory Studies (GRoLTS)(van de Schoot, Sijbrandij, Winter, Depaoli, & Vermunt, 2017) and be parsimonious with interpretations and generalizations from their findings (Infurna & Luthar, 2016a, 2016b, 2017, 2018). While the debate between Galatzer-Levy and Bonanno (2016) and Infurna and Luthar (2016a) continues, it is clear that the declaration that resilience is common is questionable.

Additionally, given that adaptation (and resilience, as one trajectory of adaption) are multi-dimensional phenomenon, it is less rigorous to make generalizations solely based on only one or two proxies of adaptation. Multiple adjustment proxies of adaptation should be used simultaneously for analyses (Infurna & Luthar, 2018). Therefore, Infurna and Luthar (2017) used five proxies of adaptation together in their study (positive affect, negative affect, life satisfaction, perceptions of general health, and levels of physical functioning) to examine adaptation to late-life spousal loss. They found that participant rates for resilience were 66% on life satisfaction, 26% on positive affect, 29% on physical functioning, 37% on general health, and 32% on negative affect (Infurna & Luthar, 2017). These findings underscore that due to the multi-dimensionality of adaptation (and resilience, as one trajectory of adaption), trajectories of adaptation can vary substantially depending on the outcome variables. As such, this cautions researchers to not make generalizations about how most people are resilient by drawing only on optimistic findings from studies with one or two outcomes (Infurna & Luthar, 2017).

What is the nature of resilience? The second debate regarding the nature of resilience concerns whether it is an adaptive process that can be developed versus a personality trait regardless of social environmental influences. In the field of psychology, although aware of the

impact of external factors, a considerable amount of research has treated resilience as a personality trait, generally referred to as trait resilience or ego-resiliency, which allows people to respond and adapt to changing circumstances more quickly (Block & Kremen, 1996). As such, resilience is considered a protective factor against negative outcomes (Block & Block, 2006). A great number of studies have found a positive influence of trait resilience or ego resiliency on protecting individuals from negative outcomes across various developmental phases and life conditions (Duan, Guo, & Gan, 2015; T. Hu, Zhang, & Wang, 2015; Milioni, Alessandri, Eisenberg, Vecchione, & Caprara, 2015; Ong et al., 2006; Taylor, Doane, & Eisenberg, 2013).

Windle (2010), however, argues that resilience per se is a much broader phenomenon compared to ego-resiliency or trait resilience. Trait resilience is relatively stable across life span, while resilience changes under different circumstances. Likewise, ego-resiliency does not rely on risk or adversity because ego-resilience is part of the process of dealing with general, day-to-day change, while resilience per se is a response to traumatic life events and has to be triggered by adversities (Windle, 2010). Thus, scholars in fields such as social work, social services, or sociology emphasize the influences of social ecology and environmental factors, including resources, culture, policy, and social engagement, as well as cultivating and promoting individual resilience. They believe that resilience can be developed through person-environment interactions, e.g., by increasing access to supportive resources, involvement in social activities, and the like (Folke et al., 2010; Ungar, 2011; Ungar et al., 2013; van Kessel, 2013; Windle & Bennett, 2012).

Despite these debates, universal agreement across all social science fields obtains for the notion that resilience is multidimensional. In other words, resilience and adaptation are not unidimensional constructs, meaning that it is never an “across-the-board” phenomenon. The

numbers and patterns of adaptation trajectories can differ dramatically when looking at the adaptation from different perspectives. Statistically, this means that when engaging different outcomes, the findings can be distinct.

However, this acknowledgement of multi-dimensionality is often only at the conceptual level. There is a missing element of operational guidelines about how to measure this multi-dimensionality in research, especially in secondary data analysis studies. One strategy that can be used for implementing a multidimensional approach is to select multiple relevant domains and analyze them separately in one study (Infurna & Luthar, 2018). Therefore, in the current study, six different adaptation outcomes were employed to operationalize the multidimensional nature of adaptation. These six outcomes included two meaning-related outcomes (subjective age and life satisfaction) and four outcomes (depression, anxiety, negative affect and positive affect), which all have been studied in prior research. The primary purpose of including studied outcomes was to triangulate the findings from past studies. Additionally, the loss of a spouse may not only influence negative outcomes; it may also contribute to the changes in positive outcomes. However, there is a lack of literature that compared the impact of spousal loss on positive and negative outcomes. Therefore, the current study included three positive and three negative outcomes and compared the prevalence of resilience between positive and negative outcomes.

Meaning Making

Grief is a typical response to the loss of a loved one. Freud saw grief as the process of energy detachment from ties to the deceased (Freud, 1924). Bowlby conceptualized grief as a separation anxiety, the attempt to maintain proximity to the deceased (Bowlby, 1982). Regardless of the various descriptions of grief, there is a general agreement that grief is not

something to “get over.” Instead, the connections to the deceased are transformed and transcended to other forms over time. Mourning does not end but continues in other ways. It might take a lifetime to savor the meaning of loss, and the emotions associated with loss can be triggered throughout lives (Clewell, 2004). In other words, the fact of loss is unchanging, but the patterns of mourning, attachment, and emotions associated with the deceased change over time. The interpretations of loss will change as its meaning in life is developed and modified over time after the loss (Klass et al., 2014).

The experience of spousal loss disrupts life’s narratives and can shatter a person’s assumptive world view or the established beliefs that a person holds (Bauer, 2003; Gillies & Neimeyer, 2006; Janoff-Bulman, 1999). Thus, mourning is inherently a process of reconstructing meaning (Eckholdt et al., 2018; R. A. Neimeyer, 2016). A qualitative study interviewed five newly widowed Canadian women to understand their grief reactions (Lowe & McClement, 2010). One of the five the themes was “who am I?” The participants reflected that after the loss of their husband, they found that their relationships with friends, children, and themselves had changed. They struggled with finding their new roles or identifies.

One study examined the longitudinal patterns of anger and the effect of finding meaning using three-wave panel data (6, 18, and 48 months after spousal death) from the *Changing Lives of Older Couples* project. Meaning was measured by asking participants the question “have you made any sense or found any meaning in your (husband’s/wife’s) death?” A total of 101 older adults who had lost a spouse from chronic conditions and had data at all three time points were included in the study. The study found that finding meaning had a significant direct negative effect on the initial level of anger; participants who had found meaning reported a significantly lower level of anger at 6 months post-loss with a very slight decrease over 48 months. Finding

meaning also positively mediates the associations between social support and negative anger (Su Hyun, 2009).

Another study aiming to explore the role of death anxiety in grief, complicated grief, and trauma recruited 84 bereaved adults from the U.S. and Canada. Of the participants, 72.6% had lost a child, 9.5% had lost a spouse, and 17.9% had lost some other important person in life, such as a sibling or a close friend. Meaning was also measured by asking participants whether they found themselves finding some meaning in the death of the loved one. The study found that those who searched for meanings but were unable to find it had higher scores on grief and complicated grief than those who never searched for meanings or searched and found meanings. Additionally, every participant who had complicated grief reported the experience of not finding meanings (Tolstikova et al., 2005).

Despite past studies that highlighted the importance of finding meaning, the primary focus of existing studies tends to be on two issues: making sense of the death and finding some benefit in one's experience with the loss (Davis & Nolen-Hoeksema, 2001; Davis et al., 1998). Very little attention, in fact, has been given to what I call self-meaning: the finding of meaning for the self after a loss. Although self-meaning could be operationalized in different ways, the present research studied two proxies of meaning, subjective age and life satisfaction.

Subjective Age

Unlike chronological age, which reflects the objective count of years since birth, subjective age is an introspective reflection on a person's perceptions and interpretations of their own aging process across a life span (Diehl et al., 2014; Montepare, 2009). In general, regardless of age group, people's subjective ages rarely match their chronological ages (Kotter-Grühn, Kleinspehn-Ammerlahn, Gerstorf, & Smith, 2009). Adolescents and young adults tend to

perceive their age as older than their chronological age (Galambos, Kolaric, Sears, & Maggs, 1999; Galambos, Turner, & Tilton-Weaver, 2005), while middle-aged and older adults more often have younger perceived age than their actual age (Montepare, 2009; Westerhof & Barrett, 2005). One study of 1,470 participants aged between 20 and 97 examined how subjective age varied among age groups (Rubin & Berntsen, 2006). The findings suggest that on average, the cut-off age between feeling younger and older than chronological age is 25; that is, participants younger than 25 felt older, while those older than 25 felt younger. When the discrepancy between chronological and subjective age is considered, no increase was identified after 40 years old, and all age groups after 40 reported an average 20% younger than their actual age (Rubin & Berntsen, 2006). One possible reason for the younger subjective age is the fact that older adults attempt to protect themselves from negative aging stereotypes by making themselves feel younger, because the culture of modern society prize young age (Weiss & Lang, 2012).

Empirical research on subjective age indicates that satisfaction with one's own age and feeling young are indicators of positive well-being in the later life (Kotter-Grühn et al., 2009). Feeling younger is associated with lower major depressive episodes, better physical health, optimism, successful aging, material security, reduced mortality rate, higher probability of flourishing mental health, and better physical function (Ambrosi-Randić, Nekić, & Tucak Junaković, 2017; Demakakos, Gjonca, & Nazroo, 2007; Keyes & Westerhof, 2012; Kotter-Grühn et al., 2009; Uotinen, Rantanen, & Suutama, 2005). Subjective age also reflects a person's faith about the future (Uotinen et al., 2005). Older adults who perceived themselves younger were more likely to perceive their future as open-ended. In contrast, those who strongly associated with their chronological age were more likely to consider their future time as limited (Weiss & Lang, 2012). Conversely, feeling older is associated with negative well-being,

including being more passive about cognitive aging, lower life satisfaction, and lower cognitive function (Montepare, 2009; Markus H. Schafer & Tetyana P. Shippee, 2010; Y. Stephan, Caudroit, Jaconelli, & Terracciano, 2014).

Past studies have identified various mediators between older adults' well-being and subjective age. For example, higher subjective physical health and memory self-efficacy can mediate the associations between felt younger and higher life satisfaction in older adults (Yannick Stephan, Caudroit, & Chalabaev, 2011). Older subjective age is related to lower life satisfaction, while higher negative affect can be offset by positive aging attitude (Mock & Eibach, 2011). Few studies, however, have explicitly examined the influence of life event or stress on subjective age in older adults. One study used a nine-day, daily-diary survey to measure older adults' stressors, subjective ages, personal control, and affect among 43 older community dwellers (Bellingtier, Neupert, & Kotter-Grühn, 2017). It found that older adults high in major life-event stressors showed little change in their subjective age in response to daily stressors, but individuals without major life-event stressors felt considerably older when facing daily stressors (Bellingtier et al., 2017).This is to say that major life events can change older adults' perceptions of subjective age. However, this study did not specify the types of major life stress or to what extent the influence was.

Another study examined the associations between subjective age changes and stress at three levels (intimate social networks, social roles, and physical health) using a longitudinal data from 1,668 participants (Schafer & Shippee, 2010). It found that increased levels of stress within intimate social networks, such as spouses and children, and the incidence of chronic health problems associated with greater increases in subjective ages, but also that these relationships could be buffered by psychological resources. The study also found that changing family roles

does not associate with subjective age changes (Schafer & Shippee, 2010). However, the authors mentioned that although they recognized the influences of spousal loss, their data did not allow them to analyze the association between subjective age and spousal loss due to limited sample size. Therefore, they suggested future research to fill this gap by examining the association more closely.

Life Satisfaction

George (1981) defined life satisfaction as a cognitive comparison of actual life to the desired life. Although positive emotions, such as life satisfaction, are usually subjective, past studies found that such perceptions are highly related to the well-being of a person's loved one. For instance, as suggested in the socioemotional selectivity theory, closer social relationships are more valued by older adults than young adults. A meta-analysis confirmed this theory by synthesizing findings from 286 empirical studies on the association of social network and competence with subjective well-being in older adults (Pinquart & Sörensen, 2000). This meta-analysis found that family ties are particularly important components of life satisfaction in late adulthood. Likewise, a 35-year longitudinal study with 178 pairs of married couples found that spouses reported similar level of happiness and that longitudinal changes in happiness were also highly correlated (Hoppmann, Gerstorf, Willis, & Schaie, 2011). Another longitudinal study using 26 waves of nationally representative data of 2,973 couples in Germany analyzed the patterns of life satisfaction and found that the ratings of life satisfaction between couples were highly interdepend before and after unemployment (Luhmann, Weiss, Hosoya, & Eid, 2014). The similar ratings of life satisfaction between couples may due to the shared and interdependent life circumstances and resources. Therefore, when a spouse passed away, the surviving spouse

lost the interdependence and was forced to adjust to life by him/herself. Life satisfaction, in this case, becomes a significant indicator of meaning to one's life.

Empirical bereavement studies have predominantly found the positive role of meaning making (Bogensperger & Lueger-Schuster, 2014; Boyraz, Waits, & Horne, 2015; Coleman & Neimeyer, 2010; Holland, Currier, & Neimeyer, 2006; Lichtenthal, Currier, Neimeyer, & Keesee, 2010; Steger, 2013). Existing research suggested that a life framed by meaning is more satisfying than oriented by pleasure (Peterson, Park, & Seligman, 2005; Peterson, et al, 2007). This demonstration provides important evidence supporting the fact that life satisfaction in broader sense is about meaning in life and sense of control of life.

Meaning in life is often linked with psychological well-being, especially the eudaimonic aspect of well-being (Ryff & Singer, 2008). In general, the more meaning in life people reported, the greater well-being they experienced (Michael F. Steger, Oishi, & Kashdan, 2009). Many studies have identified the positive association between meaning in life and positive psychological well-being, including positive affect and life satisfaction (Michael F. Steger & Kashdan, 2007), quality of life, hope (Dogra, Basu, & Das, 2011), and happiness.

Highly stressful events can result in a loss of meaning for some people (Boyraz, Horne, & Sayger†, 2012; Holtslander & Duggleby, 2009), but also can contribute to the relocation of meaning in life, thereby further enhancing it (Joseph & Linley, 2005). Growing numbers of studies, especially in the field of positive psychology, have investigated the influence of meaning in life on personal growth or post-traumatic growth in various circumstances, including terrorist attacks, social role transitions, natural disasters, cancer, and amongst medical team members (Ben-Ari, Shlomo, & Findler, 2012; Dursun, Steger, Bentele, & Schulenberg, 2016; Elekes, 2017; Taubman-Ben-Ari & Weintroub, 2008; Yasien Esmael, Eshel, & Shimshon Rubin, 2017). To

better understand the process of evolving posttraumatic growth and its influence on well-being following traumatic life events, one study conducted an online survey with 350 undergraduate psychology students who were asked to select the *most* stressful event in the past two and half years. Results showed that most participants identified losing a loved one as the most stressful event. The path analyses showed that posttraumatic growth was independently and oppositely related to meaning in life and to life satisfactions. However, the direct association between posttraumatic growth and life satisfaction is weak, while the indirect pathway through meaning in life is strong. Therefore, the authors suggested that posttraumatic growth can influence well-being indirectly through an increased sense of meaning or purpose in life following trauma (Triplett, Tedeschi, Cann, Calhoun, & Reeve, 2012).

It has been widely recognized that how we live influences how we react to death (Goodman, 1981). Some frameworks suggest that meaning in life becomes even more important for people in late adulthood than for those at other developmental stages. For example, Wong (1986, 2000) demonstrated that meaning in life is an important source for successful aging as meaning in life not only offsets the fear of death, but also provides reasons for living under whatever circumstances. Butler (1963) suggests that older people are more afraid of meaninglessness than death. However, empirical studies investigating meaning in life were conducted with young adult samples; older adults, who are more often facing death and loss, are rarely examined. It might be because younger people are more vulnerable about finding meanings (as several studies have found) that older people tend to have higher levels of meaning in life than people of other age groups (Cotton Bronk, Hill, Lapsley, Talib, & Finch, 2009; Michael F. Steger et al., 2009) .

Another aspect of life satisfaction is the perceived control of life. Kegan (1982) suggested that meaning can be made through either the aspects of life over which people have control or which have control over people. Rooted in social learning theory, sense of control refers to a subjective belief about a person's ability to perform behaviors aimed at achieving expected outcomes (Abeles, 1991). It is a learned view of self and the environment (Lachman, Neupert, & Agrigoroaei, 2011; Rotter, 1966). Having a strong sense of control is associated with a considerable number of positive outcomes, such as life satisfaction (Helzer & Jayawickreme, 2015), physical and mental health (Bailis, Segall, Mahon, Chipperfield, & Dunn, 2001; Jang, Chiriboga, Kim, & Rhew, 2010; Manturuk, 2012; Roepke & Grant, 2011), resilience (Elliot, Turiano, Infurna, Lachman, & Chapman, 2018; Schetter & Dolbier, 2011), and low mortality (Infurna, Gerstorf, Ram, Schupp, & Wagner, 2011).

Frazier, Berman, and Steward (2001) proposed that the temporal model of control highlights how survivors of traumatic life events are facing three important questions: could I have prevented this? (Past control). Can I prevent this in the future? (Future control). What can I do about the situation now? (Current control). They reviewed theories and research on the relations between perceived control and PTSD and suggested that relations between different types of control and distress vary greatly. Future research should provide a specific context when examining a sense of control and be mindful of the aspect of control that might have particular influence on adaptation (Frazier et al., 2001). Later, the same researchers conducted an empirical study comparing perceived control and adjustment among women who had experienced two traumatic events—sexual assault (n=135) and bereavement (n=159)—and found that present control, which refers to the control over the recovery process, was associated with better adjustment for both types of event. In contrast, perceived past control of trauma was not

significant for adjustment, while future control associated only with better adjustment to sexual assault (Frazier, Steward, & Mortensen, 2004).

Although some studies suggest that aging is not associated with changes in perceived control (Infurna et al., 2011; Slagsvold & Sørensen, 2013) ,the general pattern in the literature is that a sense of control increases during childhood and young adulthood, maintains stably during middle age, and declines as people age (Abeles, 1991; Clark-Plaskie & Lachman, 1999; Specht, Egloff, & Schmukle, 2013; Vargas Lascano, Galambos, Krahn, & Lachman, 2015; Wolinsky, Wyrwich, Babu, Kroenke, & Tierney, 2003). One reason for such decline is due to decreases in physical and cognitive function and the increased occurrence of illness (Lachman, Agrigoroaei, & Rickenbach, 2015). Another apparent reason is the accumulating number of trauma experiences, such as losing loved ones, which can reinforce the feeling of a lack of control.

The above findings underline the importance of considering life satisfaction as critical indicator of subjective well-being among older adults. In the context of marriage, life satisfaction is usually interdependent, meaning that couples, as developmental unites, shared similar values and purposes of their lives. Once a spouse passed away, the surviving spouses may not only lose the meanings in life, but also lose some control of life. As such, spousal loss can contribute to the decline of life satisfaction. In recent literature, studies have taken an interpersonal perspective when examining the with-in and between-person variabilities in life satisfaction (Orth, Erol, Ledermann & Grob, 2018; Wortman & Lucas, 2016). However, few studies investigated the individualized longitudinal patterns of life satisfaction in the context of late-life spousal loss.

Depression and Anxiety

Depressive symptoms often accompany bereavement. Ample studies examined the association between spousal loss and depression. For example, a resent systematic review and

meta-analysis aimed to examine the association between the prevalence of depression and time since spousal loss in widowed people (Kristiansen, Kjær, Hjorth, Andersen, & Prina, 2019). Using search terms regarding widowhood and common mental disorders, this review identified 8,614 peer reviewed studies published before May 2017 for title and abstract screening, and with 483 studies were left for full-text review. This study found that the prevalence of depression was 38% at less than one month, 25% between 1 month and 3 months, 23% between 3 and 6 months, 19% between 6 and 12 months, 11% between 12 and 18 months, 15% between 18 and 24 months, and 11% between 24 and 60 months after loss (Kristiansen, Kjær, Hjorth, Andersen, & Prina, 2019). In addition to the studies on the prevalence of depression among widowed individuals, many investigations have also been conducted to examine the trajectories of depression among bereaved individuals.

One systematic review identified studies published in 1994 and 2012 to synthesize distinct depressive-symptom trajectories for bereaved family members of chronically ill patients (Kuo, Sun, and Tang, 2017). This study identified six studies and synthesized five distinct depression trajectories including endurance, resilience, transient reaction, chronic grief, and chronic depression trajectories. Of these five trajectories, the most common one was the "endurance" trajectory, in which members reported depressive symptoms lower than the cut-off score, and the score remained constant over the studies. Another trajectory was the resilient trajectory, which was considered as "rapidly recovering from depression". In the present study, the endurance trajectory is defined as the resilient trajectory, and the resilient trajectory is defined as the recovery trajectory. As such, this systematic review found that resilient trajectory (54%), rather than the recovery trajectory (8.8%), was the most common trajectory of depression for bereaved family members. This finding was in line with the findings of a later study of

depression trajectories following spousal and child loss (Maccallum, Galatzer-Levy, & Bonanno, 2015). This study consisted of 2,512 bereaved individuals, and identified four trajectories, of which 68% participants were fell into the resilient trajectory. Therefore, although studies named trajectories differently, the trajectory that remains constant over time and lower than the cut-off score of depression is the most common trajectory.

The association between spousal loss and anxiety has been examined extensively. For example, a recent meta-analysis identified 42 studies to examine the prevalence of depression and anxiety in widowhood (Kristiansen, Kjaer, Hjorth, Andersen, & Prina, 2019). Of these 42 studies, five studies examined the prevalence of anxiety in widowhood. This meta-analysis found that the prevalence of anxiety reported in the identified studies ranged from 5.3% to 60.1%. A pooled prevalence of 26.9% of anxiety disorders were finally synthesized in the study. This finding is much higher than the estimates from other two meta-analysis with the general population. One meta-analysis of 155 studies estimated the global prevalence of 6.7% of anxiety disorder in adults aged between 18 and 65 (Steel et al, 2014). It is comparable to the other meta-analysis that also estimated the global prevalence of 7.3% of anxiety in the general population (Baxter, Scott, Vos, & Whiteford, 2013). The discrepancies in the findings suggest that widowed individuals have increased risks of developing anxiety disorders.

Despite that many studies have investigated the association between bereavement and anxiety, and the prevalence of anxiety after spousal loss, surprisingly few studies described the trajectories of anxiety after spousal loss. It might because bereavement studies tended to measure grief directly using grief inventory, in which anxiety is often treated as a subset or symptom of grief (Bonanno, Moskowitz, Papa, & Folkman, 2005; Bonanno et al, 2002). However, trajectories of anxiety were identified in participants following other life events or in older adults.

One study tracked 423 older community dwellers over six years, and identified two trajectories of anxiety: an elevated anxiety symptom trajectory and a stable trajectory (Holmes et al, 2018). This study found that 81.8% of older adults fell into the stable trajectory, which is defined as the resilience trajectory in the present study. This finding is comparable to another study that examined the anxiety trajectories among patients of spinal cord injury (Bonanno et al, 2012). This study followed 233 participants for two years and identified three anxiety trajectories: delayed, improvement, and stable low. Most of the participants (58%) were in the trajectory of stable low, which is defined as resilient trajectory in the present study. However, the findings of studies are not always consistent. A longitudinal study described trajectories of anxiety among 378 older adults with late-life depression and identified three trajectories: moderate (33.5%), low (57.9%), and severe (8.6%) anxiety groups (Spinhoven, Veen, Voshaar, & Comijs, 2017). In these three trajectories, the most common one is the low group, which was described as experienced significantly decreased anxiety over time. In the present study, the low group is defined as the recovery group, while the moderate group, which was described as having moderate level of anxiety and no significant change over time, is defined as resilient trajectory in the present study. Therefore, this study suggested that the recovery trajectory was the most common trajectory among older adults with late-life depression (Spinhoven, Veen, Voshaar, & Comijs, 2017).

The above findings suggest that both depression and anxiety have high prevalence among individuals who lose a spouse. While the findings on the trajectories of depression consistently show that the resilient trajectory is the most common pathway, the findings on anxiety were not concurrent. Given to different life events and circumstances, the number and the membership of anxiety trajectories varied. Additionally, due to the lack of evidence on widowed older adults,

future studies are encouraged to further investigate the trajectories of anxiety following late-life spousal loss.

Positive and Negative Affect

In stressful situations, positive and negative emotions can coexist and are inversely correlated. Additionally, negative emotions may be experienced more frequently than positive emotions (Lewandowski & Radice, 2012). It may be because older adults are more vulnerable to adversities due to the decreased positive attitude toward their own aging and increased daily fluctuations in awareness of age-related changes (Neupert, & Bellingtier, 2017). The post-traumatic growth model stresses that positive affect may both promote positive changes among individuals who have experienced a major life crisis, and reduce negative emotions (Tedeschi & Calhoun, 1995, 1996). An important implication of this theory is that it is possible that positive adaptation and resilient can be fostered by promoting positive emotions.

Supporting this implication, multiple empirical studies found positive associations between positive affect and positive experiences after stressful life events. One study of 380 bereaved individuals aimed to find the mediating role of reflection on the relationships between searching for meaning, positive and negative affect, and positive meaning findings (Boyraz, Horne, & Thomas, 2010). This study found that participants who endorsed positive affect reported higher level of self-reflection, which directly predicted positive meaning finding. Conversely, negative affect had both direct and indirect effects on positive meaning-findings through negative self-reflection among widowed individuals. As such, it is safe to infer that higher level of positive affect promote meaning findings among widowed individuals, and thereby, promote positive adaptations to widowhood.

Additionally, studies that introduced positive affect as an intervention also found favorable results in promoting adaptation to stressful life events. One study explored the influence of positive affect on successful and unsuccessful adaptation to perceived work stress, and found that after controlling for demographic characteristics and work stress, positive affect was positively associated with resilience and negatively associated with burnout; further, positive affect can completely mediate the association between works stress and resilience, meaning that participants with higher level of positive affect were more resilient to work stress (Gloria, Faulk, & Steinhardt, 2013).

Moreover, a longitudinal study of 1,558 older Hispanic adults found that participants who reported increasing positive affect can significantly reduce the risk of being classified as frail based on their physical functions over seven years. In other words, as the positive affect increased, the risk of frailty decreased (Ostir, Ottenbacher, & Markides, 2004). Positive affect was also found to be associated with better adaptation to other stressful life events, such as body pain (Sturgeon, & Zautra, 2010, 2013), parenting (Ekas, & Whitman, 2011), and violence (Grych, Hamby, & Banyard, 2015).

Despite findings from studies that examined the influences of positive and negative affect are relatively comparable, the limited findings of the trajectories of positive and negative affect are inconsistent. Infurna and Luthar (2017) identified three trajectories for negative affect and two trajectories for positive affect in widowed older adults over five years post loss. Among the three trajectories of negative affect, 19% of participants were belonged to the resilient trajectory, 49% belonged to the recovery trajectory, and 32% belonged to the chronic high trajectory. Among the two trajectories of positive affect, 26% of participants belonged to the resilient

trajectory, and 74% belonged to the recovery trajectory. Therefore, Infurna and Luthar (2017) demonstrated that resilient trajectory was not the most common trajectory.

This finding is partially supported by a study using data from186 colorectal cancer patients of three time points (1 month, 7 months, and 18 months after diagnosis) (Ciere et al, 2017). This study identified two trajectories for negative affect, and with 36% of the participants belonging to the resilient trajectory. However, four trajectories of positive affect were identified, and 68% of the participants belonged to the resilient group. Thus, this study suggested that resilient trajectory was the most common trajectory only for positive affect. To respond to the call for the exploration of adaptation trajectories in different stressful social contexts, a sample of 160 patients with severely physical injury were recruited to a longitudinal study for the examination of their adaptation trajectories (Quale & Schanke, 2010). These participants were classified into three trajectories: Those who reported low psychological distress, including PTSD, depression, anxiety, and negative affect, and high positive affected were considered as resilient; those who showed improvement on at least one symptom of distress were classified as recovery trajectory; and those who presented high distress, high negative affect, or low positive affect were operationalized as distress trajectory. The study found that 54% of the participants were resilient, followed by the recovery trajectory (25%) and the distress trajectory (21%) (Quale, & Schanke, 2010). Thus, this finding is the opposite of Luthar and Infurna's study.

The above investigations suggest that the number of trajectories and the prevalence of resilience are distinct given to different social contexts and life events. Resilience can be the most common response to some stressful events, but the least common for others. It would be arbitrary to declare that resilience is the most common across the board. Additionally, it is worth noting that the analytical methods in existing literature are diverse, which may contribute to the

disparities of the findings in the study. While the studies in early years tented to use MANOVA or linear regression (Quale, & Schanke, 2010), increasing studies in recent years engaged more advanced statistical methods, which are often person-centered approaches, such as Latent Class Growth Model (Ciere et al, 2017), or Growth Mixture Model (Infurna & Luthar, 2017). Growth Mixture Model (GMM) is a person-centered statistical approach that allows differences across unobserved subgroups (Jung & Wickrama, 2007; Liu & Hancock, 2014). However, due to the lack of empirical studies examining positive and negative affect in the context of late-life spousal loss, further analyses using person-centered approaches are in demand.

2.3 Research Gaps

First, while resilience continues to exhibit growing research attention, debates about its nature or function continue. With still no clear answers to questions about whether resilience is common or not, the present study sheds light on the debate by examining prototypical adaptation trajectories and specifies the prevalence of resilience in the context of spousal loss in late adulthood.

Second, although meaning making is widely recognized as a central task of the grief experience, the majority of theories did not adequately acknowledge the importance of self-meaning from the standpoint of the widowed. Even less has been learned about longitudinal patterns of self-meaning among the widowed. Therefore, the present study examined whether self-meanings also changed over time and what the prototypical patterns of self-meaning are.

Third, while many studies acknowledge the multi-dimensional nature of adaptation and/r resilience specifically, they did not operationalize this multi-dimensionality in practice. The majority of the studies only examined one or two dimensions, such as depression, positive and negative affect (Bonanno et al., 2002; Luthar, 2015). Given the call for future studies to explore

more dimensions of resilience, especially in the context of spousal loss (Infurna & Luthar, 2017), the proposed study explored six dimensions of adaptation to extend the literature.

Fourth, although many studies have examined the impact of spousal loss on the well-being of older adults, past studies predominantly used cross-sectional design. Few studies depicted the trajectories of aging or examined how spousal loss may influence the trajectory of aging. Therefore, this study takes advantage of available nationally representative longitudinal data (National Health & Aging Trends Study) to investigate the longitudinal patterns of aging and to estimate the impact of spousal loss on the longitudinal trajectories of aging.

Lastly, while an increasing number of studies have investigated adaptive trajectories, there remains a lack of evidence around the trajectories of adaptation to spousal loss among older adults. To my knowledge, the longest study is that conducted by Luthar and Infurna (2017), which tracked widowed individuals for five years post-loss. The present study extends that timeframe and depicts the trajectories for up to eight years.

2.4 Research Questions and Hypotheses

In order to address the gaps outlined above, the proposed study will answer five research questions. The first two research questions respond to gap 3, and the second last three questions address gaps 1,2, 4 and 5. Table 1 summarizes each research question and their hypotheses.

Table 2.1

Summary of Research Questions and Hypotheses

Research questions	Hypotheses
1. What are the average changes in the means of six dimensions (life satisfaction, subjective age, depression, anxiety, positive and negative affect) respectively over eight waves among older adults in non-widowed and widowed groups?	(H1) Compared to the non-widowed group, widowed group will report higher levels of depression, anxiety, negative affect, and subjective age, and lower levels of life satisfaction, and positive affect.
2. Do heterogeneous adaptation trajectories exist? Does spousal loss affect the memberships of different adaptation trajectories on six dimensions among older adults?	(H2) Older adults who experienced spousal loss will be more likely to belong to unfavorable adaptation trajectories than their non-widowed counterparts.
3. Do different adaption trajectories emerge on six dimensions among widowed older adults?	(H3) More than one trajectory will emerge in every studied dimension.
4. Is the resilience trajectory (the trajectory that maintains function overtime) the most common on six dimensions among widowed older adults?	(H4) Resilient trajectory will not be the most common trajectory on every dimension (life satisfaction, subjective age, depression, anxiety, positive and negative affect).
5. What characteristics predict the membership of resilient trajectory among widowed older adults?	(H5) Older ethnic minority women with lower education will be less like to be resilient.

CHAPTER 3: METHODS

This chapter describes the methodology of the study in the following subsections: data, participants, measures, data preparation, missing data, and data analysis strategies.

3.1 Data

This study used secondary data from Waves 1-8 of the National Health & Aging Trends Study (NHATS). The NHATS is a nationally representative study of Medicare beneficiaries aged 65 and older living in the contiguous United States. The NHATS is sponsored by the National Institute on Aging (NIA) (grant number NIA U01AG032947) and led by the Johns Hopkins University Bloomberg School of Public Health. The initial sample was first interviewed in 2011(wave 1). Annual re-interviews are conducted to document changes over time. In order to maintain its representativeness of the older Medicare population, a replenishment of the sample was undertaken in 2015 (wave 5). For more information about this dataset, please see: https://www.nhats.org/

The NHATS engaged a stratified three-stage sample design using the Medicare enrollment database as the sampling frame. In 2011 (wave 1), a total of 14,643 beneficiaries were sampled. The final sample size in wave 1 is 8,245. In order to achieve sufficient numbers of participants to track trends by age and ethnicity, in 2015 (wave 5), NHATS replenished the dataset by adding new samples. After sample replenishment, the total sample size in wave 5 was n=8,334. For more details on NHATS Round 1 sample design and selection see Montaquila, Freedman, Edwards, and Kasper (2012).

The NHATS is a prospective cohort study, and is one of the few datasets that provides new, in-depth information on end-of-life experiences and late-life functioning. This dataset has

both publicly available and sensitive data files. The sensitive data includes information, such as geographic data, and data linked to NHATS sample persons, such as Medicare information. The sensitive data is only available to researchers who fulfill the additional requirements and maintain a contractual agreement with the NHATS Data Confidentiality Committee. The current study was based on both publicly available and sensitive data, and was approved by the Internal Review Board (IRB #19810) at University of Illinois at Urbana-Champaign. The request for access to sensitive data was approved by the NHATS Committee in December, 2017.

3.2 Sample

This study included two sample groups: (a) Widowed group: Participants were assigned to the widowed group if they were initially married, and experienced spousal loss during the study. There were 570 participants who met these criteria. (b) Non-widowed group: Participants who did not experience spousal loss throughout the study were considered potential participants for the non-widowed group. A total of 3,193 participants met these criteria. Participants who could not respond to the questions by themselves for reasons such as lower cognitive function, or severe diseases, or unable to hear or speak, were excluded from the study. To reduce selection bias, Propensity Score Matching (PSM) was conducted to select non-widowed participants who matched seven characteristics of participants in the widowed group at baseline. The procedure of PSM was described in the data analysis section.

Table 3.1 shows the descriptive characteristics of the full sample and the widowed sample at baselines (W1 for the initial sample, and W5 for newly added replenishment sample). Among the initial sample (n=8,245) at wave1, the average age was 78.4 (*SD* = 7.0, range 66 to 102), 59.7% were female, 68.6% were White, and the majority (27.5%) had completed a high school education. Among the newly added sample (n=4,182) at W5, the average age is 76.82 (*SD*

= 8.2, range 65 to 107), 57.8% were female, 65.14% were White, and the majority (27.7%) completed a high school education. Among widowed sample (n=570), the average age was 81.8 (*SD* = 6.8, range 66 to 102), 58.25% were female, 80% were non-Hispanic white, and the majority (28.67%) completed at least some college education.

Table 3.1

Descriptive of Full Sample and Widowed Sample at Baselines (w1/w5), NHATS Data

	Full Sample at W1 (n=8,245)				**Replenishment Sample at W5 (n=4,182)**				**Widowed Sample (n=570)**			
Variables	n (%)	M (SD)	Range	Missing n (%)	n (%)	M (SD)	Range	Missing n (%)	n (%)	M (SD)	Range	Missing n (%)
Age, M(SD)		78.37 (8.19)	65-106	0		76.82 (8.22)	65-107	0		81.83 (6.76)	66-102	0
Gender				0				0				0
Male	3,320 (40.27%)				1,767 (42.25%)				238 (41.75%)			
Female	4,925 (59.73%)				2,415 (57.75%)				332 (58.25%)			
Race				0				0				0
Non-Hispanic White	5,655 (68.59%)				2,724 (65.14)				456 (80.00%)			
African American	1,794 (21.76%)				866 (20.71%)				72 (12.63%)			
Others	796 (9.65%)				592 (14.16%)				42 (7.37%)			
Education				732 (8.88%)				390 (9.33%)				2 (0.5%)
< high school	2,047 (27.25%)				798 (21.04)				112 (19.82 %)			
High school	2,069 (27.54%)				1,050 (27.69%)				151 (26.73%)			
Some college	1,818 (24.20%)				1,037 (27.35%)				162 (28.67 %)			
College+	1,579 (21.02%)				907 (23.92%)				140 (24.78 %)			

3.3 Measures

3.3.1 Dependent Variables (DV)

Given that adaptation is a multi-dimensional concept, this study operationalized this multi-dimensional nature by using six proxies: life satisfaction, subjective age, depression, anxiety, positive, and negative affect,

Life satisfaction The NHATS adopted seven items from the *Midlife in the U.S.A. Study of National Health and Wellbeing (MIDUS).* These items ask participants agreement with statements about life: *Tell me whether you agree a lot, agree a little, or not at all with the following statements*: *(a) "My life has meaning and purpose." (b) "I feel confident and good about myself." (c) "I gave up trying to improve my life a long time ago." (d) "I like my living situation very much." (e) "Other people determine most of what I can and cannot do." (f) "When I really want to do something, I usually find a way to do it." (g) "I have an easy time adjusting to change."* The items of negative wordings (item c and item e) were recoded with higher score indicating higher level of agreement. The scoring method for these items was: 3=agree a lot, 2=agree a little, 1=agree not at all. According to the latest NHATS user guide (Kasper & Freedman, 2019), the first four items were used to measure self-realization, and the last three items were used to measure self-efficacy and resilience. However, although these variables were appeared in the MIDUS, most of these items were used separately in different scales. For example, item (b) was used in a seven-item self-acceptance scale; item (c) was used in a seven-item personal growth scale; item (e) was used in an eight-item sense of control scale; and item (f) was used in a four-item personal mastery scale. The NHATS does not provide evidence that supports the use of these items together as a composite rating scale. Therefore, I

conducted Factory Analysis (FA) to explore the number of items that should be used in the current study.

FA was accomplished in two major steps: factor extraction and factor rotation. Factor extraction involved exploring and reducing the number of factors to extract, while factor rotation, which performed after factor extraction, helped to simplify the structure for the improvement of interpretability. The current study engaged Principal Component Analysis (PCA) approach for factor extraction with varimax rotation. An exploratory PCA was performed on the seven items without rotation to determine the number of components, and then another PCA with varimax rotation was conducted to decide the structure of the scales. To determine which items represented the constructs denoted by unique factors, the Kaiser rule of an eigenvalue greater than one (Kaiser, 1960) and a factor-loading criterion greater than 0.32 (Tabachnick & Fidell, 2007) were engaged. The Kaiser-Meyer-Olkin (KMO) test was conducted to assess the sample adequacy. KMO values that were greater than 0.6 indicated good sample adequacy (Cerny & Kaiser, 1977). Internal consistency and reliability were computed by calculating the Cronbach alpha coefficient. This analysis was designed as a cross-sectional investigation. The FA was accomplished using data from Wave 1 of NHATS. After excluding missing values in the seven items, the final sample size was 6,787. All the analysis was conducted in STATA 15.1 SE version (Stata Corp, TX)..

Table 3.2 displays the Eigenvalues, proportions and cumulative proportion from the first PCA model. Graph 1 provides a visual inspection of the scree plot. The CFA model before applying rotation suggested 2 components (Eigenvalue >1): the first component explained 33% of the variance, and the second component explained 16% of the variance; the two components together explained a total of 48% of variance.

Table 3.2
Principal Component Analysis: Eigenvalue, proportion, and cumulative proportion of each component

Component	Eigenvalue	Proportion	Cumulative Proportion
1	2.29	0.33	0.33
2	1.09	0.16	0.48
3	0.89	0.13	0.61
4	0.81	0.11	0.73
5	0.73	0.1	0.83
6	0.69	0.1	0.93
7	0.51	0.07	1

Table 3.3 displays the factor loadings of each item after applying varimax rotation and KMO. The results of this PCA model showed that each item loaded on a single factor without any cross loadings, and that all the items were greater than 0.32. Additionally, all the items were greater than 0.6 KMO values, which indicated the proportions of variance in these items were more likely due to underlying factors rather than limited sample size.

Table 3.3
Principal Component Analysis with Varimax Rotation: Scale Items, factor loading, and Kaiser-Meyer-Olkin (KMO).

Items	Factors		KMO
	1	2	
My life has meaning and purpose.	**0.47**	0.09	0.71
I feel confident and good about myself.	**0.52**	0.03	0.71
I gave up trying to improve my life a long time ago.	0.01	**0.68**	0.71
I like my living situation very much.	**0.48**	-0.08	0.81
Other people determine most of what I can and cannot do.	-0.01	**0.69**	0.71
When I really want to do something, I usually find a way to do it.	**0.33**	0.14	0.80
I have an easy time adjusting to change.	**0.41**	-0.16	0.80

As seen in Table 3.4, Cronbach's Alpha Coefficients for these two factors yielded values of 0.61 and 0.45 respectively. Although did not show excellent reliability, the first factor showed acceptable reliability while the second factor had unacceptable reliability (Griethuijsen et al,

2015). The low reliability might due to the negative-wording of these two items. Allen (2017) suggested that negative-wording items may result in multiple problems with reliability and validity when applied to children and older adults. Therefore, the current study only used items that fell into the first factor, and named this factor *life satisfaction*.

Table 3.4
Cronbach's Alpha Coefficient by factors

Factor	Cronbach's Alpha Coefficient
1 (5 items)	0.61
2 (2 items)	0.45

Subjective age was measured by asking participants the question: "Sometimes people feel older or younger than their age. During the last month, what age did you feel most of the time?" Subjective age was a continuous variable ranging from 18 to 110. In the current study, the gap between chronological age and subjective age (chronological age minus subjective age) was used as a proxy of adaptation. Feeling younger was a sign of better adaptation.

Depression and anxiety were assessed by using the Patient Health Questionnair-2 (PHQ-2) (Löwe, Kroenke, & Gräfe, 2005) and the Generalized Anxiety Disorder-2 (GAD-2) (Kroenke, Spitzer, Williams, Monahan, & Löwe, 2007), which were brief screening instruments for depression and anxiety respectively. The questions are "over the last month, how often have you…" . *PHQ-2* items are "had little interest or pleasure in doing things" and "felt down, depressed, or hopeless" *GAD-2* items are "felt nervous, anxious, or on edge" and "been unable to stop or control worrying." Answers ranged from 0 (not at all) to 3 (nearly every day). Scores were calculated for each measurement separately. The scores of *PHQ-2 and GAD-2* ranged from 0-6. A PHQ-2 score of 3 was suggested as the optimal cutoff score for screening purposes (Löwe,

Kroenke, & Gräfe, 2005). Likewise, a GAD-2 score of 3 was the suggested optimal cut off point for screening purposes (Kroenke, Spitzer, Williams, Monahan, & Löwe, 2007).

Positive and negative affect were assessed by asking participants frequencies of feelings in the past month: *During the last month, how often did you feel: (a) cheerful (b) bored (c) full of life (d) upset.* Answers were reversely coded ranging between 5 (every day) and 1(never). Items *(a)* and *(c)* were summed to create a 10-point scale for positive affect with higher scores indicating higher *positive affect*. Item *(b)* and *(d)* were summed to create another 10-point scale for negative affect with higher scores indicating higher levels of *negative affect*.

3.3.2 Matching variables for propensity score matching

Self-rated physical health was measured by a single item scale. Participants were asked to rate their health: "Would you say that in general your health is excellent, very good, good, fair, or poor?" This variable was recoded as 3= "excellent/very good", 2= "good", and 1= "fair/poor".

Number of onset chronic diseases. All NHATS participants were asked whether they had ever been diagnosed with 10 major chronic diseases, including heart attack, heart disease, high blood pressure, arthritis, osteoporosis, diabetes, lung disease, stroke, dementia, or cancer. The wording of the specific questions was: "Has a doctor told you that you had [name of the specific disease]?" Each chronic disease was a dichotomous variable with 1=yes, and 0=no. These 10 variables were aggregated as one composite variable indicating the number of diagnosed chronic diseases. The range of this variable was from 0 to 10.

Mobility was indicated by frequency of leaving one's home. All participants were asked: "In the last month, how often did you leave your home/building to go outside?" Based on the distribution of this variable, it was recoded as 1="every day/7 days a week", 0= "less than once a day".

Demographic variables were also included: **Chronological age** was a continuous variable ranging between 68 and 108. **Gender** was a dichotomous variable with a value of 0 indicating female and 1 indicating male. **Race/ethnicity** was recoded as a categorical variable including three racial/ethnical groups: White, Black, and Others, which included American Indian, Alaska native, Asian, native Hawaiian, Pacific Islander, and other specified racial groups. **Education** was recoded as a categorical with four education levels: Less than high school, high school, some college, and college degree or above.

3.4 Data Preparation

3.4.1 Data restructure

Because current study aimed to track newly widowed older adults for up to seven years, current wave arrangement of the NHATS cannot meet this need. Therefore, the entire dataset was rearranged. Specifically, for participants in the widowed group, new wave 1 was the year before spousal loss; new wave 2 was the year of spousal loss; new wave 3 was one year after loss, etc. For participants in the non-widowed group and joined the NHATS at its initial wave, their new wave arrangement remained the same as the NHATS's. For participants who were replenished in wave 5 of the NHATS, their new wave 1 was the wave 5 of NHATS, new wave 2 was the wave 6 of NHATS, etc. The new structured dataset only included participants of the two groups of interests with repeated measures for eight waves. The total sample size was 4,636, including 570 participants of widowed group (12.3%), and 4,066 participants of non-widowed group (87.7%). The characteristics of the participants of the new wave 1 (baseline) were displayed in Table 3.5.

Table 3.5
Descriptive of participants of non-widowed and widowed groups in new wave 1 (N=7,829)

	Non-widowed group N (%)	Widowed group N (%)
Age (mean,sd)	76.23 (7.62)	81.20 (7.00)
Gender		
Male	3,672 (50.59)	238 (41.75)
Female	3,587(49.41)	332 (58.25)
Race		
White	4,996 (68.82)	456 (80)
Black	1,348 (18.57)	72 (12.63)
Other	915 (12.61)	42 (7.37)
Education		
< high school	1,443 (21.11)	112 (19.82)
High school	1,841 (26,93)	151 (26,73)
Some college	1,782 (26.07)	162 (28.67)
College or above	1,770 (25.89)	140 (24.78)
Mobility		
Everyday	4,783 (68.1)	358 (63.36)
< once/day	2,241 (31.9)	207 (36.64)
Physical health		
Excellent	3,004 (42.79)	202 (35.82)
Good	2,211 (31.49)	205 (36.35)
Poor/fair	1,806 (25.72)	157 (27.84)
Number of chronic illness (mean,sd)	2.47 (1.57)	2.41 (1.38)
N	7,259 (92.72)	570 (7.28)

3.4.2 Missing data

Different patterns of missing data, e.g., missing completely at random (MCAR), missing at random (MAR), or miss not at random (MNAR), require different approaches for addressing missingness. Therefore, I first tested the patterns of missing data using Little's Missing Completely at Random (MCAR) test. The MCAR tests were conducted with all the dependent variables and independent variables in wave 1. MCAR test examined whether significant differences existed between the means of different missing patterns (Li, 2013). According to

Little (1988), if the *p* value of the MCAR test is greater than 0.05, it fails to reject the null hypothesis that the data is MCAR; in other words, the pattern of missing data is MCAR (Little, 1988). This analysis was conducted using STATA SE 15.1 with the command *mcartest*, which implemented the χ_2 test of MCAR for multivariate quantitative data. The results of the MCAR tests suggested that the pattern of missing was MCAR at wave 1.

After clarifying the pattern of missing data, the next step was to decide appropriate approaches to deal with missing data in the PSM and GMM. A recent simulation study compared different methods of handling missing data (complete cases analysis, the missingness pattern approach, and multiple imputation) in the context of propensity score analysis, and suggested that when the missingness pattern was MCAR, and there were no unmeasured confounding variables, complete cases could yield a valid estimate in the context of PSM (Choi, Dekkers & le Cessie, 2019). Therefore, for PSM, I only included participants who did not have missing values on the matching variables.

Full information maximum likelihood (FIML) was implemented in the Growth Mixture Model (GMM) to deal with missing data with the assumption that missing data were unrelated to outcome variables. Past simulation studies found that FIML estimates were less biased compared to other approaches such as multiple imputation in the context of Structural Equation Modeling (SEM), SEM with latent factors, and with small samples (Cham, Reshetnyak, Rosenfeld & Breitbart, 2017; vo Hippel, 2016; Graham, 2009)

3.5 Data Analyses

Table 3.6 provides a general overview of research questions, hypotheses, and analytic strategies. Data analyses were implemented in three major analysis methods: propensity score matching (PSM), GMM, and bivariate analysis. PSM and bivariate analysis were conducted

using STATA 15.1 SE version (Stata Corp, TX). GMM were conducted using Mplus Version 7.4. Detailed analytic strategies are described below:

Table 3.6
Summary of Research Questions, Hypotheses, and Analytic Strategies

Research questions	Analytic strategy
1. What are the average changes in the means of six dimensions (life satisfaction, subjective age, depression, anxiety, positive and negative affect) respectively over eight waves among older adults in non-widowed and widowed groups?	Paired sample t-tests
2. Do heterogeneous adaptation trajectories exist? Does spousal loss affect the memberships of different adaptation trajectories on six dimensions among older adults?	GMM
3. Do different adaption trajectories emerge on six dimensions among widowed older adults?	GMM
4. Is the resilience trajectory (the trajectory that maintains function overtime) the most common on six dimensions among widowed older adults?	GMM
5. What characteristics of widowed older adults predict the membership of resilient trajectory?	Logistic regression, and binary analysis

3.5.1 Propensity Score Matching

Propensity Score Matching (PSM) was developed for estimating treatment effects with non-experimental or observational data. The assumption of PSM is that, given an exposed individual and unexposed individual with the same propensity score, treatment effect is independent of all controlled conditions (Rosenbaum &Rubin, 1983). In other words, PSM can help to control confounding bias in the assessment of the effect of certain exposure.

In the current study, the exposure was late-life spousal loss. A group of non-widowed older adults was identified by matching seven variables that have been discussed in section 3.3.2: self-rated physical health, number of onset chronic diseases, mobility, and demographic factors, including chronological age, gender, education, and race/ethnicity.

Nearest neighbor matching with a caliper at 25% standard deviation of propensity score was used to achieve balanced groups. Specifically, PSM was implemented in four major steps: First, estimate the propensity score. A logit model was fitted to predict the probability of being widowed using the matching variables in wave 1. Second, calculate caliper. Because current study used 1:1 nearest neighbor matching (described in step three), a suggested strategy to avoid poor matches was to impose a caliper and only selected a match within the caliper (Stuart, 2008). Although researchers have different preferences on the size of caliper, there is no consensus on setting the size of caliper or even whether to use one. Stuart and Rubin (2008) recommended that, from the best practice perspective, a caliper of 25% of a standard deviation of the propensity score was better than a fix value. Therefore, the caliper was calculated based on the propensity score that was derived from the first step. Third, 1:1 nearest neighbor matching without replacement was implemented. The rational of 1:1 nearest neighbor matching is that for each widowed (or treated) individual *i*, the non-widowed (or control) individual(s) with the smallest distance from individual *i* is selected. Although this approach may discard a large number of observations, the reduction in power was minimal for the current study. Theoretically, because the identification process is largely driven by the smaller group, the reduction of observation only happened in the control group. If the treatment group has small size, and the control group has a large sample size, the power would not be influenced too much (Stuart, 2010).

In the current study, the non-widowed group (control group) had 7,259 participants, and the widowed group (treatment group) only had 570 participants. As such, due to the huge discrepancy in the sample sizes between two groups, the power of the analysis would not be influenced too much. Conversely, the power would be increased for further comparisons once the participants of the two groups have similar characteristics (Stuart, 2010). The last step of

PSM was to compare balance. After the matching, the qualities of the matches were compared by comparing the balance both numerically and visually (Stuart, 2010).

3.5.2 Main Analyses

Research Question 1: After achieving two balanced groups, multiple paired sample t-tests on six dimensions (subjective age, life satisfaction, positive and negative affect, depression, and anxiety) were conducted to compare the mean values of the two groups at each wave.

Research Questions 2 - 4. GMM were conducted to identify the latent subgroups of adaptation on six dimensions separately. GMM is a person-centered statistical approach that allows differences across unobserved subgroups (Jung & Wickrama, 2007; Liu & Hancock, 2014). While other growth models assume that all individuals are drawn from the same group with common parameters, GMM relaxes this assumption and allows for differences in growth parameters across groups (Jung & Wickrama, 2007). In other words, conventional growth models assumes that factors influence each individual in the same way, while GMM is able to identify the heterogeneous latent subgroups by different factors. This is achieved by using latent trajectories, which allow individuals of each subgroup to vary around different means. Each trajectory has its own unique estimates f variances and covariances (Jung & Wickrama, 2007). Additionally, since GMM is a combination of latent growth curve and mixture models, GMM can estimate trajectories and identify heterogeneous subgroups simultaneously (Grimm & Ram, 2009; Ram & Grimm, 2009).

To promote better practice in applying GMM, Infurna and Luthar (2018) recommend researchers to use GRoLTS (van de Schoot et al., 2017) for reporting latent trajectories. The ultimate goal of GRoLTS is to enhance the uniformity of reporting latent trajectory studies by presenting criteria for reporting the results of latent trajectory analysis. As such, the results of

studies across fields can be used for comparisons, replications, systematic reviews, and meta-analyses. GRoLTS has a checklist with 16 items, which were identified through a systematic process by a panel of expert statisticians and senior users (van de Schoot et al., 2017). The current study followed this checklist when reporting the methods and results of GMM in Chapter 3 and Chapter 4.

To answer RQ2, conditional GMM with spousal loss (yes/no) as the predictor was conducted on each dimension respectively. The primary purpose of these analyses was to examine how spousal loss predicted the membership of each trajectory. To answer RQ3-4, unconditional GMMs were conducted on each dimension only with the widowed participants. The purpose of using this model was to identify heterogeneous subgroups among widowed older adults. Models with one to maximum four classes were estimated. All the GMMs were conducted using Mplus 7.4 (Muthén & Muthén, 1998-2002).

Before conducting GMM, several analyses were conducted to inform the selections of estimators for GMM. First, the distributions of the outcome variables were examined by calculating kurtosis. All the outcome variables were found not normally distributed. Second, the patterns of missing data were examined. While the missing patterns in wave 1 were MCAR, Little's MCAR tests for wave 2 to wave 8 were significant, suggesting that the missing patterns were not MCAR. However, because there was no good strategy to distinguish MAR and MNAR, the current study assumed the missing patterns were MAR for all observed variables. Given that the observed outcome variables were non- normally distributed and MAR, the current study used the estimator of MLR, a maximum likelihood estimator with robust standard errors, to account for the non-normality and missingness. MLR uses FIML to handle missing data, and is robust to non-normality. Lastly, a series of pilot models were tested to determine the effect of variances

and covariance between latent intercepts and slops. For both conditional and unconditional models, I first allowed the covariance and variances to vary across classes, and then fixed them to be equal across classes. The fit indices (described in the following paragraph) suggested that for the unconditional models and conditional models with outcomes of depression, anxiety, and negative affect, freeing the parameters did not improve the fit or the interpretability of the model, and there were no significant differences among those parameters across classes. Therefore, for those models, I fixed the variances and covariance between latent intercepts and slopes to be equal across classes.

To select optimal models, four fit indices were assessed: Bayesian information criterion (BIC), sample-size adjusted BIC (SSABIC), Consistent AIC (CAIC), and adjusted Lo-Mendell-Rubin likelihood ratio test (ALMR). Lower values of BIC, SSABIC, and CAIC indicted a better fitting model. According to the guideline proposed by Raftery (1996), for BIC, differences less than 2 suggested weak evidence, between 2 and 6 suggested positive evidence, between 6 and 10 suggested strong evidence, and greater than 10 suggested very strong evidence. Although there is no rule of thumb for CAIC and SABIC, I also followed Raftery's guideline because CAIC and SABIC are similar to BIC in computation (Chen, Luo, Palardy, Glaman & McEnturff, 2017). A significant ALMR indicated that the specified model fitted better than this model with one less class. A study compared the accuracy of six fit indices (AIC, BIC, SABIC, CAIC, ALMR, VLMR) in GMM, and found that BIC, SABIC, CABIC were the most effective model selection indices; ALMR and SSABIC tended to favor models with more classes (Chen, Luo, Palardy, Glaman & McEnturff, 2017). Therefore, if any class of a specified model had less than 5% of participants, even though reported better fit indices, I selected the specified model with one less class to maintain the representativeness of samples that class.

Research Questions 5. To answer RQ5, data were imported into STATA to describe the characteristics of participants in each trajectory of the six dimensions. The characteristics included age at baseline, gender, race, and education. Logistic regressions (binary logistic regression and multinomial) were conducted to estimate the association between each studied dimension and the demographic characteristics. Additionally, participants of recovery and resilient trajectories were classified into groups by the number of recovery and resilient dimensions. Chi-square or ANOVA was conducted to compare the demographic characteristics across groups.

CHAPTER 4: RESULTS

This chapter reports analysis findings and presents by research questions. This chapter first presents the results from propensity score matching, and followed by the results of each research questions. Specifically, section 4.2 presents the findings from the bivariate analysis; section 4.3 presents the results of conditional GMM; section 4.4 and 4.5 present the findings from unconditional GMM; the last section presents the results from logistic regressions. Each finding is reported below in details.

4.1 Propensity Score Matching

Nearest neighbor matching with a caliper at 25% standard deviation of propensity score was used to achieve balanced groups. The logit model found that the estimated mean of propensity score was 0.11 (SD= 0.08); the size of a caliper of 25% of a standard deviation of the propensity score was 0.02. After the 1:1 nearest neighbor matching, 464 pairs of widowed and non-widowed participants were matched.

Table 4.1 displays the differences of matching variables of both groups before and after PSM. Before PSM, age, gender, race, mobility and self-rated health were significantly contributing to the imbalanced compositions of two groups. After PSM, none of these variables was significant. In addition, the standardized mean differences of these variables were all under 0.2 indicating that two groups had achieved good balance (Stuart, 2010).

Figure 4.1 and 4.2 show the propensity score distribution differences between non-widowed and widowed groups before and after PSM. The overlap of two lines represented a good match of two groups. It is very clear that after PSM, the two groups achieved a great match and the range of propensity scores reduced.

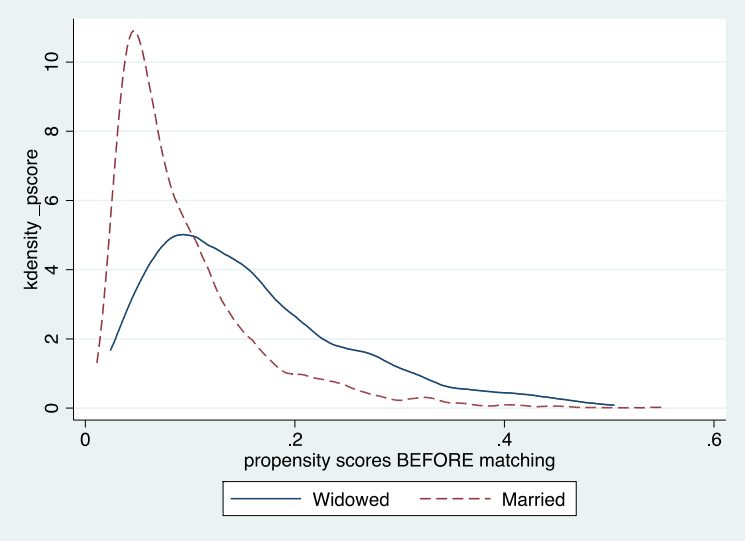

Figure 4.1 *Propensity Score Distribution before Matching*

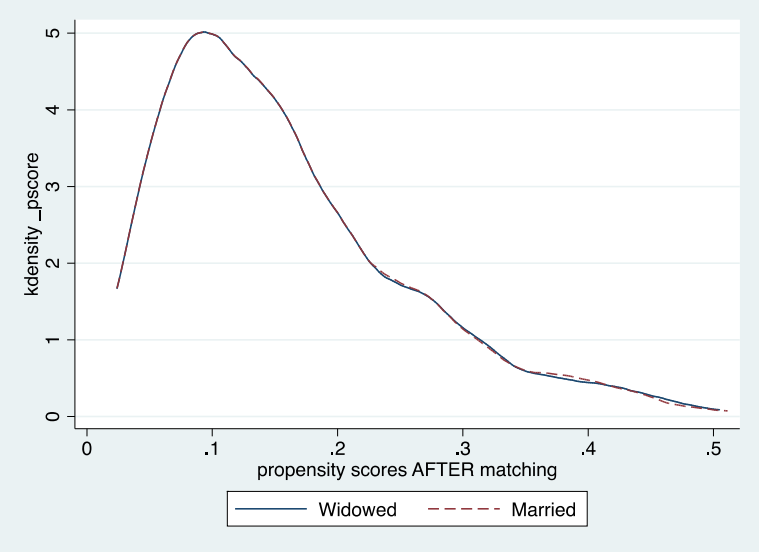

Figure 4.2 *Propensity Score Distribution after Matching*

Table 4.1

Baseline Differences in Matching Variables Prior to and After Propensity Score Matching

	Prior to Propensity Score Matching				After Propensity Score Matching			
Variables	Non-widowed group n= 7,259	Widowed group n= 570	P	Standard mean difference	non-widowed group n= 464	Widowed group n= 464	P	Standard mean difference
Age (mean, sd)	76.23 (7.62)	81.20 (7.00)	**<0.001**	-0.68	80.70 (0.33)	80.78 (0.31)	0.85	-0.01
Gender			**<0.001**	0.18			0.55	-0.04
Male	3,672 (50.59)	238 (41.75)			275 (59.27)	198 (42.67)		
Female	3,587(49.41)	332 (58.25)			189 (40.73)	266 (57.33)		
Race			**<0.001**	0.25			0.90	-0.02
White	4,996 (68.82)	456 (80.00)			389 (83.84)	384 (82.76)		
Black	1,348 (18.57)	72 (12.63)			48 (10.34)	52 (11.21)		
Other	915 (12.61)	42 (7.37)			27 (5.82)	28 (6.03)		
Education			0.57	-0.02			0.28	-0.09
< high school	1,443 (21.11)	112 (19.82)			82 (17.67)	82 (17.67)		
high school	1,841 (26,93)	151 (26,73)			146 (31.47)	124 (26.72)		
some college	1,782 (26.07)	162 (28.67)			138 (29.74)	139 (29.96)		
college or above	1,770 (25.89)	140 (24.78)			98 (21.12)	119 (25.65)		
Mobility			**0.02**	0.10			0.26	0.08
Everyday	4,783 (68.10)	358 (63.36)			328 (70.69)	312 (67.42)		
< once/day	2,241 (31.90)	207 (36.64)			136 (29.31)	152 (32.76)		
Physical health			**0.005**	0.11			0.84	0.04
Excellent	3,004 (42.79)	202 (35.82)			185 (39.87)	179 (38.58)		
Good	2,211 (31.49)	205 (36.35)			180 (38.97)	179 (38.58)		
Poor/fair	1,806 (25.72)	157 (27.84)			99 (21.34)	106 (22.84)		
No. of chronic illness	2.47 (1.57)	2.41 (1.38)	0.43	0.04	2.41 (0.06)	2.38 (0.06)	0.68	0.03

4.2 RQ 1. What are the average changes in the means of six dimensions (life satisfaction, subjective age, depression, anxiety, positive and negative affect) respectively over eight waves among older adults in non-widowed and widowed groups?

Table 4.2 presents the results from paired sample t-tests between non-widowed and widowed groups on depression, anxiety, positive and negative affect, life satisfaction, and subjective age across eight waves. Compared to non-widowed group, at baseline (w1), widowed group had significantly higher levels of depression, anxiety, and negative affect, and lower levels of positive affect, and life satisfaction. The significant differences in depression lasted for two years, and one year in anxiety, positive affect, and life satisfaction. Additionally, compared to non-widowed group, widowed group showed significantly higher levels of anxiety in wave 4 and wave 7, and significantly lower levels of life satisfaction in wave 5 and wave 6. No statistical significant difference was found in subjective age between two groups at any wave.

To summarize, these findings partially support the hypotheses. Widowed older adults reported higher levels of depression, anxiety, negative affect, and lower levels of life satisfaction and positive affect than non-widowed older adults. In contrast to the research hypothesis, however, the significant differences were not permanent. For example, the significantly higher level of depression only lasted for two years post loss and the significant lower level of positive affect only lasted one year post loss. Further, the hypothesized significant difference in subjective age was not supported by the findings. The work and statistical definitions of all identified trajectories are displayed in appendix A and appendix B.

Table 4.2

Comparisons between non-widowed *and widowed groups on the means of life satisfaction, subjective age, depression, anxiety, positive and negative affect across eight waves (N=928).*

	Life Satisfaction			Subjective Age		
	Non-widowed Mean (SD)	Widowed Mean (SD)	t-score (df)	Non-widowed Mean (SD)	Widowed Mean (SD)	t-score (df)
w1	13.05 (1.45)	13.36 (1.63)	-3.09 (926)**	12.91 (13.30)	12. 61 (14.68)	0.33 (926)
w2	13.74 (1.48)	13.32 (1.76)	3.91 (881)***	12.74 (13.15)	11. 13 (12.99)	1.82 (863)
w3	13.69 (1.45)	13.47 (1.64)	1.93 (762)	12.64 (13.26)	11. 72 (13.35)	0.94 (750)
w4	13.69 (1.45)	13.75 (1.53)	-0.54 (623)	12.39 (13.81)	13.12 (13.41)	-0.65 (610)
w5	13.97 (1.24)	13.52 (1.58)	2.83 (315)*	12.75 (12.45)	12. 71 (13.08)	0.03 (306)
w6	13.93 (1.16)	13.47 (1.75)	2.45 (246)*	12.36 (11.94)	11. 95 (14.46)	0.25 (241)
w7	13.67 (1.52)	13.59 (1.66)	0.32 (185)	11.60 (10.29)	13.36 (14.53)	-0.96 (183)
w8	13.67 (1.45)	13.69 (1.43)	-0.07 (138)	11.77 (11.37)	12. 08 (15.26)	-0.12 (135)

	Depression			Anxiety		
	Non-widowed Mean (SD)	Widowed Mean (SD)	t-score (df)	Non-widowed Mean (SD)	Widowed Mean (SD)	t-score (df)
w1	2.81 (1.29)	3.00 (1.36)	-2.23 (926)*	2.84 (1.28)	3.03 (1.41)	-2.15 (926) *
w2	2.87 (1.21)	3.51 (1.67)	-6.55 (914)***	2.82 (1.27)	3.08 (1.47)	-2.91 (914)**
w3	2.85 (1.26)	3.07 (1.36)	-2.28 (804)*	2.85 (1.31)	2.78 (1.32)	0.78 (805)
w4	2.82 (1.18)	2.87 (1.21)	-0.53 (666)	2.80 (1.21)	2.61 (1.05)	2.13 (663)*
w5	2.74 (1.16)	2.87 (1.18)	-1.01 (330)	2.58 (0.95)	2.76 (1.23)	-1.43 (332)
w6	2.62 (1.07)	2.73 (1.33)	-0.68 (259)	2.69 (1.14)	2.64 (1.16)	0.33 (257)
w7	2.75 (1.19)	2.68 (1.03)	0.42 (201)	2.88 (1.27)	2.45 (0.83)	2.64 (203)*
W8	2.83 (1.27)	2.81 (1.37)	0.10 (146)	2.72 (1.17)	2.58 (1.27)	0.60 (145)

	Positive Affect			Negative Affect		
	Non-widowed, Mean (SD)	Widowed, Mean (SD)	t-score (df)	Non-widowed Mean (SD)	Widowed Mean (SD)	t-score (df)
w1	8.16 (1.47)	7.82 (1.60)	3.40 (926)***	4.04 (1.45)	4.39 (1.54)	-3.63 (926)***
w2	7.89 (1.49)	7.20 (1.84)	6.14 (894)***	4.28 (1.50)	4.40 (1.66)	-1.20 (892)
w3	7.84 (1.47)	7.70 (1.59)	1.30 (770)	4.29 (1.46)	4.20 (1.63)	0.74 (773)
w4	7.89 (1.40)	7.94 (1.61)	-0.40 (628)	4.18 (1.42)	4.02 (1.52)	1.32 (634)
w5	8.17 (1.29)	7.95 (1.52)	1.38 (318)	3.91 (1.37)	4.12 (1.47)	-1.36 (319)
w6	8.01 (1.35)	7.92 (1.69)	0.47 (251)	3.97 (1.19)	4.02 (1.55)	-0.27 (251)
w7	7.78 (1.42)	8.17 (1.59)	-1.77 (190)	4.23 (1.44)	4.06 (1.65)	0.77 (190)
w8	7.74 (1.52)	8.17 (1.58)	-1.46 (139)	4.15 (1.46)	3.40 (1.14)	2.77 (139)*

*Notes: *p<.05; **p<.01;***p<.001*

w1=wave1, w2=wave 2, w3=wave 3, w4=wave 4, w5=wave 5, w6=wave 6, w7=wave 7, w8=wave 8.

4.3 RQ 2: Do heterogeneous adaptation trajectories exist? Does spousal loss affect the memberships of different adaptation trajectories on six dimensions among older adults?

This study employed GMM to answer the second research question. The analyses were conducted in two major steps: identified GMMs with better fits and conducted GMMs using spousal loss (yes/no) to predict trajectories. The results of each step were reported below.

Table 4.3 displays the model fit indices for a series of conditional GMMs allowing 1 to 4 classes to be estimated in the analyses examining changes in life satisfaction, subjective age, depression, anxiety, negative and positive affect in non-widowed and widowed groups.

Life satisfaction: The 3-class model was selected given that it's BIC=13509.7, SSABIC=13404.93, and CAIC=13542.73 were lower than the 1- class, 2- class, and 4-class models. Therefore, 3-class model was the best fitting model among the four models.

Subjective age: the 3-class model was selected because it's BIC=30730.17, SSABIC=30625.36, and CAIC=30763.17 were lower than the 1- class and 2- class models. Although the 4-class model showed better fit than the 3-class model, the LRT test was not significant ($p= 0.23$), indicating that the 4-class model was not a better fit than the 3-class model. Therefore, 3-class model was the best fitting model among the four models.

Depression: the 3-class model was selected. The fit indices, BIC=13159.93, SSABIC=13074.18, and CAIC=13186.93, were lower than the 1- class and 2- class models, and the LRT test was also significant ($p< 0.01$) suggesting that the 3-class model (BIC=13319.90, SSABIC=13074.18, CAIC= 13517.66) was a better fit than the 2-class model. Although the fit indices of the 4-class model showed better fit than the 3-class model, the LRT test was not significant ($p= 0.61$) indicating that the 4-class model was not a better fit than the 3-class model. Therefore, 3-class model was the best fitting model among the four models.

Anxiety: The 4-class model was selected. The fit indices, BIC=12613.34, SSABIC=12508.54, CAIC= 12646.34, were lower than the 1- class, 2- class, and 3-class models. Therefore, 4-class model was the best fitting model among the four models.

Negative affect: The 3-class model was selected. The fit indices, BIC=13819.07, SSABIC=13733.32, and CAIC=13846.07, were lower than the 1- class, 2- class, and 4-class models. Therefore, 3-class model was the best fitting model among the four models.

Positive affect: The 2-class models were selected. The fit indices, BIC=13490.16, SSABIC=13413.94, and CAIC=13514.16, were lower than the 1- class, 3- class, and 4-class models. Therefore, 2-class model was the best fitting model among the four models.

Table 4.3

Model Fit Indices for Conditional Growth Mixture Models of Life Satisfaction, Subjective Age, Depression, Anxiety, Negative Affect, Positive Affect among Non-widowed and Widowed Older Adults (N=928)

	Life Satisfaction					**Subjective Age**			
	1-Class n (%)	2-Class n (%)	**3-Class** n (%)	4-Class n (%)		1-Class n (%)	2-Class n (%)	**3-Class n (%)**	4-Class n (%)
Sample size					*Sample size*				
Nc =1 (%)	928 (100)	546 (58.84)	**456 (49.14)**	369 (39.76)	Nc =1 (%)	928 (100)	833 (89.76)	**76 (8.19)**	606 (65.30)
Nc =2 (%)		382 (41.16)	**359 (38.69)**	397 (42.78)	Nc =2 (%)		95 (10.24)	**707 (76.19)**	112 (12.07)
Nc =3 (%)			**113 (12.18)**	63 (6.79)	Nc =3 (%)			**145 (15.63)**	187 (20.15)
Nc =4 (%)				99 (10.67)	Nc =4 (%)				23 (2.48)
Fit indices					*Fit indices*				
K_a	15	24	**33**	42	K_a	15	24	**33**	42
LL_b	-6868.96	-6711.78	**-6642.12**	-6623.95	LL_b	-15441.70	-15303.52	**-15252.34**	-15216.34
BIC_c	13840.42	13587.54	**13509.73**	13534.89	BIC_c	30985.95	30771.03	**30730.17**	30719.67
$SSABIC_d$	13792.78	13511.32	**13404.93**	13401.50	$SSABIC_d$	30938.31	30694.81	**30625.36**	30586.28
$CAIC_e$	13855.42	13611.54	**13542.73**	13576.89	$CAIC_e$	31000.95	30795.03	**30763.17**	30761.67
P_f		<0.001	**<0.001**	0.372	P_f		0.011	**0.049**	0.228

a. Number of free parameters; b. Maximum likelihood; c. Bayesian information criterion;
d. Sample-size adjusted Bayesian information criterion; e. Consistent Akaike information criterion;
f. Lo-Mendell-Rubin adjusted LRT test

Table 4.3 cont.

Model Fit Indices for Conditional Growth Mixture Models of Life Satisfaction, Subjective Age, Depression, Anxiety, Negative Affect, Positive Affect among Non-widowed and Widowed Older Adults (N=928)

	Depression					**Anxiety**			
	1-Class n (%)	2-Class n (%)	**3-Class** n (%)	4-Class n (%)		1-Class n (%)	2-Class n (%)	3-Class n (%)	**4-Class n (%)**
Sample size					*Sample size*				
Nc =1 (%)	928 (100)	130 (14.01)	**133 (14.33)**	55 (5.93)	Nc =1 (%)	928 (100)	480 (51.72)	425 (45.80)	**44 (4.74)**
Nc =2 (%)		798 (85.99)	**140 (15.09)**	52 (5.60)	Nc =2 (%)		448 (48.28)	56 (6.03)	**51 (5.50)**
Nc =3 (%)			**655 (70.58)**	455 (49.03)	Nc =3 (%)			447 (48.17)	**779 (83.94)**
Nc =4 (%)				366 (39.44)	Nc =4 (%)				**54 (5.82)**
Fit indices					*Fit indices*				
K_a	15	21	**27**	33	K_a	15	21	27	**33**
LL_b	-6700.08	-6588.205	**-6487.72**	-6437.24	LL_b	-6478.83	-6333.94	-6253.02	**-6193.93**
BIC_c	13502.66	13319.904	**13159.93**	13099.98	BIC_c	13060.15	12811.38	12690.54	**12613.34**
$SSABIC_d$	13455.02	13074.182	**13074.182**	12995.17	$SSABIC_d$	13012.52	12744.69	12604.79	**12508.54**
$CAIC_e$	13517.66	13340.90	**13186.93**	13132.97	$CAIC_e$	13075.15	12832.38	12717.54	**12646.34**
P_f		0.01	**<0.01**	0.61	P_f		0.10	0.22	**0.04**

a. Number of free parameters; b. Maximum likelihood; c. Bayesian information criterion;
d. Sample-size adjusted Bayesian information criterion; e. Consistent Akaike information criterion;
f. Lo-Mendell-Rubin adjusted LRT test

Table 4.3 cont.

Model Fit Indices for Conditional Growth Mixture Models of Life Satisfaction, Subjective Age, Depression, Anxiety, Negative Affect, Positive Affect among Non-widowed and Widowed Older Adults (N=928)

	Negative Affect					**Positive Affect**			
	1-Class n (%)	2-Class n (%)	**3-Class** n (%)	4-Class n (%)		1-Class n (%)	**2-Class** n (%)	3-Class n (%)	4-Class n (%)
Sample size					*Sample size*				
Nc =1 (%)	928 (100)	446 (48.06)	**420 (45.26)**	139 (14.98)	Nc =1 (%)	928 (100)	**226 (24.35)**	57 (6.14)	594 (64.01)
Nc =2 (%)		482 (51.94)	**424 (45.69)**	67 (7.22)	Nc =2 (%)		**702 (75.65)**	640 (69)	16 (1.72)
Nc =3 (%)			**84 (9.05)**	644 (69.40)	Nc =3 (%)			231 (24.9)	239 (25.75)
Nc =4 (%)				78 (8.41)	Nc =4 (%)				79 (8.5)
Fit indices					*Fit indices*				
K_a	15	21	**27**	33	K_a	15	**24**	33	42
LL_b	-6858.18	-6831.41	**-6817.29**	-6812.25	LL_b	-6729.88	**-6663.08**	-6642.462	-6628.71
BIC_c	13818.86	13806.32	**13819.07**	13849.99	BIC_c	13562.26	**13490.16**	13510.415	13544.41
$SSABIC_d$	13771.22	13739.62	**13733.32**	13745.19	$SSABIC_d$	13514.62	**13413.94**	13405.61	13411.02
$CAIC_e$	13833.86	13827.32	**13846.07**	13882.99	$CAIC_e$	13577.26	**13514.16**	13543.414	13586.41
P_f		0.02	**0.04**	0.19	P_f		**<0.01**	0.41	0.04

a. Number of free parameters; b. Maximum likelihood; c. Bayesian information criterion;
d. Sample-size adjusted Bayesian information criterion; e. Consistent Akaike information criterion;
f. Lo-Mendell-Rubin adjusted LRT test

Table 4.4 provides the estimated model parameters of GMM with spousal loss (yes/no) as the predictor. Figures 4 present the trajectories of each model. The result of each GMM model was described below. Appendix A provides the working definitions of all identified trajectories.

Life satisfaction— Figure 4.3 shows the trajectories of life satisfaction for 3-class model. The three trajectories included resilient trajectory (red line), growth trajectory (blue line), and chronic low trajectory (green line). Class1 (resilient) included 49% of the participants; at baseline, the intercept was 13.40 (SE=0.10) and the slope was not significant. Participants of this class reported the high level of life satisfaction at the baseline, and remained the same level over the years. Within the resilient group, spousal loss did not have impact on either intercept or slope. Class 2 (growth) included 39% of the participants; at baseline, the intercept was 14.33 (SE=0.07), and the slope was 0.11 (SE=0.01). Participants of this class reported the highest level of life satisfaction, and their satisfaction level was increasing of the years. Within the growth group, spousal loss did not have impact on either intercept or slope. Class3 (chronic low) included 12% of the participants; at baseline, the intercept was 11.5 1(SE=0.45), and the slope was not significant. Participants of this class reported the lowest level of life satisfaction, and they remained the same level over the years. Within the chronic low group, spousal loss did not have impact on either intercept or slope. Additionally, because the variance of each class was not constrained to be the same across three classes, the variances and covariance of slope and intercept were wary in the three classes. Specifically, in the resilient and chronic low groups, only the variances of intercepts were significant. In the growth group, variances and covariance of intercept and slope were all significant, indicating large variability within this class.

In general, compared to the resilient group, spousal loss did not increase the odds of being in the growth group (OR=1.23, 95% CI = 0.63, 1.84) or the chronic low group (OR= 1.66,

95% CI = 0.51, 2.81). Compared to the growth group, participants who experienced spousal loss did not have increased odds of being in the resilient low group (OR= 1.35, 95% CI = 0.42, 2.28).

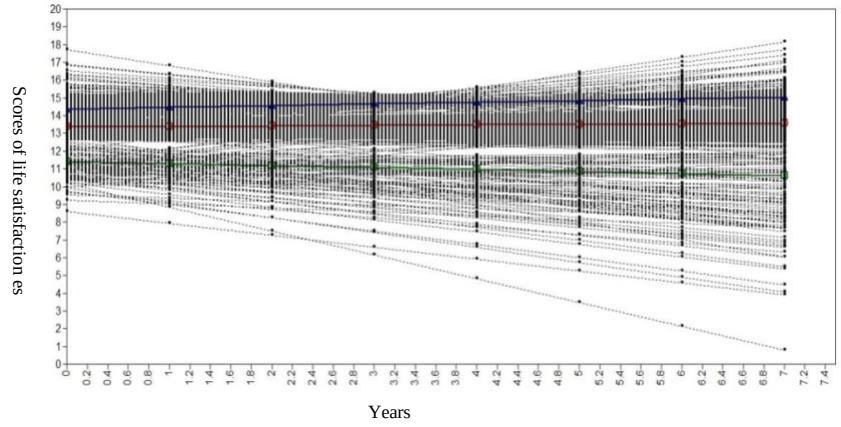

Figure 4.3 *Model implied trajectories of life satisfaction using entire sample (N=928).*

Note. Blue line: growth trajectory: 39% of the participants, intercept =14.33, slope = 0.11; Red line: resilient trajectory: 49% of the participants, intercept = 13.40; Green line: chronic low trajectory: 12% of the participants, intercept =11.51

Subjective age —Figure 4.4 shows the trajectories of life satisfaction for 3-class model. The three trajectories included resilient high trajectory (red line), resilient low trajectory (blue line), and declined trajectory (green line). Class1 (resilient high) included 8% of the participants; at baseline, the intercept was 33.15 (SE=5.26) and the slope was not significant. Participants of this class perceived themselves 33 years younger than their chronological age, and this perception did not change over time. Within the resilient high group, spousal loss did not have impact on either intercept or slope. Class 2 (resilient low) included 76% of the participants; at baseline, the intercept was 13.00 (SE=0.77), and the slope was not significant. Participants of this class perceived themselves 13 years younger than their chronological age, and their perception also remained the same over the years. Within the resilient low group, spousal loss only influenced the intercept (β= -2.28, *SE*=0.96). Class3 (declined) included 16% of the

participants; at baseline, the intercept was 3.62 (SE=0.79), and the slope was -0.52 (SE=0.14). Participants of this class perceived themselves 3.6 years younger than their chronological age at the baseline, but they consider themselves getting older over the years. Within the declined group, spousal loss did not have significant impact on either intercept or slope. All three classes had large variabilities in their intercepts. The declined group also presented high variability in slop the covariance of slop and intercept.

In general, the odds of being in the resilient low group for participants who experienced spousal loss were 42% less (OR= 0.58, 95% CI = 0.19, 0.97) than in the resilient high group. The odds of being in the declined group were 53% less (OR=0.47, 95% CI = 0.08, 0.86) than in the resilient high group. . Compared to the resilient group, spousal loss did not increase the odds of being in the declined group (OR= 0.81, 95% CI = 0.29, 1.33).

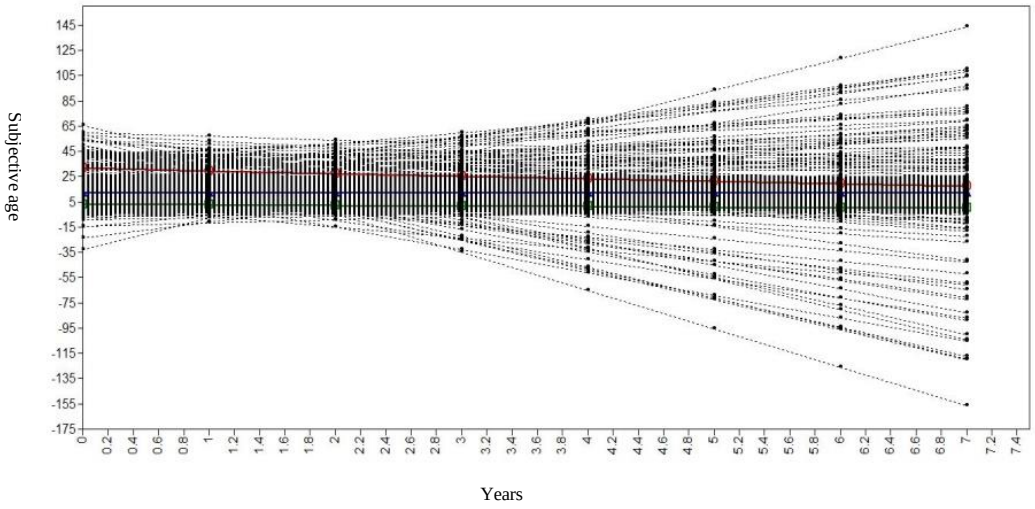

Figure 4.4 *Model implied trajectories of subjective age using entire sample (N=928).*

Note. Red line: resilient high trajectory: 8% of the participants, intercept = 33; Blue line: resilient low trajectory: 76% of the participants, intercept =13; Green line: declined trajectory: 6% of the participants, intercept = 3.6, slope = -0.52.

Depression—Figure 4.5 shows the trajectories of depression for 3-class model. The three trajectories included chronic recovery trajectory (blue line), recovery trajectory (red line), and chronic increased trajectory (green line). Class1 (chronic recovery) included 14% of the participants. At baseline, its intercept was 4.25 (SE=0.12) and the slope was -0.19 (SE=0.07). This class showed medium level of depression at the baseline, but the level of depression declined over seven years. Within the chronic recovery group, participants who experienced spousal loss showed significantly bigger intercept (β=1.87, *SE*=0.22) and smaller slope (β=-0.40, *SE*=0.13) than their non-widowed counterparts. Class 2 (recovery group) included 15% of the participants. At baseline, the intercept was 7.05 (SE=0.29), and the slope was -0.73 (SE=0.17). Although this class showed the highest level of depression at the baseline in the three classes, it declined faster than other classes. Within class2, participants who experienced spousal loss showed significantly lower intercept (β=-3.10, *SE*=0.30), and bigger slope (β=0.64, *SE*=0.17). Participants in class1and class 2 were clinically depressed at baseline given that their intercepts were above the cutoff point 3. Class3 (chronic increased) included 71% of the participants. At baseline, the intercept was 2.27 (SE=0.03), and the slope was 0.11 (SE=0.01). This class showed the lowest level of depression at the baseline in the three classes, but depressive symptoms were increased over the seven years. Within chronic declined group, participants who experienced spousal loss showed significantly higher intercept (β=0.11, *SE*=0.05) and smaller slope (β= -0.05, *SE*=0.02).

In general, the odds of being in the recovery group were 25 times more (OR=25.26, 95% CI = 6.31, 44.22) than in the chronic recovery group for participants who experienced spousal loss; the odds of being in the chronic increased group were 2 times more (OR=2.17, 95% CI = 1.11, 3.23) more than in the chronic recovery group for participants who experienced spousal

loss. Additionally, the odds of being in the chronic increased group were 91% less (OR=0.09, 95% CI = 0.14, 0.03) than in recovery group for widowed participants.

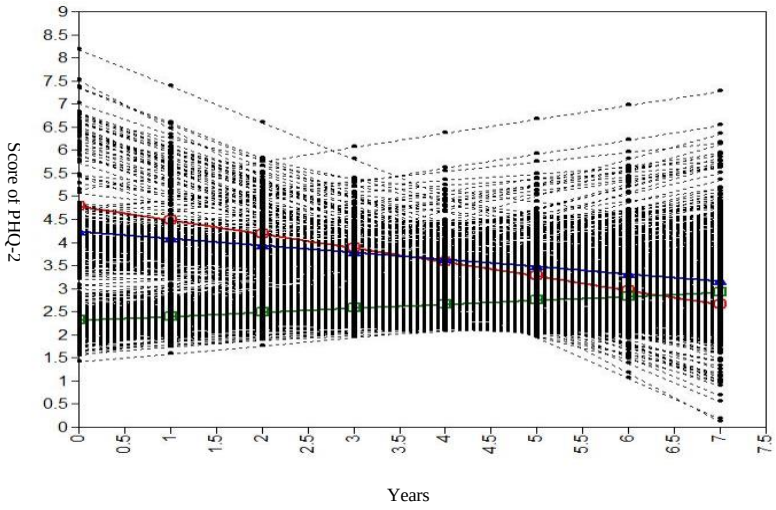

Figure 4.5 *Model implied trajectories of depression using entire sample (N=928).*

Note. Red line: recovery trajectory: 15% of the participants, intercept = 7.05, slope = -0.73; Blue line: chronic recovery trajectory: 14% of the participants, intercept = 4.25, slope = -0.19; Green line: chronic increased trajectory: 71% of the participants, intercept = 2.27, slope = 0.11.

Anxiety—Figure 4.6 shows the trajectories of depression for 4-class model. The four trajectories included recovery trajectory (second group), increased trajectory (third group), resilient trajectory (fourth group), and chronic recovery trajectory (first group). Class1 (recovery group) included 5% of the participants. At baseline, the intercept was 5.55 (SE=0.25) and the slope was -0.78 (SE=0.09). The recovery group reported the second highest anxiety level at the baseline, but anxiety level declined over the years. Within recovery group, participants who experienced spousal loss showed significantly lower intercept (β= -2.26, *SE*=0.34) and higher slope (β= 1.33, *SE*=0.12) than their non-widowed counterparts. Class2 (increased group) included 6% of the participants. At baseline, the intercept was 3.44(SE=0.40), and the slope was

0.41 (SE=0.10). Although participants of this class reported the second lowest anxiety level at the baseline, their anxiety level was significantly increased over the years, and ended up to be the highest in the four classes. Within increased group, participants who experienced spousal loss reported significantly higher intercept (β= 3.00, *SE*=0.47), and lower slope (β= -0.45, *SE*=0.13). Class3 (resilient group) included most of the participants (84%). At baseline, the intercept was 2.49 (SE=0.04) with no significant slop. Participants in the resilient group reported the lowest level of anxiety at baseline, and remained the same level over the years. Within resilient group, participants who experienced spousal loss reported significantly higher intercept (β=0.16, *SE*=0.05) and smaller slope (β= -0.06, *SE*=0.01). Class4 (chronic recovery) included 6% of the participants. At baseline, the intercept was 7.30 (SE=1.18) and the slope was -0.22 (SE=0.11). Participants in this class reported the highest anxiety level at the baseline, and slowly declined over the years. Within chronic high group, participants who experienced loss reported significantly smaller slop (β= -0.51, *SE*=0.16).

In general, the odds of being in the declined group were 72% less (OR=0.28, 95% CI = 0.31, 0.25) than in the recovery group for participants who experienced spousal loss; the odds of being in resilient group and being in the chronic high group were 15% more (OR=1.15, 95% CI = 1.24, 1.06), and about seven times more (OR= 6.95, 95% CI = 7.99, 5.92), respectively, than being in the recovery group for widowed participants, The odds of being in the resilient group and being in the chronic high group were 4 times more (OR= 4.14, 95% CI = 4.47, 3.81) and 25 times more (OR= 25.13, 95% CI = 29.48, 20.77) for widowed participants than being in the declined group. The odds of being in the chronic high group were 6 times more (OR= 6.07, 95% CI = 6.97, 5.17) than in the resilient group for widowed participants. Additionally, at baseline, participants in the recovery, declined, and chronic high group could be clinically diagnosed as

anxiety given that their intercepts were above the cutoff point 3. In the last wave, participants in the recovery group were not clinically anxious.

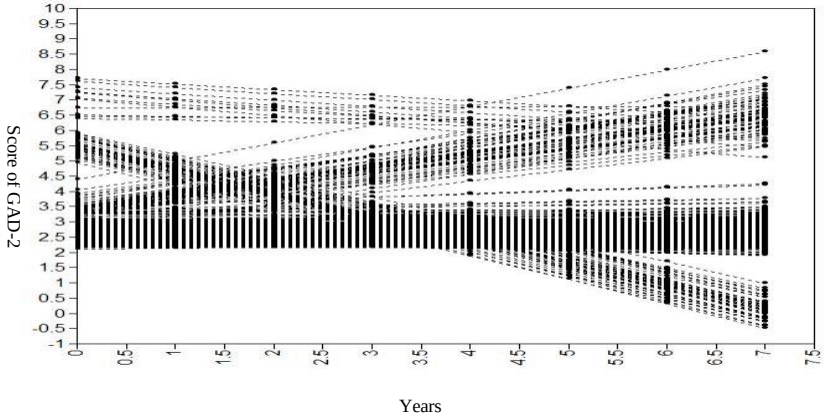

Figure 4.6 *Model implied trajectories of anxiety using entire sample (N=928).*

Note. Trajectories from the top the bottom are: class 1: chronic recovery trajectory: 6% of the participants, intercept = 7.3, slope = -0.22; class 2: recovery trajectory: 5% of the participants, intercept = 5.55, slope = -0.78; class 3: increased trajectory: 6% of the participants, intercept = 3.44, slope = 0.41; class 4: resilient trajectory: 84% of the participants, intercept = 2.49.

Negative affect—Figure 4.7 shows the trajectories of negative affect for 3-class model. The three trajectories included: resilient trajectory (blue line), increased trajectory (red line), and recovery trajectory (green line). Class1 (resilient) included 45% of the participants. At baseline, the intercept was 3.72 (SE=0.12) and the slope was not significant. Participants of this class reported the lowest negative affect at the baseline and it remained over the time. Within the resilient group, participants who experienced spousal loss showed significantly bigger intercept (β=1.22, *SE*=0.28) and slope (β= 0.22, *SE*=0.06) than their non-widowed counterparts. Class 2 (Increased) included 46% of the participants. At baseline, the intercept was 4.70 (SE=0.27), and the slope was 0.28 (SE=0.10). Participants of this class reported the medium level of negative

affect, but increased over time. Within the chronic declined group, participants who experienced spousal loss showed significantly lower intercept (β= -0.80, *SE*=0.27) and slope (β= -0.34, *SE*=0.10). Class3 (recovery) included 9% of the participants; at baseline, the intercept was 6.00 (SE=0.46), and the slope was -0.13 (SE=0.06). Participants of this class reported the highest level of negative affect at the baseline, but gradually decreased over the years. Within the recovery group, participants who experienced spousal loss showed significantly smaller slope (β= -0.34, *SE*=0.12).

In general, compared to the resilient group, spousal loss did not increase the odds of being in the chronic declined (OR=18.14, 95% CI = -12.28, 48.56) or recovery group (OR= 3.65, 95% CI = -1.26, 8.57). Compared to those in the chronic declined group, spousal loss did not increase the odds of being in the recovery group (OR= 0.20, 95% CI = 0.60, -0.19).

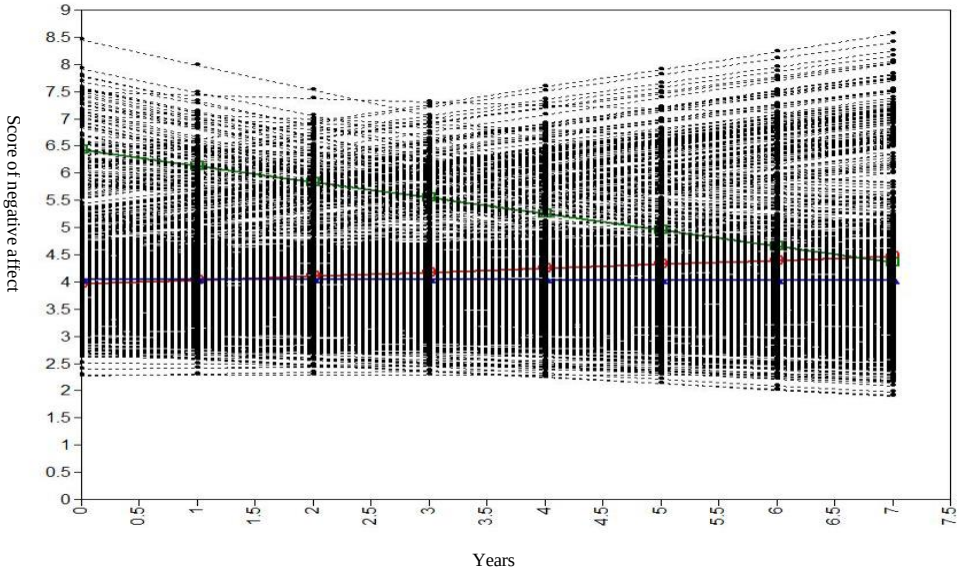

Figure 4.7 *Model implied trajectories of negative affect using entire sample (N=928).*

Note. Red line: increased trajectory: 46% of the participants, intercept = 4.70, slope = 0.28; Blue line: resilient trajectory: 45% of the participants, intercept = 3.72; Green line: recovery trajectory: 9% of the participants, intercept = 6.00, slope = -0.13.

Positive affect—Figure 4.8 shows the trajectories of positive affect for 2-class model. The two trajectories included declined trajectory (red line) and chronic declined trajectory (blue line). Class1 (declined) included 24% of the participants; at baseline, the intercept was 6.71 (SE=0.23), and the slope was -0.18 (SE=0.07). Participants of this class reported the low level of positive affect, and it declined over the years. Within the declined group, participants who experienced spousal loss showed significantly lower intercept (β= -0.50, *SE*=0.25) and bigger slope (β=0.21, *SE*=0.09) than their non-widowed counterparts. Class 2 (chronic declined group) included 76% of the participants; at baseline, the intercept was 8.50 (SE=0.08), and the slope was -0.09 (SE=0.02). Participants of this class report high level of positive affect, but slowly declined over the years. Within the chronic declined group, participants who experienced spousal loss showed significantly bigger slope (β=0.09, *SE*=0.02). Additionally, because the variance of each class was not constrained to be the same across three classes, the declined group showed variabilities in intercept (β= 1.28, *SE*=0.25), slope (β= 0.19, *SE*=0.09) and the covariance between intercept and slope (β= -0.25, *SE*=0.13).

In general, the odds of being in the chronic declined group were 40% less (OR=0.598, 95% CI = 0.29, 0.90) than in the declined group for participants who experienced spousal loss.

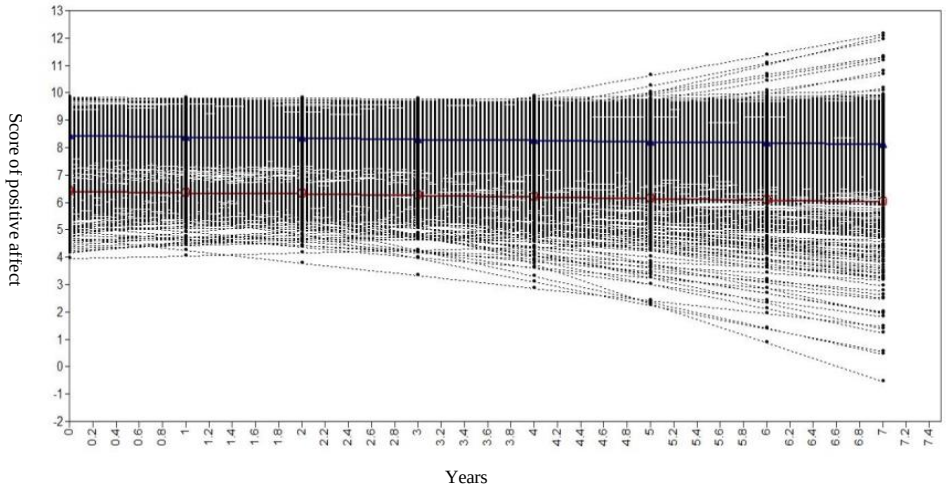

Figure 4.8 *Model implied trajectories of positive affect using entire sample (N=928).*

Note. Blue line: chronic declined trajectory: 76% of the participants, intercept = 8.5, slope = -0.09; Red line: declined trajectory: 24% of the participants, intercept = 6.71, slope = -0.18.

In summary, widowed older adults had significantly higher chance to be in the recovery trajectory and chronic increased trajectory of depression than in the chronic recovery trajectory. The anxiety level of widowed older adults was less likely to decline, but more likely to be in the trajectory of chronic high or resilient than in the recovery trajectory. Although the levels of positive affect were decreased in the participants of both trajectories, participants in the widowed group were more likely to be in the trajectory of low positive affect at the beginning and faster declined over time than in the chronic declined trajectory (started high and declined slowly). The discrepancies between subjective age and chronological age remained the same for the majority of the participants (84%), widowed older adults were more likely to be in the resilient high trajectory, where participants reported the largest age discrepancy and the discrepancy remained overtime, than in other trajectories. Spousal loss did not have significant impact on the membership of negative affect and life satisfaction.

Table 4.4

Parameter Estimates of Conditional Growth Mixture Model with Spousal Loss as Predictor of Life Satisfaction, Subjective Age, Depression, Anxiety, Negative Affect, and Positive Affect among All Participants.(N=928)

	Life Satisfaction			**Subjective Age**		
	Resilient (class1)	Growth (class 2)	Chronic low (class 3)	Resilient high (class1)	Resilient low (class 2)	Declined (class3)
N (%)	456 (49.14)	359 (38.69)	113 (12.18)	76 (8.19)	707 (76.19)	145 (15.63)
Odds Ratios (95% CI)						
Class1 [a]		1.232 (0.63, 1.84)	1.660 (0.51, 2.81)		0.584 (0.19, 0.97)	0.471 (0.08, 0.86)
Class2 [b]			1.348 (0.42, 2.28)			0.808 (0.29, 1.33)
Direct Effect of Loss (*β*, SE)						
Intercept	-0.084(0.15)	0.076(0.08)	-0.158(0.41)	-2.558 (5.44)	-2.277* (0.96)	-1.245 (0.78)
Slope	-0.002(0.04)	-0.019(0.02)	0.044(0.18)	-2.385 (3.21)	0.360 (0.22)	0.129 (0.14)
Starting Value (mean, SE)						
Intercept	13.398***(0.10)	14.334*** (0.07)	11.508*** (0.45)	33.153*** (5.26)	13.001*** (0.77)	3.615*** (0.79)
Slope	0.031(0.02)	0.106*** (0.01)	-0.142(0.15)	-0.579 (2.41)	-0.138 (0.11)	-0.519*** (0.14)
Residual Variance/Covariance						
Intercept	0.179*(0.08)	-0.370*** (0.04)	1.376* (0.69)	249.778**(83.92)	49.315*** (11.47)	-24.179***(3.28)
Slope	0.006(0.01)	-0.025*** (0.01)	0.302(0.16)	99.09 (84.85)	-0.038 (0.45)	-1.516***(0.19)
Intercept and slope	0.016(0.02)	0.086*** (0.01)	-0.129(0.18)	-104.756*(52.35)	-0.422(1.68)	5.027***(0.66)

Notes: * <0.05, ** <0.01, ***<0.001

a. reference class is class 1

b. reference class is class 2

Table 4.4 cont.

Parameter Estimates of Conditional Growth Mixture Model with Spousal Loss as Predictor of Life Satisfaction, Subjective Age, Depression, Anxiety, Negative Affect, and Positive Affect among All Participants.(N=928)

	Depression		
	Chronic recovery (class 1)	Recovery (class 2)	Chronic increased (class 3)
N (%)	133 (14.33)	140 (15.09)	655 (70.58)
Odds Ratios (95% CI)			
Class1[a]		25.266 (6.31, 44.22)	2.170 (1.11, 3.23)
Class2[b]			0.086 (0.14, 0.03)
Direct Effect of Loss (*β*, *SE*)			
Intercept	1.869*** (0.22)	-3.096*** (0.30)	0.106* (0.05)
Slope	-0.403** (0.13)	0.64*** (0.17)	-0.051* (0.02)
Starting Value (Mean, SE)			
Intercept	4.249*** (0.12)	7.046*** (0.29)	2.266*** (0.03)
Slope	-0.188*** (0.07)	-0.732*** (0.17)	0.109*** (0.01)
Residual Variance/Covariance			
Intercept	-0.136** (0.04)	-0.136** (0.04)	-0.136** (0.04)
Slope	0.016* (0.01)	0.016* (0.01)	0.016* (0.01)
Intercept and slope	0.053*** (0.01)	0.053*** (0.01)	0.053*** (0.01)

Notes: * <0.05, ** <0.01, ***<0.001

a. reference class is class 1

b. reference class is class 2

Table 4.4 cont.

Parameter Estimates of Conditional Growth Mixture Model with Spousal Loss as Predictor of Life Satisfaction, Subjective Age, Depression, Anxiety, Negative Affect, and Positive Affect among All Participants. (N=928)

	Anxiety			
	Recovery (class 1)	Increased (class 2)	Resilient (class3)	Chronic high (class 4)
N (%)	44 (4.74)	51 (5.50)	779 (83.94)	54 (5.82)
Odds Ratios (95% CI)				
Class1[a]		0.277 (0.31, 0.25)	1.146 (1.24, 1.06)	6.954 (7.99, 5.92)
Class2[b]			4.140 (4.47, 3.81)	25.125 (29.48, 20.77)
Class3[c]				6.069 (6.97, 5.17)
Direct Effect of Loss (*β, SE*)				
Intercept	-2.259*** (0.34)	2.997*** (0.47)	0.164** (0.05)	-1.972 (1.21)
Slope	1.325*** (0.12)	-0.454*** (0.13)	-0.055 *** (0.01)	-0.512** (0.16)
Starting Value (Mean, SE)				
Intercept	5.553*** (0.25)	3.438*** (0.40)	2.486*** (0.04)	7.297*** (1.18)
Slope	-0.777*** (0.09)	0.411*** (0.10)	0.008 (0.01)	-0.222* (0.11)
Residual Variance/Covariance				
Intercept	0.099* (0.04)	0.099* (0.04)	0.099* (0.04)	0.099* (0.04)
Slope	-0.003 (0.01)	-0.003 (0.01)	-0.003 (0.01)	-0.003 (0.01)
Intercept and slope	0.018**(0.01)	0.018**(0.01)	0.018**(0.01)	0.018**(0.01)

Notes: * <0.05, ** <0.01, ***<0.001

a. reference class is class 1

b. reference class is class 2

c. reference class is class 3

Table 4.4 cont.

Parameter Estimates of Conditional Growth Mixture Model with Spousal Loss as Predictor of Life Satisfaction, Subjective Age, Depression, Anxiety, Negative Affect, and Positive Affect among All Participants.(N=928)

	Negative Affect			**Positive Affect**	
	Resilient (class 1)	Increased (class 2)	Recovery (class 3)	Declined (class1)	Chronic declined (class 2)
N (%)	420 (45.26)	424 (45.69)	84 (9.05)	226 (24.35)	702 (75.65)
Odds Ratios (95% CI)					
Class1 [a]		18.141 (-12.28, 48.56)	3.653 (-1.26, 8.57)		0.598 (0.29, 0.90)
Class2 [b]			0.201 (0.60, -0.19)		
Direct Effect of Loss (*β, SE*)					
Intercept	1.219*** (0.28)	-0.798** (0.27)	0.919 (0.55)	-0.495* (0.25)	-0.131(0.10)
Slope	0.221*** (0.06)	-0.342*** (0.10)	-0.344** (0.12)	0.213* (0.09)	0.091*** (0.02)
Starting Value (mean, sd)					
Intercept	3.721*** (0.12)	4.703*** (0.27)	5.996*** (0.46)	6.705*** (0.23)	8.504*** (0.08)
Slope	0.029(0.03)	0.276*** (0.10)	-0.133*(0.06)	-0.182*(0.07)	-0.088*** (0.02)
Residual Variance/Covariance					
Intercept	0.470*** (0.09)	0.470*** (0.09)	0.470*** (0.09)	1.280*** (0.25)	0.407*** (0.09)
Slope	-0.005 (0.01)	-0.005*** (0.01)	-0.005(0.01)	0.187* (0.09)	-0.002(0.01)
Intercept and slope	0.029*(0.02)	0.029 (0.02)	0.029 (0.02)	-0.253* (0.13)	0.041*** (0.01)

Notes: * <0.05, ** <0.01, ***<0.001

a. reference class is class 1

b. reference class is class 2

4.4 RQ 3. *Do heterogeneous adaptation trajectories emerge for six dimensions of adaptation among widowed older adults?*

To answer RQ3, one unconditional GMM with each dimension (life satisfaction, subjective age depression, anxiety, negative and positive affect,) were conducted only with the widowed participants. Before estimating the trajectories, a series of unconditional GMMs were conducted to identify a better fitting model. Specifically, for each dimension, models with 1 to 4 classes were conducted, and the ones with better fit indices were finally selected. Table 4.5 presents the model fit indices of all the models.

Life satisfaction: The 3-class model was selected given that it's BIC=7198.14, SSABIC=7137.83, and CAIC=7217.14 were lower than the other three models: 1- class (BIC=7301.77, SSABIC=7260.51, CAIC= 7314.77), 2- class (BIC=7206.98, SSABIC=7156.19, CAIC= 7222.98), and 4-class (BIC=7397.44, SSABIC=7327.60, CAIC= 7418.58) models.

Subjective age: the 2-class model was selected because it's BIC=30730.17, SSABIC=30625.36, and CAIC=30763.17 were lower than the 1- class model (BIC=14865.03, SSABIC=14814.25, CAIC= 14881.03). Some model fit indices of the 3-class (BIC=14822.97, SSABIC=14762.66, CAIC= 14841.97) and 4-class models (BIC=14814.45, SSABIC=14744.63, CAIC= 14836.45) showed better fit than the 3-class model, but both models had classes that included smaller than 3% of the total participants. Therefore, the 2-class model was final selected.

Depression: the 2-class model was selected because it's BIC=7547.57, SSABIC=7496.78, and CAIC=7563.66 were lower than the 1- class model (BIC=7645.67, SSABIC=7604.40, CAIC= 7658.74). Although some fit indices of the 3-class (BIC=7506.53, SSABIC=7446.21, CAIC= 7525.63) and 4-class models (BIC=7506.53, SSABIC=7446.21,

CAIC= 7525.63) showed better fit than the 2-class model, the LRT test was not significant indicating that the 4-class model was not a better fit than the 2-class model.

Anxiety: The 3-class model was selected because it's BIC= 7163.03, SSABIC= 7102.71, CAIC= 7182.03 were lower than the 1- class (BIC=7424.31, SSABIC=7383.04, CAIC= 7437.31) and 2- class (BIC= 7266.13, SSABIC=7215.34, CAIC= 7282.13). Although some fit indices of the 4-class model (BIC=7123.00, SSABIC=7053.16, and CAIC=7145.00) were smaller than the 3-clss model, the LRT test was not significant (p=0.15) indicating that the 4-class model was not a better fit than the 3-class model.

Negative affect: The 2-class model was selected given that it's BIC=7329.82, SSABIC=7279.04, and CAIC=7346.76 were smaller than the other three models: 1- class (BIC=7347.12, SSABIC=7305.86, CAIC= 7360.89), 3- class (BIC=7336.31, SSABIC=7276.00, CAIC= 7356.42), and 4-class (BIC=7343.83, SSABIC=7274.00, CAIC= 7367.12) models.

Positive affect: The 2-class models were selected given that it's BIC=7259.52, SSABIC=7208.73, and CAIC=7275.52 were lower than the 1- class (BIC=7475.38, SSABIC=7434.11, CAIC= 7487.95), 3- class (BIC=7258.45, SSABIC=7198.14, CAIC= 7277.45), and 4-class (BIC=7265.30, SSABIC=7195.46, CAIC= 7287.30) models.

In summary, among widowed participants, two adaptation trajectories were emerged for the dimensions of depression, negative and positive affect, and subjective age. Three adaptation trajectories were identified for the dimensions of anxiety and life satisfaction. As such, the findings supported hypotheses 3 by identifying at least two adaptation trajectories of each dimension.

Table 4.5

Model Fit Indices for Unconditional Growth Mixture Models of Life Satisfaction, Subjective Age Depression, Anxiety, Negative Affect, and Positive Affect, among Widowed Older Adults (N=570)

	Life Satisfaction					**Subjective Age**			
	1-Class	**2-Class**	3-Class	4-Class		1-Class	**2-Class**	3-Class	4-Class
Sample size					*Sample size*				
Nc_g =1 (%)	560 (100)	**480 (85.71)**	77 (13.75)	10 (1.79)	Nc =1 (%)	478 (100)	**47 (9.83)**	40 (8.37)	43 (9.00)
Nc_g =2 (%)		**80 (14.29)**	33 (5.89)	429 (76.61)	Nc =2 (%)		**431 (90.17)**	7 (1.46)	427(89.33)
Nc_g =3 (%)			450 (80.36)	35 (6.25)	Nc =3 (%)			431(90.17)	5 (1.05)
Nc_g =4 (%)				86 (15.36)	Nc =4 (%)				3 (0.63)
Fit indices					*Fit indices*				
K_a	13	**16**	19	22	K_a	13	**16**	19	22
LL_b	-3781.7	**-3723.16**	-3693.15	-3673.41	LL_b	-7417.59	**-7383.16**	-7352.87	-7339.36
BIC_c	7645.67	**7547.57**	7506.53	7486.04	BIC_c	14915.38	**14865.03**	14822.97	14814.45
$SSABIC_d$	7604.40	**7496.78**	7446.21	7416.20	$SSABIC_d$	14874.12	**14814.25**	14762.66	14744.63
$CAIC_e$	7658.74	**7563.66**	7525.63	7508.16	$CAIC_e$	14928.38	**14881.03**	14841.97	14836.45
p_f		**<0.01**	0.20	0.13	p_f		**0.02**	0.05	<0.01

Note. a. Number of free parameters; b. Maximum likelihood; c. Bayesian information criterion;
d. Sample-size adjusted Bayesian information criterion; e. Consistent Akaike information criterion;
f. Lo-Mendell-Rubin adjusted LRT test;
g. Number of participants in each class.

Table 4.5 cont.

Model Fit Indices for Unconditional Growth Mixture Models of Life Satisfaction, Subjective Age Depression, Anxiety, Negative Affect, and Positive Affect, among Widowed Older Adults (N=570)

	Depression					**Anxiety**			
	1-Class	2-Class	**3-Class**	4-Class		1-Class	2-Class	**3-Class**	4-Class
Sample size					*Sample size*				
Nc_g =1	527	467	**376**		Nc =1	563	508	**423**	
(%)	(100)	(88.62)	**(71.35)**	9 (1.64)	(%)	(100)	(90.23)	**(75.13)**	38 (6.75)
Nc_g =2					Nc =2				
(%)		60 (11.39)	**111(21.06)**	150(27.37)	(%)		55 (9.77)	**42 (7.46)**	22 (3.91)
Nc_g =3					Nc =3				
(%)			**40 (7.59)**	338(61.68)	(%)			**98 (17.41)**	88 (15.63)
Nc_g =4					Nc =4				
(%)				51 (9.31)	(%)				415(73.71)
Fit indices					*Fit indices*				
K_a	13	16	**19**	22	K_a	13	16	**19**	22
LL_b	-3610.15	-3553.35	**-3539.53**	-3629.35	LL_b	-3670.99	-3582.40	**-3521.35**	-3491.83
BIC_c	7301.77	7206.98	**7198.14**	7397.44	BIC_c	7424.31	7266.13	**7163.03**	7123.00
$SSABIC_d$	7260.51	7156.19	**7137.83**	7327.60	$SSABIC_d$	7383.04	7215.34	**7102.71**	7053.16
$CAIC_e$	7314.77	7222.98	**7217.14**	7418.58	$CAIC_e$	7437.31	7282.13	**7182.03**	7145.00
p_f		0.06	**0.44**	0.09	p_f		0.01	**0.01**	0.15

a. Number of free parameters; b. Maximum likelihood; c. Bayesian information criterion;
d. Sample-size adjusted Bayesian information criterion; e. Consistent Akaike information criterion;
f. Lo-Mendell-Rubin adjusted LRT test;
g. Number of participants in each class.

Table 4.5 cont.

Model Fit Indices for Unconditional Growth Mixture Models of Life Satisfaction, Subjective Age Depression, Anxiety, Negative Affect, and Positive Affect, among Widowed Older Adults (N=570)

	Negative Affect					**Positive Affect**			
	1-Class	**2-Class**	3-Class	4-Class		1-Class	**2-Class**	3-Class	4-Class
Sample size					*Sample size*				
Nc_g =1 (%)	531 (100)	**60 (11.30)**	57 (10.73)	72 (13.56)	Nc =1 (%)	548 (100)	**113 (21.32)**	410 (77.36)	399 (75.28)
Nc_g =2 (%)		**471(88.70)**	33 (6.22)	48 (9.04)	Nc =2 (%)		**417(78.68)**	7 (1.32)	28 (5.28)
Nc_g =3 (%)			441 (83.05)	11 (2.07)	Nc =3 (%)			113 (21.32)	82 (15.47)
Nc_g =4 (%)				400 (75.33)	Nc =4 (%)				21 (3.96)
Fit indices					*Fit indices*				
K_a	13	**16**	19	22	K_a	13	16	19	22
LL_b	-3632.78	**-3614.71**	-3608.55	-3602.89	LL_b	-3696.70	**-3579.58**	-3569.63	-3563.65
BIC_c	7347.12	**7329.82**	7336.31	7343.83	BIC_c	7475.38	**7259.52**	7258.45	7265.30
$SSABIC_d$	7305.86	**7279.04**	7276.00	7274.00	$SSABIC_d$	7434.11	**7208.73**	7198.14	7195.46
$CAIC_e$	7360.89	**7346.76**	7356.42	7367.12	$CAIC_e$	7487.95	**7275.52**	7277.45	7287.30
p_f		**0.01**	0.28	0.30	p_f		**0.02**	0.07	0.65

a. Number of free parameters; b. Maximum likelihood; c. Bayesian information criterion;
d. Sample-size adjusted Bayesian information criterion; e. Consistent Akaike information criterion;
f. Lo-Mendell-Rubin adjusted LRT test;
g. Number of participants in each class.

4.5 RQ 4. Is the resilience trajectory the most common on six dimensions among widowed older adults?

Table 4.6 displays the estimated model parameters of each unconditional model. Figure 6 presents the model implied trajectories of each dimension. The results of unconditional GMM on studied dimensions were described below.

Life satisfaction—Figure 4.9 shows the trajectories of life satisfaction for 3-class model, including the chronic low resilient trajectory (red line), recovery trajectory (blue line), and resilient trajectory (green line). (a)The chronic low resilient trajectory included 8% of the participants. The intercept of this trajectory at baseline was 10.03 (SE=0.40) and the slope was not significant. Participants of the chronic high trajectory reported the lowest level of life satisfaction pre-loss, and maintained the same level over time. (b)The recovery trajectory included 21% of the participants. The intercept of this trajectory at baseline was 11.96 (SE=0.63), and the slope was 0.19 (SE=0.06). Participants of the recovery trajectory started with the medium life satisfaction level pre-loss, but it increased over time. Their average satisfaction level was closed to the participants in the chronic high trajectory after seven years post-loss. (c) The resilient trajectory included 71% of the participants. The intercept of this trajectory at baseline was 14.01 (SE=0.22), and the slope was not significant. Participants of the resilient trajectory started with the highest life satisfaction level pre-loss, and maintained the same level over time.

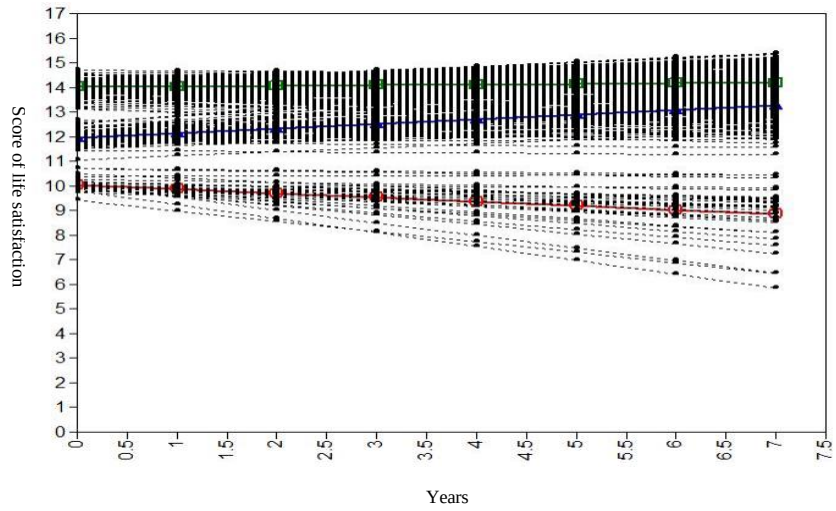

Figure 4.9 *Model implied trajectories of life satisfaction among widowed participants (N=570).*

Note. Green line: resilient trajectory: 71% of the participants, intercept = 14.01; Blue line: recovery trajectory: 21% of the participants, intercept = 11.96, slope = 0.19; Red line: chronic low trajectory: 8% of the participants, intercept = 10.03.

Subjective age—Figure 4.10 shows the trajectories of subjective age for 2-class model, including the resilient low trajectory (red line) and resilient high trajectory (blue line). (a) The resilient low trajectory included 90% of the participants. The intercept of this trajectory at baseline was 8.79 (SE=0.67) and the slope was not significant. Participants of the resilient low trajectory, on average, considered themselves about 9 years younger than their chronological age, and this perception did not change over time. (b)The resilient high trajectory included 10% of the participants. The intercept of this trajectory at baseline was 34.82 (SE=2.39), and the slope was not significant. Participants of the resilient high trajectory, on average, considered themselves about 35 years younger than their chronological age.

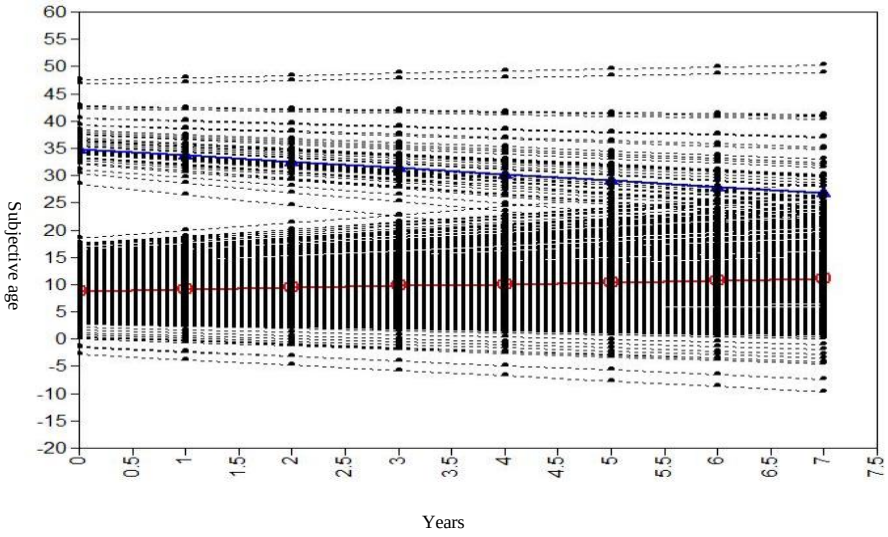

Figure 4.10 *Model implied trajectories of subjective age among widowed participants (N=570).*

Note. Blue line: resilient high trajectory: 90% of the participants, intercept = 34.82; Red line: resilient low trajectory: 10% of the participants, intercept = 8.79.

Depression—Figure 4.11 shows the trajectories of depression for 2-class model, including the resilient trajectory (red line) and the recovery trajectory (blue line). (a) The resilient trajectory included 86% of the participants. The intercept of this trajectory at baseline was 2.78 (SE=0.06) and the slope was not significant. Participants of the resilient trajectory reported low level of depression (lower than the cut-off point 3.0) pre-loss, and maintained the same level over time. (b) The recovery trajectory included 14% of the participants. The intercept of this trajectory at baseline was 5.52 (SE=0.19), and the slope was -0.40 (SE=0.09). Participants of the recovery trajectory started with high level of depression (higher than the cut-off point 3.0) pre-loss, but it declined over time. The average depression score was even lower than the resilient trajectory after seven years post-loss.

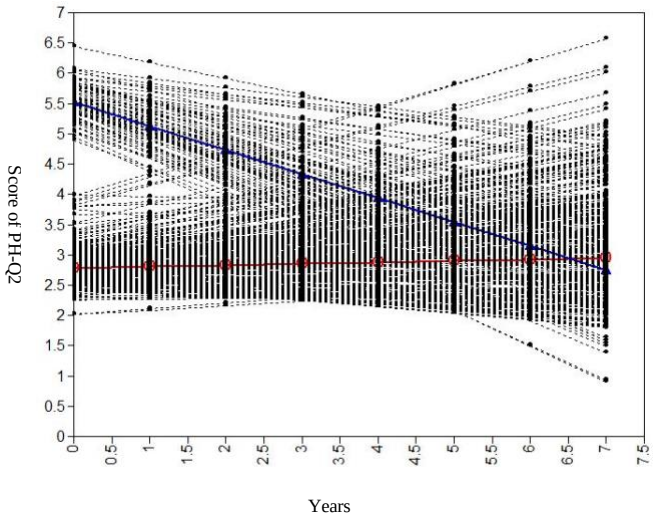

Figure 4.11 *Model implied trajectories of depression among widowed participants.*

Note. Blue line: recovery trajectory: 14% of the participants, intercept = 5.52, slope = -0.40; Red line: resilient trajectory: 86% of the participants, intercept = 2.78, slope = -0.40.

Anxiety—Figure 4.12 shows the trajectories of anxiety for 3-class model, including the chronic high trajectory (blue line), the growth trajectory (red line), and the recovery trajectory (green line), but no resilient trajectory was identified. The three trajectories were: (a) the chronic high trajectory included 7% of the participants. The intercept of this trajectory at baseline was 5.51 (SE=0.31) and the slope was not significant. Participants of the chronic high trajectory reported the highest level of anxiety (higher than the cut-off point 3.0) pre-loss, and maintained the same level over time. (b) The growth trajectory included 75% of the participants. The intercept of this trajectory at baseline was 2.62 (SE=0.05), and the slope was -0.10 (SE=0.01). Participants of the growth trajectory started with the lowest level of anxiety (lower than the cut-off point 3.0) pre-loss, and it kept declining over time. (c)The recovery trajectory included 17% of the participants. The intercept of this trajectory at baseline was 3.90 (SE=0.16), and the slope was -0.08 (SE=0.04). Participants of the recovery trajectory started with a medium level of anxiety (higher than the cut-off point 3.0) pre-loss, but it declined over time.

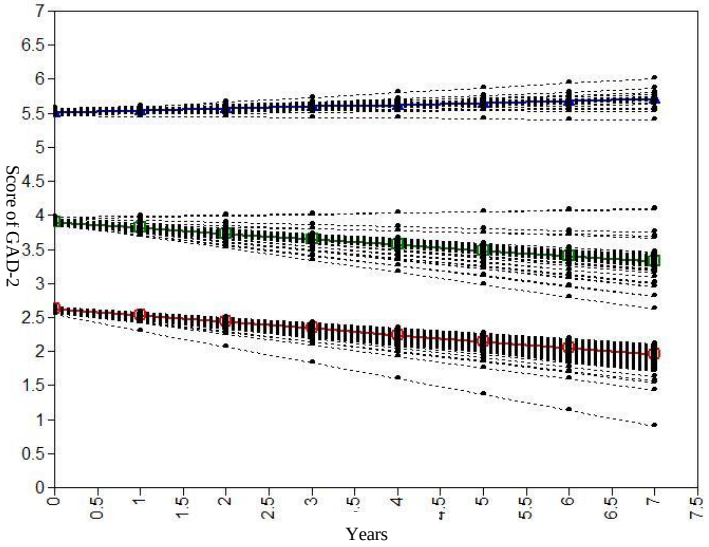

Figure 4.12 *Model implied trajectories of anxiety among widowed participants (N=570).*

Note. Blue line: chronic high trajectory: 7% of the participants, intercept = 5.51; Green line: recovery trajectory: 17% of the participants, intercept = 3.9, slope = -0.08; Red line: growth trajectory: 75% of the participants, intercept = 2.62, slope = -0.10.

Negative affect—Figure 1.13 shows the trajectories of negative affect for 2-class model, including the resilient trajectory (blue line) and the recovery trajectory (red line). (a)The resilient trajectory included 89% of the participants. The intercept of this trajectory at baseline was 4.06 (SE=0.10) and the slope was not significant. Participants of the resilient trajectory reported low level of negative affect pre-loss, and maintained the same level over time. (b)The recovery trajectory included 11% of the participants. The intercept of this trajectory at baseline was 6.80 (SE=0.37), and the slope was -0.40 (SE=0.09). Participants of the recovery trajectory started with high level of negative affect pre-loss, but it declined significantly over time. Their average level of negative affect among participants in the recovery group was close to that of the participants in the resilient trajectory after seven years post-loss.

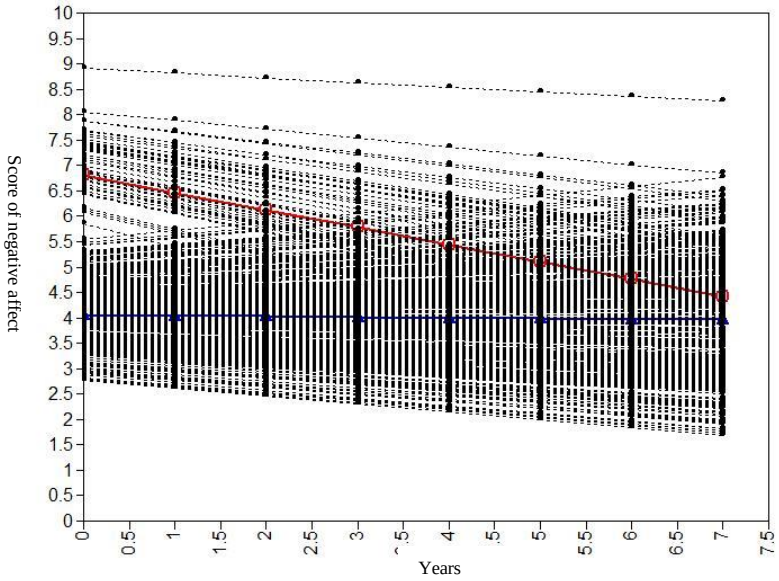

Figure 4.13 *Model implied trajectories of negative affect among widowed participants(N=570).*.

Note. Red line: recovery trajectory: 11% of the participants, intercept = 6.80, slope = -0.40. Blue line: resilient trajectory: 89% of the participants, intercept = 4.06.

Positive affect—Figure 4.14 shows the trajectories of negative affect for 2-class model, including the resilient trajectory (blue line) and the recovery trajectory (red line). (a) The resilient trajectory included 79% of the participants. The intercept of this trajectory at baseline was 8.24 (SE=0.09) and the slope was not significant. Participants of the resilient trajectory reported higher level of positive affect pre-loss, and maintained the same level over time. (b) The recovery trajectory included 21% of the participants. The intercept of this trajectory at baseline was 5.56 (SE=0.19), and the slope was -0.20 (SE=0.09). Participants of the recovery trajectory started with low level of positive affect pre-loss, but it increased significantly over time. Their average level of positive affect was close to the participants in the resilient trajectory after seven years post-loss.

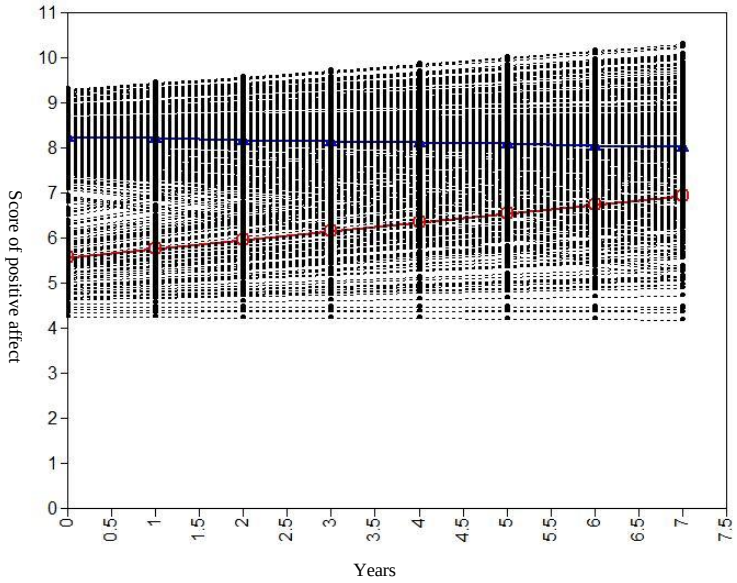

Figure 4.14 *Model implied trajectories of positive affect among widowed participants (N=570).*

Note. Red line: recovery trajectory: 21% of the participants, intercept = 5.56, slope = -0.20. Blue line: resilient trajectory: 79% of the participants, intercept = 8.24.

To summary, the findings of the unconditional GMM with widowed participants partially supported the forth hypothesis. The resilient trajectory was not the most common trajectory for anxiety. However, resilient was the most common trajectory for depression, negative and positive affect, life satisfaction, and subjective age.

Table 4.6

Parameter Estimates for Life Satisfaction, Subjective Age, Depression, Anxiety, Negative Affect, Positive Affect, with Widowed Participants (n=570)

	Life Satisfaction			**Subjective Age**		**Depression**	
	Chronic low	Recovery	Resilient	Resilient low	Resilient high	Resilient	Recovery
N (%)	40 (7.59)	111 (21.06)	376 (71.35)	47 (9.83)	431 (90.17)	480 (85.71%)	80 (14.29%)
Starting Value							
Intercept	10.03***	11.96***	14.01***	8.79***	34.82***	2.780***	5.52***
(mean, se)	(0.40)	(0.63)	(0.22)	(0.67)	(2.39)	(0.06)	(0.19)
Slope	-0.17	0.19**	0.02	0.32	-1.14	0.02	-0.40***
(mean, se)	(0.19)	(0.06)	(0.03)	(0.16)	(1.21)	(0.02)	(0.09)
Residual Variance/Covariance							
	-0.047	-0.047	-0.047	27.091*	27.091*	0.01	0.01
Intercept	(0.23)	(0.23)	(0.23)	(10.59)	(10.59)	(0.07)	(0.07)
Slope	0.01(0.01)	0.01(0.01)	0.01(0.01)	0.40(0.77)	0.40(0.77)	0.01(0.01)	0.01(0.01)
Intercept	0.08**	0.08**	0.08**	2.99	2.99	0.08***	0.08***
and slope	(0.03)	(0.03)	(0.03)	(2.68)	(2.68)	(0.02)	(0.02)

	Anxiety			**Negative Affect**		**Positive Affect**	
	Chronic high	Growth	Recovery	Resilient	Recovery	Resilient	Recovery
N (%)	42 (7.46)	423 (75.13)	98 (17.41)	471 (88.70)	60 (11.30)	417 (78.68)	113 (21.32)
Starting Value							
Intercept	5.513***	2.62***	3.90***	4.06***	6.80***	8.24***	5.56***
(mean, se)	(0.31)	(0.05)	(0.16)	(0.10)	(0.37)	(0.09)	(0.19)
Slope	0.03	-0.10***	-0.08*	-0.01	-0.34***	-0.03	0.20*
(mean, se)	(0.09)	(0.01)	(0.04)	(0.03)	(0.09)	(0.03)	(0.09)
Residual Variance/Covariance							
	-0.01	-0.01	-0.01	0.578***	0.578***	0.42***	0.42***
Intercept	(0.07)	(0.07)	(0.07)	(0.12)	(0.12)	(0.10)	(0.10)
Slope	-0.01(0.01)	-0.01(0.01)	-0.01(0.01)	0.01(0.01)	0.01(0.01)	0.01(0.01)	0.01(0.01)
Intercept							
and slope	0.01(0.02)	0.01(0.02)	0.01(0.02)	0.06(0.03)	0.06(0.03)	0.08(0.04)	0.08(0.04)

Notes: * <0.05, ** <0.01, ***<0.001

4.6 RQ 5. What characteristics of widowed older adults predict the membership of resilient trajectory?

To answer this research question, binary logistic regression and multinomial logistic regression were conducted to estimate the associations between demographic characteristic and the memberships of adaptation trajectories. Table 4.7 presents the descriptive statistics of members in each trajectory and the odds ratios/relative risk ratios of the regression models. Table 15 and Table 16, respectively, present the number of recovery and resilient trajectories that individuals were classified into. Each studied dimension was discussed below.

Life satisfaction— three trajectories (chronic low, recovery, and resilient) were identified on life satisfaction. Participants of all three groups were above 80 years old before loss (80.52 vs. 81.48 vs. 82.97). In chronic high and resilient groups, participants were most often male (59% vs. 65%), whereas, in the recovery group, participants were mostly female (51%). In all the three groups, over 80% of the participants were White. While the majority of participants in chronic low group (33%) accepted some college education, participants in the recovery (32%) and resilient (38%) groups reported earning less than high school education. Multinomial logistic regression estimated that compared to White participants, Black participants had 65% less relative risks (RRR= 0.35) of being a member of recovery group than the chronic low group. Compared to participants pursed high school education, participants pursed less than high school education had 3 times more relative risks (RRR=2.77, p=0.021) of being a member of the recovery trajectory, and 3 times more relative risks (RRR=3.09, p=0.003) of being a member of the resilient trajectory than chronic low trajectory.

Subjective age—two trajectories (resilient and resilient high) were identified on subjective age. The average ages of the participants in the resilient group was 83 (SD=6.89), and

of the participants in the resilient high group was 81 (SD=6.69). While the majority of the participants in the resilient group were female (64%), the participants in the resilient high group were mostly male (60%). Additionally, no participant in the resilient low group was from the race groups other than white and black. Furthermore, no significant different were found between two groups on Education. Binary logistic regression estimated that compared to male participants, female participants had 56% less odds (OR= 0.44, p=0.01) of being a member of resilient high trajectory than the resilient trajectory. Compared to White participants, Black participants had 58% less odds (OR=0.42, p=0.04) of being a member of the resilient high trajectory than resilient trajectory.

Depression— two rectories (resilient vs. recovery) were identified on depression. Participants of both groups were aged more than 80 years old one year before loss, with an average age of 81 (SD=6.95) for the resilient participants, and an average age of 82 (SD=6.95) for those in the recovery group. In resilient and recovery groups, participants were most often male (58% vs. 60%) and White (81% vs. 76%). While no significant differences were found between two groups on age, gender, and race, participants of the resilient groups tended to have a higher level of education than those in the recovery group. That is, the majority of resilient participants (30%) reported earning some college education, whereas, the majority of the recovery participants (39%) reported earning less than high school education. Binary logistic regression estimated that compared to participants who pursed high school education, those who pursed less than high school education had 3 times more odds (OR=2.99, p<0.01) of being a member of the resilient trajectory than the recovery trajectory.

Anxiety— three trajectories (chronic high, growth and recovery) were identified on anxiety. Participants of all three groups were little over 81 years old before loss (81.4 vs. 81.1 vs.

81.1). Although participants were most male in all three groups, growth group had significantly fewer male (55%) than the chronic high group (69%) and the recovery group (67%). The majority of participants in the three groups were white. Participants of the chronic high group tended to have a lower level of education than other two groups. The majority of the participants in the chronic high group reported earning high school (36%) or lower than high school (36%) education. On the contrary, majorities of participants in the growth (30%) and recovery (32%) groups reported earning some college education. Multinomial logistic regression estimated that compared to participants who pursed high school education, participants pursed some college education had 78% less relative risks (RRR= 0.22, p=0.021) of being a member of the chronic high trajectory than the growth trajectory; and those who pursed less than high school education had 2 times more relative risks (RRR=2.22, p=0.03) of being a member of the recovery trajectory than the growth trajectory.

Negative affect—two trajectories (resilient and recovery) were identified on negative affect. Participants of both two groups were about 80 years older before loss, with an average age of 80 (SD=7.07) for resilient participants, and 81 (SD=6.82) for recovery participants. In resilient and recovery groups, participants were most often male (55% vs. 57%) and White (75% vs. 82%). While no significant differences were found between two groups on age, gender, and race, participants of the resilient groups tended to have a lower level of education than those in the recovery group. That is, the majority of resilient participants (42%) reported earning lower than high school education, whereas, the majority of the recovery participants (31%) reported earning some college education. Binary logistic regression estimated that compared to participants who pursed high school education, those who pursed less than high school education had 65% less

relative risks (OR=0.35, p=0.01) of being a member of the resilient trajectory than the recovery trajectory.

Positive affect—two trajectories (resilient and recovery) were identified on negative affect. Participants of both two groups were above 80 years older before loss, with an average age of 81 (SD=6.67) for resilient participants, and 82 (SD=7.50) for recovery participants. In resilient and recovery groups, participants were most often male (57% vs. 58%) and White (82% vs. 81%). While no significant differences were found between two groups on age, gender, and race, participants of the resilient groups tended to have a higher level of education than those in the recovery group. That is, the majority of resilient participants (32%) reported earning some college education, whereas, the majority of the recovery participants reported earning high school (29%) or less than high school (29%) education.

Table 4.8 presents the number of resilient domains that individuals were classified into. Because only four dimensions (life satisfaction, depression, negative affect, and positive affect) had resilient trajectory, only these four domains were included in this comparison. Of the 570 participants who experienced spousal loss, no one was resilient across all dimensions; the majority participants were resilient in four dimensions (61%). Across the four dimensions, 16 participants (3%) did not exhibit in any resilient trajectory. Additionally, bivariate analysis (i.e. Chi-square and ANOVA) suggested that participants with higher level of education were likely to belong to the resilient trajectory.

In conclusion, results of this study partially support the hypotheses. On average, compared to non-widowed older adults, widowed participants reported higher levels of depressive symptoms, anxiety symptoms and negative affect, as well as lower levels of life satisfaction and positive affect prior to and after loss. However the significant differences were

only evidenced in the first one or two years after loss (H1). Two to four heterogeneous adaptation trajectories emerged; spousal loss affected the membership of trajectories on subjective age, depression, anxiety and positive affect, but not on life satisfaction and negative affect (H2). Among widowed older adults, two to three adaptation trajectories emerged (H3); the resilient trajectory of five dimensions of adaptation (life satisfaction, subjective age, depression, negative affect and positive affect) included high proportions of participants (71% - 100%), but no participants were resilient across all six dimensions. (H4). Older adults with some college education were more likely to exhibit in the resilient trajectory than their counterparts with lower than high school education (H5). Table 4.9 provides the summary of research questions, hypotheses and results. Interpretations and implications of these findings as well as limitations of the study were discussed in the next chapter.

Table 4.7

Odds Ratio/Relative Risk Ratio of Logistic Regressions and Characteristics of Participants in Each Trajectory of Life Satisfaction, Subjective Age, Depression , Anxiety, Negative and Positive Affect (n=570)

	Life Satisfaction					Subjective Age			Depression		
	Resilient[a] N (%)	Recovery N (%)	RRR[b]	Chronic low N (%)	RRR[b]	Resilient low[a] N (%)	Resilient high N (%)	OR[c]	Resilient N (%)	Recovery[a] N (%)	OR[c]
N (%)	376 (71.35)	111 (21.06)		40 (7.59)		47 (9.83)	428 (90.17)		80 (14.29)	480 (85.7)	
Age (mean,sd)	80.52 (6.73)	81.48 (7.01)	1.02	82.97 (7.33)	1.06*	81.65 (7.50)	80.68 (6.67)	0.96	80.98 (6.95)	81.88 (6.95)	0.98
Gender											
Male[a]	221 (58.78)	54 (48.65)		26 (65.00)		17 (36.17)	258 (59.86)		278 (57.92)	48 (60.00)	
Female	155 (41.22)	57 (51.35)	1.53	14 (35.00)	0.62	30 (63.83)	173 (40.14)	0.43*	202 (42.08)	32 (40.00)	1.13
Race											
White[a]	304 (80.85)	92 (82.88)		32(80.00)		36(76.60)	357(82.83)		387 (80.63)	61 (76.25)	
Black	50 (13.30)	9 (8.11)	0.44	4 (10.00)	0.51	11(23.40)	43 (9.98)	0.38*	61 (12.71)	10 (12.50)	0.93
Other	22 (5.85)	10 (9.01)	1.11	4 (10.00)	0.99	0	31 (7.19)	1	32 (6.67)	9 (11.25)	0.61
Education											
>=high school[a]	151 (40.37)	62 (56.88)		25 (62.50)		21(44.68)	188 (43.93)		48 (60.76)	209 (43.91)	
>=some college	223 (59.63)	47 (43.12)	0.46**	15 (37.50)	0.36**	26(55.32)	240 (56.07)	0.75	31 (39.24)	267 (56.09)	1.85*

Notes: a. reference group ; b: relative risk ration; c:odds ratio

* <0.05, ** <0.01, ***<0.001

Table 4.7 cont.

Odds Ratio/Relative Risk Ratio of Logistic Regressions and Characteristics of Participants in Each Trajectory of Life Satisfaction, Subjective Age, Depression , Anxiety, Negative and Positive Affect (n=570)

	Anxiety					Negative Affect			Positive Affect		
	Growth[a] N (%)	Chronic High N (%)	RRR[b]	Recovery N (%)	RRR[b]	Resilient N (%)	Recovery[a] N (%)	OR[c]	Resilient N (%)	Recovery[a] N (%)	OR[c]
N (%)	423 (75.13)	42 (7.46)		98 (17.41)		471 (88.70)	60 (11.30)		417 (78.68)	113 (21.32)	
Age (mean,sd)	81.12 (6.37)	81.41 (7.43)	1.01	81.10 (7.01)	1.01	81.02 (6.82)	79.81 (7.07)	1.03	80.68 (6.67)	81.65 (7.50)	0.98
Gender											
Male [a]	231 (54.61)	29 (69.05)		66 (67.35)		270 (57.32)	33 (55.00)		237 (56.83)	65 (57.52)	
Female	192 (45.39)	13 (30.95)	0.51	32 (32.65)	0.60	201 (42.68)	27 (45.00)	0.66	180 (43.17)	48 (42.48)	1.12
Race											
White [a]	340 (80.38)	31 (73.81)		79 (80.61)		386 (81.95)	45 (75.00)		340 (81.53)	91 (80.53)	
Black	57 (13.48)	7 (16.67)	1.04	8 (8.16)	0.41	54 (11.46)	10 (16.67)	0.78	51 (12.23)	13 (11.50)	1.19
Other	26 (6.15)	4 (9.52)	1.31	11 (11.22)	1.32	31 (6.58)	5 (8.33)	1.06	26 (6.24)	9 (7.96)	0.87
Education											
>=high school [a]	185 (44.15)	30 (71.43)		47 (48.45)		199 (42.61)	39 (65.00)		172 (41.65)	66 (58.41)	
>=college	234 (55.85)	12 (28.57)	0.35**	50 (51.55)	0.83	268 (57.39)	21 (35.00)	2.57 **	241 (58.35)	47 (41.59)	1.97 **

Notes: a. reference group ; b: relative risk ration; c:odds ratio

* <0.05, ** <0.01, ***<0.001

Table 4.8

Comparison of Participants on Number of Adapted Dimensions in Which They Were Classified as Resilient (n=570).

	Group 0	Group 1	Group 2	Group 3	Group 4	p
N (%)	16 (3.07)	37 (7.09)	56 (10.73)	96 (18.39)	317 (60.73)	
Age (mean, sd)	81.67 (8.37)	80.86 (7.01)	82.17 (7.41)	80.85 (7.08)	80.61 (6.66)	0.65
Gender						0.75
Female (%)	56.25	40.54	48.21	41.67	42.59	
Race (%)						0.74
White	81.25	75.68	85.71	81.25	81.39	
Black	6.25	10.81	10.71	12.50	12.30	
Other	12.50	13.51	3.57	6.25	6.31	
Education (%)						0.001
<= high school	62.50	67.57	58.18	47.37	38.73	
>= some college	37.50	32.43	41.82	52.63	61.27	

Note: Group 0: not resilient in all domains; Group 1: resilient in any one domain; Group 2: resilient in any two domains; Group 3: resilient in any three domains; Group 4: resilient in any four domains.

Table 4.9

Summary of Research Questions, Hypotheses and Results

Research questions	Hypotheses	Supported
1. What are the average changes in the means of six dimensions (life satisfaction, subjective age, depression, anxiety, positive and negative affect) respectively over eight waves among older adults in non-widowed and widowed groups?	(H1) Compared to the non-widowed group, widowed group will report higher levels of depression, anxiety, negative affect, and subjective age, and lower levels of life satisfaction, and positive affect.	Partially supported
2. Do heterogeneous adaptation trajectories exist? Does spousal loss affect the memberships of different adaptation trajectories on six dimensions among older adults?	(H2) Older adults who experienced spousal loss will be more likely to belong to unfavorable adaptation trajectories than their non-widowed counterparts.	Partially supported
3. Do different adaption trajectories emerge on six dimensions among widowed older adults?	(H3) More than one trajectory will emerge in every studied dimension.	Yes
4. Is the resilience trajectory (the trajectory that maintains function overtime) the most common on six dimensions among widowed older adults?	(H4) Resilient trajectory will not be the most common trajectory on every dimension (life satisfaction, subjective age, depression, anxiety, positive and negative affect).	Partially supported
5. What characteristics predict the membership of resilient trajectory among widowed older adults?	(H5) Older ethnic minority women with lower education will be less like to be resilient.	Partially supported

CHAPTER 5: DISCUSSION

The purpose of this study was to respond to a heated debate regarding whether resilience is the most common response to adversities by examining adaptation trajectories following spousal loss in a nationally representative sample of Medicare beneficiaries from the NHATS. This study first compared the average differences of six dimensions of adaptation between widowed and non-widowed participants at each of the eight time points (RQ1). Then the study explored whether heterogonous adaptation trajectories exit among older adults in general, and how spousal loss predict the membership of each trajectory (RQ2). The study further examined whether heterogonous adaptation trajectories, especially resilient trajectory, exist among the subgroup of widowed older adults, and investigated the demographic factors that predict the membership of the resilient trajectory (RQ3- RQ5). This chapter discusses and interprets the main findings in relation to the current literature and is organized by research questions. Limitations of the current study are then described. Implications for social work practice, policy and research are discussed at the end to provide suggestions for future research.

5.1 Discussion of Findings

5.1.1 Average differences between widowed and non-widowed older adults in 8 years (RQ1).

Widowed participants reported significantly lower life satisfaction, and positive affect, as well as higher depression, anxiety, and negative affect one year pre-loss and one to two years post-loss than their non-widowed counterparts. These findings highlight the fact that psychological changes caused by spousal loss started before the death of the spouse, but the changes may not be permanent. The impact of spousal loss only last for maximum two years after loss. From the crisis theory perspective, spousal loss can be considered a significant short-term risk factor, whose adverse effect becoming weaker after two or three years (Hagedoorn et

al., 2006; Wade & Pevalin, 2004). Although this is not the main focus of the study, this more nuanced adjustment over time adds to the literature, which has reported mixed findings. For example, this study found that widowed older adults reported significantly higher depression before loss and it lasted for about two years. This finding is consistent with previous studies, which demonstrated that depressive symptoms were elevated before and during the transition to widowhood and lasted in about two to three years (Hagedoorn et al., 2006; Monserud & Markides, 2017; Williams, 2004; Williams, Sawyer, Roseman, & Allman, 2008). However, it is worth noting that the findings of the current study are based on bivariate analysis, which did not control for the influence of other factors. From a chronic strain perspective, discussed in the introduction, widowhood can have long-term effect on individuals because spousal loss is associated with other negative changes such as financial difficulties, loss of role models, or disruption of daily routines, which require continuous effort to resolve (Carnelley, Wortman, Bolger, & Burke, 2006; Thoits, 2010). It may take about eight years for widowed individuals to adapt to widowhood (Lucas, Clark, Georgellis, & Diener, 2003). To address the mixed findings in the literature, this study used nationally representative date to examine the longitudinal impact of spousal loss on the individual adaptation trajectories using a person-centered method, GMM. These findings are discussed below.

5.1.2 The impact of spousal loss on the memberships of heterogeneous adaptation trajectories among older adults (RQ2).

Aging is not a uniform process. Individuals age in various ways and at different paces. Consistent with reports of previous studies (Jeste, Wolkowitz, & Palmer, 2011; Payette, Gueye, Gaudreau, Morais, Shatenstein, & Gray-Donald, 2011), the current study identified two to four trajectories on the six dimensions of adaptation among older adults. It was hypothesized that

older adults who experienced spousal loss will be more likely to belong to unfavorable adaptation trajectories than their non-widowed counterparts. Findings from the current study partially support the hypothesis. Supporting the hypothesis, the findings of depression, anxiety, and positive affect suggested that widowed older adults were more likely to be in the unfavorable trajectories, such as chronic high or fast decline. The findings for subjective age, however, were against the hypothesis: widowed older adults were more likely to be in the resilient high trajectory than the resilient low or the declined trajectories. Additionally, spousal loss was found have no impact on memberships in any trajectory for life satisfaction and negative affect. Each finding is discussed below in detail.

Life satisfaction. Life satisfaction is the first meaning-related dimension of adaptation that was introduced by the present study. Individual's subjective evaluation of life is a significant indicator of subjective well-being. Major life events in the aging affect life satisfaction of older adults (Chen, 2001). Previous studies suggested that spousal loss associated with significant decline in life satisfaction (Bonanno et al, 2002; Infurna, et al, 2017). While multiple pathways of life satisfaction emerged, unexpectedly, this study found that spousal loss had no impact on life satisfaction among older adults. One aspect of life satisfaction is the perceived control of life. Kegan (1982) suggested that the evaluation of life can be made through either the aspects of life over which people have control or which have control over people. Thus, life satisfaction is a global evaluation of life. When facing loss, widowed older adults may present both immediate and long-term responses. Immediate responses include emotions such as depressive and anxiety symptoms, whereas long-term response to loss may involve life satisfaction (Lucas, Clark, Georgellis, & Diener, 2003). Widowed older adults may experience daily fluctuations of some emotions, but maintain confidence about having control over their own lives. Therefore, the

impact of spousal on life satisfaction is not as apparent as expected. On the other hand, it is also possible that the report of this study was underpowered due to the limited reliability of the instrument that was used to measure life satisfaction. The Cronbach's Alpha of this instrument was 0.61 for the studied sample. Although it is acceptable, medium reliability suggests potential weakness of the measure.

Subjective Age. Subjective age is the second meaning-related dimension of adaptation that was introduced by the present study. In line with previous studies (Kotter-Grühn et al., 2009; Montepare, 2009; Westerhof & Barrett, 2005), the present study suggests that older adults in general perceived themselves younger than their chronological ages. It was hypothesized that widowed older adults were more likely to exhibit in the low resilient trajectory, but the current study found the opposite result suggesting that widowed older adults were more likely to belong to the high resilience trajectory of subjective age, in which the average discrepancy between chronological age and subjective age was 33, much larger than the discrepancy in the low resilient group. Because younger subjective age reflects positive evaluation of one's life (Kleinspehn-Ammerlahn, Kotter-Grühn, & Smith, 2008), this finding may suggest that some older adults can still hold a positive attitude to their lives even in the face of spousal loss. Previous studies found that, for older adults who were playing the role of spousal caregivers, the death of the spouse can be a relief and may not increase the level of distress (Schulz, et al, 2001). Additionally, these widowed older adults tended to have positive self-narratives that perceived themselves as strong and capable survivors after the loss (Peacock, 2018). Alternatively, feeling younger can also be a protective factor to against age-related stereotypes. Older adults may intentionally report younger self-perceived age as a way to protest against ageism (Rothermund & Brandtstädter, 2003; Weiss & Lang, 2012), which is a significant social stressor for older

adults. It is possible that widowed older adults utilize the same approach to defend themselves against negative impact of spousal loss by reporting a much younger subjective age. This may explain why the discrepancies between subjective and chronological ages were much larger among widowed older adults than that of the non-widowed older adults.

Depression. Depressive symptoms can be frequently experienced by older adults, especially during important life changes. This study found that most participants, both widowed and non-widowed, showed increasing depressive symptoms over eight years, even though mostly at sub-clinical levels. This may due to age-associated changes such as comorbidities, social isolation, and cognitive impairments (Aneshensel, et al, 2007; Dotson, Beydoun, & Zonderman, 2010; Karakus & Patton, 2011). Death of a loved one is another unavoidable experience for most older adults. As expected, the results showed that widowed older adults were more likely to experience increased depressive symptoms as many studies have documented the close association between bereavement and depressive symptoms (Dotson, Beydoun, & Zonderman, 2010; Utz, Caserta, & Lund, 2012). It is surprising, however, to find that the depression level tends to decrease faster among widowed older adults than the non-widowed older adults. This may due to the different natures of bereavement-related depressive symptoms and non event-related depressive symptoms. Many symptoms of grief overlap or are very similar to depressive symptoms (Shah & Meeks, 2012). While treating depression tends to be a persistent process, bereavement-related depressive symptoms are expected to naturally decrease over a short period of time for the majority of individuals (Shear, et al, 2011; Wakefield, Schmitz, & Baer, 2011). Thus, widowed participants were more likely to recover faster than those who persistently experience depressive symptoms in daily life.

Anxiety. Anxiety symptoms are another type of emotion that is frequently experienced by older adults. Although four heterogonous trajectories (recovery, increased, resilient, and chronic high) emerged, this study found that most participants (84%), including both widowed and non-widowed, were belonged to the resilient trajectory for the anxiety dimension, meaning that the majority of the participants had low level of anxiety and sustained a similar level over time. More participants (90%), regardless of their marital status, reported their anxiety levels as lower than the cut-off point. This suggests that, although aging may associate with anxiety, for the majority of older adults, it was not clinically significant. The study also found that widowed older adults had higher odds to belong to the chronic high trajectory than the resilient trajectory. It means that some widowed older adults can experience high levels of anxiety prior to loss, and rather than decreasing, it persisted over time. This may be explained by the terror management theory (Greenberg & Pyszczynski, 1991), which posits that humans have an innate fear of death leading to anxiety. This death anxiety drives people to adopt certain worldviews or daily behaviors to suppress such fear (Rosenblatt, Greenberg, Solomon, Pyszczynski, & Lyon, 1989; Solomon, Greenberg & Pyszczynski, 1991); but when major loss happens, death anxiety can be triggered and intensified (Ghufran & Ansari, 2008). Older adults may become more prone to death anxiety when encountering loss than other population. As such, it is possible that death anxiety becomes chronic for some widowed older adults, and sustained over time.

Positive affect. Positive emotions that counteract the experience of negative emotions were also witnessed during the bereavement process (Ong, Bergeman & Bisconti, 2004). Overall, this study found that the level of positive affect was decreasing as people aging regardless of their marital status. This finding adds to the literature, which has reported mixed findings. For example, in line with the current study, Charles (2001) found that positive affect remained

constant in young and middle life, and declined in late adulthood. Alternatively, some studies found that older people reported more positive affect than younger adults or increasing over the life course (Charles, et al, 2010; Shook, Ford, Strough, Delaney & Barker, 2017). The mixed results may be attributable to different measures of positive affect, sample age range, and study design. The current study with longitudinal design using nationally representative data adds more clarity to the literature. Additionally, consistent with many previous studies that documented the similar patterns of positive emotions following loss (Boyraz, Horne, & Sayger, 2010; Coleman & Neimeyer, 2010; Ong, Fuller-Rowell, Bonanno, & Almeida, 2011), the current study found that, compared to their non-widowed counterparts, widowed older adults had higher odds to belong to the trajectory that had lower levels of positive affect at baseline and which decreased faster over time. The faster decline is not surprising, because of the grief and emotional strain, as well as the loss of social and economic resources, spousal loss has been identified as a significant barrier to positive emotions (Kalpakjian, et al., 2011; Specht, Egloff, & Schmukle, 2011).

Negative affect. In contrast to positive affect, this study did not find any influence of spousal loss on the membership of the trajectories on negative affect. One explanation may be that unlike positive emotions, which older adults experienced as intensely as younger adults, negative emotions were found to be less frequent and stabilized in later life (Carstensen, Pasupathi, Mayr, & Nesselroade, 2000; Carstensen, 2011). Additionally, the Dynamic Model of Affect suggests that stressed individuals are only able to hold limited dimensions of affective experiences at a time, because individuals are required to focus their cognitive resources on the stress; individuals will regain the capacity of complex effective experiences once the stress is alleviated or being adapted (Zautra, Berkhof & Nicolson, 2002; Zautra et al, 2000). It is possible

that the affective experiences of widowed participants were not focused on negative affect. Thus, no fluctuations of negative affect were identified in the current study.

5.1.3 The multi-dimensional nature of adaptation among widowed older adults (RQ 3)

The main debate in the literature is about whether resilience is the most common response to adversities. Overall, this study adds to the literature by examining not only the most commonly studied dimensions of adaption (life satisfaction, depression, negative affect and positive affect), but also two novel dimensions of adaptation (subjective age and anxiety). The examination of six dimensions together responds to the growing demand for operationalizing the multi-dimensional nature of adaptation. This study found that most older adults were relatively resilient in the face of spousal loss on most dimensions of adaptation except for anxiety. This finding seems to support previous research, which looked at resilience in the face of adversity, and found that older adults can be highly resiliently and successfully adapt to some aspects of the loss of a spouse (Bonanno et al., 2020; Ong, Bergeman, Bisconti & Wallance, 2006; Luthar & Infurna, 2017). However, to operationalize the multidimensional nature of adaptation, it is important to examine adaptation across all six dimensions. When considered collectively across all the dimensions, no individuals were in the resilient trajectory across all six dimensions, and the majority of the participants (60.7%) only presented resilience on four dimensions of adaptation. This indicates that most participants showed some declines in several areas of functioning, even if they were resilient in others. These findings support Infurna and Luther's argument that resilience is not common. Older adults who experienced spousal loss may cope well in one dimension, while experiencing difficulties in other dimensions. It is too arbitrary to identify some individuals as resilient without ruling out other significant problems/dimensions of adaptation. Yet, it is impossible to measure all the potential concerns and problems of adaption

due to the complexity of social contexts (Rutter, 2006). It is important for researchers to design and conduct studies that examine adaptation as a multi-dimensional phenomenon, and to avoid over generalizations only based on findings about one or two dimensions of adaptation.

It is worth noting that the pre-assumption of the debate is the existence of individual adaptation pathways. Thus, the present study first implemented person-centered approach (GMM) to identify possible trajectories (RQ3) and then drew on the findings from the analysis to examine the prevalence of resilience among widowed older adults (RQ4). Consistent with the resilience and resiliency model that demonstrates individual adaptation pathways, the findings of RQ3 suggested more than one trajectory for each dimension of adaptation, supporting the notion that adaptation is multi-dimensional, and that individuals experience different adaptation pathways. Specifically, among widowed participants, three trajectories were identified for life satisfaction and anxiety; and two trajectories were identified for subjective age, depression, negative and positive affect. Results are discussed below (please refer to Appendix A for the definitions of trajectories).

Subjective age. The present study involved subjective age as the first novel dimension of adaption. Although subject age reflects a collection of physical, psychological and cognitive functioning (Stephan, Chalabaev, Kotter-Grühn, & Jaconelli, 2013; Stephan, Demulier, & Terracciano, 2012; Stephan, Sutin, & Terracciano, 2015), very few studies have attempted to understand the patterns of subjective age in the context of spousal loss in late adulthood. This study classified two heterogeneous trajectories for subjective age in the sub-group of widowed older adults: The resilient low and resilient high trajectories. Participants of both trajectories reported younger subjective than their chronological ages (9 and 35 years younger, respectively), and such discrepancy maintained over eight years. In contrast to other dimensions of adaption,

the unique feature of subjective age is its consistency. The age discrepancies did not change following spousal loss. On one hand, the findings suggest that most older adults remained positive attitude to life even in the face of spousal loss. On the other hand, because 90% of the widowed participants reported 35 years age discrepancy, which is beyond the range of -3 to 20.5 years discrepancy found in the general population (Kleinspehn-Ammerlahn, Kotter-Grühn, & Smith, 2008; Stephan, Caudroit,& Chalabaev, 2011). Since older adults may intentionally report younger subjective age as a way to against age-related stereotypes (Rothermund & Brandtstädter, 2003; Weiss & Lang, 2012), it is possible that the majority of the widowed older adults started to protect themselves from negative influences of spousal loss by persuading themselves as young and capable. The big age discrepancy becomes a protective factor to cope with bereavement. On the other hand, a small but distinct percentage of widowed older adults (10%) were not influenced by spousal loss and had the ability to against the disruption of spousal loss. Future research is needed to understand the mechanisms and factors that result in large age discrepancy.

Anxiety. The second novel dimension of adaption introduced by this study was anxiety. The trajectories of anxiety following spousal loss were not well studied. One possible reason is that anxiety and depression are associated (Ong, Bergeman, & Bisconti, 2005), but compared to depression, anxiety was less frequent among bereaved widowed persons (Bonanno, Mihalecz & Lejeune, 1999). Thus, considerable efforts have focused on bereavement-related depression, and less attention has been given to examining bereavement-related anxiety. The current study fills in the gap by identifying three trajectories: The majority of the widowed participants (75%) exhibited in the growth trajectory, in which participants reported the least amount of anxiety symptom prior to loss and it kept declining over time. Only small percent of the widowed participants (8%) exhibited in the chronic high trajectory reporting constantly high level of

anxiety over time. Other participants (17%) may report high level of anxiety prior to loss, but they recovered over time after loss. These findings are consistent with reports from previous studies with participants experienced other traumas, such as massive shooting (Mancini, Littleton & Grills, 2016) and spinal cord injury (Bonanno, Kennedy, Galatzer-Levy, Lude & Elfström, 2012), which also identified 3-4 heterogeneous trajectories of anxiety.

Life satisfaction, negative affect and positive affect. Aiming to triangulate the findings from previous studies, the present study examined life satisfaction, negative affect and positive affect, which were examined in a similar study conducted by Infurna and Luthar (2017). Their study applied GMM to data from 421 widowed older adults and classified two trajectories (resilient and recovery) for life satisfaction and positive affect and three trajectories (chronic high, recovery, resilient) for negative affect. The findings from the current study were partially in line with that study. The resilient and recovery trajectories were identified in all three dimensions. Specifically, for positive affect and negative affect, these two trajectories were the only trajectories that were identified, and resilient trajectory was the most common trajectory including 79% and 89% of the widowed participants respectively. For life satisfaction, another chronic low trajectory, suggesting consistently low level of life satisfaction over time, was identified with about 7% of the participants. One possible explanation is the difference in study designs. The present study collected data for seven years following loss, whereas the previous study only followed widowed participants for five years after the loss. Because the adaptation to widowhood takes about eight years (Lucas, Clark, Georgellis, & Diener, 2003), it is possible that participants were not fully adapted in five years. The current study may capture a more comprehensive picture of the adaptation process following loss comparing to the previous study. On the other hand, the current study may be underpowered to detect the impact of pre-loss status

on post-loss adaptation. The baseline of this study was less than one year before loss, whereas the baseline of Infurna and Luthar's study was five years before loss. Depending on the context and purposes of investigations, both studies have important implications.

Depression. With respect to depressive symptoms, this study identified two trajectories (resilient and recovery), and 86% of the widowed participants exhibited in the resilient trajectory , suggesting that most participants reported low levels of depressive symptoms prior to loss and remained low after loss. The rest of the participants, although reported high level of depressive symptoms prior to loss, the symptoms declined over time post loss. This finding is partially supported by a previous study which also examined depression among 686 widowed older adults for up to 12 years post loss (Szabó, Kok, Beekman, & Huisman, 2019). Similar to the present study, the resilient and recovery trajectories also emerged. In addition, the previous study identified a chronically high trajectory of depression; in this trajectory, participants presented and sustained a high level of depressive symptoms over time. It is possible that, given the longer investigation time (12 years post loss) of their study, more trajectories emerged in the study by Szabó and his colleges (2019). Alternatively, the previous study implemented latent class growth model (LCGM), which constrains the individual variations within each class, whereas the present study allows the within class differences in growth. Because less constrained models require fewer classes, it is possible that the previous study using LCGM over extracted the proper number of class to accommodate heterogeneity (Bauer & Curran, 2004).

5.1.4 Resilience was the most common response to some dimensions of spousal loss (RQ 4)

RQ4 responds to the questions whether resilience is the most common response to spousal loss. The current study found that the resilient trajectory was the most common trajectory for most of the studied dimensions (life satisfaction, subjective age, depression,

negative affect and positive affect). However, the resilient trajectory did not emerge for the dimension of anxiety, supporting the notion that resilience was not persistent across the board, even though the rate of resilience was 71% -100%. Each dimension is discussed below.

Life satisfaction. Results on life satisfaction are in line with previous research on spousal loss, showing resilience was the most common response (Galatzer-Levy, Bonanno, & Mancini, 2010; Infurna & Luthar, 2017a). Trajectories identified here demonstrated that in the context of spousal loss, majority (71%) viewed their lives in general as being satisfied; even if there were decreases at the transitioning stage for some individuals (21%), life satisfaction would bump up to a relatively high level seven years following loss; only a small amount of widowed older adults (8%) reported consistent low life satisfaction. One explanation for the stability of life satisfaction might be due to its nature. Unlike depression, negative or positive affect, which directly reflect individual's emotions, life satisfaction is a global evaluation of life. Ruut Veenhoven (1996) defines life satisfaction as "the degree to which a person positively evaluates the overall quality of his/her life as-a-whole". Thus, for some people, life satisfaction can be overall positive while having negative daily emotions (Infurna & Luthar, 2017a).

Subjective age. Unexpectedly, both trajectories of subjective age were resilient trajectories, indicating that the discrepancies between subjective and chronological ages remained the same over time following spousal loss among older adults. This finding implies that resilience might be the only response in the context of spousal loss. Theoretically, positive subjective age is viewed as an indicator for successful aging (Baltes & Smith, 2003). In line with previous studies using the framework of successful aging (Knoll, Rieckmann, Scholz, & Schwarzer, 2004; Kleinspehn-Ammerlahn, Kotter-Grühn, & Smith, 2008), this study also found that positive subjective age remained over time among older adults, although individual

differences existed. Despite previous study found that subjective age changed when older adults experienced life transitions, such as retirement (Kim & Moen, 2002), the current study suggests that in the face of loss, most participants remained positive about their age. Even if some life transitions may influence the patterns of subjective age and successful aging, the findings suggest that spousal loss may not alter the pathways to successful aging, despite it may add barriers.

Depression, negative affect and positive affect. Similar to life satisfaction, the current study found that resilient trajectory was the most common trajectory for depression (85.7%), negative affect (88.7%), and positive affect (78.7%). These findings are partially supported by previous research that engaged GMM and reported high prevalence of resilience in the context of adaptation bereavement and loss. For example, the rates of resilience on depression ranged between 66.3% (Isaac, Galatzer-Levy, & Bonanno, 2012) and 68.2% (Maccallum, Galatzer-Levy, & Bonanno, 2015), and on negative affect was 56%. However, to the best of my knowledge, there are only two studies of bereavement and adaptation conducted with GMM, and both of the studies suggested that resilient trajectory was not the most prevalent (Infurna & Luthar, 2017a, 2017b). The findings of the current study reported much higher rates (78.7%-88.7%) of resilience than the previous study (56%-68.2%). One possible reason is age difference. The average age of the participants for this study was 81 years old at the time of loss, whereas for other studies was about 67 years old. One side of old age is facing increasing death of close relatives. These experiences can enhance the inner strength of the oldest old (Nygren, Norberg, & Lundman, 2007), and most of them tend to be somewhat prepared for loss and ready for death (Fleming, et al, 2016). A qualitative study with older adults aged 80 or above found that preparing for death was a fundamental part of older adults' daily experience and was engaged as

a way to address age-related changes (Tuohy & Stephens, 2016). Thus, it is possible that people who are at their 80s may be calmer and have fewer negative attitudes towards loss and death than those who just officially classified as older adults. This finding, therefore, highlights the importance of distinguishing age stage in aging studies.

Anxiety. With respect to anxiety, unexpectedly, the present study did not identify a resilient trajectory for anxiety. This implies that anxiety symptoms, as a negative emotion, can be fluctuating among older adults who experienced spousal loss. Moreover, the lack of resilient trajectory supports the multi-dimensional nature of adaptation, and that resilience is not common; the high rate of resilience may just be found in certain dimensions of adaptation (Infurna & Luthar, 2017a, 2017b). In the present study, the majority of the participants (75.1%) was belonged to the growth trajectory, indicating that most widowed older adults would present low levels of anxiety symptoms during the end of life time of the spouse, and the symptoms would continually decrease over seven years. It is also worth noting that only 7.5% of widowed participants reported clinical anxiety disorder, most participants only presented mild anxiety symptoms. It is consistent with the findings of a comprehensive review, which found the prevalence of anxiety disorder were about 10% among bereaved persons (Wolitzky, Taylor, Castriotta, Lenze, Stanley & Craske, 2010). Thus, it is safe to imply that the majority of the widowed older adults only experienced mild anxiety symptoms prior to loss, and the symptoms can gradually resolve over time after loss.

5.1.5 Predictors of the membership of the resilient trajectory (RQ 5).

According to the socioecological model, determinants of resilience can be broken down into multiple layers of factors, such as environment, social support and social demographic factors. This study found that education was the only factor that predict resilience of widowed

older adults in the long term. Widowed older adults with some college education or above were significantly more likely to be in the resilient trajectory than their counterparts who had high school education or lower. This suggests that education improves or enhances older adults' abilities of coping and dealing with adversities. The impact of education has been widely documented in the literature. For example, older adults who had higher levels of education reported less health disparities (Bago, O'Donnell, & Van Doorslaer, 2008), better cognitive function (Yaffe, et al, 2009), physical function (Louie & Ward, 2010), and higher socioeconomic status. All of these can contribute to the overall well-being of older adults. Additionally, good education enables older adults to evaluate their own situation and feel more control in their lives. It has been found that older adults with higher education were more likely to live in communities in the last year of life and less likely to transition to an institute in the last weeks before death (Kelfve, Wastesson, Fors, Johnell, & Morin, 2018). Moreover, it is possible that well-educated older adults had more access to resources, which provided older adults more options and supports on coping with loss and on navigating their way around.

Regarding the two meaning-related dimensions included in this study, life satisfaction and subjective age, it is surprising to discover that most older adults can still present positive self-meanings even in the face of spousal loss. One explanation is that most older adults (71%) can hold on to their worldviews or self-meanings following loss, suggesting that it is possible that majority of the older adults do not need to go through meaning reconstruction as suggested by Neimeyer (1998; 2001), or can quickly re-identify meanings. Given the average age of the participants was 81, it is also possible that positive self-meanings have been engaged as daily routine for the middle-old (aged between 75 and 84 years) and oldest old (aged over 85 years) to cope with daily challenges. These older adults might present greater inner strength when facing

life adversities, such as loss and death (Tuohy & Stephens, 2016), even though these older adults, especially those over 80 years old, can be considered physically vulnerable. These unique features of older adults require further research to explore.

An unexpected finding of this study is the confirmation that the impact of spousal loss started even prior to loss. The high proportion of participants in the resilient trajectory of each studied dimension of adaptation indicates that most surviving spouses sustained similar levels of well-being before and after loss. In other words, if widowed participants had positive attitude to loss before spousal loss, they were more likely to sustain positive functioning over time. This finding highlights the importance of high quality Hospice and other end-of-life care for dying patients and their family members. It can not only benefit the dying patients, but also help their loved to survive after loss. This area requires future research to explore.

5.2 Limitations

A few limitations of this study should be noted. First, due the limited information in the NHATS, the cause of death of the spouses was not accounted in the analysis. There might be heterogeneity in spousal loss and this may influence adaptation to loss. For example, adaptation to an expected loss may vary from a sudden death (Carr, House, Wortman, Nesse, & Kessler, 2001), and also differ depending on the length and quality of marriage. As a result, the estimated impact of spousal loss and the adaptation trajectories are likely to be different once these factors are considered.

Second, caution is warranted when making inferences to the general older population. Although NHATS included older adults of all age groups, the average age of the studied sample was 81, which is beyond the average life expectancy (78) of the U.S. citizens. The preparation for death and loss can be a daily practice for people over 80 years old (Tuohy & Stephens, 2016),

but not for those just over 65 years old. As a result, the findings of the study are likely to be more accurate for the middle-old (ages 75 and 84) than other age groups.

Third, longitudinal panel study has advantages of large samples and of allowing to examine longitudinal behavioral patterns, but is limited in the breadth of time intervals. The NHATS collects data annually, which is more frequent than other datasets which may collect data every other year or every five years. However, the one-year time interval can still be too wide for bereavement studies. Many changes in emotions can take a place at the first three to six months. The large time intervals prevent the study to capture immediate psychological changes to spousal loss. As a result, there may be more variations in the adaption trajectories once we have more frequent data.

Fourth, to avoid using single-item measurement, the study conducted factor analysis to examine the reliability of the five-item scale of life satisfaction. Although the scale presented an acceptable reliability, this scale has not been testified in other studies or populations. This may have the risk of underpowered analysis and results.

Lastly, all studied variables relied on participants' self-reports. Although for subjective age, the purpose of the study is to use the discrepancy to reflect psychological well-being of older adults, it is important to acknowledge that self-reported measures are subject to the issues such as honesty and reliability. Participants may exaggerate or under-report the severity of their symptoms to make their situation seem better or worse. The results can be inherently biased due to inaccurate self-report responses.

5.3 Implications for Practice, Policy and Research

Despite these limitations, the present study suggests three major findings: a) the proportions of widowed older adults who exhibited resilient trajectories were relatively high

across most of the studied dimensions; however, no participants were resilient across all the dimensions. b) The End-of-Life (EOL) stage of the deceased spouse is critical for the adaption of the survived spouse. c) Education is the most important factor that contributes to a positive adaptation to spousal loss in the long run. These critical findings provide significant implications for social work practice, policy and research, which are discussed below.

5.3.1. Practice Implications

Promote comprehensive evaluation for service referrals. This study confirmed the multi-dimensional nature of adaption, and found that most participants showed some declines in several areas of functioning, even if they were resilient in others. Thus, healthcare professionals should not rule out individuals simply because they are "doing well" in one area. Currently in the United States, many bereavement services are based on referral. Social workers draw on their experiences and knowledge to determine whether a patient needs bereavement counselling or other related services. Although social workers used screening tests to inform decisions, it is important to conduct a comprehensive evaluation of the clients rather than only assessing one area of well-being. This study suggested that although older adults exhibited positive responses to loss in one area, such as depressive symptoms, it did not mean they don't need help in other areas. In-depth assessments may assist practitioners in making their best judgment.

Promote strength-based practice with older adults. This study suggests that most older adults have the ability to resist negative changes caused by adversities. Even though some might have difficulties in the face of adversities, these older adults were able to bounce back in about two years. Thus, it is important to acknowledge and take advantage of these strengths when working with older adults. Strengths-based approaches, which emphasizes clients' strengths, and views clients as resourceful and resilient in the face of adversity, has informed social work

practice. With respect to practice with older adults, the World Health Organization (2015) advocated for strength-based practice as an alternative to a deficit and disease model. In practice, however, practitioners may have difficulties identifying strengths among older adults, especially the oldest old, given to their physical and social constrains. The findings of this study highlighted the psychological strength of older adults, particularly on the perception of self-meanings. Older adults have the ability to resist or recover from adversities, such as spousal loss. It is important for healthcare professionals to take the person-centered approach to facilitate and stimulate resilience and the psychological strengths of older adults in the face of adversities.

Promote the utilization of hospice and palliative care in EOL care. This study suggested that the impact of spousal loss started before loss and that most surviving spouses could sustain similar levels of functioning before and after loss. This finding highlights the importance of early utilization of hospice and palliative care, which provides comprehensive comfort care for dying patients and support for the families (World Health Organization, 2002). One of the services that provided to surviving families is bereavement counselling, which can reduce the risk of distress, dysfunction or complicated grief of bereaved families (Aoun, Breen, O'Connor, Rumbold & Nordstrom, 2012; Gysels, Higginson, Rajasekara, Davies & Harding, 2004). However, the enrollment rate for hospice is suboptimal. According to the National Hospice and Palliative Care Organization (2019), of all Medicare decedents in 2016, only 48% were enrolled in hospice at the time of death, and 27.9% were enrolled for only seven days or less. Many families may not know or have limited understanding of hospice and palliative care. Social workers, who are the integral component of the hospice and palliative care, should promote and encourage patients and their families to ask for those services from their healthcare providers. Additionally, physicians serve a key role in hospice and palliative care; they should be encouraged to make

hospice and palliative referrals at an early stage to enable a timely and beneficial experience for both patients and their families.

5.3.2. Policy Implications

Promote grief counseling programs. This study underscores the urgency for prevention and early interventions in grief among older adults facing loss of loved ones. Although many older adults are able to resist some negative impact of loss, every individual has to cope with grief and loss. Identify signs of distress and dysfunction and mitigate the effect at an early stage can prevent older adults from severe mental illness and promote positive adaptations after loss. Medicare Part B provides coverage on grief and loss counseling to the beneficiary and their family before and after beneficiary's death, and grief counseling is a required hospice service for up to one year following the beneficiary's death (Centers for Medicare & Medicaid Services, 2019). However, the utilization of grief counseling remains low (Bergman, Haley, & Small, 2010). One of the reasons is the limited accesses to bereavement services; grief services tend to be more likely in agencies that provide only hospice care rather than other services (Dean, Libby, McAuley, & Van Nostrand, 2014). It would be beneficial to increase service access by promoting the grief counseling services in more general mental health settings. Additionally, Medicare only covers hospice-based grief counselling for up to one year. Funding and supports at the national and state levels are warranted for programs that provide non-hospice-based bereavement services. These programs and Medicare together would help to provide consistent support for bereaved older adults to minimize suffering, improve overall functioning and facilitate resilience in the long term.

Encourage and advocate for senior education programs. The findings of this study suggest that education plays a key role on cultivating positive adaptation among older adults in

the face of adversity. For older adults, education is essential for promoting social inclusion, active citizenship and personal development (Narushima, Liu, & Diestelkamp, 2018). There is a clear link between learning and health among older adults (Escolar &De Guzman, 2014; Jenkins & Mostafa, 2015; Narushima, 2008).The World Health Organization (2002) developed a policy framework, Active Aging, to advocate for optimizing opportunities for "health", "participation", and "security" among older adults. This framework not only raises the concerns and recommendations for government about financing health care and social services for aging population, but also promotes positive shift in social attitude towards aging. One of the main aspect of active aging is to promote lifelong learning in late adulthood. To follow this trend, it is important to encourage all level of governments to create age-friendly communities for learning.

Additionally, many colleges and universities are offering education programs to senior citizens. It might be beneficial to provide more options and avenues for older adults to access to education by replicating existing educational programs in communities, or deliver classes through online education. Most importantly, it is important to create a culture of life-long learning to embrace and motivate older adults to engage in life-long learning.

5.3.3. Research Implications

Uncover more dimensions of adaptation. This study confirmed the multi-dimensional nature of adaptation. In the literature, several dimensions of adaptation have been examined However, most studies examined similar dimensions repeatedly. It still remains unknown what other dimensions of adaption may exist. Our understanding of adaptation can be improved by further specification of the potential dimensions of adaptation. Additionally, an essential piece of knowledge currently missing is how do different dimensions operate or correlate with each other

to inform the adaptation process. More sophisticated statistical models maybe beneficial for answering these questions.

Examine the association of pre- and post-loss experiences. This study found that psychological status one year before loss influenced the post-loss adaptation pathways. Building on this finding, future studies should extend the investigation to a longer time frame to understand when the pre-loss influence starts. Additionally, it could be beneficial to conduct dyadic analyses with couples to examine the impact of pre-loss interactions between couples on the adaptation of surviving spouses. Additionally, due to the dataset limitations, essential factors such as cause of death, and length and quality of marriage were not accounted in this study. Future studies can address this limitation by including more factors into the investigation.

Investigate the influences of special occasions on adaptation. A study that attempted to examine anniversary effects suggested that there may be declines in well-being around the time of the death, both before and after, creating anticipatory anniversary effects (Chow, 2010). In a study with a national sample of widows, the influence of the anniversary of death can last up to eight years post-loss (Carnelley, Wortman, Bolger, & Burke, 2006). Future studies are warranted to test how the occasions, such as anniversaries, influence the shape of adaptation trajectory.

Compare adaptation across age groups. Consistent with previous studies, this study confirmed the multi-dimensional nature and the heterogeneous pathways of adaptation. This study extracted more positive findings than Infurna and Luthar's study (2016), which also used GMM to identify adaptation trajectories of widowed older adults. One critical difference between this study and Infurna and Luther (2016) is the average age of the participants. The average age was 82 in this study versus 67 in their study. It would be beneficial for future studies

to examine and compare adaptation trajectories by age groups to obtain in-depth understandings on the effect of age.

5.4 Conclusion

This study responded to the heated debate regarding whether resilience is the most common response to adversities by using a nationally representative longitudinal dataset to track widowed older adults for eight years to depict heterogeneous adaptation trajectories. Compared to their non-widowed counterparts, widowed older adults were more likely to be in the chronic high trajectory of depression, anxiety and subjective age, as well as low positive affect trajectory. However, spousal loss did not have impact on negative affect and life satisfaction. Among widowed participants, two adaptation trajectories emerged for depression, negative and positive affect, and subjective age; three trajectories were identified for anxiety and life satisfaction. Among these distinct trajectories, most participants belonged to the resilient trajectory for depression, negative and positive affect, and life satisfaction. However, no resilient trajectory was identified for anxiety. Education turned out to be the only significant predictor of membership in positive adaptation trajectories. The proportions of widowed older adults who exhibited resilient trajectories were relatively high across most of the studied dimensions; however, no participants were resilient across all the dimensions. Future research is warranted for uncovering more dimensions of adaptation, examining the association between pre- and post-loss experiences, investigating the influences of special occasions on adaptation and comparing adaptation across age groups.

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APPENDIX A: WORK DEFINITIONS FOR TRAJECTORIES

Working definitions for adaptation trajectories in this study

Trajectory	Definition
Resilient/ Resilient Low/ Resilient High	An ability to resist changes and maintain equilibrium in the face of spousal loss. Statistically, the slope of the trajectory is not statistically significant, and the intercept is below the cut-off point. If two resilient trajectories emerged, the one with smaller intercept is defined as *resilient low*, and the other one with larger intercept is defined as *resilient high*.
Recovery/ Chronic Recovery	An ability to "bounce back" in the face of spousal loss. Statistically, the slope of the trajectory is negative (< 0) and significant. If there are two recovery trajectories emerged, the one with smaller slope is defined as *chronic recovery*
Growth	An ability to maintain a low level of distress/dysfunction (or high level of positive emotions) in the face of spousal loss, and to experience continuing positive change over time. Statistically, the intercept of the trajectory is lower than the cut-off point, and the slope is significant.
Increased	The level of distress/dysfunction continuingly increase over time in the face of spousal loss. Statistically, the slope of the trajectory is positive (>0) and significant.
Declined/ Chronic Declined	The level of positive emotions decrease over time in the face of spousal loss. Statistically, the slope of the trajectory is negative (< 0) and significant. If two declined trajectories emerged, the one with smaller slop is defined as *chronic declined.*
Chronic Low	The level of positive emotions remains low over time in the face of spousal loss. Statistically, the intercept of the trajectory is small or lower than the cut-off point, and the slope is not significant.
Chronic High	The level of distress/dysfunction remains high over time in the face of spousal loss. Statistically, the intercept of the trajectory is small or lower than the cut-off point, and the slope is not significant.

APPENDIX B: STATISTICAL DEFINITIONS FOR TRAJECTORIES

Statistical definitions for adaptation trajectories in this study

Trajectory	Intercept	Slope	Example:
Resilient/ Resilient Low/ Resilient High	P<0.05 < cut-off point	P>0.05	Flat line:
Recovery/ Chronic Recovery	P<0.05	P<0.05 -- negative emotion + positive emotion	Negative emotion  Positive emotion 
Growth	P<0.05 Largest intercept Lowest intercept	P<0.05 -- negative emotion + positive emotion	Negative emotion  Positive emotion 
Increased	P<0.05 < cut-off point	P<0.05 + negative emotion	Negative emotion 
Declined/ Chronic Declined	P<0.05 < cut-off point	P<0.05 -- positive emotion	Positive emotion 
Chronic Low	P<0.05 Largest intercept	P>0.05	positive emotion
Chronic High	P<0.05 Lowest intercept	P>0.05	negative emotion