

LONGITUDINAL STUDY OF LONELINESS AND DEPRESSION AS PREDICTORS
OF HEALTH IN MID- TO LATER LIFE

M. Linda Chlipala, B.S., M.A.

Thesis Prepared for the Degree of
MASTER OF SCIENCE

UNIVERSITY OF NORTH TEXAS

May 2008

APPROVED:

Charles A. Guarnaccia, Major Professor
Randall Cox, Committee Member
Kenneth Sewell, Committee Member and Clinical
Psychology Program Director
Linda Marshall, Chair of the Department of
Psychology
Sandra L. Terrell, Dean of the Robert B. Toulouse
School of Graduate Studies

Chlipala, M. Linda, Longitudinal Study of Loneliness and Depression as Predictors of Health in Mid- to Later Life. Master of Science (Psychology), May 2008, 103 pp. 12 tables, 1 figure, references, 66 titles.

The longitudinal relationship between loneliness and depression as predictors of chronic health conditions in middle-aged to older adults was investigated utilizing data collected by the Health and Retirement Study (HRS), a national representative longitudinal study of health, retirement, and aging, conducted by the Institute for Social Research (ISR) Survey Research Center (SRC) at the University of Michigan, funded by the National Institute on Aging and the Social Security Administration. The correlation between these loneliness and depression was moderate ($r = .32$ to $r = .51$). The single-item subjective self-report of loneliness was found to be an adequate measure of loneliness. A cross-lagged panel correlation and regression design was used to examine the longitudinal relationship between loneliness, depression, and chronic health conditions. A temporal precedence was indicated implying a causal relationship with depression leading to subsequent loneliness. The relationship between recurring loneliness and chronic health conditions was weak ($r = .13$).

Copyright 2007

by

M. Linda Chlipala

TABLE OF CONTENTS

	Page
LIST OF TABLES AND FIGURES.....	iv
Chapters	
I. INTRODUCTION	1
Conceptualizations of Loneliness	
Operationalization of Loneliness	
Previous Research Relevant to the Current Study of Loneliness	
Study Objectives	
II. METHOD	36
Participants and Procedures	
Measures	
III. RESULTS	58
Descriptive Statistics	
Scale Reliabilities	
Inferential Statistics	
Tests of Hypotheses	
IV. DISCUSSION.....	68
APPENDICES	89
REFERENCES	95

LIST OF TABLES AND FIGURES

	Page
Tables	
1. Items in Revised UCLA Loneliness Scale (R-UCLA), Three-Item Loneliness Scale and HRS Short Loneliness Scale	76
2. Items in CES-D 20-Item Version, CES-D 10-Item Version, HRS CES-D 8-Item Scale	77
3. Descriptive Statistics for Categorical Demographic Variables	78
4. Descriptive Statistics for Self-Report Single-Item Loneliness Measure from CES-D	79
5. Continuous Demographic Variables	80
6. Loneliness and Depression Measurement Variables	81
7. Chronic Health Conditions Measurement Variables	82
8. Stress, Positive Social Support, Negative Social Support/Social Burden Variables	83
9. Means, Standard Deviations, and Pearson Correlations Among Variables 2002.....	84
10. Independent Samples t-tests Wave 6 (2002).....	85
11. One Way Analysis of Variance for Race Ethnicity Wave 6 (2002)	86
12. Cross-Lag Panel Correlations of Figure 1 and Differences for Loneliness (L) Depression (D) and Chronic Health Conditions (H).....	87
Figures	
1. Cross-lagged panel correlational design for loneliness, depression, and health.....	88

CHAPTER I

INTRODUCTION

Loneliness is defined as the negative subjective experience resulting from a discrepancy between the desired and achieved levels of interpersonal relationships (De Jong-Gierveld, 1987, 1998; De Jong-Gierveld & Tilburg, 1999; Perlman, Gerson, & Spinner, 1978). The discrepancy can be long standing or can result from changes in the individual's social relations, such as through a loss or move, or changes in the person's social needs or desires (Blazer, 2002). Changes in an individual's life which result in loneliness can be temporary situational changes or can be persistent, long-term, perhaps even permanent situational changes.

The study of loneliness poses numerous challenges for researchers. Like other emotions, loneliness is an ambiguous and somewhat "fuzzy" construct that eludes exact description and challenges our ability to measure. To complicate the research, the terms "loneliness," "alone," "social isolation," "limited social support" and "limited social network," often are used interchangeably. Further complicating the study of loneliness are the diverse multidisciplinary interests in the construct of loneliness which serve to divide the research among a wide range of fields of study including clinical, counseling, health, social, and developmental psychology, cultural and applied anthropology, sociology, nursing, medicine, social work, epidemiology, and gerontology, each representing a unique body of literature (Van Der Geest, 2004).

Conceptualizations of Loneliness

There is not a single unifying, life-span development conceptualization of loneliness; rather, loneliness has been conceptualized in the literature using various theoretical frameworks with two primary areas of focus (a) developmental perspectives dealing with adolescents and young adults, and (b) adult development and aging perspectives dealing with older adults. The

following sections provide an overview of some of the theoretical conceptualizations of loneliness found in a review of the relevant literature. Three theoretical conceptualizations of loneliness commonly employed by researchers in the field of psychology in the United States are summarized in the following sections: (a) attachment theory and loneliness (Stroebe, Stroebe, Abakoumkin, & Schut, 1996; Wei, Russell, & Zakalik, 2005); (b) Weiss's typologies of loneliness (Weiss, 1973); and (c) evolutionary theory and loneliness (Cacioppo & Hawkley, 2003; Cacioppo, Hawkley, et al., 2006). Also included in the following sections is a theoretical conceptualization of loneliness less frequently employed by researchers in the field of psychology in the United States: loneliness as a multidimensional construct (De Jong-Gierveld 1987, 1998; De Jong-Gierveld & Tilburg, 1999). These various theoretical conceptualizations of loneliness are presented in order to provide a comprehensive overview of the theoretical conceptualizations of loneliness as background information. Rather than attempt to test these different models of loneliness, this study attempted to integrate these various conceptualizations of loneliness. Specifically, this study investigated loneliness as both a chronic, recurrent condition and as an acute, transient condition relating to situations and circumstances as conceptualized by attachment theory and further developed by Weiss' typologies of loneliness. In addition, this study investigated the relationship between loneliness and physiological concomitants or physiological consequences as predicted by evolutionary theory.

Attachment theory and loneliness. Loneliness has been conceptualized from a developmental perspective using attachment theory (Stroebe, Stroebe, Abakoumkin, & Schut, 1996; Wei, Russell, & Zakalik, 2005). In addition, attachment theory (Ainsworth, 1989; Ainsworth & Bowlby, 1991; Bowlby, 1969/1982; Pietromonaco & Barrett, 2000) has been influential in other conceptualizations of loneliness which will be addressed in subsequent

sections of this literature review. Specifically, attachment theory served as the basis for Weiss' typologies of loneliness (1973) and, more recently, attachment theory has been incorporated into the evolutionary theory of loneliness (Cacioppo & Hawkley, 2003; Cacioppo, Hawkley, et al., 2006). Therefore, an understanding of attachment theory seems important in understanding the conceptualizations of loneliness.

According to attachment theory, as conceived by Bowlby (1969/1982) and expanded by Ainsworth and their colleagues (Ainsworth, 1989; Ainsworth & Bowlby, 1991; Pietromonaco & Barrett, 2000), there is a species specific attachment system manifested in behavior that serves to keep an individual in proximity to significant others. This attachment system is regulated by neurophysiological processes, genetically influenced, subject to developmental changes in hormones, and sensitive to the environment. Attachment theory has several basic tenets which pertain to loneliness: (a) the attachment process is innate and species specific, (b) "an attachment figure is never wholly interchangeable with or replaceable by another, even though there may be others to whom one is also attached" (Ainsworth, p. 711), (c) "there is a need to maintain proximity, distress upon inexplicable separation, pleasure or joy upon reunion, and grief at loss" (Ainsworth, p. 711), and (d) there is "a seeking of closeness that, if found, would result in feeling secure and comfortable in relation to the partner" (Ainsworth, p.711).

In addition, attachment theory predicts that children with responsive caregivers and secure attachments will develop positive representations of self and others leading to secure adult attachments, while children with inconsistent or unresponsive caregivers and insecure attachments will develop negative representations of self and/or others leading to insecure attachments (Pietromonaco & Barrett, 2000; Wei, Russell, & Zakalik, 2005). Furthermore, attachment theory predicts that these internal representations, or working models, will remain

relatively stable over time, while allowing for maturation and development to produce more complex internal representations of self and others. These internal representations of self and others can be changed due to changes in life circumstances or major life events (Pietromonaco & Barrett).

In summary, attachment theory predicts an innate human need to remain close to an attachment figure, distress upon separation, and grief upon loss. In addition, attachment theory predicts that loneliness will be related to personal characteristics and will remain relatively stable over time unless changes in life circumstance or major life events alter the individual's internal representations of self and others.

Research based on attachment theory suggests that insecure attachment styles contribute to loneliness (Wei, Russell, & Zakalik, 2005). In support of this premise, Wei, Russell, and Zakalik in a study of college freshman, found that social self-efficacy mediated attachment anxiety and loneliness, and subsequent depression and that comfort with self-disclosing feelings of distress mediated attachment avoidance and loneliness, and subsequent depression.

Attachment theory has some notable shortcomings. Specifically, although attachment theory may explain chronic loneliness related to personal characteristics, loneliness and distress related to separation from an attachment figure, and grief upon the loss of an attachment figure, attachment theory does not adequately explain loneliness due to an inadequate social network in the presence of an adequate attachment figure, such as may be experienced when a couple moves to another location. As a consequence of this deficiency in attachment theory to explain all situations which could result in loneliness, Weiss (1973) developed his theory of typologies of loneliness which is summarized in the following section.

In addition, attachment theory has no provisions to explain individuals who are satisfied with a solitary life. Furthermore, attachment theory does not attempt to explain physiological responses, concomitants, and consequences of loneliness. Thus, the evolutionary theory of loneliness, summarized in a subsequent section of this paper, was developed in an attempt to account for individual differences in loneliness, physiological responses, concomitants, and consequences of loneliness.

Weiss' typologies of loneliness. Another conceptualization of loneliness, Weiss' (1973) typologies of loneliness, expanded on attachment theory by attempting to differentiate and explain loneliness in response to various circumstances. In this influential book, *Loneliness: The Experience of Emotional and Social Isolation*, Weiss conceptualized loneliness in terms of two distinct types of loneliness: emotional loneliness and social loneliness. Emotional loneliness was attributed to the lack of a close, intimate attachment to another person. Social loneliness was attributed to the lack of a social network sharing common interests. Weiss' typology was based on his theory that different types of relationships meet different types of needs and a deficiency in having these needs met will result in different kinds of distress, loneliness, which will respond to different types of remediation (Russell, Cutrona, Rose, & Yurko, 1984; Weiss, 1973).

Weiss (1973) identified six social provisions or interpersonal needs that a social relationship could meet: (a) attachment, a relationship that provides safety and security, usually a parent, spouse, or romantic partner; (b) social integration, a relationship that provides a sense of belonging, usually friends (c) opportunity for nurturance, a relationship that provides a sense of responsibility for another individual, usually a child; (d) reassurance of worth, a relationship that provides the individual with a sense of competence, usually co-workers or employers; (e) reliable alliance, a relationship that provides assistance as needed, usually close family members; and (f)

guidance, a relationship that provides trustworthy and authoritative assistance, usually a parent, mentor, or teacher. Weiss related emotional loneliness to deficiencies in the attachment provision and social loneliness to deficiencies in social integration. Since Weiss suggested that a deficiency in each type of provision would lead to a different kind of distress; then, according to Weiss' theory, the distress associated with experience of emotional loneliness and the distress associated with the experience of social loneliness would be qualitatively distinct. Weiss proposed that emotional loneliness would lead to feelings of anxiety and isolation and social loneliness would lead to feelings of boredom, aimlessness, and marginality. Furthermore, Weiss speculated that different types of loneliness would respond to different types of remediation.

Research inspired by Weiss' conceptualization of loneliness attempts to examine emotional and social loneliness, their antecedents and their consequences (Russell et al., 1984). The examination of emotional loneliness, by definition, involves examination of close, intimate attachments to another person. The examination of social loneliness, by definition, involves the examination of the individual's social network.

Russell et al. (1984) examined the typology of loneliness as proposed by Weiss. Their study supported Weiss' conceptualization of the two typologies of loneliness, emotional loneliness and social loneliness, since the socially lonely and the emotionally lonely appeared to be two different groups of people differentiated by specific items on the UCLA Loneliness Scale (Russell, Peplau, & Cutrona, 1980). Emotional loneliness was more strongly correlated with not having someone with whom one can turn, feeling that no one knows one well, and not feeling close to anyone. Social loneliness was more strongly correlated with not feeling in tune with others, not feeling a part of a group, and not having much in common with others.

Consistent with Weiss' (1973) predictions, Russell et al. (1984) found differences in the experience of social and emotional loneliness; however, Russell et al. also found that the two types of loneliness share commonalities. Thus there appears to be overlap in social and emotional loneliness. As suggested by Weiss, emotional loneliness was associated with deficiencies in attachment provision, that is, in the quantity or quality of romantic relationships. However, they found social loneliness to be related to social integration provision, as well as reassurance of worth provision, reliable alliance, and guidance, indicating that social loneliness is related to more aspects of the social network and is more complicated than originally proposed by Weiss.

Weiss' (1973) typological theory of loneliness has some notable shortcomings. Specifically, Weiss' typological theory of loneliness does not attempt to account for individual differences in loneliness, physiological responses, concomitants, and consequences of loneliness.

Evolutionary theory and loneliness. A third conceptualization of loneliness developed from evolutionary theory (Darwin, 1859). Evolutionary theory as originally conceived by Darwin was based on the premise that organisms compete for resources and individuals with some trait that conveyed some advantage would survive and reproduce, resulting in survival of the fittest (Cacioppo, Hawkley, et al., 2006; Hergenhahn, 2001). Fitness was originally defined as an organism's ability to survive and reproduce. In the 1970's the definition of fitness was modified by sociobiologists to include the perpetuation of one's genes (Cacioppo, Hawkley, et al., 2006; Hergenhahn, 2001), thus the genetic evolution of humans is determined by the success of the individual's offspring to reproduce (Cacioppo & Hawkley, 2003; Cacioppo, Hawkley, et al., 2006). The evolutionary theory of loneliness is based on this later definition of fitness and

attempts to explain loneliness in the context of the perpetuation of an individual's genes (Cacioppo & Hawkley, 2003; Cacioppo et al., 2006).

According to the theory of loneliness developed by Cacioppo and Hawkley (2003) and Cacioppo, Hawkley, et al. (2006):

Loneliness is thought to operate in part through social pain, which co-opts the physical pain system (Eisenberger, Lieberman, & Williams, 2003), and social reward, which co-opts the appetitive system (Rilling et al., 2002), to protect the gene if not the individual. Specifically, the social pain of loneliness and the social reward of connecting with others motivate the person to repair and maintain social connections even when his or her immediate self-interests are not served by the sharing of resources or defense. In this way, loneliness, like punitive altruism (Boyd, Gintis, Bowles, & Richerson, 2003; Fehr & Gächter, 2002), promotes adaptive collective behavior to preserve the selfish molecules known as genes (Dawkins, 1990). Moreover, loneliness like physical pain and reward is posited to be influenced by situational factors but there are also stable individual differences in sensitivity. (p. 1056)

Thus, the evolutionary theory of loneliness incorporates attachment theory by attempting to explain attachment in terms of evolution, that is, infants who do not elicit and receive nurturance and protection from caregivers do not survive and do not pass on the genetic legacy of their parents; therefore, social connection and care are important to survival. In addition the evolutionary theory of loneliness accounts for the role of various types of social connections in the context of evolutionary advantage. As Cacioppo, Hawkley, et al. (2006) explained:

Ancestors who were inclined to form social connections, communicate and work together, share food and defense, and retaliate in the face of violations of reciprocity

norms had a selective advantage to survive. In conditions of hardship, hunter-gatherers who had a genetic predisposition to experience social pain from social separation (i.e., loneliness) may have been more likely to return to share their food, shelter, or defense with their family and allies to diminish the pain of loneliness. Individuals with no such feeling of loneliness when separated from others may have roamed the earth better nourished than those who felt distressed by social separation, but the abandoned offspring—and the genetic predisposition of the parents—would have been less likely to survive (p. 1056).

Furthermore, evolutionary theory accounts for individual differences in sensitivity to loneliness, thus accounting for individuals who prefer a solitary life. Moreover, the evolutionary theory of loneliness attempts to explain physiological responses, concomitants, and consequences of loneliness.

According to Cacioppo, Hawkley, et al. (2006), evolutionary loneliness theory predicts (a) heritability and genetic contributions to loneliness, (b) shared neuroanatomical connections with more primitive mechanisms, since the mechanisms of loneliness must have evolved from more primitive mechanisms such as the pain and appetitive mechanisms and, therefore, would share connections, (c) individual differences in sensitivity to social pain associated with separation (loneliness) and to social reward in connection with reunion, (c) social pain of loneliness as a motivating force to drive the individual to repair the disconnect even when their immediate self-interests are not served, and (d) in response to loneliness, activation of a survival mechanism that heightens sensitivity to threats and attacks. Research based on the evolutionary theory of loneliness has investigated heritability and the genetic basis of loneliness (Boomsma, Cacioppo, Slagboom, & Posthuma, 2006), the shared neurological substrates of loneliness and

physical pain (Eisenberger, Lieberman, & Williams, 2003), and socioemotional correlates of loneliness including hypervigilance, anxiety, and negative affect (Cacioppo, Hawkley, et al., 2006).

Regarding heritability and genetic contributions of loneliness, Boomsma et al. (2006), using a study of 8387 adult Dutch twins and 2295 of their non-twin full siblings, investigated the genetic component of variations in loneliness. Their results suggested a 40% heritability estimate for loneliness with no significant differences between males and females indicating that the same genes influence loneliness in males and females. According to Boomsma et al., their results implicated an area on chromosome 12 which has been associated with other psychiatric disorders leading them to conclude that “loneliness may be a consequence as well as a predictor of psychiatric problems” (p. 141 and continued on p. 144).

Regarding the shared neuroanatomical connections with more primitive mechanisms, research has implicated a neuroanatomical connection between social pain, social connection, and physical pain (Eisenberger et al., 2003). Eisenberger et al. used functional magnetic resonance imaging (fMRI) to investigate the neuroanatomical connections between social pain and physical pain. Their results indicated a shared neurological substrate leading the researchers to suggest that “the social attachment system...may have piggybacked onto the physical pain system to promote survival” (p. 291).

Regarding the hypothesized activation of a survival mechanism in response to loneliness that heightens sensitivity to threats and attacks, in two large studies, each with over 2500 undergraduate students (Cacioppo et al., 2000; Cacioppo, Hawkley, et al., 2006), higher loneliness scores were associated with higher levels of anxiety, anger, and negative affect, and with lower levels of optimism, security, comfort, and positive affect. In addition, Cacioppo et al.

(2000) found that loneliness was associated with physiological processes associated with the stress response, specifically, chronically lonely individuals showed elevated activation of the hypothalamic-pituitary-adrenocortical system (HPA) and dysregulated sleep (longer latency time to fall asleep, poorer sleep quality, longer sleep duration, and greater sleepiness during the day). HPA function was assessed using salivary cortisol samples collected at nine random intervals during a normal day. Analysis revealed that mean salivary cortisol levels were significantly positively correlated with chronic, trait loneliness. Mean salivary levels were positively, but non-significantly correlated with state loneliness and scores on the UCLA Loneliness Scale (Russell et al., 1980). HPA functioning and the stress response will be discussed in more detail in a subsequent section dealing with the health effects of loneliness and proposed mechanisms.

Loneliness as a multidimensional construct. The last conceptualization of loneliness to be included in this review of the literature was developed by De Jong-Gierveld (1987, 1998) and De Jong-Gierveld and Tilburg (1999). De Jong-Gierveld and De Jong-Gierveld and Tilburg conceptualized loneliness as a multidimensional construct with three components: (a) deprivation, (b) time perspective, and (c) emotional aspects. According to De Jong-Gierveld, the core component of loneliness, deprivation, refers to the feelings associated with loneliness, such as emptiness or abandonment. Time perspective refers to an individual's future perspective of the situation and accountability for the situation. Emotional aspects refer to the range of emotions that are associated with the experience of loneliness.

De Jong-Gierveld (1987, 1998) and De Jong-Gierveld and Tilburg (1999) emphasized the importance of the individual's cognitive processes that mediate the social network and the subjective experience of loneliness. Thus, loneliness is based on the individual's cognitive appraisal of the situation in the context of the individual's values and beliefs concerning social

relationships. Loneliness is viewed as the negative subjective experience resulting from a discrepancy between the desired and achieved levels of interpersonal relationships (De Jong-Gierveld, 1987,1998; De Jong-Gierveld & Tilburg, 1999; Perlman et al., 1978).

Operationalization of Loneliness

In attempts to study loneliness and its correlates, loneliness has been operationalized in various ways and measured using various methods. This section will define and describe various ways in which loneliness has been operationally defined and studied. Implications of the various operational definitions of loneliness will be overviewed and briefly discussed.

Social isolation. Social isolation generally is defined by the time individuals spend alone and focuses on contact deficits (Pinquart & Sorenson, 2001), that is, “the objective absence or paucity of contacts” (Cattan, White, Bond, & Learmouth, 2005, p. 43) between an individual and a social network. Thus, using Weiss’ typology of loneliness (1973), this would equate with social loneliness. However, Hawkley, Masi, Berry, and Cacioppo (2006) defined social isolation more specifically to indicate the absence of a significant other, or psychological distance from a significant other, which would equate with Weiss’ emotional loneliness. Thus, research using these different definitions of social isolation may be tapping different types or different aspects of loneliness. Therefore, one should be cognizant of the researchers’ definition of social isolation when comparing research.

The relationship between the objective measurement of social isolation (paucity of social contacts and/or lack of a significant other) and the subjective experience of loneliness is not as straightforward as it might seem. There does not appear to be a direct link between social isolation and loneliness, although many of the same factors are associated with both (De Jong-Gierveld, 1998). It appears that social isolation, or the lack of social contacts may predispose an

individual to loneliness, but the experience of loneliness is more closely related to the quality of social relationships, than to the quantity of social interactions (Hawkley, Burleson, Berntson, & Cacioppo, 2003; Russell et al., 1980). In a meta-analysis, Pinquart and Sorensen (2001) summarized findings regarding the correlations between loneliness and quantity of social ($r = -.16$) contacts and quality of social contacts ($r = -.29$). Thus, measures of the number of social contacts, the presence or absence of a significant other, or the amount of time spent alone, are inadequate to measure loneliness, as these measures do not tap the qualitative components of the relationships or the subjective experience of loneliness.

Social network. Typically, social network for adults is assessed by measuring the number of people in the respondent's social environment, the frequency of contact, and the types of relationships in the individual's social environment, typically spouse/partner, friends, neighbors, family members, and adult children (Pinquart & Sorensen, 2001). Thus, social network measures tap the quantitative aspects of an individual's social environment, specifically a count of the number and types of social contacts. From social network research, it appears that the type of relationship is important in the experience of loneliness (Perlman et al., 1978). In a study of loneliness and social network utilizing Canadian adults, loneliness was tied more closely to having fewer friends ($r = -.28, p < .01$) and less close friend contact ($r = -.51, p < .001$) than to contact with adult children ($r = -.18, p < .05$) or other relatives (no significant association) (Perlman et al.). Pinquart and Sorensen (2001) in a meta-analysis of loneliness studies reported the correlation with loneliness was stronger for relationships with friends ($r = -.20$) and neighbors ($-.20$) than with family ($-.12$). Thus, social contacts appear to be more important for averting loneliness in adults than family contact. The researchers concluded that older adults

should be encouraged to maintain their social contacts and encouraged to develop new friendships in order to prevent loneliness.

Social support/social burden. One problem with the quantitative measures of social relationships, such as social isolation and social network, is that these measures do not capture the qualitative aspects of social relationships. Measures of social support/social burden attempt to capture some of the qualitative aspects of social relationships. Social support measures attempt to capture some of the positive aspects of social relationships, such as assistance, guidance, and reliance. While social burden measures attempt to capture some of the negative aspects of social relationships, such as demanding, critical, and dependent. In some conceptualizations, social support and its measures may overlap with social network and its measures.

Social support is defined as “interpersonal transactions in which problem-focused aid is exchanged” (Rook, 1987, p. 1133). Thus, social support refers to a helping or problem-solving relationship, not merely companionship for mutual enjoyment (Rook). According to Rook, “social support and companionship make equally important but complementary contributions to psychological well-being. Support protects people from the debilitating effects of life stress, whereas companionship protects people from the emptiness and despair associated with loneliness” (p. 1134). Support can take the form of emotional support or instrumental support. According to De Jong-Gierveld (1998), diversity of relationships, including weakly and strongly supportive ones, reduces the likelihood of loneliness, with more supportive relationships indicating less loneliness.

As previously mentioned, social support/social burden research attempts to capture some of the qualitative aspects of social interactions not been tapped by the quantitative measures of social isolation and social network. However, in a meta-analysis of loneliness studies of middle-

age to older adults, Pinquart and Sorenson (2001) found that only 46 out of 149 studies (approximately 30%) included some measure of quality of social contacts (social support/social burden), while all 149 studies included a measure of quantity of social contact. Thus, the qualitative components of relationships have been largely ignored in loneliness research.

Aloneness versus loneliness. The terms loneliness and alone, while used interchangeably, have interrelated, but quite different meanings. Loneliness is defined as the negative subjective experience resulting from a discrepancy between the desired and achieved levels of interpersonal relationships (De Jong-Gierveld, 1987, 1998; De Jong-Gierveld & Tilburg, 1999; Perlman et al., 1978); whereas, aloneness is defined as “the objective reality of being without others, without company” (Moustakas, 1972, p. 17-18).

Based upon the definition of loneliness as a discrepancy between desired and achieved interpersonal relationships, it is possible to feel lonely in a partnered relationship if the individual’s expectations are not being met or in a social network if the individual feels alienated from the group or marginalize in some way. The individual’s psychological construal of the situation seems to be more important than objective life circumstances in distinguishing loneliness (Hawkley et al., 2003). Thus, objective measures counting the number and type of social contacts do not adequately address the subjective components of loneliness.

Although the experience of loneliness may be difficult to define and measure, the concept of loneliness clearly has a negative connotation; whereas, the concept of being alone does not necessarily carry the negative connotation of loneliness. As elucidated by Moustakas (1972):

Being alone contains an infinite number of possibilities. As such, without further concrete information, the phrase does not reveal the nature of the feelings or the actuality of the

moment.... [one does] not know whether being alone is a positive or negative condition until [one knows] what it expresses for the person involved. (p. 18)

According to Moustakas, the experience of being alone may be stressful, may be an insignificant fact of one's life, or may provide a welcome opportunity for self-determination and personal development without pressure or influence from others. After a stressful experience, aloneness may provide an opportunity for restoration of resources. Thus, being alone is not necessarily an unpleasant experience, and may even be pleasant. As suggested by Holmen, Ericsson, Andersson, and Winblad (1992), the condition of being alone may be a positive experience if self chosen. According to Davidson (2002), in a study of 26 widowed men and 25 widowed women, all but one reported loneliness as difficult to bear, but for most of the women, being alone was perceived as liberating. The men in her study were more likely to report a sense of deprivation.

Measures of Loneliness

The following sections will give a brief overview of some of the more commonly used instruments developed to measure loneliness in adult samples. According to a meta-analysis of studies of loneliness in middle age to older adults (Pinquart & Sorenson, 2001), a single-item measure of loneliness was the most frequently utilized measure of loneliness (used in 73 studies included in the meta-analysis). The most frequently used loneliness scale was the UCLA Loneliness Scale (Russell et al., 1980), used in 40 studies. The De Jong-Gierveld Loneliness Scale (De Jong-Gierveld, 1987, 1998; De Jong-Gierveld & Tilburg, 1999) was used in 11 studies. Other scales were infrequently used.

The UCLA Loneliness Scale. The UCLA Loneliness Scale (UCLA) originally developed by Russell et al. (1980) is a frequently used measure with good psychometric properties (Perlman et al., 1978; Pinquart & Sorensen, 2001). In a meta-analysis of loneliness studies of

middle age to older adults, Pinqart and Sorenson found 40 of the 149 studies (approximately 27%) used the UCLA. However, the use of a standard measure of loneliness such as the UCLA is not always possible due to the constraints of the study. The use of a lengthy measure, such as the full UCLA which has 20 items with four response categories each (see Table 1 for wording and items), may not be feasible in the case of study designs utilizing lengthy interviews or telephone interviews in which brevity is essential, in the case of data collected for studies in which loneliness was not the primary focus (Rook, 1987), or in the case of archival data.

The De Jong Gierveld Loneliness Scale. De Jong-Gierveld and her colleagues (1987, 1998; De Jong-Gierveld & Raadschelders, 1982; De Jong-Gierveld & Tilburg, 1999) developed an instrument designed to capture the components of loneliness according to De Jong-Gierveld's theoretical conceptualization, the De Jong-Gierveld Loneliness Scale. The De Jong Gierveld Loneliness Scale consists of 34 items (De Jong-Gierveld & Raadschelders) with a 6-point Likert-type scale response format (Russell, 1982). Using this measure, De Jong-Gierveld and her colleagues identified a typology of loneliness with four distinct groups (a) hopelessly lonely and dissatisfied, (b) hopelessly lonely and resigned, (c) socially active lonely and optimistic, (d) not, or only slightly, lonely. Coefficient alphas for the De Jong Gierveld Loneliness Scale were reported to range from .64 to .87 (Russell, 1982). Studies inspired by De Jong-Gierveld's multidimensional conceptualization commonly use the De Jong-Gierveld Loneliness Scale. In a meta-analysis of loneliness studies of middle age to older adults, Pinqart and Sorenson (2001) found that only 11 out of 149 studies (approximately 7%) used the De Jong Gierveld Loneliness Scale.

The NYU Loneliness Scale. The NYU Loneliness Scale was developed by Rubenstein and Shaver (1982) to be included in an 84 item questionnaire that was published in six newspapers in

the United States. Readers were asked to complete the questionnaire and return their responses to the researchers by mail. The NYU Loneliness Scale has 8 items with each of the items explicitly mentioning loneliness. The response format varies from a 4-point to a 7-point Likert-type response. The researchers reported acceptable reliability for the scale with Cronbach's alpha of .88 for the New York sample and .89 for the Worcester, Massachusetts sample. The NYU Loneliness Scale is infrequently used. It was not mentioned in the meta-analysis of loneliness studies (Pinquart & Sorensen, 2001). A recent library search in multiple databases for "NYU Loneliness Scale" returned no items. Although not commonly used, the NYU was included in this overview of loneliness measures because it was utilized in a study discussed elsewhere in this paper.

The Young Loneliness Inventory. Young (1982) developed a 19-point self-report inventory of loneliness with each item including 4 response options in the form of statements. Young recommended that this inventory be used in the diagnosis of loneliness and in cognitive-behavioral treatment of loneliness. Young reported coefficient alphas ranging from .78 to .84 in samples of college students and a clinic sample (Russell, 1982). Young considered chronicity to be an important aspect of loneliness and differentiated between transient loneliness, situational loneliness, and chronic loneliness in his writings (Young, 1982); however, the Young Loneliness Inventory does not attempt to measure chronicity. The Young Loneliness Inventory was not mentioned in the meta-analysis of loneliness studies (Pinquart & Sorensen, 2001). A recent library search in multiple databases for the Young Loneliness Inventory returned no recently published articles utilizing the Young Loneliness Inventory. Although not commonly used, the Young Loneliness Inventory was included in this overview of loneliness measures in the interest of thoroughness.

Short loneliness scales. To address the need for brevity, short scales have been developed that show adequate psychometric properties using a reduced number of items (Hays & DiMatteo, 1987; Hughes, Waite, Hawkey, & Cacioppo, 2004). Shortened versions of the UCLA Loneliness Scale have shown good psychometric properties (Hays & DiMatteo, 1987; Hughes et al., 2004; Perlman et al., 1978). Hughes et al. (2004) developed a shortened version of the UCLA specifically for use on a telephone survey. The number of items was reduced from 20 items to three items and the response format was shortened from four response categories to three response categories. Using exploratory and factory analyses of the Revised UCLA Loneliness Scale (R-UCLA, 20 items), Hughes et al. selected three items from the R-UCLA scale to be used in the Health and Retirement Study (HRS). Hughes et al. assessed the psychometric properties of the shortened version of the loneliness scale and reported good convergent and discriminant validity. In addition, Hughes et al. reported a high correlation between this 3-item shortened HRS version and the full the 20-item R-UCLA (see Table 1 for comparison of wording and items). Hays and DiMatteo (1987) developed an 8-item form of the UCLA, which they reported to have better psychometric properties than the full 20-item UCLA. Shortened scales, such as the UCLA may serve the needs of study designs utilizing lengthy interviews or telephone interviews, but shortened scales do not solve the problems of archival data or data collected for a study which was not originally designed specifically to study loneliness, but which has been co-opted and adapted in order to study loneliness.

Single-item measures of loneliness. Single-item measures have been used in gerontology research to investigate depression (Yochim, Kerker, & Lichtenberg, 2006) and loneliness (Andersson, 1982; Holmen et al., 1992; Hughes et al., 2004; Pinqart & Sorensen, 2001; Rook, 1987). Although single-item measures of loneliness lack the depth, breadth and accuracy of a

multi-item scale, and psychometrically must be assumed to have perfect reliability (i.e., the assumption of no measurement error for single-item indicator constructs), the use of a single-item measure of loneliness is attractive to researchers because a single-item measure of loneliness was included in several longitudinal archival datasets in the United States and other countries. In addition, Holmen et al. suggested that a single-item measure of loneliness might be better adapted than a multi-item scale measure, such as the UCLA, for use with the oldest age group (those over 75 years to 101 years of age) citing the increased risk of cognitive decline, dementia, memory loss, and communication difficulties in the oldest age group. In a meta-analysis of loneliness studies of middle-age to older adults, Pinquart and Sorenson (2001) found 73 of the 149 studies (approximately 49%) used a single-item measure of loneliness.

The Center for Epidemiologic Studies—Depression Scale (CES-D), a scale commonly used in longitudinal studies and present in archival research datasets, includes a single-item measure of loneliness. Because of the widespread use of the CES-D, and the inclusion of a single-item measure of loneliness in other large datasets, there is great potential value in the use of a single-item measure of loneliness to study loneliness due to the wealth of other information included in these numerous datasets, but questions remain about the performance of a single-item measure of loneliness. Since being lonely has negative connotations, one of the problems with a single-item measure of loneliness is its face validity. That is, participants may be reluctant to endorse items that carry negative connotations or social stigma; therefore, one concern with single-item loneliness measures is underreporting due to the explicit nature of the single-item measure of loneliness (De Jong-Gierveld, 1998; Pinquart & Sorensen, 2001). Rook (1987) suggested multi-item measures such as the 20-item UCLA may be more somewhat less explicit than a single-item loneliness measure, thus less susceptible to underreporting.

Andersson (1982) compared the results of three different Swedish studies using a single-item measure of loneliness. The wording, translated here to English, of the single-item measures varied for all three of the Swedish studies (“Do you feel lonely?”, “Do you personally feel very lonely?”, and “Does it happen that you feel lonely?”). Each of the studies employed a four-point response format (*often, sometimes, rarely, never*). Two of the studies used an interview methodology. The first study used a representative sample of people in an urban area age 70 years. The second study used a sample of participants age 60 and older from the same urban area. The third study used a mailed questionnaire to sample the population of Sweden age 16 years to 74 years old. The third study divided the respondents into four age groups (age 16-24, age 25-34, age 35-54, and age 55-74). In addition the results were analyzed separately for males and females. Using the single-item measure of loneliness, the third study found males reported lower degrees of loneliness than females. The percentage of reported loneliness in the oldest age group (age 55-74) was comparable to the percentages for the youngest age group (age 16-24). These studies represented early attempts to study loneliness in representative samples, but lacked sophistication in research design and statistical analysis.

Evidence of construct validity and convergent validity of a measure is accumulated when studies report similar results using two different measures of the same construct. Rook (1987) reported similar results in a study utilizing a single-item loneliness measure and in studies using a lengthier measure, thus providing evidence of construct and convergent validity (Rook, 1987). Rook investigated the relationship between companionship and loneliness in studies using three different measures of loneliness, the 20-item UCLA Loneliness Scale (Russell, Peplau, & Cutrona, 1980), six items from the NYU Loneliness Scale (Rubenstein & Shaver, 1982), and a single-item measure of loneliness asking respondents how often in the past week they had felt

lonely utilizing a four-point response format (*most of the time, occasionally, rarely, never*). The NYU and the UCLA were used in a study utilizing a sample of college students. The single-item measure of loneliness was used with an archival data sample of adults residing in Orange County California which was obtained via telephone interview. Rook found the single-item measure of loneliness and the NYU scale of loneliness showed similar patterns of relationships. Both the single-item measure of loneliness and the NYU were significantly negatively related to companionship and both measures were not significantly related to other study variables (emotional support and instrumental support), thus providing evidence for convergent validity since two measures of the same construct (loneliness) reported similar results. Interestingly, Rook found the UCLA and the NYU showed different patterns of relationships. Rook concluded that the UCLA and the NYU tapped either different subgroups of lonely participants or different concepts of loneliness. In examining the scale items, Rook concluded that the NYU and the single-loneliness item were more explicit than the UCLA.

In summary, Rook (1987) was able to demonstrate that a single-item measure of loneliness converged with the results a lengthier scale measure (NYU) since similar results were obtained using the two measures. Specifically, in Rook's studies, both the single-item measure of loneliness and the NYU were significantly negatively correlated with companionship, and both measures were not significantly related to the other study variables (emotional support and instrumental support). However, Rook's study had a notable limitation, since the single-item measure was used with one sample and the NYU and UCLA were used with a different sample, it was not possible to calculate direct correlations between the single-item and the scale measures. Thus, concurrent convergent validity of the single-item loneliness measure with the scales, at the same point in time, using the same sample could not be determined.

Pinquart and Sorensen (2001) performed a meta-analysis of the correlates of loneliness in samples of older adults using 149 studies published between the years 1948 and 1999. To be included in the meta-analysis, a study had to include some participants at least 60 years of age and the sample had to have a mean age of at least 50. As a criterion for inclusion in the meta-analysis, studies were written in English, German, or French, but the studies were not necessarily from English-speaking, German-speaking, or French-speaking countries. Most of the studies were written in the English language, with 18 articles written in German, and only one article written in French. Of the studies included in the meta-analysis, 73 studies used a single-item measure of loneliness, 40 studies used a multi-item version of the UCLA Loneliness Scale, and 11 used DeJong-Gierveld's Loneliness Scale. Pinquart and Sorenson reported single-item measures of loneliness highly correlated with the UCLA Loneliness Scale. They found women reported higher levels of loneliness using both the UCLA loneliness scale and a single-item measure of loneliness, but these differences were not found using the De Jong-Gierveld Loneliness Scale. The relationship between SES was significantly stronger when assessed using a single-item measure of loneliness as opposed to the UCLA.

Previous Research Relevant to the Current Study of Loneliness.

Loneliness in later life. Unlike depression, loneliness is not viewed as a disorder; therefore, loneliness is not defined by specific diagnostic criteria. The absence of specific diagnostic criteria makes it difficult to obtain precise measures of the incidence and prevalence of loneliness, since studies use different definitions and various indicators of loneliness. However, studies indicate that it is a myth that loneliness is associated with advancing age. To the contrary, studies indicate that loneliness is not characteristic of later life (Adams, Sanders, & Auth, 2004; Andersson, 1982; Pinquart & Sorensen, 2001). In a meta-analysis of loneliness in

older adults, Pinqart and Sorensen found a U-shaped relationship between age and loneliness. Specially, in the youngest age group (mean age ≤ 60) loneliness decreased with increasing age, they found no relationship between age and loneliness for those participants between the ages of 60 to 80 years; however, for the participants over the age of 80, loneliness significantly increased with age. Estimates of loneliness in mid-to-later life ranged from 5% to 27% (Adams et al., 2004; Andersson, 1982; Pinqart & Sorensen, 2001). These percentages likely show such variability because there are no standard differentiating criteria and studies used different definitions of what constitutes loneliness; however, these percentages represent a substantial and ever growing number of individuals. Risk factors associated with loneliness included reduced quality of social relationships, fewer social contacts, institutionalization, limitations in competence to perform activities of daily living (ADL's), limitations in instrumental activities of daily living (IADL's), and lower income (Pinqart & Sorensen, 2001). Loneliness in adolescents and young adults seems to be related to personality characteristics; whereas in older adults, loss of a partner and deteriorating health become important factors (De Jong-Gierveld, 1998).

Loneliness and depression. Depression and loneliness appear to be two interrelated, yet distinct constructs (Adams et al., 2004; Cacioppo, Hughes, Waite, Hawkley, & Thisted, 2006; Pressman et al., 2005). In a cross-sectional study, Adams et al. found a moderate positive correlation ($r = .48$) between depression (30-item Geriatric Depression Scale, GDS) and loneliness (20-item UCLA); however, there were different significant predictors associated with loneliness and depression in the regression models, highlighting the differences in the two constructs. In a hierarchical regression model with loneliness as measured using the UCLA Loneliness Scale entered last at Step 5, after Step 1: demographics (age, gender, marital status, SES), Step 2: personal stressors (chronic health conditions, grieving), Step 3: social network

measures, Step 4: social involvement (organized activities, church attendance), and loneliness, loneliness ($\beta = .341, p < .0005$) explained 8% of the unique variance in the depression score, suggesting that loneliness is an independent risk factor for depression. Grieving, smaller social network, and fewer visits from friends explained 30.8% of the variance in loneliness. Cacioppo, Hughes et al. reported the results of factor analysis of loneliness (UCLA Loneliness Scale) and depression (Beck Depression Index) using a convenience sample to examine the relationship between loneliness and depression as two separate constructs. Loneliness and depression items showed very low loading on the other symptom factor. In additional factor analyses, the loneliness and depression items separated into two distinct factors. However, the cross-sectional study designs precluded the establishment of a temporal relationship between the two constructs. Blazer (2002) suggested loneliness might lead to depression, particularly in older adults who have experienced a loss.

Pressman et al. (2005) examined depression as a mediating pathway between loneliness and poorer immune-system response in 83 healthy first semester university freshman. A large positive correlation was found between loneliness and depression ($r = .52, p < .01$). Immune-system response was measured by antibody response to an influenza immunization containing 4 viruses given on day 3 of the study with blood samples taken before immunization, and subsequently at 1 month and 4 months postvaccination. Using a procedure referred to as ecological momentary assessment (EMA), for 13 days participants reported their current loneliness, stress, and affect four times daily (1 hour, 4 hours, 9 hours, and 11 hours after waking) when cued by a palm computer. Their responses were recorded using the palm computer device and retrieved at the end of the EMA period. Depression, as measured using a 10-item version of the CES-D, was significantly positively correlated with loneliness ($r = .52$), as

measured using EMA. In addition, Pressman et al. found loneliness, as measured using EMA several times daily, was associated with poorer immune-system response as measured by antibody response to the influenza immunization at both 1 month and 4 months postvaccination. Specifically, loneliness as measured using EMA was associated with poorer antibody response to 1 component of the 4 virus components of the influenza immunization. However, depression was not found to be associated with immune-system response. These results provide evidence for depression and loneliness as two correlated, but distinct constructs.

Loneliness and health. Although loneliness has been hypothesized to serve an important adaptive function and to promote the genetic legacy of the individual (Cacioppo & Hawkley, 2003; Cacioppo, Hawkley, et al., 2006), loneliness may be detrimental for the individual's long-term survival. Studies have linked loneliness to poor health (Holmen et al., 1992; Perlman et al., 1978), to nursing home admission (Russell, Cutrona, de la Mora, & Wallace, 1997), to increased risk of mortality (Penninx et al., 1997), to increased blood pressure (Hawkley et al., 2006), and to impaired immune function (Kiecolt-Glaser et al., 1984; Pressman et al., 2005; Scanlan, Vitaliano, Zhang, Savage, & Ochs, 2001). The effects of loneliness on health may not be apparent until later in life (Hawkley et al., 2003).

Perlman et al. (1978), in a study of older adults living in Canada, reported greater loneliness was associated with a general measure of poor self-reported health ($r = .18, p < .04$) however, loneliness was not associated with having a handicap, nor was loneliness associated with frequent doctor's visits. Since this was a cross-sectional study, the temporal relationship, if any, between loneliness and health cannot be determined.

Hawkley et al. (2006) found that loneliness was significantly positively correlated ($r = .19, n = 217, p < .01$) with systolic blood pressure (SBP) in a cross-sectional population-based

study of urban adults age 50-68 years. The magnitude of the relationship was sizable; controlling for all other variables, a 1 *SD* increase in loneliness predicted a SBP increased of more than 5mm Hg, comparable to 5 years of typical age-related increase in SBP. This model predicts that individuals scoring in the top third of the loneliness scale would have an increased SBP of 10 to 30 mm Hg higher than would those scoring in the lower third. To put these results in perspective, a 20 mm Hg difference in SBP has been shown to double the risk of mortality from cardiovascular disease including ischemic heart disease and stroke (Chobanian et al., 2003). Conversely, a 10 mm Hg reduction in SBP would be associated with a 40% lower long-term risk of death due to stroke (CVA) and a 30% lower risk of death due to ischemic heart disease (IHD); a 2 mm Hg reduction would equate to a 10% lower CVA death rate and a 7% lower IHD death rate (Lewington, Clarke, Qizilbash, Peto, & Collins, 2002) .

The effects of loneliness on SBP were independent of the effects of depressive symptoms and other variables, indicating that loneliness is a unique predictor of SBP (Hawkey et al., 2006). In addition, an Age X Loneliness interaction was observed ($b = 0.7$, $SE = 0.3$, $p = .028$), with older individuals showing a greater effect of loneliness on SBP. This led the authors to suspect gradual and cumulative health effects of enduring loneliness. Clearly, further investigation of the long-term and cumulative effects of loneliness is indicated.

In a sample of healthy college freshman, Pressman et al. (2005) compared the effects of social isolation and loneliness on immune system functioning, specifically antibody response to influenza immunization, in healthy college freshman. Loneliness was assessed at baseline using the eight-item UCLA. Beginning 2 days prior to the study, and continuing throughout the study, loneliness, stress, and affect were assessed using ecological momentary assessment (EMA) four times daily when prompted by a palm computer. Both the socially isolated and the lonely showed

poorer immune responses. Individuals with both high loneliness and social isolation had the lowest immunity response. Interestingly, Pressman et al. found a differential immune response is association with social isolation and loneliness. Specifically, social isolation was associated with a depressed immune response to one component (out of four components) of the vaccine, while loneliness was associated with a depressed immune response to one different component (out of four components) of the vaccine, at 1 month $\Delta R^2 = .04$, $F(1,72) = 4.79$, and at 4 months $\Delta R^2 = .04$, $F(1,71) = 5.94$, $p < .05$. These results support the conceptualization of social isolation and loneliness as two separate constructs. Questions remain concerning the reason immunity was depressed for only one component of the vaccine and not all four components.

Interestingly, Pressman et al. (2005) found loneliness (as assessed by EMA) was associated with poorer immune response 1 month following vaccination and again at 4 months post vaccination. However, baseline measures of loneliness were not associated with immune response. Pressman et al. reasoned that the baseline measure might have picked up acute transient loneliness, as opposed to chronic loneliness assessed by EMA over the course of the study. These results were interpreted as a possible indication that acute, transient levels of loneliness may not pose the same risk to immunity as chronic loneliness, highlighting the need for further investigation of chronic loneliness.

The exact mechanisms responsible for the deleterious effects of loneliness on health are not understood. One theoretical pathway by which loneliness may influence health proposes that loneliness leads to health-compromising behaviors (Hawkley et al., 2006; Hays & DiMatteo, 1987; Lauder, Mummery, Jones, & Caperchione, 2006; Pressman et al., 2005). Health-compromising behaviors could include poor self-care such as failure to utilize medical services, unhealthy life style, or substance use. The evidence concerning a link between loneliness, health-

compromising behaviors, and health is contradictory (Lauder et al., 2006). In a cross-sectional study of college students, Hays and DiMatteo (1987) examined the relationship between loneliness and health-related behaviors including exercise, diet, alcohol, drug use, smoking, and sleep habits. They found no support for the hypothesis that loneliness leads to health-compromising behaviors, that is, they found no significant association between loneliness and health-related behaviors. Furthermore, Hawkley et al. (2006) found that utilization of medical services did not differ as a function of loneliness in a cross-sectional study of urban adults, age 50-68 years. Pressman et al. (2005) tested health-related behaviors (smoking, alcohol use, sleep, and physical activity) in college students as a mediating pathway between loneliness and poorer immune response. Of the health behaviors assessed, only poor sleep $\Delta R^2 = .07$, $F(1,72) = 6.34$, $p < .05$, was associated with loneliness in college students, but sleep was not associated with decreased immune response in the Pressman et al. study. Lauder et al. (2006) examined health-compromising behaviors (smoking, overweight, and sedentary lifestyle) in a random sample of adults in Australia. Controlling for gender, marital status, age, annual income, and employment status, results indicated lonely individuals ($M = 27.08$, $SD = 6.28$) had a significantly higher Body Mass Index (BMI) than non-lonely individuals ($M = 26.26$, $SD = 5.19$). In a study of college students, Hawkley et al. (2003) failed to find a link between health related activities (exercising, smoking, drinking) and loneliness. Based on these results, there appears to be little support for the theory that loneliness affects health through health-compromising behaviors. However, health behaviors as a mediator of loneliness and health remain a plausible theory worthy of further consideration.

Another theoretical pathway by which loneliness may influence mortality and disease involves the stress response. The body responds to stress with a series of physiological reactions,

the stress response, commonly referred to as the fight or flight response. Intense repeated or chronic stress results in frequent or chronic activation of the sympathetic nervous system (SNS) and chronic adaptations of the hypothalamic-pituitary-adrenal (HPA) axis, *hypothalamic arousal syndrome* (Bjorntorp, Holm, & Rosmond, 2000). Elevated levels of epinephrine, norepinephrine, and glucocorticoids (e.g., cortisol) have been used as indicators of stress related SNS activity and HPA activation (Hawkley et al., 2006; Kiecolt-Glaser et al., 1984; Pressman et al., 2005).

Kiecolt-Glaser et al. (1984) found higher urinary cortisol levels in psychiatric inpatients who had higher loneliness scores, thus supporting the hypothesis of HPA activation in response to loneliness. In addition, the high loneliness group had poorer immune systems. Specifically, Kiecolt-Glaser et al. found significantly lower levels of natural killer cell activity and poorer T-lymphocyte response in association with loneliness. Natural killer cell activity is thought to be important in tumor surveillance and virus control. T-lymphocyte response is important for the immune response. Thus, these immune system differences may increase susceptibility to infection and malignancy.

Hawkley et al. (2006) used overnight urinary excretion of cortisol to examine the relationship between loneliness and HPA activity in a cross-sectional population-based study of urban adults, age 50-68 years. Higher levels of cortisol were not significantly associated with increased levels of loneliness. Thus, the hypothesis of HPA activation in response to loneliness was not supported by this study.

Pressman et al. (2005) tested various possible mediating pathways between loneliness and poorer immune response and between social isolation and immune response. Stress was found to reduce the association of loneliness with immune response by 50%; however, 50% of the variability remained unaccounted for, suggesting the involvement of other factors. Stress,

however, did not reduce the association between social isolation and immune response.

Providing additional support for social isolation and loneliness as two distinct constructs.

Cross-sectional studies of loneliness. Loneliness has been studied using cross-sectional study designs (Adams et al., 2004; Cacioppo, Hughes, et al., 2006, 2006; Hawkley et al., 2003; Hawkley et al., 2006; Hays & DiMatteo, 1987; Holmen et al., 1992; Perlman et al., 1978; Rook, 1987; Russell et al., 1980). Cross-sectional studies of loneliness have established a significant positive relationship between loneliness and depression and loneliness and health. Cross-sectional studies cannot establish a temporal relationship, if any, precluding causal inference.

Much of the cross-sectional research on loneliness has been conducted using convenience samples of college students (Hawkley et al, 2003; Hayes & DiMatteo, 1987; Rook, 1987; Russell et al., 1984; Russell et al., 1980) and may not generalize to older adult populations. However, cross-sectional studies have been conducted using samples of adult populations in the United States (Adams et al., 2004; Cacioppo, Hughes, et al., 2006, 2006; Davidson, 2002; Hawkley et al., 2006; Hughes et al., 2004; Kiecolt-Glaser et al., 1984; Rook, 1987). Adams et al. (2004) studied primarily Caucasian female residents of two retirement communities in the northeastern United States. Several studies have used the HRS 2002 wave to examine loneliness and depression using the HRS Experimental Module 6: Loneliness, Stress, and Social Support/Social Burden (Cacioppo, Hughes, et al., 2006, 2006; Hughes et al., 2004). In addition to the HRS 2002 wave, Hughes et al. used the Chicago Health, Aging, and Social Relations Study (CHASRS), a population based urban sample. The CHASRS was also used to study loneliness as a predictor of blood pressure (Hawkley et al., 2006). Davidson (2002) studied loneliness in men and women who had been widowed. Rook (1987) looked at loneliness in a representative sample of adult residents of Orange County, California. These studies using adult population based samples have

greater potential for generalizability and external validity, but lack the ability to establish the temporal relationships, if any, between loneliness and depression and loneliness and health, precluding causal inference.

Longitudinal studies of loneliness. Loneliness has been studied using longitudinal study designs. Some of the longitudinal studies have been conducted using convenience samples of college students (Pressman et al., 2005; Wei, Russell, & Zakalik, 2005). Pressman et al. used a longitudinal design to study loneliness and immune response in college students. Wei et al. conducted a longitudinal study of primarily Caucasian college students to determine the relationship between loneliness and subsequent depression.

Older adult populations have been used in longitudinal studies in the United States. Russell et al. (1997) conducted a longitudinal study of primarily Caucasian older adults in rural Iowa to determine the relationships between loneliness and nursing home admission. Cacioppo, Hughes et al., 2006 (2006) used a population based urban sample from Chicago, the Chicago Health, Aging, and Social Relations Study (CHASRS), to study loneliness. Scanlan et al. (2001) used a longitudinal design to study immune system response in the primarily Caucasian spouse caregivers of individuals with Alzheimer's disease.

These studies have serious limitations to their generalizability. Specifically, these studies may not generalize to other populations due to under representation of racial and ethnic groups, and due to potentially important differences in the experiences of adults residing in urban and rural areas because of factors such as population density, proximity of neighbors, availability of public transportation, access to cultural and recreational activities, and varying degrees of neighborhood security and urban stress.

Loneliness has been studied worldwide. Cross-sectional studies of loneliness have been conducted with populations from other countries including Australia (Lauder et al., 2006), Canada (Perlman et al., 1978), Ghana (Van Der Geest, 2004), the Netherlands (De Jong-Gierveld, 1987; Penninx et al., 1997), and Sweden (Andersson, 1982; Holmen et al., 1992). In addition, longitudinal studies have been conducted in other countries including Canada, Denmark, the Netherlands, Finland, Germany, and Wales (Perlman, 2004; Stroebe et al., 1996).

Studies from other countries may not generalize to the United States population, as there may be important cultural and/or societal differences that would influence the meaning and expression of loneliness and depression (Perlman, 2004). In addition, there could be important differences that might influence the experience of loneliness and depression within this age group, such as differences in the stature of elders within the community, generational interactions, family living arrangements, perceptions of aging, retirement practices, and governmental programs addressing the needs of older adults. For example, Van Der Geest (2004) reported African and Asian visitors to the Netherlands “expressed shock and disdain at the social isolation of the elderly” (p. 77) in comparison to the treatment of the elderly in African and Asian societies.

Study Objectives

The current study investigated the relationship between loneliness and depression, as two distinct constructs, and their relationship to chronic health conditions in middle-aged to older adults using longitudinal data collected by the Health and Retirement Study (HRS), a national representative longitudinal study of health, retirement, and aging, conducted by the Institute for Social Research (ISR) Survey Research Center (SRC) at the University of Michigan, funded by the National Institute on Aging and the Social Security Administration. This study had a long-

term component to evaluate recurrent loneliness as well as situational and time-limited loneliness, in attempting to relate the somewhat colloquial concept of loneliness to more carefully considered constructs of depression, social support, and social burden. This study had several goals.

The first goal of this study was to distinguish and test for construct overlap between the constructs of loneliness and depression. Based on previous research (Adams et al., 2004; Hughes et al., 2004; Pressman et al., 2005), I expected to find a moderate positive correlation (in the range of $r = .40$ to $.50$) between loneliness and depression. A larger correlation, which may indicate lack of clear distinction between these two constructs, was not expected to be found.

The second goal of this study, which contained subgoals, was to validate the concurrent, convergent, and discriminant validity of the single-item subjective self-report of loneliness, the single-item measure of loneliness from the CES-D (see Table 2 for items and wording), as an indicator of loneliness, using the same sample of respondents and data collected at the same point in time. Based on previous research (Andersson, 1982; Hughes et al., 2004; Pinquart & Sorensen, 2001; Rook, 1987), I expected to find a significant positive correlation between the single-item measure of loneliness and the Short Loneliness Scale included in the HRS:

Loneliness, Stress, and Social Support Scale. I expected the Single-item measure of loneliness to be more highly correlated with other measures of loneliness than with a measure of depression (CES-D without the single loneliness item) and a measure of physical health (Chronic Health Condition Index).

In addition, I was interested in what respondents might mean when they respond to the single-item measure of loneliness. To explore the meaning of the single-item measure of loneliness I examined the relationship between the single-item measure of loneliness and each

component subscale of the HRS Experimental Module 6: Loneliness, Stress, and Social Support/Social Burden, specifically loneliness, perceived stress, social support, and social burden to determine the strengths of the relationships.

The third goal of this study used a cross-lagged panel correlation design (see Figure 1), as described by Kenny and Harackiewicz (1979), and regression to examine the longitudinal relationship between loneliness, depression, and chronic health conditions at two waves (HRS Wave 6, 2002 and HRS Wave 7, 2004) and to investigate loneliness and depression at Wave 6 (HRS 2002) as predictors of chronic health conditions at Wave 7 (HRS 2004). In examining the temporal precedence of the variables, it was hypothesized that higher levels of loneliness lead to subsequent depression and that higher levels of loneliness lead to subsequent increase in chronic health conditions. In addition, I expected to find that higher levels of depression lead to a subsequent increase in chronic health conditions.

Goal four was to investigate the subjective self-report of recurring loneliness as a predictor of chronic health conditions. I predicted a positive relationship between the recurring loneliness score and the chronic health index, that is, as the recurring loneliness scores increase, the chronic health conditions will increase as well. I expected to find that increased recurring loneliness will predict chronic health conditions, controlling for variables such as age and gender.

CHAPTER II

METHOD

Participants and Procedures

Health and Retirement Study. This project utilized longitudinal data collected by the Health and Retirement Study (HRS). The HRS is a nationally representative, longitudinal study of health, retirement, and aging, conducted by the Institute for Social Research (ISR) Survey Research Center (SRC) at the University of Michigan, funded by the National Institute on Aging (Health and Retirement Study), with additional funds provided by the Social Security Administration (Willis & Weir, 2006). HRS was designed to collect information on individuals from pre-retirement through retirement. HRS participants included 30,715 individuals representing a population probability sample of United States residents from the 48 contiguous states over 50 years of age and their spouses. HRS employed a stratified, multistage area probability sample design with Hispanics, African-Americans and residents of Florida over-sampled by 100%. Participants are followed with biennial surveys and supplemental data collections (Heeringa & Connor, 1995).

At the time of this study, the HRS, and related study samples, consisted of 5 cohort groups enrolled in the study in different calendar years (Health and Retirement Study, 2006): (a) Individuals born 1931 through 1941 and their partners were interviewed initially in 1992, (b) Individuals born in 1923 or earlier and their partners were interviewed initially in 1993 or 1994, (c) the War Baby sub-sample consisting of individuals born 1942 through 1947 and their partners were interviewed initially in 1998, (d) the Children of the Depression sub-sample consisting of individuals born 1924 through 1930 and their partners were interviewed initially in 1998, and (e) The Early Baby Boomer sub-sample consisting of individuals born in 1948 through 1953 and

their partners were interviewed initially in 2004. According to HRS study design, a new birth cohort is added every 6 years in order to maintain a representative sample of the population of the United States.

The HRS interview consisted of a lengthy, structured Core Interview administered to each participant. In addition, each HRS wave included experimental modules administered to a random subsample of the respondents. The modules were administered following the Core Interview and were limited to 3 minutes (Hughes et al., 2004). This study utilized Experimental Module 6: Loneliness, Stress, Social Support/Social Burden.

Participants for the present study. A subsample of the HRS participants was selected for inclusion in this study based on four criteria (a) self-identified as Hispanic, Non-Hispanic African American, or Non-Hispanic Caucasian, (b) responded to the loneliness items included in Experimental Module 6: Loneliness, Stress, and Social Support/Social Burden for Wave 6 (2002) or Wave 7 (2004), (c) age criteria of 50 years or older at Wave 6 (2002) and no older than age 70 at Wave 7 (2004), and (d) non-institutionalized/resided in the community at the time of interview for Wave 6 (2002). The first step of selecting respondents based on self-identification as Hispanic, Non-Hispanic African American, or Non-Hispanic Caucasian, required the combination of two HRS variables (Hispanic, Race) into one new variable (Race/Ethnicity). Individuals who self-identified as Hispanic were coded 3 (Hispanic) in the new Race/Ethnicity variable. The remaining respondents who self-identified as African American were coded as 2 (Non-Hispanic African American) and the remaining respondents who self-identified as Caucasian were coded as 1 (Non-Hispanic Caucasian). This selection process step resulted in the selection of 30,006 respondents from the original 30,715 respondents. The decision to select only those respondents who identified as Hispanic, Non-Hispanic Caucasian, or Non-Hispanic

African American was made in order to facilitate comparisons based on race/ethnicity; therefore those respondents who did not provide information concerning race/ethnicity and those respondents identified as other race/ethnicity were not included in this study.

The second step in the selection process, to select individuals who responded to the loneliness items included in Experimental Module 6: Loneliness, Stress, and Social Support/Social Burden for Wave 6 (2002) or Wave 7 (2004), was accomplished by constructing loneliness scales for each of the two waves in which Experimental Module 6 was included, Wave 6 (2002) and Wave 7 (2004), using the loneliness items included in Experimental Module 6. Respondents were selected on the basis of having a Loneliness Scale score greater than or equal to 1 on a scale of 1 to 3 for either Wave 6 (2002) or Wave 7 (2004). By selecting respondents using this process, respondents who provided data for the loneliness items for only one wave of Experimental Module 6, but not the other wave, remained in the data set and were included in wave-specific, cross-sectional analyses, but were excluded from longitudinal analyses.

Concurrently with the selection of respondents to the loneliness items of HRS Module 6, respondents were selected on the basis of age criteria. Since the purpose of this study was to investigate loneliness, depression, and health in middle-aged to older adults, participants were limited to respondents age 50 years and older at the time of data collection for HRS Wave 6 (2002) and no older than age 70 years at the time of data collection for HRS Wave 7 (2004). A search of the relevant literature did not reveal any consistent age definitions or conventions for what would be considered middle-aged to older adults; therefore the age selection criteria was based on the researcher's judgment. Age 50 years was selected by the developers of HRS as the lower limit for age-eligible respondents; therefore the decision was made to establish age 50 years for the lower age limit of this study. The upper age limit was established to capture

retirement age while at the same time attempting to avoid the precipitous health decline that may accompany advanced age.

The final step in the selection process involved the selection of respondents who were non-institutionalized (residing in the community) at the time of interview for Wave 6 (2002). This criterion resulted in the exclusion of 2 cases who were interviewed in a residential nursing facility at the time of data collection for the first wave of the cross-lagged panel analyses (Wave 6, 2002), thus the sample was limited to individuals residing in the community at the time of data collection for the Wave 6 (2002).

The described selection process resulted in the selection of 1265 respondents. Of these 1265 respondents selected for inclusion in this study, 181 respondents provided data on the Loneliness Scale for Wave 7 (2004) but not Wave 6 (2002); therefore cross-sectional analyses for Wave 6 included 1084 respondents. Of the 1265 respondents selected for inclusion in this study, 159 respondents provided data on the Loneliness Scale for Wave 6 (2002) but not Wave 7; therefore cross-sectional analyses for Wave 7 included 1106 respondents. Exclusion of one member of a couple was desirable due to likely non-independence of spousal responses on the constructs of interest, loneliness, depression, and health. Due to the HRS study module assignment rules, two members of a couple were not assigned to the same module; therefore two members of a couple were not included in this study (Health and Retirement Study, 2006). Only those participants who completed the HRS sections relevant to this study and selected on the basis of the selection criteria were included in the data analyses.

For the longitudinal analyses, only those respondents who had data for both Wave 6 (2002) and Wave 7 (2004) and met the above selection requirements were included in this study. This means that the sample excluded individuals who participated in Wave 6 (2002), but were

not available to participate in Wave 7 (2004) for any of a number of reasons including, but not limited to refusal to participate, death, institutionalization, and inability to locate. For the analyses relating to the Recurring Loneliness Scale, participants were limited to those respondents who responded to the Recurring Loneliness Scale items for all for waves of interest (Wave 4, 1998; Wave 5, 2000; Wave 6, 2002; Wave 7, 2004) and also had Loneliness Scale scores at Wave 6 (2002) and Wave 7 (2004), so that the same sample was utilized for all analyses.

Measures

Demographic information. Extensive detailed demographic information concerning respondents was included in the HRS. For the purposes of this study, demographic variables of interest were respondents' age, gender, race/ethnicity, marital status (currently married or living with a partner as married), employment status (currently working), height, weight, and education level (highest grade of school or year of college completed).

HRS Module 6: Loneliness, Stress, and Social Support/Social Burden. Data on loneliness was obtained using the HRS Module 6: Loneliness, Stress, and Social Support/Social Burden (Module 6), developed by Waite, Cacioppo, and Hughes (*Documentation: Health and Retirement Study*). Module 6 was included in HRS Wave 6 (2002) and HRS Wave 7 (2004) as experimental modules administered following the Core Interview. Module 6 contained 20 items including 4 items relating to loneliness, 4 items relating to stress, 6 items relating to social support, and 6 items relating to social burden (see Appendix A for a list of items and wording). Responses were rated on a 3-point Likert-type scale, 1 (*hardly ever/never*), 2 (*some of the time*), 3 (*often*), with missing responses indicated, 8 (*don't know*), 9 (*refused*). Due to the length, this module counted as two modules, Module 6 and Module 7. In HRS Wave 6 (2002), this module

was assigned to 3,008 potential respondents, twice the sample size of other HRS experimental modules (Hughes et al., 2004).

Short loneliness scale. HRS Module 6 included a Short Loneliness Scale consisting of four items (see Appendix A for items and wording). The HRS Module 6 Short Loneliness Scale includes the 3-Item Loneliness Scale adapted by Hughes et al. (2004) from the 20-item Revised UCLA Loneliness Scale (R-UCLA) originally developed by Russell et al. (1980). Using exploratory and factory analyses of the R-UCLA, Hughes et al. selected three items from the R-UCLA scale to be included in the HRS Short Loneliness Scale based on high loadings on the first factor. The items were reworded from the original version of the R-UCLA. Specifically, the wording was changed from first person to second person since the items were to be read to the respondents. In addition, the number of response categories was shortened from four categories to three since respondents had trouble remembering the response categories in pilot testing and to remain within the three minute time limit (see Table 1 for comparison of items and wording). In the HRS data, responses were rated on a 3-point Likert-type scale, 1 (*hardly ever/never*), 2 (*some of the time*), 3 (*often*), with missing responses indicated, 8 (*don't know*), 9 (*refused*).

Hughes et al. (2004) assessed the convergent and discriminant validity of the 3-Item Loneliness Scale. Using the Chicago Health, Aging, and Social Relations Study (CHASRS), a population based urban sample between the ages of 50 and 67 from the Chicago area, Hughes et al. reported a high correlation of .82 ($p \leq .001$) between the 3-Item Loneliness Scale composed of 3 items from the full 20-item R-UCLA. Since the authors did not clarify whether the correlations were computed with the R-UCLA including the three loneliness scale items and/or excluding the three loneliness scale items, this correlation might be slightly inflated due to the fact that the 3-Item Loneliness Scale is embedded within the R-UCLA. In a cross-sectional study using

respondents to the HRS Wave 6 (2002) Loneliness Module, the sample of interest in the proposed study, Hughes et al. reported the 3-Item Loneliness Scale alpha reliability coefficient was .72. In addition, the 3-Item Loneliness Scale was correlated at .48 ($p \leq .001$) with depression symptoms as measured by the 8-item Center for Epidemiologic Studies—Depression Scale (CES-D), was correlated at .49 ($p < .01$) with depression symptoms as measured by the full 20-item CES-D; was correlated at .49 ($p \leq .001$) with the single-item measure of loneliness in the CES-D, and was correlated at .44 ($p \leq .001$) with perceived stress as measured by the four-item Perceived Stress Scale. Regarding the discriminant validity, scores on the 3-Item Loneliness Scale were more weakly associated with indicators of emotions not associated with loneliness, such as enjoyment ($r = -.28, p \leq .001$), energy ($r = -.15, p \leq .001$) and motivation ($r = -.20, p \leq .001$).

During the course of this study, six loneliness scales were constructed (a) a 4-Item Loneliness Scale for Wave 6 (2002), (b) a 3-Item Loneliness Scale for Wave 6 (2002), (c) a 4-Item Loneliness Scale for Wave 7 (2004), (d) a 3-Item Loneliness Scale for Wave 7 (2004), (e) an Ordinalized 3-Item Loneliness Scale for Wave 6 (2002), and (f) an Ordinalized 3-Item Loneliness Scale for Wave 7 (2004). The first loneliness scale, the 4-Item Loneliness Scale, was constructed using all four items included in the HRS Loneliness Module. The 4-Item Loneliness Scale included the previously researched 3-Item Loneliness Scale (Hughes et al.) discussed earlier in this paper with an additional item, "How often do you feel in tune with the people around you?" The items were coded 1 (*hardly ever or never*), 2 (*some of the time*), 3 (*often*), with missing responses coded, 8 (*don't know*), 9 (*refused*). The fourth item was reverse scored, so that a higher score reflected higher levels of loneliness. The score for each respondent was obtained

by calculating the mean of the responses for the included items. Scores could range from 1 to 3 with higher scores reflecting higher levels of loneliness.

The standardized alpha coefficient computed for the 4-Item Scale 2002 was .69. Further analysis of the scale properties revealed that the reversed scored item did not function well within this scale (alpha if item deleted = .74); therefore the second loneliness scale, the 3-Item Loneliness Scale, was constructed by omitting the poor performing reversed scored fourth item. Pearson product-moment correlations for the two Loneliness Scales for 2002 were computed. The two Loneliness Scales for 2002 (the 4-Item scale and the 3-Item scale) were so highly correlated ($r = .92$) that they were deemed to be essentially equivalent measures and the standardized alpha coefficient computed for the 3-Item Scale was .75; therefore a decision was made to use the better performing 3-Item Loneliness Scale 2002 rather than the 4-item version in further analyses.

These procedures were repeated for Wave 7 (2004), with one notable exception. In Wave 7 (2004) the poor performing fourth item of the loneliness scale had been reworded to "How often do you feel alone?" so that reverse scoring was no longer necessary. The computed standardized alpha coefficient for the 4-Item Loneliness 2004 scale was .82 and for the 3-Item Loneliness 2004 scale was .75. Pearson product-moment correlations were computed for the 4-item and the 3-item versions of the 2004 scales. The two scales were so highly correlated ($r = .98$) that these two scales were deemed to be essentially equivalent measures. The decision was made to use the 3-Item Loneliness Scale for 2004 rather than the 4-item in further analyses so that Wave 6 (2002) and Wave 7 (2002) would have parallel measures for longitudinal analyses.

Analysis of the distributional characteristics of the Loneliness Scales revealed that all versions were positively skewed (3-Item Loneliness 2002 Skewness/ $SE = 24.149$, 2004

Skewness/ SE = 23.162) and peaked (3-Item Loneliness 2002 Kurtosis/ SE = 19.426, 2004 Kurtosis/ SE = 17.020) with very heavy tails at the low end of the scale. Further analysis of the distribution of the Loneliness Scales indicated that the scales had poor discrimination at the lower end of the scale likely due in part to the distribution of the characteristic of loneliness in the population and in part due to the collapse of *hardly/ever* and *never* into 1 scale point. After consulting with the research advisor, the decision was made to attempt to improve the scales' distributional properties by creating an ordinalized version of the 3-Item Loneliness Scales. This was accomplished by establishing the following cut points (a) scores of 1 to 1.33 were set equal to 1 (60% of the distribution), (b) scores greater than 1.33 and less than 2 were set equal to 2 (28%), (c) scores 2 and above were set equal to 3 (12%). The distributional properties of the ordinalized versions of both scales were improved (Ordinalized Loneliness 2002 Skewness/ SE ratio = 13.283, 2004 Skewness/ SE = 12.865; 3-Item Loneliness 2002 Kurtosis/ SE = -2.338; 2004 Kurtosis/ SE = -3.041). The decision was made to use the 3-Item Ordinalized Loneliness Scale in hypotheses testing.

Perceived Stress Scale. HRS Module 6 included a Perceived Stress Scale consisting of four items (see Appendix A for items and wording). The 4-item Perceived Stress Scale included in HRS Module 6 was originally adapted for use in a telephone interview from a 14-item Perceived Stress Scale (Cohen, Tamarck, & Mermelstein, 1983).

Originally, in the HRS data, the items were coded 1 (*hardly ever or never*), 2 (*some of the time*), 3 (*often*), with missing responses coded, 8 (*don't know*), 9 (*refused*). For the purposes of this study, the total score for the Perceived Stress Scale was derived by reverse scoring the following items (a) item V256 "...how often have you felt confident about your ability to handle your personal problems?" and (b) item V257 "...how often have you felt that things were going

your way?" so that higher scores reflected a higher level of perceived stress. The Perceived Stress Scale score for each respondent was obtained by calculating the mean of the responses for the items of the Perceived Stress Scale. Scores for the Perceived Stress Scale calculation can thus range from 1 to 3 with higher scores reflecting higher levels of perceived stress. These procedures were repeated for Wave 6 (2002) and for Wave 7 (2004), so that a total of two Perceived Stress Scales were constructed (a) Perceived Stress 2002 and (b) Perceived Stress 2004.

The Perceived Stress Scale was designed to measure the degree to which respondents perceive their life to be unpredictable, uncontrollable, and overloaded (Cohen & Williamson, 1988). The Perceived Stress Scale was originally designed for use with community samples with at least a junior high school education; therefore, the items were designed to be understandable and relatively free of content specific to any population subgroup (Cohen, Karmarck, & Mermelstein, 1983). The original Perceived Stress Scale consisted of 14 items. HRS Module 6 used a 4-item version of the Perceived Stress Scale developed by the authors of the original 14-item version of the scale for use in a telephone interview format (Cohen, Karmarck, & Mermelstein). In the original reliability and validity study of the 4-item version of the Perceived Stress Scale, the 4-item version was reported to have a coefficient alpha reliability of .72 and test-retest reliability over a two-month interval of .55 with a community sample in a smoking-cessation program. As expected, due to the limited number of items, the 4-item scale had lower internal reliability than the 14-item scale (Cohen, Karmarck, & Mermelstein). In a national probability sample based on Bureau of Census information with 2,387 participants, factor analysis of the 4-item Perceived Stress Scale using a principal components method revealed only one factor with an eigenvalue over 1.0 (eigenvalue = 1.8), accounting for 45.6% of the variance.

The reported alpha reliability coefficient for the 4-item Perceived Stress Scale used in this study was .60 (Cohen & Williamson, 1988). In the current study, the computed standardized alpha coefficient for the 4-item Perceived Stress Scale was .64.

Social Support/Social Burden Scales. HRS Module 6 included two items parallel for each of three relationship categories (partner, family, friend) relating to social support and two items parallel for the same relationship categories (partner, family, friend) relating to social burden for a total of 12 items. These items were used to construct two scales, each with three subscales, the Positive Social Support Scale with subscales for Partner Support, Family Support, and Friend Support; and the Negative Social Support Scale with subscales for Partner Negative Support, Family Negative Support, and Friend Negative Support. The positive and negative scales and subscales were not combined in this study since positive social support and negative social support (burden, strain) have been reported to be independent constructs (Walen & Lachman, 2000). These items were coded 1 (*hardly ever or never*), 2 (*some of the time*), 3 (*often*), with missing responses coded, 8 (*don't know*), 9 (*refused*). The scale scores and subscale scores for each respondent were computed by calculating the mean of the responses for the items of each scale and subscale. Scores for the scales and subscales can range from 1 to 3 with higher scores on the Positive Support Scale and subscales reflecting higher levels of positive social support, and higher scores on the Negative Support Scale reflecting higher levels of negative social support. These procedures were repeated for Wave 6 (2002) and for Wave 7 (2004), so that a total of eight Social Support Scales were constructed (a) Positive Social Support Scale 2002 (b) Partner Support 2002, (c) Family Support 2002, (d) Friend Support 2002, (e) Positive Social Support Scale 2004 (f) Partner Support 2004, (g) Family Support 2004, (h) Friend Support 2004; and eight Negative Support Scales were constructed (a) Negative Social Support Scale 2002, (b)

Partner Negative Support 2002, (c) Family Negative Support 2002, (d) Friend Negative Support 2002, (e) Negative Social Support Scale 2004, (f) Partner Negative Support 2004, (g) Family Negative Support 2004, (h) Friend Negative Support 2004.

The 12-item Social Support/Social Burden items included in HRS Module 6 were adapted from a 24-item Social Support and Strain scale used by Walen and Lachman (2000) and a 28-item version used in Midlife in the United States (MIDUS), a national study of health and well-being (*Documentation of Scales in MIDUS I*, 2004). The original 24-item Social Support and Strain scales included four items relating to social support and four items relating to social burden parallel for each of three relationship categories (partner, family, friend) with a 4-point Likert-type format. In a study of 2,348 adults age 25 to 75 years, using factor analysis two factors were extracted for all three relationships based on two eigenvalues greater than 1 (factor loadings ranged from .64 to .89). The reported Cronbach's alpha reliability coefficients were .82 for family support, .80 for family strain, .88 for friend support, .79 for friend strain, .86 for partner support, and .81 for partner strain (Walen & Lachman). In the current study, the computed standardized alpha coefficients were (a) .68 for Positive Social Support Scale 2002, (b) .76 for Partner Support 2002, (c) .73 for Family Support 2002, (d) .78 for Friend Support 2002, (e) .69 for Positive Social Support Scale 2004 (f) .73 for Partner Support 2004, (g) .69 for Family Support 2004, (h) .78 for Friend Support 2004, (i) .57 for Negative Social Support Scale 2002, (b) .62 for Partner Negative Support 2002, (c) .48 for Family Negative Support 2002, (d) .37 for Friend Negative Support 2002, (e) .63 for Negative Social Support Scale 2004, (f) .62 for Partner Negative Support 2004, (g) .48 for Family Negative Support 2004, (h) .49 for Friend Negative Support 2004. The reliability for these Social Support/Social Burden scales included in the HRS and used in this study was compromised due to the reduction in items from 4-items per

scale to 2-items per scale. The reliability for the positive support scales used in this study was adequate. The negative support/burden scales were less reliable. Since these were 2-item scales, the performance of the scales could not be improved by removing items.

Living alone. The structure and flow of the Social Support/Social Burden Scale allowed for the computation of a variable indicating whether the respondent lived in a household with a spouse/partner or other household member. This variable was coded 1 (lives alone) 0 (lives with spouse, partner, or other). This variable was used to examine group differences in those who live alone versus those who live with a spouse/partner/or other.

Center for Epidemiological Studies—Depression Scale (CES-D). During the course of this study, eight versions of the CES-D Scale were constructed (a) CES-D 2002, (b) CES-D 2004, (c) CES-D minus the loneliness item 2002, (d) CES-D minus the loneliness item 2004, (e) an ordinalized version of CES-D 2002, (f) an ordinalized version CES-D 2004, (g) an ordinalized version of CES-D minus the loneliness item 2002 (CES-D ML02), and (h) an ordinalized version CES-D minus the loneliness item 2004 (CES-D ML04). The HRS study included an abbreviated and modified 8-item version of the CES-D with a yes/no response format (Steffick, 2000). The original version of the CES-D contained 20 items. Due to the length of the HRS interview and time constraints, initially the designers of the HRS elected to use an 11-item subset of the original version of the CES-D selected on the basis on factor analysis. After the first wave of data collection in 1992, the CES-D used in the HRS was reduced to 8 items and the response format was changed to a yes/no format in order to facilitate telephone administration of the measure (see Table 2 for comparison of items and wording). According to Steffick (2000), for HRS Wave 2 (1994) and subsequent waves the CES-D items and response format have remained unchanged (see Appendix B for a list of items and wording). The wording and response format

of the CES-D were consistent for the two waves of interest for this study, HRS Wave 6 (2002) and HRS Wave 7 (2004). Responses were coded 1 (*yes*), 5 (*no*), with missing responses coded, 8 (*don't know*), 9 (*refused*).

For the purposes of this study, depression was measured using the HRS version of the CES-D, both with and without the single "Loneliness" item (item D114 in Appendix B). The total score for the CES-D was derived by reverse scoring the following CES-D items (a) "You felt everything you did was an effort," (b) "Your sleep was restless," (c) "You felt lonely," (d) "You felt sad," and (e) "You could not get going," so that higher scores reflected a higher level of depression. The CES-D score for each respondent was obtained by calculating the mean of the responses for the items of the CES-D both with and without the loneliness item so that two scores were computed for each respondent, the CES-D and the CES-D minus the loneliness item. Scores for both versions of the CES-D calculation can thus range from 1 to 5 with higher scores reflecting higher levels of depression.

Analysis of the distributional characteristics of the CES-D Scales revealed that all versions were positively skewed (CES-D 2002 Skewness/*SE* = 20.652, 2004 Skewness/*SE* = 20.246, CES-D minus Loneliness 2002 Skewness/*SE* = 19.058, CES-D minus Loneliness 2004 Skewness/*SE* = 18.768) and peaked (CES-D 2002 Kurtosis/*SE* = 10.986, 2004 Kurtosis/*SE* = 12.304, CES-D minus Loneliness 2002 Kurtosis/*SE* = 8.050, CES-D minus Loneliness 2004 Kurtosis/*SE* = 7.906) with heavy tails at the low end of the scale. Further analysis of the distribution of the CES-D Scales indicated that the scales had poor discrimination at the lower end of the scale likely due to the distribution of the characteristic of depression in the population and in part due to the collapse of the original version 4-point Likert-type scale to the HRS version with a 2-point scale (1, 5). After consulting with the research advisor, the decision was

made to attempt to improve the scales' distributional properties by creating an ordinalized version of the CES-D Scales. This was accomplished by establishing the following cut points (a) scores of 1 to 1.67 were set equal to 1 (62% for CES-D 2002, 61% for CES-D 2004), (b) scores between 1.67 and 3 were set equal to 2 (22% for CES-D 2002, 29% for CES-D 2004), (c) scores above 2 were set equal to 3 (14% for CES-D 2002, 10% for CES-D 2004). The distributional properties of the ordinalized versions of the scales were improved (Ordinalized CES-D 2002 Kurtosis/ SE = 10.986, Ordinalized CES-D 2004 Kurtosis/ SE = 12.304, Ordinalized CES-D minus Loneliness 2002 Kurtosis/ SE = 8.050, Ordinalized CES-D minus Loneliness 2004 Kurtosis/ SE = 7.906). The decision was made to use the Ordinal versions of the CES-D minus Loneliness for the testing of hypotheses.

The CES-D was selected for use in the HRS because the widespread use, reliability, and validity with various populations facilitated comparisons with other research (Steffick, 2000). Steffick reported good reliability and good internal consistency for the 8-item version of the CES-D with the yes/no format used by the HRS. According to Steffick, Cronbach's alphas were calculated for two waves of the AHEAD study (0.77 to 0.79) and for HRS Wave 2 (1994) and HRS Wave 3 (1996) (0.81 to 0.83) indicating good reliability. Principal components analysis with subsequent rotation revealed similar factor structure for the four study waves investigated. Two factors were identified, depressed mood and somatic complaints. Five symptoms loaded on the depressed mood factor and three symptoms loaded on the somatic complaints factor. Multivariate and bivariate relationships were used to evaluate the construct validity of the CES-D. The CES-D showed predicted relationships with other respondent characteristics leading to the conclusion that the CES-D was an acceptable measure of psychological distress and depression. In the current study, the computed standardized alpha coefficients for (a) CES-D

2002 = .79, (b) CES-D 2004 = .78, (c) CES-D minus the loneliness item 2002 = .76, and (d) CES-D minus the loneliness item 2004 = .75. These standardized alpha coefficients represented adequate scale reliability for this study population and were comparable to the previously reported values.

Single-item measure of loneliness from the CES-D. The CES-D included a single-item self-report of loneliness in a yes/no format (item D114 in Appendix B). The single-item loneliness measure was used in this study to investigate its value and usefulness as an indicator of loneliness by assessing the concurrent convergent and discriminant validity of this item and to construct the Recurring Loneliness Scale. For the purposes of this study, the CES-D single-item loneliness measure (HD114 for 2002/ JD114 for 2004 "You felt lonely") was reverse scored so that higher scores reflected a higher level of loneliness.

The single-item measure of loneliness has been included in each wave of the HRS and the wording has remained unchanged. The response format was changed to a yes/no format for HRS Wave 2 (1994) and subsequent waves. The single-item measure of loneliness wording and response format were consistent for the waves of interest in this study, HRS Wave 4 (1998), HRS Wave 5 (2000), HRS Wave 6 (2002), and HRS Wave 7 (2004). In a cross-sectional study using respondents to the HRS Wave 6 (2002) Loneliness Module, the sample of interest in the proposed study, Hughes et al. (2004) reported the correlation between the CES-D single-item measure of loneliness and the 3-Item Loneliness Scale was .49 ($p \leq .001$). The authors' purpose, however, was to investigate the properties of the 3-Item Loneliness Scale, not the properties of the single-item measure of loneliness; therefore, convergent and discriminant validity of the single-item measure of loneliness were not reported. For the current study, the correlation between the CES-D single-item measure of loneliness with the 3-Item Loneliness Scale and the

Ordinal version of the 3-Item Loneliness Scale was computed using cross-sectional analyses for each wave (Wave 6 2002, Wave 7 2002) and longitudinal analyses. For Wave 6 (2002), the correlation between the CES-D single item loneliness and the 3-Item Loneliness Scale was .48 ($n = 1083, p < .01$) and .44 ($n = 1083, p < .01$) for the Ordinalized 3-Item Scale. For Wave 7 (2004) the correlation between the CES-D single item loneliness and the 3-Item Loneliness Scale was .51 ($n = 1105, p < .01$) and .47 ($n = 1105, p < .01$) for the Ordinalized 3-Item Scale. These correlations were similar to those reported by Hughes et al. (2004).

Recurring loneliness scale. A recurring loneliness scale was constructed using the single-item measure of loneliness from the CES-D for four waves of the HRS, Wave 4 (1998), Wave 5 (2000), Wave 6 (2002), and Wave 7 (2004). The CES-D single-item measure of loneliness was reverse scored 1 (*no*), 5 (*yes*), so that the higher score was indicative of loneliness. For each respondent, the mean scores for the Recurring Loneliness Scale were calculated over the four waves of interest including HRS Wave 4 (1998), HRS Wave 5 (2000), HRS Wave 6 (2002), and HRS Wave 7 (2004). This mean recurring loneliness score was used as an indicator of recurring loneliness. Recurring Loneliness mean scores could range from 1 to 5. A mean Recurring Loneliness score of 1 indicated no reported loneliness for any of the 4 waves. A score of 2 indicated loneliness was reported during only one of the 4 waves of data collection and perhaps represented situational loneliness. Higher mean score values indicated recurring episodes of loneliness during the waves of interest and were considered to be more indicative of an enduring pattern of loneliness.

Chronic health condition index. During the course of this study, eight chronic health condition indices were constructed (a) Chronic Health Conditions 2002, (b) Chronic Health Conditions minus the mental health item 2002, (c) Chronic Health Conditions minus the obesity

item 2002, (d) Chronic Health Conditions minus the mental health item and the obesity item 2002, (e) Chronic Health Conditions 2004, (f) Chronic Health Conditions minus the mental health item 2004, (g) Chronic Health Conditions minus the obesity item 2004, (h) Chronic Health Conditions minus the mental health item and the obesity item 2004. For the purposes of this study, the Chronic Health Condition Index was used as an indication of physical health status. The Chronic Health Condition Index included chronic conditions with which the respondents reported having ever been diagnosed by a doctor. The wording “has a doctor ever told you that you have...” was selected by the HRS designers in an attempt to reduce the subjectivity of self report (Fisher, Faul, Weir, & Wallace, 2005); however, this format may bias the reporting for those individuals who did not have adequate health care. If a respondent did not report a specific health condition, in subsequent waves the question was worded "Since we last talked to you, has a doctor told you that you have (condition)." Responses were coded 1 (*yes*) and 5 (*no*).

If a respondent reported a health condition, in subsequent waves, the question was worded, "Our records from your last interview show that you have had (condition)." Using this format, respondents had the opportunity to dispute their report from a previous wave. Respondents who disputed their report from a previous wave that they had the condition, but reported they now have the condition (No I didn't have ...when interviewed before, but now I do.) were coded in the HRS data as "3". For the purposes of this study, a value of 3 was treated as a *yes* response and recoded accordingly. Respondents who disputed their report from a previous wave that they had the condition and reported at the time of data collection that they did not have the condition (No, I did not have ... when interviewed before and I do not have it now.) originally were coded in the HRS data set as "4". This situation may have been the case for

individuals whose conditions were misdiagnosed initially or for individuals who inaccurately reported at the time of the previous wave. For the purposes of this study, a value of 4 was treated as a *no* response.

In addition, obesity was included as one of the chronic health conditions for the purposes of calculating the Chronic Health Condition Index. Obesity was included as a chronic health condition for the purposes of this study based on the rationale that (a) obesity has reached epidemic proportions globally, (b) obesity contributes substantially to the global burden of chronic disease, (c) obesity as a chronic condition is often a precursor to other chronic conditions, (d) the recommendation that obesity should be considered a disease (World Health Organization, 2003), and (e) obesity is diagnostically coded under endocrine, nutritional, and metabolic diseases according to ICD-9 and ICD-10 (World Health Organization, 2007). Obesity was defined using the World Health Organization (WHO) and the United States Department of Health and Human Services Centers for Disease Control and Prevention (CDC) definition of $BMI \geq 30 \text{ kg/m}^2$ (United States Department of Health and Human Services Centers for Disease Control and Prevention, 2007; World Health Organization, 2006).

One criticism of BMI is that some individuals who have large muscle mass may be over identified as obese using BMI even though they do not have excessive body fat (CDC, 2007). This may be less of a concern in the sample of individuals age 50 years to 70 years included in this study, although there may be participants with an athletic build in the sample who were incorrectly identified as obese using the definition of $BMI \geq 30$. Other methods of determining obesity may be preferred to BMI, such as calculation of the ratio of waist/hip circumference, ultrasound, computer tomography, and magnetic resonance imaging (CDC, 2007); however, BMI was chosen as the method for determining obesity for this study because (a) respondents'

heights and weights were included in the HRS data, thereby making calculation of BMI possible, (b) in epidemiology, BMI alone has been used as an indicator of obesity (Mei et al., 2002), and (c) hip and waist measurements and other methods of determining obesity were not available for this sample of respondents. To address concerns of over identifying obesity based on BMI, a second BMI indicator was constructed, Severe Obesity, defined as $BMI \geq 40$.

The Chronic Health Conditions Index was constructed by reverse coding the chronic health conditions 1 (*no*), 5 (*yes*) and calculating mean scores for each respondent so that Chronic Health Condition Index scores could range from 1 to 5, with higher scores reflecting higher levels of chronic health conditions. Specific chronic conditions included in this index were hypertension/high blood pressure, diabetes, cancer (other than skin cancer), lung disease, heart disease, stroke, arthritis, emotional/psychiatric conditions and obesity. In order to address possible controversy regarding including obesity as a chronic health condition with other conditions such as heart disease and cancer, obesity was omitted from one construction of the Chronic Health Conditions Index. The emotional/psychiatric item was omitted from one construction of the Chronic Health Condition Index due to probable overlap with this item and the constructs of loneliness and depression. Both the obesity item and the emotional/psychiatric item were omitted from one construction of the Chronic Health Condition Index. These procedures were repeated for Wave 6 (2002) and for Wave 7 (2004), so that a total of eight Chronic Health Indices were computed (a) the 2002 Chronic Health Condition Index including all of the listed conditions, (b) the 2002 Chronic Health Condition Index minus obesity, (c) the 2002 Chronic Health Condition Index minus emotional/psychiatric conditions, (d) the 2002 Chronic Health Conditions Index minus both the obesity and the emotional/psychiatric conditions, and parallel scales for Wave 7 (2004). These Chronic Health Condition Indices did

not take into account the severity of the condition so that reported hypertension and severe heart disease were weighted equally; however, these conditions included in the index often were not independent, so higher scores may be an indication of more severe symptoms (Dwyer & Mitchell, 1999). Using the HRS data and a similar health index, Dwyer and Mitchell reported that respondents with severe heart conditions obtained a mean health condition score of twice the overall mean, indicating that the measure was sensitive to severity through co-morbidity.

Regarding the validity of the using the HRS health conditions data to construct a chronic health conditions index, Fisher et al. (2005) compared the chronic health conditions data obtained by the HRS to data obtained by the National Health Interview Survey (NHIS). The question format is similar for both studies in that respondents are asked if a doctor has ever told them that they have the various chronic health conditions. A high degree of correspondence between the prevalence estimates for chronic health conditions of the two studies provides evidence for external validity for the HRS chronic health condition measures (Fisher et al.). In addition, Fisher et al. noted that an index measure of the number of health conditions for the two studies would be comparable.

Single-item measure of emotional/psychiatric condition. The chronic disease section of the HRS included an item asking if a doctor has ever indicated that an individual has an emotional or psychiatric condition. In the HRS data, responses were coded 1 (*yes*), 5 (*no*). For the purposes of this study, this variable was reverse coded 1 (*no*), 5 (*yes*) so that the higher score indicated the presence of the characteristic. This variable was used as an indication of a history of emotional or psychiatric conditions.

Change scores. Change scores were calculated for loneliness, depression, and chronic health conditions. The Loneliness Change scores were calculated for each respondent by

subtracting the Loneliness Scale score at Wave 6 (2002) from the Loneliness Scale score at Wave 7 (2004). The Depression Change scores were calculated for each respondent by subtracting the CES-D score at Wave 6 (2002) from the CES-D score at Wave 7 (2004). The Health Change scores were calculated for each respondent by subtracting the Chronic Health Conditions score at Wave 6 (2002) from the Chronic Health Conditions score at Wave 7 (2004).

CHAPTER III

RESULTS

Descriptive Statistics

In order to describe the characteristics of the sample used for this study, frequency counts and percentages were calculated for the categorical variables gender, race/ethnicity (non-Hispanic Caucasian, non-Hispanic African American, and Hispanic), marital status at the time of data collection (married or living with a partner as married), living arrangement (living alone or living with spouse/partner/other), employment status at the time of data collection (working, not working), and health conditions. The frequency counts and percentages for the categorical variables are reported in Table 3. In addition, for the single-item loneliness measure for Wave 4 (1998), Wave 5 (2000), Wave 6 (2002), and Wave 7 (2004) frequency counts and percentages were calculated (see Table 4). For the continuous demographic variables age, education, height, weight, and body mass index (BMI), sample means and standard deviations were computed. The descriptive statistics for the continuous demographic variables are presented in Table 5. Descriptive statistics were calculated for Wave 6 (2002) and for Wave 7 (2004) with the exception of education and height which were deemed relatively stable and were not repeated after the initial interview.

For the continuous measurement variables, sample means, standard deviations, skewness, standard error of skewness, ratio of skewness/standard error of skewness, kurtosis, standard error of kurtosis, and ratio of kurtosis/standard error of kurtosis were computed. Refer to Table 6 for the characteristics of the loneliness and depression variables, Table 7 for the characteristics of the chronic health conditions measures, and Table 8 for the characteristics of the ancillary variables of stress and social support. The two ratio scores were examined to determine gross

departures from univariate normality. Analysis of the distributional characteristics of the measurement scales revealed numerous departures from normality. Most scales were positively skewed, but a few scales were negatively skewed. The loneliness and depression scales were positively skewed and peaked with very heavy tails at the low end of the scale (refer to Table 6). The ordinalized versions of these scales were less positively skewed.

Scale Reliabilities

Scale reliability analyses were performed for all scales used in this study. Inter-item correlations were calculated and standardized item alpha reported for each scale used in this study. Refer to Table 9 for standardized item alpha values for each scale. The results of scale analyses revealed that the loneliness, depression, and positive support scales used in this study demonstrated adequate reliability with this sample. The negative social support/social burden scales used in this study showed less than ideal reliability.

Inferential Statistics

In order to characterize the sample and to look for group differences, a number of atheoretical analyses that may capitalize on chance were completed before doing any formal testing of hypotheses. Independent *t*-tests were conducted for Wave 6 (2002) to compare the participants scores based on gender, living arrangements (lives alone or lives with spouse/partner/other) marital status (married or living with a partner as married), employment status (employed at the time of data collection) . Table 10 presents the means and standard deviations by group. The results indicated significant differences between groups based on gender, specifically females demonstrated significantly higher scores on measures of loneliness (Ordinalized Loneliness Scale $M = 1.57$, $SD = .72$, $t(694.190) = -4.18$, $p < .001$), depression (Ordinalized Center for Epidemiologic Studies—Depression Scale [CES-D] minus loneliness

item $M = 1.56$, $SD = .75$, $t(843.599) = -3.48$, $p = .001$), and perceived stress ($M = 1.44$, $SD = .45$, $t(710.363)$, $p < .001$), than males on loneliness ($M = 1.39$, $SD = .64$), depression ($M = 1.41$, $SD = .66$), and stress ($M = 1.34$, $SD = .39$). Refer to Table 10 for all means, standard deviations, t -test values, and degrees of freedom. There were no significant differences in the scores of men ($M = 1.91$, $SD = .67$) and women ($M = 1.91$, $SD = .67$) on the chronic health condition index, $t(1263) = .09$, $p = .93$. In addition, group comparisons on the basis of respondents' living arrangements revealed that the group of respondents living alone had significantly higher mean scores on measures of loneliness, Ordinalized Loneliness Scale $M = 1.87$, $SD = .80$; $t(127.092) = -4.94$, $p < .001$, depression, Ordinalized CES-D minus loneliness $M = 1.60$, $SD = .77$; $t(400.609) = -2.11$, $p = .04$, and perceived stress $M = 1.49$, $SD = .46$; $t(1082) = -2.15$, $p = .032$, than the group of respondents living with a spouse, partner, or other household member (loneliness $M = 1.48$, $SD = .68$, depression $M = 1.46$, $SD = .65$, perceived stress $M = 1.40$, $SD = .43$).

Additionally, results revealed significant differences between groups on the basis of marital status, specifically the group of participants not married or cohabitating had significantly higher mean scores on measures of loneliness, $M = 1.83$, $SD = .78$; $t(211.588) = -5.62$, $p < .001$, depression $M = 1.63$, $SD = .80$; $t(274.428) = -2.39$, $p = .02$, and perceived stress $M = 1.50$, $SD = .46$; $t(1082) = -3.165$, $p < .002$ than the group of participants who were married/living with a partner as if married at the time of data collection (loneliness $M = 1.46$, $SD = .67$; depression $M = 1.49$, $SD = .71$; perceived stress $M = 1.39$, $SD = .43$). Furthermore, group comparisons on the basis of employment status revealed that the group of respondents who were not working at the time of data collection had higher mean scores on the measures of loneliness, $M = 1.60$, $SD = .75$; $t(1081.958) = -4.24$, $p < .001$, depression $M = 1.63$, $SD = .77$; $t(1238.951) = -6.50$, $p < .001$, chronic health conditions $M = 2.04$, $SD = .71$; $t(1261.962) = -7.74$, $p < .001$, and stress, $M =$

1.46, $SD = .46$; $t(1080.880) = -4.31, p < .001$ than the group who was employed. The results of t -test analyses are presented in Table 10.

One-way Analysis of Variance (ANOVA) was conducted to explore the impact of race/ethnicity for the three groups Non-Hispanic Caucasian, Non-Hispanic African American, and Hispanic on the variables of interest. There were statistically significant differences based on race/ethnicity for the measures of loneliness, depression, chronic health conditions, and perceived stress (see Table 11). Post-hoc comparisons using the Tukey HSD range test for significance indicated the mean score for Non-Hispanic Caucasians (Ordinalized Loneliness $M = 1.46, SD = .69$) was significantly different from Non-Hispanic African Americans ($M = 1.81, SD = .78$) on loneliness measures. In addition, Non-Hispanic Caucasians ($M = 1.45, SD = .65$) differed significantly from Hispanics ($M = 1.73, SD = .77$) on depression. Furthermore, Non-Hispanic Caucasians differed significantly from both Non-Hispanic African Americans and Hispanics on the measures of chronic health conditions, recurring loneliness, and stress (see Table 11).

In addition, exploratory correlational data analyses were performed to examine the relationship among the continuous variables. Correlational analyses are reported in Table 9. Correlational analyses revealed a number of significant correlations among the study variables as expected due to the selection of variables and the large sample size for most analyses. The Chronic Health Condition Indices were very highly correlated ($r = .91, p < .01$; $r = .94, r = .95, p < .01$; $r = .96, p < .01$; $r = .97, p < .01$; $r = .99, p < .01$;) and exhibited similar patterns of correlations with other variables; therefore the Chronic Health Condition Indices appeared to be essentially equivalent measures (refer to Table 9). Removing the mental health item from the Chronic Health Condition Index slightly lowered the correlation with the other Chronic Health

Condition Indices and with other study variables. The addition of the obesity item to the Chronic Health Condition Index did not appear to add much to the measure. The decision was made to use the more traditional health indicators for inferential analyses; therefore, the Chronic Health Condition Index utilized for further analyses was the Chronic Health Condition Index minus the obesity item and minus the mental health item.

Tests of Hypotheses

The first goal of this study was to distinguish and test for construct overlap between the constructs of loneliness and depression. The Pearson product-moment correlations were calculated between loneliness and depression (see Table 9 and Table 12). This correlation also was calculated adjusting for the suppression in observed correlations due to unreliability of the measures (Carmines & Zellar, 1979). Since adjusting for the suppression due to unreliability of measures results in a larger correlation, this is a controversial procedure; however, Carmines and Zellar suggest that correction of correlations is one important use of a reliability measure. There was a moderate positive correlation between loneliness and depression. The observed correlations ranged from $r = .36, n = 925, p < .01$ (using the ordinalized Loneliness Scale 2002 and the ordinalized CES-D minus the loneliness item 2002) to $r = .51, n = 925, p < .001$ (using the single-item measure of loneliness 2002 and the ordinalized CES-D minus the loneliness item 2002) depending on which measures were used (see Table 9 and Table 12). In addition, the two constructs showed similar patterns of correlations with the variables in this study, but the strengths of the correlations varied (refer to Table 9). For example, using z -test for two correlation coefficients (Kanji, 1993), the correlation between loneliness and partner support ($r = -.40$) was significantly different from the correlation between depression and partner support ($r = -.27, z = -3.79, p < .001$).

The second goal of this study was to validate the single-item subjective self-report of loneliness, the single-item measure of loneliness from the CES-D, as an indicator of loneliness. To assess the concurrent validity of the single-item measure of loneliness, relationships were examined using Pearson product moment correlations between the single-item measure of loneliness and the various versions of the Loneliness Scale computed for this study and between the single-item measure of loneliness and the Perceived Stress Scale and the Social Support Scales. There was a significant moderate, positive correlation between the single-item measure of loneliness and the various versions of the Loneliness Scale ($r = .48$ for the 3-Item Loneliness, $r = .44$ for the Ordinalized Loneliness, $r = .47$ for the 4-Item Loneliness $n = 925$, $p < .001$). In addition, the single-item measure of loneliness showed similar patterns of significant correlations ($p < .001$) as the 3-Item Loneliness Scale with other measures included in the HRS: Loneliness, Stress, and Social Support Scale.

As a test of discriminant validity, the Pearson product-moment correlations were calculated between the single-item measure of loneliness and CES-D minus the single-item measure of loneliness (CES-D ML) and between the single-item measure of loneliness and the Chronic Health Condition Index (refer to Table 9). The single-item measure of loneliness showed similar correlations with another measure of loneliness (Ordinalized Loneliness $r = .44$, $N = 1084$, $p < .001$) and a measure of depression ($r = .46$, $n = 1242$, $p < .001$), thus did not appear to discriminate between depression and loneliness. As expected, the single-item measure of loneliness was more highly correlated with a measure of depression ($r = .46$, $n = 1242$, $p < .001$) than with a measure of chronic health conditions ($r = .12$, $N = 1265$, $p < .001$). To explore the meaning of the single-item measure of loneliness, Pearson product-moment correlations were calculated between the single-item measure of loneliness and each component subscale of

Module 6, specifically loneliness, perceived stress, social support, and social burden to determine the strengths of the relationships (see Table 9). The single-item measure of loneliness showed similar patterns of correlations with other variables as the 3-Item Loneliness Scales.

The third goal of this study utilized hierarchical regression with each variable (loneliness, depression, and health) at Wave 7 (HRS 2004) being predicted by its previous value at Wave 6 (HRS 2002) as well as the Wave 6 (HRS 2002) value of the other variable of interest and a cross-lagged panel correlation design, as described by Kenny and Harackiewicz (1979), to examine the longitudinal relationship between loneliness, depression, and health (see Figure 1). A series of correlations were computed for the Ordinalized Loneliness Scale, the Ordinalized CES-D minus the loneliness item, and the Chronic Health Conditions Index minus the mental health item and the obesity item. Six synchronous correlations were computed (Loneliness with Depression at Wave 6 [HRS 2002] , Loneliness with Depression at Wave 7 [HRS 2004], Loneliness with Health at Wave 6 [2002], Loneliness with Health at Wave 7 [2004], Depression with Health at Wave 6 [2002], Depression with Health at Wave 7 [2004]). Three auto-correlations were computed (Loneliness at Wave 6 [HRS 2002] with Loneliness Scale at Wave 7 [2004] , Depression at Wave 6 [HRS 2002] with Depression at Wave 7 [HRS 2004], Health at Wave 6 [2002] with Health at Wave 7 [2004]). Six cross-lag correlations were computed (Loneliness at Wave 6 [HRS 2002] with Depression at Wave 7 [HRS 2004], Depression at Wave 6 [HRS 2002] with Loneliness Scale at Wave 7 [HRS 2004], Depression at Wave 6 [2002] with Health at Wave 7 [2004], Health at Wave 6 [2002] with Depression at Wave 7 [2004], Health at Wave 6 [2002] with Loneliness at Wave 7 [2004], and Loneliness at Wave 6 [2002] with Health at Wave 7 [2004]). Cross-lag correlations are summarized in Table 12.

The study design met the assumption of synchronicity since depression, loneliness, and health were measured at the same point in time. The assumption of perfect stationarity requires the synchronous correlations to be equal or equal if the correlations are corrected for attenuation due to unreliability of the measures. The significance of the difference between the synchronous correlations was tested by calculating the z -test for differences in correlations (Kanji, 1993). The assumption of stationarity was met since there were no significant differences between the synchronous correlations for loneliness, depression, and health. Since the assumptions of stationarity and synchronicity were satisfied, the significance of the difference between the cross-lag correlations was tested by calculating the z -test for differences in correlations. The z -test difference between the correlation of Loneliness at 2002 and Depression at 2004 (L02D04) and the correlation of Depression 2002 and Loneliness at 2004 (D02L04) was found to be marginally significantly (z -test difference = -1.92, $p = .054$, rounded to $p = .05$). Since the correlation between Depression 2002 and Loneliness 2004 ($r = .36$, $n = 925$, $p < .01$) was significantly stronger than the correlation between Loneliness at 2002 and Depression at 2004 ($r = .28$, $n = 925$, $p < .01$) a time-lagged causal relationship is suggested between Depression at 2002 and Loneliness at 2004. There were no significant differences detected in the cross-lag correlations for Depression and Health (D02H04 - H02D0), nor were there significant differences in the cross-lag correlations for Loneliness and Health (L02H04 - H02L04). Equal cross-lag correlations imply a situation in which the variables are statistically related, but are not causally linked.

A series of three hierarchical multiple regressions were conducted to continue the examination of the relationship between loneliness, depression, and health with Loneliness 2002, Depression 2002, and Chronic Health Conditions 2002 predicting Health at 2004, with the

variables entered in different order. For the first hierarchical multiple regression, Chronic Health Conditions 2002 was entered first, with loneliness and depression entered last. The overall model was significant ($p < .001$). After Chronic Health Conditions 2002 was entered, the overall model explained 81 percent of the variance ($R^2 = .81$). The addition of Loneliness 2002 and Depression 2002 added little to the model ($R^2\Delta = .001$). Only Chronic Health Conditions 2002 ($\beta = .89, p < .001$) made a statistically significant contribution to the model. Neither loneliness nor depression made a unique contribution. Based on the t values and significance levels for loneliness ($t = 1.45, p = .15$) and depression ($t = 1.60, p = .11$), it was determined that these variables might have contributed slightly with a larger sample and/or without the overwhelming influence of Chronic Health Conditions 2002; therefore, the analyses were continued without Chronic Health Conditions 2002 in the models to evaluate the influence of loneliness and depression.

For the second hierarchical multiple regression, Loneliness 2002 was entered first and Depression 2002 was entered last. The overall model was significant ($p < .001$). After Loneliness 2002 was entered, the overall model explained 2 percent of the variance ($R^2 = .02$). After the addition of Depression 2002 to the model, the overall model explained 5 percent of the variance ($R^2 = .05$). The addition of Depression 2002 added little to the model ($R^2\Delta = .02$). Both loneliness ($\beta = .09, t = 2.75, p = .006$) and depression ($\beta = .16, t = 5.04, p < .001$) made a unique contribution to the model.

For the third hierarchical multiple regression, Depression 2002 was entered first and Loneliness 2002 was entered last. The overall model was significant ($p < .001$). After Depression 2002 was entered, the overall model explained 4 percent of the variance ($R^2 = .04$). After the addition of Loneliness 2002 to the model, the overall model explained 5 percent of the variance

($R^2 = .05$). The addition of Loneliness 2002 added very little to the model ($R^2\Delta = .01$), as noted in the preceding paragraph.

The results of this series of multiple regression analyses indicated that health at 2002 is the best predictor of later health at 2004. Depression 2002 and Loneliness 2002 appeared to be weaker predictors of later health. Between loneliness and depression, depression was the superior predictor of later health, but loneliness appears to add some variance.

Recurring Loneliness was entered into the hierarchical multiple regression in place of Loneliness 2002 as a predictor of chronic health conditions. The results were similar to the results obtained using Loneliness 2002 in the equation.

Pearson Product Moment correlations were used to investigate the relationship between depression change, loneliness change, and health change with other variables of interest. Health change showed a small positive significant correlation with the 2004 single-item loneliness measure ($r = .19, n = 173, p = .015$). Interestingly, health change was not significantly correlated with the Loneliness Scale 2004 ($r = .02, n = 173, p = .85$), nor was health change significantly correlated with Recurring Loneliness ($r = .04, n = 173, p = .64$). These results suggest that the single-item loneliness measure has an association with change in health status that the Loneliness Scale and Recurring Loneliness do not share.

Depression change showed a small positive correlation with loneliness change ($r = .20, p = .001, n = 173$) measured using change in the CES-D minus the loneliness item. In addition, depression change showed a small but significant negative correlation with negative social support ($r = -.15, p = .02, n = 173$). Depression change was not significantly correlated with the Loneliness Scale ($r = -.03, p = .73, n = 173$), the single-item measure of loneliness ($r = .11, p = .14$), nor Recurring Loneliness ($r = -.07, p = .33$).

CHAPTER IV

DISCUSSION

The purpose of the current study was to investigate the relationship between loneliness and depression, as two distinct constructs, and their relationship to chronic health conditions in middle-aged to older adults. The project utilized longitudinal data collected by the Health and Retirement Study (HRS), a national representative longitudinal study of health, retirement, and aging, conducted by the Institute for Social Research (ISR) Survey Research Center (SRC) at the University of Michigan, funded by the National Institute on Aging and the Social Security Administration. A subsample of the HRS participants was selected for inclusion in this study based on four criteria (a) self-identified as Hispanic, Non-Hispanic African American, or Non-Hispanic Caucasian, (b) responded to the loneliness items included in Experimental Module 6: Loneliness, Stress, and Social Support/Social Burden for Wave 6 (2002) or Wave 7 (2004), (c) age criteria of 50 years or older at Wave 6 (2002) and no older than age 70 at Wave 7 (2004), and (d) non-institutionalized/resided in the community at the time of interview for Wave 6 (2002). In addition, this study had a long-term component to evaluate recurrent loneliness utilizing data from Wave 4 (1998), Wave 5 (2000), Wave 6 (2002), and Wave 7 (2004) for these same respondents.

As discussed elsewhere in this paper, numerous cross-sectional studies of loneliness have established a significant positive relationship between loneliness and depression and loneliness and health (Adams et al., 2004; Cacioppo, Hughes, et al., 2006, 2006; Hawkey et al., 2003; Hawkey et al., 2006; Hays & DiMatteo, 1987; Holmen et al., 1992; Perlman et al., 1978; Rook, 1987; Russell et al., 1980); however, these cross-sectional studies, cannot establish a temporal relationship, if any, precluding causal inference. The previous longitudinal studies in the United

States have serious limitations to their generalizability. Specifically, these studies may not generalize to other populations due to the use of an unrepresentative sample of college students (Pressman et al., 2005; Wei, Russell, & Zakalik, 2005), due to the use of a primarily Caucasian sample with under representation of racial and ethnic groups (Russell et al., 1997; Scanlan et al., 2001), and due to potentially important differences in the experiences of adults residing in an urban area (Cacioppo, Hughes, et al., 2006).

The present study has several advantages over previous studies. Specifically, the sample utilized in this study is a nationally representative longitudinal study representing a population probability sample of United States residents from the 48 contiguous states over 50 years of age and their spouses. Hispanics and African Americans were oversampled by 100%; therefore, there is adequate representation of these racial/ethnic groups. Furthermore, HRS is a large sample with 30,715 participants which provided an adequate sample of participants who met the selection criteria for this study ($N = 1265$). Therefore, this current study has improved external validity, greater potential for generalizability, and the ability to establish the temporal relationships between loneliness and depression and loneliness and health, permitting causal inference. This sample was restricted to participants 50 to 70 years of age; therefore, these results may not be generalized to other age groups.

The present study had several goals. The first goal of this study was to distinguish and test for construct overlap between the constructs of loneliness and depression. A moderate positive correlation was found between loneliness and depression in the range of $r = .36$ to $.51$ depending on which measure was used. These findings supported previous findings (Adams et al., 2004; Hughes et al., 2004; Pressman et al., 2005). A larger correlation, which may indicate lack of clear distinction between these two constructs, was not found. In addition, the constructs

of loneliness and depression showed some similar patterns of correlations, but the strengths of the relationships varied, for example the correlation between loneliness and partner support was significantly different from the correlation between depression and partner support. These findings supported the notion of loneliness and depression as two separate, but overlapping constructs.

The second goal of this study was to validate the concurrent, convergent, and discriminant validity of the single-item subjective self-report of loneliness, the single-item measure of loneliness from the Center for Epidemiologic Studies—Depression Scale (CES-D), as an indicator of loneliness, using the same sample of respondents and data collected at the same point in time. As expected there was a significant positive correlation between the single-item measure of loneliness and other loneliness measures used in this study. Contrary to expectations, the single-item measure of loneliness did not show a stronger correlation with a measure of loneliness (Ordinalized Loneliness Scale $r = .48$, $N = 1084$, $p < .001$) than with a measure of depression (CES-D without the single loneliness item $r = .51$, $n = 1242$), thus the single-item loneliness measure did not discriminate between the related constructs of loneliness and depression. As expected the single-item loneliness measure was more strongly correlated with loneliness and depression than a measure of physical health (Chronic Health Condition Index $r = .12$, $N = 1265$, $p < .001$).

As expected based on previous research (Rook, 1987), the single-item loneliness measure generally showed similar patterns of correlations with other variables as the various versions of the 3-Item Loneliness Scales utilized in this study. There was one notable exception; the single-item measure of loneliness showed a small significant positive correlation with health change ($r = .20$, $n = 173$). Neither the Ordinalized Loneliness Scale nor the Recurring Loneliness Scale

demonstrated a significant correlation with health change. After analyzing the wording of the loneliness scale items for a possible explanation for the differential association with health change, one speculation arose, that the single-item loneliness measure may be sensitive to recent loneliness ("How much of the time during the past week have you felt lonely") whereas, the Loneliness Scale may be sensitive to a more general, perhaps stable sense of loneliness ("The next questions are about how you feel about different aspects of your life...how often do you feel..."), and the Recurring Loneliness Scale measured the experience of recent loneliness (the single loneliness measure) accumulated and averaged over 4 waves (1998, 2000, 2002, 2004). Further study is needed to confirm or deny this speculation. In light of the findings, the single-item measure was judged to be an adequate, but not ideal measure of loneliness.

The third goal of this study used hierarchical multiple regression and a cross-lagged panel correlation design to examine the longitudinal relationship between loneliness, depression, and chronic health conditions at two waves (HRS Wave 6, 2002 and HRS Wave 7, 2004) and to investigate loneliness and depression at Wave 6 (HRS 2002) as predictors of chronic health conditions at Wave 7 (HRS 2004). In examining the temporal precedence of the variables, it was hypothesized that higher levels of loneliness lead to subsequent increase in depression. Loneliness at 2002 was significantly positively correlated with Depression at 2004 suggesting that a relationship does exist. However, since the correlation between Depression at 2002 and Loneliness at 2004 was significantly stronger than the relationship between Loneliness at 2002 and Depression 2004, a time-lagged causal relationship was indicated between Depression 2002 and Loneliness 2004. One limitation of this study is that the cross-lag correlations provide an indication of a temporal precedence, but not positive proof of causation. A third lag would have made replication of the effect possible; however, the HRS did not include the Loneliness Scale in

previous waves. Perhaps the Loneliness Scale will be included in future waves allowing for a third lag replication of the effect.

Regarding loneliness, depression, and health as predictors of subsequent health, hierarchical multiple regression analyses revealed that health is the best predictor of subsequent health. Depression and loneliness were weak, but significant predictors of later health. Between depression and loneliness, depression was the superior predictor of health.

The subjective self-report of recurring loneliness as a predictor of chronic health conditions was investigated in the present study using hierarchical multiple regression. To accomplish this task, Recurring Loneliness was entered into a hierarchical multiple regression as a predictor of chronic health conditions, following Depression 2002 entered in the first step. The results were similar to the results obtained using Loneliness in the hierarchical multiple regression equation suggesting that Recurring Loneliness is no better at predicting subsequent health than the loneliness scales.

Finally, it was hypothesized that higher levels of loneliness lead to a subsequent increase in chronic health conditions and that higher levels of depression lead to a subsequent increase in chronic health conditions. This hypothesis was not supported by cross-lag correlations. This finding is contrary to expectations based on previous studies linking loneliness to poor health (Holmen et al., 1992; Perlman et al., 1978), to nursing home admission (Russell, Cutrona, de la Mora, & Wallace, 1997), to increased risk of mortality (Penninx et al., 1997), to increased blood pressure (Hawkley et al., 2006), and to impaired immune function (Kiecolt-Glaser et al., 1984; Pressman et al., 2005; Scanlan, Vitaliano, Zhang, Savage, & Ochs, 2001). It has been suggested that the effects of loneliness on health may not be apparent until later in life (Hawkley et al., 2003). One explanation for the failure to find a temporal precedence in the present study may be

that the effects of loneliness on health may not be apparent until after age 70 years; therefore past the scope of this study. Another possible explanation for the absence of a significant temporal precedence may be that the two year time lag is not sufficiently long for the effects to be detectable. According to Finkel (1995), determining the appropriate lag structure for the effects of variables on one another is difficult in longitudinal studies because, as in this case, the researcher is often uncertain about the length of time it should take for the effects of the variables of interest, in this case loneliness and depression, to exert their influence on the dependent variable, in this case health. In this regard, the current study may contribute to the body of literature by providing data to suggest that a two year lag may be sufficient to detect a weak effect for loneliness and depression on health using hierarchical multiple regression, but the two-year lag may not be sufficient to produce a significant effect in the cross-lag correlation comparisons suggesting temporal precedence. Another reason for the failure to detect a temporal precedence may be that the method of measuring health conditions utilized in the current study may not be sensitive enough to change. These explanations are plausible since other research demonstrating an effect have relied on long-term outcomes such as nursing home admission (Russell, Cutrona, de la Mora, & Wallace, 1997) and mortality (Penninx et al., 1997), or sophisticated and sensitive measures such as immune response (Kiecolt-Glaser et al., 1984; Pressman et al., 2005; Scanlan, Vitaliano, Zhang, Savage, & Ochs, 2001) and measure of blood pressure (Hawkley et al., 2006). A final explanation for failing to detect a temporal precedence may be simply that the effect of loneliness and depression on health is not strong enough to generate a detectable effect in a cross-lag correlational study design with a sample of this size.

A number of significant findings were discovered in the process of describing the characteristics of the sample. Independent *t*-tests revealed group differences on the basis of

gender, specifically females demonstrated significantly higher scores on measures of loneliness, depression, and perceived stress than males. There were no significant differences in the scores of men and women on the chronic health condition index. Group comparisons on the basis of living arrangements revealed that the group of respondents living alone had significantly higher mean scores on measures of loneliness and perceived stress than the group of respondents who lived with a partner, spouse, or other individual. In addition, the participants who were not married or cohabiting had higher mean scores on loneliness and perceived stress. The group of participants who were not working had significantly higher mean scores on measures of loneliness, depression, chronic health conditions and stress. These findings, while significant, were not surprising. It should be noted that these series of *t*-tests may capitalize on chance resulting in Type I error; therefore, these results should be viewed cautiously. In addition, sample characteristics may have biased the results since the group sizes were not equal. The sample for the current study contained considerably more participants who were women, Caucasian, married, and living with others.

Analysis of the distributional characteristics of the continuous variables revealed many of the study variables were positively skewed, including loneliness, depression, and stress. One probable reason for the skewness of the scale is the distribution of the constructs in the population; specifically most people are not lonely, depressed, or stressed. Also contributing to the positive skew of the scales may have been poor sensitivity at the lower end of the scales. A 4-point scale which differentiated between *hardly ever* and *never* would have provided better discrimination at the lower end of the distribution. However, for the purposes of this study, the scores in the upper end of the distribution were of most interest and there appeared to be adequate discrimination at the upper end of the scale. One problem with this study and the HRS

data set is that many of the scales used were adapted from longer measures by shortening the scales and reducing the number of items. Shortening the scales resulted in lower alpha reliability than the original version. Collapsing the items resulted in reduced discrimination and sensitivity.

In conclusion, this study demonstrated a number of significant relationships. The present study demonstrated a small but significant relationship between loneliness and subsequent depression and a weaker, but significant relationship between depression and subsequent health and loneliness and subsequent health. The most notable finding of the present study is the indication of a temporal precedence implying a causal relationship with depression leading to subsequent loneliness rather than the hypothesized relationship of loneliness leading to depression.

The exact mechanism by which depression leads to subsequent loneliness is a topic for further research. In one possible scenario in which depression leads to subsequent loneliness, the depressed individual becomes less behaviorally activated and begins to withdraw from social engagement. Individuals within the depressed person's social network may begin to experience the social interchange with the depressed individual to be less reinforcing, and perhaps even punishing. As a result, individuals within the social network of the depressed individual may initiate social contact less frequently. The loss of social support may serve to maintain and/or deepen the depression, leading to further social withdrawal. As the depression is maintained or deepened, social connections are further weakened. The depressed individual desires the social contact, but lacks the behavioral activation to address the situation, leading to a discrepancy between the desired and achieved levels of interpersonal relationships, that is, loneliness.

Table 1

Items in Revised UCLA Loneliness Scale (R-UCLA)^a, Three-Item Loneliness Scale^b and HRS Short Loneliness Scale^c

R-UCLA Loneliness Scale 1=Never, 2=Rarely, 3=Sometimes, 4=Often	Three-Item Loneliness Scale 1=Hardly Ever, 2=Some of the Time, 3=Often	HRS Short Loneliness Scale 1=Hardly Ever, 2=Some of the Time, 3=Often
Statement	Question	Question
1. I feel in tune with the people around me. ^d		
2. I lack companionship	1. How often do you feel you lack companionship?	1. First, how often do you feel that you lack companionship?
3. There is no one I can turn to.		
4. I do not feel alone. ^d		2. How often do you feel alone?
5. I feel part of a group of friends. ^d		
6. I have a lot in common with the people around me. ^d		
7. I am no longer close to anyone.		
8. My interests and ideas are not shared by those around me.		
9. I am an outgoing person. ^d		
10. There are people I feel close to. ^d		
11. I feel left out.	2. How often do you feel left out?	3. How often do you feel left out?
12. My social relationships are superficial.		
13. No one really knows me well.		
14. I feel isolated from others	3. How often do you feel isolated from others?	4. How often do you feel isolated from others?
15. I can find companionship when I want it. ^d		
16. There are people who really understand me. ^d		
17. I am unhappy being so withdrawn.		
18. People are around me but not with me.		
19. There are people I can talk to. ^d		
20. There are people I can turn to. ^d		

^aRussell, Peplau, & Cutrona, 1980. ^bHughes et al., 2004. ^c*Documentation: Health and Retirement Study.*

^dItem reversed before scoring.

Table 2

Items in CES-D 20-Item Version^a, CES-D 10-Item Version^b, CES-D 10-Item Scale (yes/no)^c, HRS CES-D 8-Item Scale^d

CES-D 20-Item Scale ^a	CES-D 10-Item Scale ^b	CES-D 10-Item Scale ^c	HRS CES-D 8-Item Scale ^d
4-point Likert-type scale	4-point scale Likert-type scale	Yes/No Response	Yes/No Response
Please indicate how often you have felt this way during the past week.			Much of the time during the past week... (Would you say yes or no?)
1. I was bothered by things that don't usually bother me.	1. I was bothered by things that don't usually bother me.		
2. I did not feel like eating; my appetite was poor.			
3. I felt that I could not shake off the blues even with help from my family or friends.			
4. I felt that I was just as good as other people.			
5. I had trouble keeping my mind on what I was doing.	2. I had trouble keeping my mind on what I was doing.		
6. I felt depressed.	3. I felt depressed.	1. I felt depressed.	1. You felt depressed.
7. I felt that everything I did was an effort.	4. I felt that everything I did was an effort.	2. I felt that everything I did was an effort.	2. You felt that everything you did was an effort.
8. I felt hopeful about the future.	5. I felt hopeful about the future		
9. I thought my life had been a failure.			
10. I felt fearful.	6. I felt fearful.		
11. My sleep was restless.	7. My sleep was restless.	3. My sleep was restless.	3. Your sleep was restless.
12. I was happy.	8. I was happy.	4. I was happy.	4. You were happy.
13. I talked less than usual.			
14. I felt lonely.	9. I felt lonely.	5. I felt lonely.	5. You felt lonely.
15. People were unfriendly.		6. People were unfriendly.	
16. I enjoyed life.		7. I enjoyed life.	6. You enjoyed life.
17. I had crying spells.			
18. I felt sad.		8. I felt sad.	7. You felt sad.
19. I felt that people disliked me.		9. I felt that people liked me.	
20. I could not get "going."	10. I could not get "going."	10. I could not get "going."	8. You could not get "going."

^aRadloff, 1977. ^bAndresen et al., 1994. ^cIrwin, Artin, & Oxman, 2007. ^dSteffick, 2000.

Table 3

Descriptive Statistics for Categorical Demographic Variables

Characteristic	Sample		2002		2004	
	<i>n</i>	%	<i>n</i>	%	<i>n</i>	%
Gender						
Male	404	31.9				
Female	861	68.1				
Race/Ethnicity						
Non-Hispanic Caucasian	961	76.0				
Non-Hispanic African American	186	14.7				
Hispanic	118	9.3				
Marital Status						
Married/Living with Partner			1055	83.4	1017	80.4
Not Married/Living with Partner			210	16.6	248	19.6
Living Alone			291	23.0	302	23.9
Live in a Household with Others			974	77.0	963	76.1
Employment Status						
Working			588	46.5	530	41.9
Not Working			677	53.5	735	58.1
Chronic Health Conditions						
High Blood Pressure			586	46.3	642	50.8
Diabetes			209	16.5	233	18.4
Cancer			115	9.1	129	10.2
Lung Disease			78	6.2	92	7.3
Heart Condition			178	14.1	199	15.7
Stroke			47	3.7	60	4.7
Emotional/Psychiatric Condition			214	16.9	223	17.7
Arthritis			685	54.2	749	59.3
Obesity based on BMI \geq 30			402	32.4	519	33.7
Severe Obesity based on BMI \geq 40			38	3.0	52	4.2
Self-Reported Depression			198	15.9	186	14.9

Note. *N* = 1265

Table 4

Descriptive Statistics for Self-Report Single-Item Loneliness Measure from CES-D

Characteristic	<i>n</i>	%
Self-Reported Loneliness 1998	147	12.8
Self-Reported Loneliness 2000	142	12.2
Self-Reported Loneliness 2002	153	12.3
Self-Reported Loneliness 2004	166	13.3

Notes. *N* = 1265.

At all four time periods this item was scored on a "yes" or "no" scale.

Table 5

Continuous Demographic Variables

Variable	<i>n</i>	<i>M</i>	<i>SD</i>	Skewness	<i>SE</i>	Skewness/ <i>SE</i>	Kurtosis	<i>SE</i>	Kurtosis/ <i>SE</i>
Age 2002	1265	60.65	4.67	-.29	.07	-4.20	-.77	.14	-5.63
Age 2004	1265	62.64	4.68	-.29	.07	-4.23	-.77	.14	-5.59
Years School/College Completed	1264	12.48	3.05	-.93	.07	-13.44	1.97	.14	14.2
Height in Meters	1263	1.68	0.10	.32	.07	4.65	-.24	.14	-1.74
Weight in Kilograms 2002	1243	79.82	17.54	.84	.07	12.17	1.50	.14	10.81
Weight in Kilograms 2004	1246	80.01	17.98	.80	.07	11.62	1.04	.14	7.45
BMI 2002	1265	28.30	5.42	.97	.07	14.12	1.96	.14	14.07
BMI 2004	1265	28.37	5.65	.93	.07	13.42	1.40	.14	10.07

Table 6

Loneliness and Depression Measurement Variables

Variable	<i>n</i>	<i>M</i>	<i>SD</i>	Skewness	<i>SE</i>	Skewness/ <i>SE</i>	Kurtosis	<i>SE</i>	Kurtosis/ <i>SE</i>
3-Item Loneliness 2002	1084	1.29	.45	1.79	.07	24.149	2.88	.15	19.43
3-Item Loneliness 2004	1106	1.29	.44	1.71	.07	23.162	2.50	.15	17.02
4-Item Loneliness 2002	1084	1.32	.41	1.50	.07	20.284	1.99	.18	11.08
4-Item Loneliness 2004	1106	1.32	.44	1.75	.07	23.622	2.62	.15	17.82
Ordinal 3-Item Loneliness 2002	1084	1.52	.70	.98	.07	13.283	-.35	.15	-2.34
Ordinal 3-Item Loneliness 2004	1106	1.54	.71	.95	.07	12.865	-.45	.15	-3.04
CES-D 2002	1242	1.82	.97	1.43	.07	20.652	1.53	.14	10.99
CES-D 2004	1251	1.81	.96	1.40	.07	20.246	1.42	.14	10.30
CES-D minus Loneliness 2002	1242	1.87	1.0	1.32	.07	19.058	1.12	.14	8.05
CES-D minus Loneliness 2004	1251	18.86	.99	1.30	.07	18.768	1.09	.14	7.91
Ordinal CES-D 2002	1242	1.49	.67	1.03	.07	14.986	-.14	.14	-1.04
Ordinal CES-D 2004	1251	1.49	.67	1.04	.07	15.000	-.14	.14	-0.99
Ordinal CES-D - Loneliness 2002	1242	1.51	.73	1.05	.07	15.217	-.34	.14	-2.42
Ordinal CES-D - Loneliness 2004	1251	1.51	.72	1.06	.07	15.319	-.32	.14	-2.29
Recurring Loneliness	1079	1.49	.90	2.03	.07	27.419	3.81	.15	25.58

Table 7

Chronic Health Conditions Measurement Variables

Variable	<i>M</i>	<i>SD</i>	Skewness	<i>SE</i>	Skewness/ <i>SE</i>	Kurtosis	<i>SE</i>	Kurtosis/ <i>SE</i>
Chronic Health Conditions 2002	1.89	.65	.62	.07	8.93	.11	.14	.80
Minus Mental Health Item	1.91	.68	.58	.07	8.41	-.07	.14	-.51
Minus BMI Indicator	1.84	.65	.64	.07	9.26	.11	.14	.81
Minus Mental Health & BMI	1.86	.67	.62	.07	8.94	.02	.14	.11
Chronic Health Conditions 2004	1.97	.67	.58	.07	8.44	.01	.14	.05
Minus Mental Health Item	1.99	.70	.54	.07	7.87	-.08	.14	-.61
Minus BMI Indicator	1.92	.67	.58	.07	8.38	-.04	.14	-.26
Minus Mental Health & BMI	1.95	.69	.55	.07	7.99	-.05	.14	-.35

Note. *N* = 1265

Table 8

Stress, Positive Social Support, Negative Social Support/Social Burden Variables

Variable	<i>n</i>	<i>M</i>	<i>SD</i>	Skewness	<i>SE</i>	Skewness/ <i>SE</i>	Kurtosis	<i>SE</i>	Kurtosis/ <i>SE</i>
Perceived Stress 2002	1084	1.41	.43	1.04	.07	14.04	0.67	.15	4.53
Positive Social Support 2002	1084	2.50	.49	-.90	.07	-12.12	0.33	.15	2.25
Spouse/Partner Support 2002	917	2.71	.52	-1.86	.08	-22.98	2.77	.16	17.19
Household Support 2002	312	2.24	.70	-.49	.14	-3.57	-0.98	.28	-3.56
Friend Support 2002	1084	2.38	.67	-.75	.07	-10.19	-0.59	.15	-3.96
Negative Social Support 2002	1083	1.28	.34	1.27	.07	17.14	1.40	.15	9.41
Spouse/Partner Support 2002	916	1.41	.54	1.31	.08	16.16	1.00	.16	6.18
Household Support 2002	312	1.44	.51	.86	.14	6.23	-2.74	.28	-9.96
Friend Support 2002	1024	1.14	.31	2.35	.07	31.80	6.03	.15	40.46
Perceived Stress 2004	1106	1.40	.43	.99	.07	13.37	0.46	.15	3.16
Positive Social Support 2004	1106	2.49	.49	-.84	.07	-11.38	0.20	.15	1.34
Spouse/Partner Support 2004	899	2.72	.49	-1.89	.08	-23.00	3.01	.16	18.44
Household Support 2004	301	2.27	.68	-.45	.14	-3.22	-1.00	.28	-3.57
Friend Support 2004	1106	2.36	.67	-.98	.07	-13.24	-0.69	.15	-4.71
Negative Social Support 2004	1104	1.28	.36	1.44	.07	19.41	2.02	.15	13.74
Spouse/Partner Support 2004	898	1.43	.55	1.19	.08	14.54	0.69	.16	4.23
Household Support 2004	300	1.427	.51	1.17	.14	8.31	0.86	.28	3.07
Friend 2004	1104	1.141	.33	2.69	.07	36.37	7.95	.15	54.05

Table 9
Means, Standard Deviations, and Pearson Correlations Among Variables 2002

Variable	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22
1.Lone	(.75)																					
2.Ordin	.93**	—																				
3.4-Item	.92**	.86**	(.69)																			
4.CESD	.48**	.44**	.49**	(.79)																		
5.Ordin	.46**	.42**	.46**	.93**	—																	
6.-Lone	.45**	.41**	.45**	.99**	.92**	(.76)																
7.Ord	.41**	.37**	.42**	.92**	.95**	.93**	—															
8.HltCd	.19**	.19**	.22**	.28**	.27**	.28**	.28**	—														
9.CdSO	.20**	.19**	.22**	.28**	.27**	.28**	.28**	.95**	—													
10.-Psysc	.13**	.13**	.16**	.21**	.21**	.21**	.21**	.97**	.91**	—												
11.-Obes	.20**	.20**	.21**	.28**	.27**	.28**	.27**	.95**	.99**	.91**	—											
12.-PsOb	.13**	.13**	.15**	.20**	.19**	.20**	.20**	.91**	.95**	.94**	.96**	—										
13.Sg Lo	.48**	.44**	.47**	.63**	.59**	.51**	.46**	.17**	.16**	.13**	.16**	.12**	—									
14.Stress	.48**	.45**	.54**	.53**	.50**	.52**	.49**	.21**	.20**	.14**	.20**	.12**	.33**	(.64)								
15.Sup	-.36**	-.34**	-.39**	-.29**	-.27**	-.27**	-.26**	-.15**	-.14**	-.12**	-.15**	-.12**	-.23**	-.35**	(.68)							
16.PSup	-.41**	-.40**	-.42**	-.27**	-.27**	-.26**	-.25**	-.17**	-.15**	-.13**	-.17**	-.11**	-.22**	-.34**	.66**	(.76)						
17.HSup	-.18**	-.16**	-.20**	-.17**	-.16**	-.16**	-.16**	-.06	-.06**	-.05	-.08	-.06	-.11	-.13**	.76**	.25**	(.73)					
18.FrSup	-.21**	-.19**	-.25**	-.20**	-.19**	-.19**	-.19**	-.10**	-.09**	-.09**	-.09**	-.08*	-.16**	-.25**	.82**	.16**	.30**	(.78)				
19. Burd	.27**	.24**	.28**	.20**	.19**	.19**	.19**	.15**	.12**	.12**	.13**	.10**	.13**	.29**	-.24**	-.34**	-.19**	-.08**	(.57)			
20. PBur	.30**	.29**	.31**	.21**	.21**	.21**	.19**	.15**	.12**	.12**	.13**	.09**	.17**	.27**	-.23**	-.39**	-.09	-.03	.86**	(.62)		
21.HBur	.27**	.21**	.24**	.20**	.22**	.19**	.22**	.08	.07	.05	.08	.04	.16**	.24**	-.14*	-.14*	-.15**	-.05	.75**	.22**	(.48)	
22.FrBur	.14**	.12**	.16**	.10**	.09**	.10**	.09**	.10**	.10**	.09**	.10**	.09**	.08**	.16**	-.12**	-.08**	-.13*	-.08**	.65**	.24**	.18**	(.37)
<i>n</i>	1084	1084	1084	1242	1242	1242	1242	1265	1265	1265	1265	1265	1240	1084	1084	917	312	1084	1083	916	312	1082
Mean	1.29	1.52	1.32	1.82	1.49	1.87	1.51	1.89	1.76	1.91	1.84	1.86	1.50	1.41	2.50	2.71	2.24	2.38	1.28	1.41	1.44	1.14
<i>SD</i>	.45	.70	.41	.97	.67	1.00	.73	.65	.59	.68	.65	.67	1.32	.43	.49	.51	.70	.67	.34	.54	.51	.31

Note. Standardized Item Alpha on diagonals.

* $p < .01$ ** $p < .001$.

Table 10
Independent Samples t-tests Wave 6 (2002)

Variables	Males			Females			<i>t</i>	<i>df</i>	<i>p</i>
	<i>n</i>	<i>M</i>	<i>SD</i>	<i>n</i>	<i>M</i>	<i>SD</i>			
3-Item Loneliness 2002	327	1.22	.40	757	1.32	.47	-3.68	707.96	< .001
Loneliness Ordinal	327	1.39	.64	757	1.57	.72	-4.18	694.19	< .001
CES-D	388	1.69	.88	854	1.88	1.00	-3.40	847.37	.001
CES-D - Loneliness Item	388	1.74	.90	854	1.93	1.04	-3.36	849.17	.001
CES-D - Loneliness Ordinal	388	1.41	.66	854	1.56	.75	-3.48	843.6	.001
Health - Obesity & Psych	404	1.86	.67	861	1.86	.67	.09	1263	.93
Perceived Stress	327	1.34	.39	757	1.44	.45	-3.64	710.36	< .001

Variables	Live with Other			Live Alone			<i>t</i>	<i>df</i>	<i>p</i>
	<i>n</i>	<i>M</i>	<i>SD</i>	<i>n</i>	<i>M</i>	<i>SD</i>			
3-Item Loneliness 2002	974	1.26	.43	110	1.50	.55	-4.41	124.45	< .001
Loneliness Ordinal	974	1.48	.68	110	1.87	.80	-4.94	127.09	< .001
CES-D	974	1.77	.94	268	2.01	1.06	-3.28	389.99	.001
CES-D - Loneliness Item	974	1.82	.98	268	2.03	1.07	-2.96	1240	.003
CES-D - Loneliness Ordinal	974	1.46	.65	268	1.60	.72	-2.11	400.61	.035
Health - Obesity & Psych	974	1.84	.67	291	1.93	.68	-1.78	1263	.076
Perceived Stress	974	1.40	.43	110	1.50	.46	-2.15	1082	.032

Variables	Married/Partnered			Not Married/ Partnered			<i>t</i>	<i>df</i>	<i>p</i>
	<i>n</i>	<i>M</i>	<i>SD</i>	<i>n</i>	<i>M</i>	<i>SD</i>			
3-Item Loneliness 2002	918	1.25	.43	166	1.48	.53	-5.22	205.06	< .001
Loneliness Ordinal	918	1.46	.67	166	1.82	.78	-5.62	211.59	< .001
CES-D	1034	1.78	.93	208	2.05	1.11	-3.31	268.39	< .001
CES-D - Loneliness Item	1034	1.83	.97	208	2.05	1.12	-2.58	272.54	.01
CES-D - Loneliness Ordinal	1034	1.46	.65	208	1.64	.75	-3.27	272.71	.001
Health - Obesity & Psych	1034	1.49	.71	208	1.63	.81	-2.05	1263	.04
Perceived Stress	918	1.39	.43	166	1.50	.46	-3.17	1082	.002

Variables	Employed			Not Employed			<i>t</i>	<i>df</i>	<i>p</i>
	<i>n</i>	<i>M</i>	<i>SD</i>	<i>n</i>	<i>M</i>	<i>SD</i>			
3-Item Loneliness 2002	494	1.26	.39	590	1.34	.49	-4.12	1082	< .001
Loneliness Ordinal	494	1.42	.63	590	1.6	.75	-4.24	1081.96	< .001
CES-D	577	1.66	.84	665	1.97	1.05	-5.69	1232.67	< .001
CES-D - Loneliness Item	577	1.70	.87	665	2.01	1.08	-5.59	1234.11	< .001
CES-D - Loneliness Ordinal	577	1.37	.64	665	1.63	.77	-6.50	1238.95	< .001
Health - Obesity & Psych	588	1.70	.59	677	2.00	.70	-8.26	1261.96	< .001
Perceived Stress	494	1.35	.40	590	1.46	.46	-4.31	1080.88	< .001

Table 11
One Way Analysis of Variance for Race Ethnicity Wave 6 (2002)

	Non-Hispanic Caucasian			Non-Hispanic African American			Hispanic			<i>F</i>
	<i>n</i>	<i>M</i>	<i>SD</i>	<i>n</i>	<i>M</i>	<i>SD</i>	<i>n</i>	<i>M</i>	<i>SD</i>	
3-Item Loneliness 2002	844	1.25 _a	.43	145	1.46 _a	.51	95	1.35	.49	15.05 ***
Loneliness Ordinal	844	1.46 _a	.69	145	1.81 _a	.78	95	1.61	.73	16.57 ***
CES-D	948	1.77 _a	.93	182	1.90	.98	112	2.18 _a	1.16	9.79 ***
CES-D - Loneliness Item	948	1.82 _a	.97	182	1.93	.99	112	2.21 _a	1.17	8.41 ***
CES-D - Loneliness Ordinal	948	1.45 _a	.65	182	1.53	.69	112	1.73 _a	.77	7.76 ***
Health - Obesity & Psych	961	1.18 _{ab}	.66	186	2.08 _a	.65	118	2.00 _b	.71	17.31 ***
Recurring Loneliness	831	1.39 _{ab}	.77	156	1.72 _a	1.09	92	1.96 _b	1.24	23.52 ***
Perceived Stress	844	1.37 _{ab}	.43	145	1.55 _a	.43	95	1.56 _b	.41	18.73 ***

Note. Means in the same row with the same subscripts are significantly different a $p < .05$ using Tukey HSD range test.

*** $p < .001$.

Table 12

Cross-Lag Panel Correlations of Figure 1 and Differences for Loneliness (L) Depression (D) and Chronic Health Conditions (H)

Observed r			
Autocorrelations			
L(2002)L(2004)	.54**		
D(2002)D(2004)	.51**		
H(2002)H(2004)	.89**		
Synchronous Correlations			
	Observed r	z -test difference between correlations	p
L(2002)D(2002)	.36**	-0.75	.45
L(2004)D(2004)	.39**		
L(2002)H(2002)	.10**	-1.09	.28
L(2004)H(2004)	.15**		
D(2002)H(2002)	.19**	-1.35	.18
D(2004)H(2004)	.25**		
Cross-Lag Correlations			
	Observed r	z -test difference between correlations	p
L(2002)D(2004)	.28**	-1.92	.054
D(2002)L(2004)	.36**		
D(2002)H(2004)	.20**	-.45	.65
H(2002)D(2004)	.22**		
H(2002)L(2004)	.14**	.44	1.34
L(2002)H(2004)	.12**		

Note. These analyses were repeated with correction for attenuation and the findings were similar, but stronger.

$N = 925$.

** $p < .01$

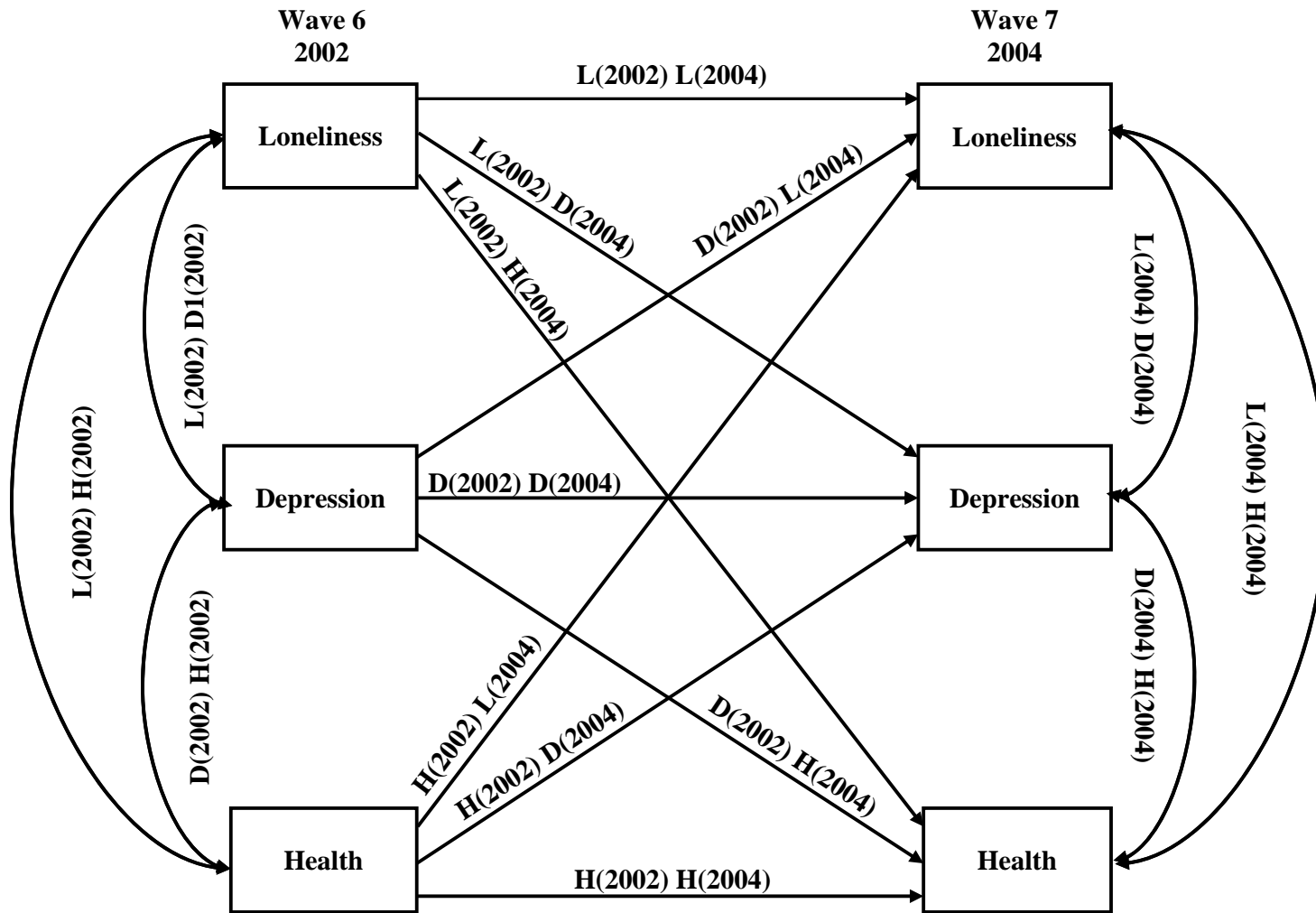


Figure 1. Cross-lagged panel correlational design for loneliness, depression, and health.

Notes. Double-headed arrows within one time period are synchronous correlations. Paths with the same construct over time are auto-correlations. Paths between different constructs over time are cross-lag correlations.

$N = 925$.

APPENDIX A

HRS MODULE 6: LONELINESS, STRESS, AND SOCIAL SUPPORT/SOCIAL BURDEN

ITEMS

HRS Module 6: Loneliness, Stress, and Social Support/Social Burden Items

Short Loneliness Scale

The next questions are about how you feel about different aspects of your life. For each one, tell me how often you feel that way.

V251 First, how often do you feel that you lack companionship: hardly ever, some of the time, or often?

V252 How often do you feel left out: hardly ever, some of the time, or often?

V253 How often do you feel isolated from others? (Is it hardly ever, some of the time, or often?)

V254 How often do you feel alone? (Is it hardly ever, some of the time, or often?)

Perceived Stress Scale

The next four questions are about how you have felt in the past month.

V255 In the last month, how often have you felt that you were unable to control the important things in your life? (Is it hardly ever, some of the time, or often?)

V256 In the last month, how often have you felt confident about your ability to handle your personal problems? (Is it hardly ever, some of the time, or often?)

V257 In the last month, how often have you felt that things were going your way? (Is it hardly ever, some of the time, or often?)

V258 (In the last month,) how often have you felt difficulties were piling up so high that you could not overcome them? (Is it hardly ever, some of the time, or often?)

Social Support Scale

These next questions ask about relationships with (your [you\husband\wife\partner], with the other family members who live with you, and with your friends.\your [you\husband\wife\partner] and with your friends.\the other family members who live with you and with your friends.\your friends.)

V260 If you need to talk about your worries, how often can you open up to your (husband\wife\partner): would you say hardly ever, some of the time, or often?

V261 [\How about the other people who live with you? If you need to talk about your worries, how often can you open up to them? (Would you say hardly ever, some of the time, or often?) \If you need to talk about your worries, how often can you open up to the other people who live with you: would you say hardly ever, some of the time, or often?]

V262 [\How about your friends? If you need to talk about your worries, how often can you open up to them? (Would you say hardly ever, some of the time, or often?) \If you need to talk about your worries, how often can you open up to your friends: would you say hardly ever, some of the time, or often?]

V263 If you have a problem, how often can you rely on your (husband\wife\partner) for help? (Would you say hardly ever, some of the time, or often?)

V264 How often can you rely on the other people who live with you for help if you have a problem? (Would you say hardly ever, some of the time or often?)

V265 How often can you rely on your friends for help if you have a problem? (Would you say hardly ever, some of the time or often?)

Social Burden Scale

V266 How often does your (husband\wife\partner) make too many demands on you? (Would you say hardly ever, some of the time, or often?)

V267 How often do the other people who live with you make too many demands on you? (Would you say hardly ever, some of the time or often?)

V268 How often do your friends make too many demands on you? (Would you say hardly ever, some of the time, or often?)

V269 How often does your (husband\wife\partner) criticize you? (Would you say hardly ever, some of the time, or often?)

V270 How often do the other people who live with you criticize you? (Would you say hardly ever, some of the time, or often?)

V271 How often do your friends criticize you? (Would you say hardly ever, some of the time, or often?)

APPENDIX B

CENTER FOR EPIDEMIOLOGICAL STUDIES' DEPRESSION SCALE (CES-D) ITEMS

Center for Epidemiological Studies' Depression Scale (CES-D) Items

Now think about the past week and the feelings you have experienced. Please tell me if each of the following was true for you much of the time during the past week. Much of the time during the past week...

D110 You felt depressed. (Would you say yes or no?)

D111 You felt that everything you did was an effort. (Would you say yes or no?)

D112 Your sleep was restless. (Would you say yes or no?)

D113 You were happy. (Would you say yes or no?)

D114 You felt lonely. (Would you say yes or no?)

D115 You enjoyed life. (Would you say yes or no?)

D116 You felt sad. (Would you say yes or no?)

D117 You could not get going. (Would you say yes or no?)

REFERENCES

- Adams, K. B., Sanders, S., & Auth, E. A. (2004). Loneliness and depression in independent living retirement communities: risk and resilience factors [Electronic version]. *Aging & Mental Health, 8*, 475-485.
- Ainsworth, M. D., (1989). Attachments beyond infancy [Electronic version]. *American Psychologist, 44*, 709-716.
- Ainsworth, M. D., & Bowlby, J. (1991). An ethological approach to personality development [Electronic version]. *American Psychologist, 46*, 333-341.
- Andersson, L. (1982). Interdisciplinary study of loneliness—with evaluation of social contacts as a means toward improving competence in old age [Electronic version]. *Acta Sociologica, 25*, 75-80.
- Andresen, E. M., Malmgren, J. A., Carter, W. B., & Patrick, D. L. (1994). Screening for depression in well older adults: Evaluation of a short form of the CES-D (Center for Epidemiological Studies Depression Scale). *American Journal of Preventative Medicine, 10*, 77-84.
- Boomsma, D. I., Cacioppo, J. T., Slagboom, P. E., & Posthuma, D. (2006). Genetic linkage association analysis in Dutch twin and sibling pairs [Electronic version]. *Behavior Genetics, 36*, 137-146.
- Bjorntorp, P., Holm, G., & Rosmond, R. (2000). Metabolic diseases: The hypothalamic arousal syndrome. In D. I. Mostofsky & D. H. Barlow (Eds.). *The management of stress and anxiety in medical disorders* (pp. 282-289). Boston: Allyn and Bacon.
- Blazer, D. G., (2002). Self-efficacy and depression in late life: A primary prevention proposal [Electronic version]. *Aging & Mental Health, 6*, 315-324.

- Bowlby, J. (1969/1982). *Attachment and loss: Voll. Attachment*. New York: Basic Books.
- Cacioppo, J. T., Ernst, J. M., Burleson, M. H., McClintock, M. K., Malarkey, W. B., Hawkley, L. C., et al. (2000). Lonely traits and concomitant physiological processes: The MacArthur social neuroscience studies [Electronic version]. *International Journal of Psychophysiology*, 35, 143-154.
- Cacioppo, J. T. & Hawkley, L. C. (2003). Social isolation and health, with an emphasis on the underlying mechanisms [Electronic version]. *Perspectives in Biology and Medicine*, 46, S39-S52.
- Cacioppo, J. T., Hawkley, L. C., Ernst, J. M., Burleson, M., Berntson, G. G., Nouriani, B., et al. (2006). Loneliness within a nomological net: An evolutionary perspective [Electronic version]. *Journal of Research in Personality*, 40, 1054-1085.
- Cacioppo, J. T., Hughes, M. E., Waite, L. J., Hawkley, L. C., & Thisted, R. A. (2006). Loneliness as a specific risk factor for depressive symptoms: Cross-sectional and longitudinal analyses [Electronic version]. *Psychology and Aging*, 21, 140-151.
- Carmines, E. G., Zellar, R. A. (1979). *Reliability and validity assessment* (Sage University Paper Series on Quantitative Applications in the Social Sciences, Series No. 17). Thousand Oaks, CA: Sage.
- Cattan, M., White, M., Bond, J., & Learmouth, A. (2005) [Electronic version]. *Ageing & Society*, 25, 41-67.
- Chobanian, A. V., Bakris, G. L., Black, H. R., Cushman, W. C., Green, L. A., Izzo, J. L., et al. (2003). Seventh report of the Joint National Committee on prevention, detection, evaluation, and treatment of high blood pressure [Electronic version]. *Hypertension*, 42,

1206-1252. Retrieved May, 25, 2007 from <http://hyper.ahajournals.org/cgi/content/full/42/6/1206>

Darwin, C. (1859). *The origin of the species by means of natural selection: Or, the preservation of favoured races in the struggle for life* [Electronic version]. London, England: John Murray.

Davidson, K. (2002). Gender differences in new partnership choices and constraints for older widows and widowers [Electronic version]. *Ageing International*, 27, 43-60.

De Jong-Gierveld, J. (1987). Developing and testing a model of loneliness [Electronic version]. *Journal of Personality and Social Psychology*, 53, 119-128.

De Jong-Gierveld, J. (1998). A review of loneliness: Concept and definitions, determinants and consequences [Electronic version]. *Reviews in Clinical Gerontology*, 8, 73-80.

De Jong-Gierveld, J. & Raadschelders, J. (1982). Types of loneliness. In L. A. Peplau & D. Perlman (Eds.), *Loneliness: A sourcebook of current theory, research, and therapy* (pp. 105-119). New York: Wiley.

De Jong-Gierveld, J., Tilburg, T. V. (1999). Living arrangements of older adults in the Netherlands and Italy: Coresidence values and behaviour and their consequences for loneliness [Electronic version]. *Journal of Cross-Cultural Gerontology*, 14, 1-24.

Documentation: Health and retirement study (HRS). (n.d.). Retrieved July 17, 2006 from University of Michigan, Institute for Social Research Web Site: http://hrsonline.isr.umich.edu/meta/sho_meta.php?hfyle=modules

Dwyer, D. S., & Mitchell, O. S. (1999). Health problems as determinants of retirement: Are self-rated measures endogenous? [Electronic version]. *Journal of Health Economics*, 18, 173-293.

- Eisenberger, N. I., Lieberman, M., & Williams, K. D. (2003). Does rejection hurt? An fMRI study of social exclusion [Electronic version]. *Science*, 302, 290-292.
- Finkel, S. E. (1995). *Causal analysis with panel data*. (Sage University Paper Series on Quantitative Applications in the Social Sciences, Series No. 105). Thousand Oaks, CA: Sage.
- Fisher, G. G., Faul, J. D., Weir, D. R., & Wallace, R. B., (2005). *Documentation of chronic disease measures in the health and retirement study* (HRS/AHEAD Documentation Report No. DR-009). Ann Arbor, MI: University of Michigan, Survey Research Center. Retrieved May 18, 2007 from University of Michigan, Institute for Social Research Web Site: <http://hrsonline.isr.umich.edu/docs/userg/dr-009.pdf>
- Hawkey, L. C., Burleson, M. H., Berntson, G. G., & Cacioppo, J. T. (2003). Loneliness in everyday life: Cardiovascular activity, psychosocial context, and health behaviors [Electronic version]. *Journal of Personality and Social Psychology*, 85, 105-120
- Hawkey, L. C., Masi, C. M., Berry, J. D., & Cacioppo, J. T. (2006). Loneliness is a unique predictor of age-related differences in systolic blood pressure [Electronic version]. *Psychology and Aging*, 21, 152-164.
- Hays, R. D., & DiMatteo, M. R. (1987). A short form measure of loneliness [Electronic version]. *Journal of Personality Assessment*, 51, 69-81.
- Health and Retirement Study (2006, October). *Data description and usage*. Retrieved February 12, 2007, from University of Michigan, Institute for Social Research Web site: <http://hrsonline.isr.umich.edu/meta/2004/core/desc/h04dd.pdf>

- Heeringa, S. G. & Connor, J. H. (1995, May). *Technical description of the health and retirement study survey sample design*. Retrieved July 17, 2006 from the University of Michigan, Institute for Social Research Web site: <http://hrsonline.isr.umich.edu/>
- Hergenhahn, B. R. (2001). *An introduction to the history of psychology*. Belmont, CA: Wadsworth/Thomson Learning.
- Holmen, K., Ericsson, K., Andersson, L., & Winblad, B. (1992). Loneliness among elderly people living in Stockholm: A population study [Electronic version]. *Journal of Advanced Nursing, 17*, 43-51.
- Hughes, M. E., Waite, L. J., Hawkey, L. C., & Cacioppo, J. T. (2004). A short scale for measuring loneliness in large surveys: Results from two population-based studies [Electronic version]. *Research on Aging, 26*, 655-672.
- Irwin, M., Artin, K. H., Oxman, M. N., (1999). Screening for depression in the older adult: Criterion validity of the 10-item Center for Epidemiological Studies Depression Scale (CES-D) [Electronic version]. *Archives of Internal Medicine, 159*, 1701-1704.
- Kanji, G. K. (1993). *100 Statistical Tests*. Thousand Oaks, CA: Sage.
- Kenny, D. A., & Harackiewicz, J. M., (1979). Cross-lagged panel correlation: Practice and promise [Electronic version]. *Journal of Applied Psychology, 64*, 372-379.
- Kiecolt-Glaser, J. K., Ricker, D., George, J., Messick, G., Speicher, C. E., Garner, W., et al. (1984). Urinary cortisol levels, cellular immunocompetency, and loneliness in psychiatric inpatients [Electronic version]. *Psychosomatic Medicine, 46*, 15-23.
- Lauder, W., Mummery, K., Jones, M., & Caperchione, C. (2006). A comparison of health behaviors in lonely and non-lonely populations [Electronic version]. *Psychology, Health, & Medicine, 11*, 233-245.

- Lewington, S., Clarke, R., Qizilbash, N., Peto, R., & Collins, R. (2002). Age-specific relevance of usual blood pressure to vascular mortality: A meta-analysis of individual data for one million adults in 61 prospective studies [Electronic version]. *The Lancet*, *360*, 1903-1913.
- Moustakas, C. E., (1972). *Loneliness and love*. Englewood Cliffs, NJ: Prentice-Hall.
- Pietromonaco, P. R., & Barrett, L. F. (2000). The internal working model concept: What do we really know about the self in relation to others? [Electronic version]. *Review of General Psychology*, *4*, 155-175.
- Penninx, B. W. J. H., Van Tilburg, T., Kriegsman, D. M. W., Deeg, D. J. H., Boeke, A. J. P., & Van Eijk, J. T. M. (1997). Effects of social support and personal coping resources on mortality in older age: The longitudinal aging study in Amsterdam [Electronic version]. *American Journal of Epidemiology*, *146*, 510-519.
- Perlman, D. (2004). European and Canadian studies of loneliness among seniors [Electronic version]. *Canadian Journal on Aging*, *23*, 181-188.
- Perlman, D., Gerson, A. C., & Spinner, B. (1978). Loneliness among senior citizens: An empirical report [Electronic version]. *Essence*, *2*, 239-248.
- Pinquart, M. & Sorenson, S. (2001). Influences on loneliness in older adults: A meta-analysis [Electronic version]. *Basic and Applied Social Psychology*, *23*, 245-266.
- Pressman, S. D., Cohen, S., Miller, G., Barkin, A., Rabin, B. S., & Treanor, J. J. (2005). Loneliness, social network size, and immune response to influenza vaccination in college freshmen [Electronic version]. *Health Psychology*, *24*, 297-306.
- Radloff, L.S. (1977). The CES-D scale: A self-report depression scale for research in the general population. *Applied Psychological Measurement*, *1*, 385-401.

- Rook, K. S. (1987). Social support versus companionship: Effects on life stress, loneliness, and evaluations by others [Electronic version]. *Journal of Personality and Social Psychology*, 52, 1132-1147.
- Rubenstein, C. M., & Shaver, P. (1982). The experience of loneliness. In L. A. Peplau & D. Perlman (Eds.), *Loneliness: A sourcebook of current theory, research, and therapy* (pp. 206-223). New York: Wiley.
- Russell, D. (1982). The measurement of loneliness. In L. A. Peplau & D. Perlman (Eds.), *Loneliness: A sourcebook of current theory, research, and therapy* (pp. 81-104). New York: Wiley.
- Russell, D., Cutrona, C. E., Rose, J., & Yurko, K. (1984). Social and emotional loneliness: An examination of Weiss's typology of loneliness [Electronic version]. *Journal of Personality and Social Psychology*, 46, 1313-1321.
- Russell, D., Peplau, L. A., & Cutrona, C. E. (1980). The revised UCLA loneliness scale: Concurrent and discriminant validity evidence [Electronic version]. *Journal of Personality and Social Psychology*, 39, 472-480.
- Russell, D. W., Cutrona, C. E., de la Mora, A., & Wallace, R. B. (1997). Loneliness and nursing home admission among rural older adults [Electronic version]. *Psychology and Aging*, 12, 574-589.
- Scanlan, J. M., Vitaliano, P. P., Zhang, J., Savage, M., & Ochs, H. D. (2001). Lymphocyte proliferation is associated with gender, caregiving, and psychosocial variables in older adults [Electronic version]. *Journal of Behavioral Medicine*, 24, 537-559.
- Steffick, D. E. (2000). *Documentation of affective functioning in the health and retirement study* (HRS/AHEAD Documentation Report No. DR-005). Ann Arbor, MI: University of

- Michigan, Survey Research Center. Retrieved March 19, 2007 from University of Michigan, Institute for Social Research Web Site: <http://hrsonline.isr.umich.edu/docs/userg/dr-005.pdf>
- Stroebe, W., Stroebe, M., Abakoumkin, G., & Schut, H. (1996). The role of loneliness and social support in adjustment to loss: A test of attachment versus stress theory [Electronic version]. *Journal of Personality and Social Psychology*, *70*, 1241-1249.
- Van Der Geest, S. (2004). "They don't come to listen": The experience of loneliness among older people in Kwahu, Ghana [Electronic version]. *Journal of Cross-Cultural Gerontology*, *19*, 77-96.
- Wei, M., Russell, D. W., & Zakalik, R. A. (2005). Adult attachment, social self-efficacy, self-disclosure, loneliness, and subsequent depression for freshman college students: A longitudinal study [Electronic version]. *Journal of Counseling Psychology*, *52*, 602-614.
- Weiss, R. S. (1973). *Loneliness: The experience of emotional and social isolation*. Cambridge, MA: MIT Press.
- Willis, R. J., & Weir, D. R. (2006). Health and Retirement Study. October 10.
- World Health Organization (2003). *Global strategy on diet, physical activity, and health: Obesity and overweight*. Retrieved May 19, 2007, from <http://www.who.int/hpr/NPH/docs/gsobesity.pdf>
- World Health Organization (2006, September). *Obesity and overweight* (Fact sheet No. 311). Retrieved May 19, 2007, from <http://www.who.int/mediacentre/factsheets/fs311/en/index.html>

Yochim, B. P., Kerker, S. P., & Lichtenberg, P. A. (2006). Cerebrovascular risk factors, activity limitations, and depressed mood in African American older adults. [Electronic version] *Psychology and Aging, 21*, 186-189.

Young, J. E. (1982). Loneliness, depression and cognitive therapy: Theory and application. In L. A. Peplau & D. Perlman (Eds.), *Loneliness: A sourcebook of current theory, research, and therapy* (pp. 379-405). New York: Wiley.