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Successful aging and social contexts: The importance of support, marital status, and spousal influences

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Successful aging and social contexts: The importance of support, marital status, and spousal influences

by

Kate E. Small

A dissertation submitted to the graduate faculty

in partial fulfillment of the requirements for the degree of

DOCTOR OF PHILOSOPHY

Major: Human Development and Family Studies

Program of Study Committee:
Jennifer Margrett, Major Professor
Warren Franke
Peter Martin
Gary Phye
Daniel Russell

Iowa State University
Ames, Iowa

2013

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# TABLE OF CONTENTS

<table>
<thead>
<tr>
<th>Section</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>LIST OF TABLES</td>
<td>iv</td>
</tr>
<tr>
<td>LIST OF FIGURES</td>
<td>v</td>
</tr>
<tr>
<td>ACKNOWLEDGEMENTS</td>
<td>vi</td>
</tr>
<tr>
<td>ABSTRACT</td>
<td>vii</td>
</tr>
<tr>
<td>CHAPTER 1: GENERAL INTRODUCTION</td>
<td>1</td>
</tr>
<tr>
<td>Introduction</td>
<td>1</td>
</tr>
<tr>
<td>Dissertation Organization</td>
<td>1</td>
</tr>
<tr>
<td>Literature Review</td>
<td>2</td>
</tr>
<tr>
<td>CHAPTER 2: SUCCESSFUL AGING AND 25 YEAR SURVIVAL:</td>
<td>6</td>
</tr>
<tr>
<td>THE IMPORTANCE OF PHYSICAL HEALTH AND FUNCTIONING,</td>
<td></td>
</tr>
<tr>
<td>CHRONIC CONDITIONS, AND SOCIAL SUPPORT</td>
<td></td>
</tr>
<tr>
<td>Abstract</td>
<td>6</td>
</tr>
<tr>
<td>Literature Review</td>
<td>7</td>
</tr>
<tr>
<td>Methods</td>
<td>10</td>
</tr>
<tr>
<td>Results</td>
<td>14</td>
</tr>
<tr>
<td>Discussion</td>
<td>16</td>
</tr>
<tr>
<td>References</td>
<td>19</td>
</tr>
<tr>
<td>CHAPTER 3: MARITAL STATUS, SEX, AND SURVIVAL: THE MEDIATING EFFECT OF</td>
<td>30</td>
</tr>
<tr>
<td>SOCIAL SUPPORT IN OLDER ADULTS</td>
<td></td>
</tr>
<tr>
<td>Abstract</td>
<td>30</td>
</tr>
<tr>
<td>Literature Review</td>
<td>30</td>
</tr>
<tr>
<td>Methods</td>
<td>36</td>
</tr>
<tr>
<td>Results</td>
<td>38</td>
</tr>
<tr>
<td>Discussion</td>
<td>41</td>
</tr>
<tr>
<td>References</td>
<td>45</td>
</tr>
<tr>
<td>CHAPTER 4: SPOUSAL CONCORDANCE ON COGNITIVE TRAJECTORIES:</td>
<td>53</td>
</tr>
<tr>
<td>AN EXPLORATORY LATENT CLASS APPROACH WITH MEXICAN AMERICAN OLDER</td>
<td></td>
</tr>
<tr>
<td>ADULTS</td>
<td></td>
</tr>
<tr>
<td>Abstract</td>
<td>53</td>
</tr>
<tr>
<td>Literature Review</td>
<td>54</td>
</tr>
<tr>
<td>Methods</td>
<td>58</td>
</tr>
</tbody>
</table>
Results 59
Discussion 61
References 65
CHAPTER 5: GENERAL CONCLUSIONS 77
Discussion 77
References 82
APPENDIX: IRB Documents 86
## LIST OF TABLES

### CHAPTER 2
- Table 2.1: 25
- Table 2.2: 26
- Table 2.3: 27
- Table 2.4: 28
- Table 2.5: 29

### CHAPTER 3
- Table 3.1: 38
- Table 3.2: 42

### CHAPTER 4
- Table 4.1: 72
- Table 4.2: 73
- Table 4.3: 74
- Table 4.4: 75

### CHAPTER 5
- Table 5.1: 78
# LIST OF FIGURES

## Chapter 3

<table>
<thead>
<tr>
<th>Figure</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>Figure 3.1</td>
<td>51</td>
</tr>
<tr>
<td>Figure 3.2</td>
<td>51</td>
</tr>
<tr>
<td>Figure 3.3</td>
<td>51</td>
</tr>
<tr>
<td>Figure 3.4</td>
<td>52</td>
</tr>
</tbody>
</table>

## Chapter 4

<table>
<thead>
<tr>
<th>Figure</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>Figure 4.1</td>
<td>76</td>
</tr>
<tr>
<td>Figure 4.2</td>
<td>76</td>
</tr>
</tbody>
</table>
I would like to first acknowledge and thank my major professor and mentor, Dr. Jennifer Margrett. Her constant support and encouragement has led me to pursue opportunities that have been invaluable to my academic career. I greatly appreciate her advice regarding academic, career, and life matters. I am always amazed at the number of resourceful and creative ideas she generates. Without her help, I would not have been able to finish my dissertation. Second, I would like to thank my committee members for their time and detailed comments they offered at both my dissertation proposal and defense. Their input was important in strengthening and completing my dissertation document. Third, I would like express extreme gratitude to Dr. Daniel Russell who allowed me to use the Linn County data set, and who frequently offered his expert statistical advice. I would still be working on my dissertation if it was not for his guidance. Fourth, I would like to thank my parents, Barb and Tim Daugherty, as their constant support enabled me to complete my graduate degree. Finally, I would like to thank my husband David Small. I am extremely lucky to have such an understanding and supportive person in my life, and could not have done this without him.
ABSTRACT

The focus of this dissertation is on the concept of “successful aging” within social contexts. Specifically, how the contexts of perceived social support, marital status, and spousal influence are related to successful aging outcomes. Paper 1 adopts Rowe and Kahn’s (1997) model of successful aging as a framework for investigating predictors related to 25-year survival. The results show that having better physical functioning (e.g., walking), low chronic illness, and higher ratings of perceived social support significantly predicted survival over 25 years. Depressive symptoms, church attendance, and participating in volunteer activities were unrelated to survival. Paper 2 investigates the relationship between perceived social support, sex, marital status and long-term survival, as well as the mediating effect of social support on marital status and sex in relation to 25-year survival. The results indicate that both sex and social support directly affected survival, and marital status indirectly influenced survival through social support. Therefore, the relationship between being married and survival appears to be due to the impact that marital status has on level of social support. The aims of Paper 3 were to describe the nature and number of latent classes that best fit cognitive trajectories for husbands and wives over seven years, as well as determine congruence of spousal membership on latent class trajectories. Results determined that the best fitting model for both husbands and wives consisted of four latent classes and nearly 50% of spouses had shared congruent latent classes. This highlights the importance of looking at spousal influences in relation to successful aging outcomes. As a whole, these papers contribute to the current discussion on successful aging and stress the importance of social contexts of successful and optimal aging.
CHAPTER 1: GENERAL INTRODUCTION

The focus of this dissertation is on the concept of “successful aging” within social contexts. Successful aging is a controversial construct in the field of gerontology, with no agreed upon definition or assessment (Depp & Jeste, 2006, Strawbridge, Cohen, Shema, & Kaplan, 1996; Strawbridge, Wallhagen, & Cohen, 2002). Successful aging generally means that one is aging well; and is often synonymous with the terms optimal, healthy, successful, productive, competent, and vital aging (as summarized in Depp & Jeste, 2006). However, much criticism has centered on the definition and conceptualization of successful aging (Dillaway & Byrnes, 2009). One criticism is that many definitions are too limiting and may leave out older adults who would otherwise consider themselves as aging successfully (Dillaway & Byrnes, 2009; McLaughlin, Connell, Heeringa, Li, & Roberts, 2010; Strawbridge, Wallhagen, & Cohen, 2002). In fact, research looking at subjective versus objective classification of successful aging found a large discrepancy in the number of older adults who were considered successful agers. Specifically, a greater number of older adults were considered successfully aging according to their own ratings than objective criteria of researchers (Strawbridge et al., 2002). Gerontologists in the field also suggest that definition might need to change depending on one’s age, taking into account age-related norms for declining physical or mental functioning (Baltes & Smith, 2003; McLaughlin, et al., 2010). In fact, a recent study found that older age was associated with higher ratings of self-rated successful aging (Jeste et al., 2013). Though the debate on defining successful aging is an important task, the aim of this dissertation was not to determine a definition. Instead, the goal was to address several social contexts and the related influences on successful aging outcomes, such as long-term survival and cognitive status over time. I
specifically investigated the relative influence of social contexts on successful aging, while considering physical and functional health, marital status, and spousal influence. Below is an outline of the following chapters that investigate these contexts in the following chapters.

One highly recognized theory by Rowe and Kahn (1987, 1997) posits that successful aging is represented by “low probability of disease and disability, maintaining high cognitive functioning and physical activity, and an active engagement in life.” The second chapter (Paper 1) uses this model as a framework, because it is a more holistic, yet defined, representation of successful aging. The constructs for this study focused on the different components of successful aging (e.g., low disease and disability, high physical and mental functioning, active engagement) and long-term survival. The literature on survival (or non-mortality) among older adults often includes studies that are designed to examine predictors of survival against all-cause mortality and fail to include multiple predictors at once, and even fewer assess survival over a long period of time (e.g., 25 years). Examining multiple predictors and outcomes over time assists in identifying which categories of successful aging are most important for long-term survival. This paper utilized data from a Linn County study of community-dwelling older adults (Russell & Cutrona, 1991), and employed Cox regression analyses to determine which components of successful aging predict survival over 25 years. Utilizing a selective framework, such as that by Rowe and Kahn (1997), for identifying individuals who are aging successfully will aid in identifying proper targets for intervention, and which factors are most important for long-term survival.

Another factor, social support, is also linked both mortality and morbidity among older adults (Avlund & Damsgaard 1998; Blazer, 1982; Cerhan & Wallace, 1997; Lyrra & Heikkinen, 2006), but it is not always included in conceptual definitions of successful aging.
The hesitancy to include social support as a dimension of successful aging may relate to inconsistencies regarding social support measurement used in the literature (i.e., marital status, frequency of contact, group membership). In addition to measurement issues, the length of the study and participant characteristics (i.e., age, sex, socio-economic status) yield varying results when linking social support and survival (Holt-Lundstad, Smith, & Layton, 2010). Also, not all social support is seen as wanted or linked to positive outcomes (Antonucci & Akiyama 1991; Antonucci, Birdett, & Webster 2010; Rook, 1984), and the mechanism in which social support is related to health outcomes is unclear (Uchino, 2009). Therefore, further research is needed to examine the role of social support and outcomes of successful aging.

Chapter 3 (Paper 2) specifically focuses on the relationship between perceived social support and survival, and investigate the effects of sex and marital status on perceived support over time. Both sex (e.g., male, female) and marital status have been consistently linked to survival among older adults. However, few studies consider social support as a mediator for survival over time. Thus, the aims of Chapter 3 were to: 1) examine the relationship between sex, marital status, and social support with survival, and 2) investigate the mediating effect of social support on sex and marital status in relation to long-term survival. Survival analyses were conducted using the Linn County data set (Russell & Cutrona, 1991) to explore the relationship of sex, marital status, and social support with survival. Discrete time survival analyses were employed to test the mediating effects of social support on sex and marital status in relation to long-term survival. The results of this paper provide additional knowledge about the importance of social support, sex, and marital status in relation to survival. Specifically, more research should look at individuals who are
married, as older adult couples may have a mutual influence on individual development and important aging outcomes such as cognitive functioning (Hoppmann & Gerstorf, 2009).

Whereas papers 1 and 2 highlight the importance of social support in relation to successful aging, the third paper (Chapter 4) addressed an often overlooked component of successful aging, cognitive functioning. A comprehensive review of studies focusing on successful aging found only 13 that included cognitive functioning in their definition (Depp & Jeste, 2006). However, “successful cognitive aging” has become more of a focus in recent studies (Daffner, 2010; Depp, Harmell, & Vahia, 2012; Vance, McNees, & Meneses, 2009). Therefore, Paper 3 explored cognitive functioning as an outcome of successful aging.

Cognitive status is important to consider within social contexts as cognitive status has been found to be influenced by social support (Amieva et al., 2010; Seeman, Lusiagnolo, Albert, & Berkman, 2001). Paper 3 utilized the Hispanic Established Populations for the Epidemiological Study of the Elderly (Markides, 1999; 2001; 2003; 2005), which includes couples assessed over multiple time points. Cognitive status among older Hispanic couples is extremely relevant in that: 1) Hispanic older adults are one of the largest growing populations in the United States (Administration on Aging, 2010), 2) Hispanic older adults have an increased risk for cognitive decline (Black & Rush, 2002; Rose, 2005), and 3) Older adult couples may have a mutual influence on individual development and important aging outcomes such as cognitive functioning (Hoppmann & Gerstorf, 2009). The primary research questions were describing the nature and number of latent classes for both husbands’ and wives’ cognitive trajectories and examining the congruence of latent classes between husbands and wives. Exploratory latent class analyses were conducted to determine the number of classes for that best fit the data for both husbands and wives and
assign group membership based on cognitive trajectories. Chi-square analyses compared spousal congruence latent class membership for cognitive trajectories. The results of this paper provide further insight regarding the influence of spouses on outcomes of successful aging, such as cognitive status.
CHAPTER 2
SUCCESSFUL AGING AND 25 YEAR SURVIVAL: THE IMPORTANCE OF PHYSICAL HEALTH AND FUNCTIONING, CHRONIC CONDITIONS, AND SOCIAL SUPPORT

A paper to be submitted to the *Journals of Gerontology Part B: Social Sciences*

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Abstract

**Objective.** Few studies have attempted to evaluate which components of successful aging are related to long-term survival. The current study examined how different factors align with Rowe and Kahn’s (1997) model of successful aging and their influence on 25-year survival.

**Method.** Participants for this study included 278 community-dwelling older adults from a rural Midwestern county. Cox survival analyses were employed to determine which factors at baseline (1985) significantly predicted 25-year survival.

**Results.** Overall, having better physical functioning (i.e., walking), low chronic illness, and higher ratings of perceived social support significantly predicted survival over 25 years. Depressive symptoms, church attendance, and participating in volunteer activities were unrelated to survival.

**Conclusion.** Future research should explore the mechanisms through which social support influence survival in older adults.

**Key Words:** Successful Aging- Survival- Social Support- Health
The number of Americans aged 65 and older is projected to double in the next 40 years (U.S. Census Bureau, 2011), and the population of the oldest old (85+) is expected to triple (U.S. Census Bureau, 2011). One of the concerns for this population is that the rates of disability and severe disability increase with age for individuals over 65 (Ferrucci et al., 1996). Thus, a major focus has been on helping older adults stay healthy as they age. Additionally, it is well recognized that the concept of healthy, or optimal, aging goes beyond the avoidance of disease and disability (World Health Organization, 2003); it is also important to examine how dimensions such as mental and physical functioning and active engagement in life also how well individuals age (Rowe & Kahn, 1997).

The term “successful aging” is one that researchers have used to define the process by which older adults age well. Successful aging has is a timely topic, but criticisms exist regarding optimal theoretical and operational definitions, as well as appropriate methodological assessment of successful aging (Depp & Jeste, 2006; Martin, Kelly, & Kahana, et al., 2012; Strawbridge, Cohen, Shema, & Kaplan, 1996; Strawbridge, Wallhagen, & Cohen, 2002).

In terms of theoretical definitions, “successful aging” may not be attainable for many older adults who have several chronic conditions, but still lead an optimal life. Baltes and Baltes (1990) acknowledge this process of compensating for age related losses by focusing on their remaining abilities as “selective optimization with compensation”. Additionally, assessments of successful aging range from single-item subjective accounts (e.g., life-satisfaction or “Are you aging successfully or well?”) to multi-factorial, objective indicators (e.g., activities of daily living, cognitive functioning, number of chronic diseases; Depp & Jeste, 2006).
In order to conceptualize the idea of healthy well-being, Rowe and Kahn (1987, 1997) proposed a model of successful aging that includes three components: 1) low probability of disease (e.g., number of chronic health conditions) and disability (e.g., impaired activities of daily living), 2) maintaining cognitive functioning and physical activity, and 3) active engagement in life. Although this model is comprehensive, it may set a standard that is too high for many individuals. For instance, an analysis of older adults from the Health and Retirement Study found that less than 12% of individuals met Rowe and Kahn’s criteria for successful aging at any given year (McLaughlin, Connell, Heeringa, Li, & Roberts, 2010). Similarly, Strawbridge et al., (2002) used Rowe and Kahn’s model to determine the prevalence of older adults (age 65 and older) who were “successfully aging” in the Alameda County Study. These researchers found that less than one fifth of the selected sample was aging successfully according to criteria included in Rowe and Kahn’s model. However, subjective ratings indicated that roughly 50% of older adults from this study considered themselves to be aging successfully. This finding suggests disconnect between what researchers and older adults define as successful aging.

Although Rowe and Kahn suggest a very broad, holistic definition of successful aging, it may be more salient to focus on which specific dimensions of well-being and functioning are related to explicit outcomes, such as survival. Survival into old age has been used as a marker of successful aging (Depp & Jeste, 2006). As Rowe and Kahn (1997) suggested, successful aging is multidimensional and people could move “in and out of success”; this leaves questions regarding the utility of identifying individuals who are “successful” based on the separate categories of the model. Few studies have modeled predictors of survival using Rowe and Kahn’s framework and no known studies have looked
at the importance of these predictors in predicting long-term survival (e.g., up to 25 years). Identifying which dimensions of successful aging are most associated with long-term survival can provide researchers and practitioners with a better understanding of specific dimensions to focus on. In turn, having a more selective framework for identifying individuals who are aging successfully can aid in developing proper targets for intervention.

**Predictors of Survival among Older Adults**

In terms of predictors of survival among older adults that fit with Rowe and Kahn’s dimensions of successful aging, much research suggests a high probability of survival with lower levels of chronic health conditions and functional disability in older adults (Leong et al., 2007). However, dimensions above physical health, such as social engagement, are also important to survival in older adults. For instance, having a large social support network (20-30 people) was more protective of mortality than marital status over 15 years in adults over age 65 (Shye, Mullooly, Freeborn, & Pope, 1995). Additionally, research suggests that involvement in social and productive activities that involved little or no cardiovascular fitness are predictive of survival in older adults (Glass, De Leon, Marottoli, & Berkman, 1999). Two social activities that have been associated with increased survival include volunteering (Harris & Thoresen, 2005) and religious attendance (Lutgendorf, Russell, Ullrich, Harris, & Wallace, 2004; Strawbridge, Shema, Cohen, & Kaplan, 2001).

Furthermore, demographic variables such as age, sex, and education should be controlled for, as being younger, a female, and having higher levels of education are consistently linked to increased rates of survival in older adults (Newson et al., 2010). Although these variables cannot be modifiable in terms of intervention strategies, it is still
important to include these factors when examining the predictors of survival in older adults to know whether certain individuals are at a greater risk of mortality (or non-survival).

**Study Rationale**

Few studies are designed to examine multiple predictors of survival against all-cause mortality over a long period of time. Including predictors that can be categorized according to the dimensions of Rowe and Kahn’s model of successful aging may be helpful in understanding the different aspects of well-being and functioning that do influence long-term survival. Having a more selective framework for identifying individuals who are aging successfully would aid in identifying proper targets for intervention, based on which factors are most important for long-term survival. The current study examined the relative importance of predictors related to survival at 25 years.

**Method**

**Participants and Procedure**

The participants for this study are from a sample of community-dwelling older adults from Linn County, Iowa (Russell & Cutrona, 1991). Individuals were admitted to the study after meeting the following criteria:

“1) 65 years of age or older, 2) no major physical illnesses or conditions, 3) no psychological or emotional treatment in the previous 6 months, 4) no evidence of dementia [as indicated by not being disoriented as to time, person, or place on the Mini-Mental State Examination (Folstein, Folstein, & McHugh, 1975)], and 5) not institutionalized” (Schmitz, Russell, & Cutrona, 2002).

The initial sample consisted of 301 participants, with approximately 60% females. Initial interviews were conducted in 1985. The average age at baseline was 71.90 years
(range = 65-97) and 73% of the individuals had completed high school. The sample was mostly White (99.70%).

In order to calculate survival time, individuals were verified as either being deceased or still living as of December 2010 (25 years). To do this, permission was granted by the Iowa State University Institutional Review Board (Appendix A) to use participant names and birth dates to search public, online records (e.g., Social Security Death Index, whitepages.com, peoplesearch.com) for either: a) a confirmed death or b) confirmed living status that matched the name and approximate birth date. Of the 301 participants, a confirmed status could not be determined for 23 individuals due to inconsistent names or birthdates, leaving 278 participants (115 males, 183 females) in the final analyses. Missing data was imputed using the regression method, which estimates values based on the linear trend for that time point. A total of 32 participants (8 males, 24 females) were still living in 2010. Table 2.1 illustrates the number and proportion of participants who died during each 5-year interval.

The average age of participants at the time of the baseline interview was 71.71 years (range 65-97) and the average age at death was 87.77 years (range 67-106). This was a well-educated sample, with the average grade level being 12.21 (SD = 2.78). In addition, 140 individuals (50%) of the sample were married at baseline and 89 individuals (32%) were living alone.

Measures

**Dependent variable.** The dependent variable in this study was time to death (or survival). Survival time was calculated in years from the baseline interviews (1985) to the date of death (up to December, 2010) for a total span of 25 years.
**Demographic variables.** The demographic characteristics of age and sex were controlled in the survival analyses. Table 2.2 provides the summary statistics for all variables used in the analyses.

**Physical Health and Functioning**

**Functional limitations.** Functional limitations were assessed using the Functional Limitations Health Profile from Duke University (Parkerson et al., 1981). The total scale consisted of 18 functional activities, including items such as taking a bath or shower, doing housework, handling money, and shopping for groceries. For each function, participants indicated whether or not they had: (1) no trouble, (2) some trouble, or (3) a lot of trouble. Items were summed so that higher total scores indicate greater functional limitations ($\alpha = .71$).

**Low Probability of Disease and Disability**

**Chronic illnesses.** The number of chronic illnesses was based on self-reports from a list of 26 chronic illnesses common to older adults, including heart disease, stroke, and rheumatoid arthritis (Russell & Cutrona, 1991). For each illness, participants indicated if they: (0) did not have the illness, (1) had the illness, but did not experience trouble, (2) had the illness and experienced some trouble, or (3) had the illness and experienced a lot of trouble. Possible scores ranged from 0 to 64 with higher scores indicating greater problems with chronic illnesses ($\alpha = .74$).

**Depressed mood.** Depressed mood was assessed via the Zung Self-Rating Depression Scale (Zung, 1965), which was designed to assess affective psychological and physiological symptoms of depression and has been used in many studies involving older adults. The scale is comprised of 18 questions, in which participants responded to the
frequency that they experienced depressive symptoms: (1) never or rarely, (2) some of the
time, (3) most of the time, or (4) all of the time. Possible scores ranged from 18 to 64 with
higher scores indicating greater depressive symptoms (α = .80).

**Active Engagement with Life**

**Social support.** Perceived social support was assessed using the Social Provisions
Scale (Cutrona & Russell, 1987). This scale measures the degree to which social support is
provided in terms of six relational provisions identified by Weiss (1974): guidance, reliable
alliance, reassurance of worth, social integration, attachment, and opportunity for nurturance.
Each provision is represented by four items measuring the absence or presence of each
support type (α = .72). Answers were scored as (1) yes, (2) not sure, and (3) no. Possible
scores ranged from 24-72 and items were reverse coded so that higher scores indicated
greater perceived support.

**Volunteer work.** Participants indicated if they regularly engaged in volunteer work
(1) or not (0).

**Religious attendance.** Religious attendance was determined by asking participants
how frequently they attended religious services. Responses included: (1) more than once a
week, (2) weekly, (3) every other week, (4) once a month, (5) 2-11 times a year, (6) less
than once a year, and (7) never. Possible scores ranged from 1 to 7 with lower scores
indicating more frequent church attendance

**Analyses**

**Survival curves.** Survival analyses were conducted using Cox regression analyses
(Cox & Oates, 1987) to determine which predictors (at baseline) were significantly related
to 25-year survival. Table 2.3 provides a correlation matrix for all variables included in the study. Analyses were performed using SPSS 19.0 (SPSS, Chicago, IL).

The hypothesis for this study is that each component of Rowe and Kahn’s theory of successful aging will be differentially important for survival over 25 years. Thus, categories of predictors were added in a hierarchical fashion to demonstrate the relative impact of each dimension (or block) added to the model. The variables were added in the following order: demographic variables (step 1), predictors of physical health and functioning (step 2), low probability of disease and disability (step 3), and active engagement with life (step 4).

**RESULTS**

Cox survival analyses demonstrated that age and sex were significant predictors of mortality over 25 years. In the full model, being a male, having a greater age, more functional limitations, greater of chronic illnesses, and lower perceived social support at baseline independently predicted mortality over 25 years. Volunteering, church attendance, education level, and church attendance were not significantly associated with survival. Table 2.4 illustrates the results for each model.

In terms of whether or not each component of successful aging significantly influenced the chance of survival over 25 years, chi-square change was calculated to determine if each additional step yielded a significant change in the fit of the data. As indicated in Table 2.4, step 2 (physical functioning) significantly added to the model. The category of low disease and disability (step 3) and active engagement (step 4) only demonstrated a slight trend as a significant step added to the model. However, it should be noted that the relative order in which each component is added to the model does influence
the significance. Therefore, I conducted a commonality analysis that measured the amount of unique variance each step (or component) accounted for in terms of explained variance (Seibold & McPhee, 1979). Overall, the model accounted for a small amount of explained variance ($R^2 = .16$). In terms of the different components of successful aging, Physical Health and Functioning added the least amount of explained variance in survival (Unique $R^2 = .001$), followed by Low Disease and Disability (Unique $R^2 = .014$), and Active Engagement (Unique $R^2 = .032$).

In addition to the full model, survival analyses were conducted for each individual factor included in the model to determine the hazard ratios and 95% confidence intervals. The individual analyses were similar to the full model in that being younger, female, having fewer functional limitations, fewer chronic illnesses, and greater perceived social support at baseline significantly predicted survival over 25 years (See Table 2.5). Specifically, men had a 1.38 times (95% CI = 1.06-1.79) greater chance of mortality before 25 years compared to women. However, being a volunteer (hazard ratio [HR] = .75, 95% confidence interval [CI] = 0.56-0.99, $p < .05$) appeared to be a significant protective factor against mortality and higher church attendance (hazard ratio [HR] = .94, 95% confidence interval [CI] = 0.88-1.01, $p < .10$) showed a slight trend as a protective factor. Also, there was a large unique influence of social support on mortality in that higher rating of perceived support resulted in a lower risk of mortality over time (hazard ratio [HR] = .76, 95% confidence interval [CI] = 0.67-0.86, $p < .001$).
Discussion

The aim of this study was to identify baseline predictors of long-term survival (25 years) among community-dwelling older adults. These predictors were grouped according to Rowe and Kahn’s theory of Successful Aging (1997), to determine the components that predicted survival. The results of this study suggest that being younger, a female, having fewer functional limitations, minimal chronic illnesses, and greater perceived social support at baseline significantly predicted duration of survival. It is interesting to note that depressive symptomatology was not predictive of survival in both the full model and individual analyses. This is inconsistent with previous literature that suggests a link between survival and low depressive symptoms (Shults et al., 2000).

The results of this study demonstrated that overall, the components of Rowe and Kahn’s model of successful aging (physical functioning, low disease and disability, and social engagement) did not have a large influence on survival over 25 years. However, it should be noted that at least one factor from each component significantly predicted survival. Even though the different components from Rowe and Kahn’s model predicted survival, the relation of successful aging and survival is likely unique to different individuals. Future studies should consider including additional variables to represent the different dimensions of successful aging.

This study adds to the literature in that few studies have investigated the long-term (25 year) relationship between the baseline status of these predictors and survival. Multiple predictors of successful aging were included in the analyses that showed an independent effect on survival. Notably, social support independently predicted survival even after controlling for functional limitations and the number of chronic diseases, and social
engagement had the most unique variance of the three dimensions. This is an important finding given that many definitions of successful aging do not include social support or social resources as a criterion, or factor, related to successful aging. However, the finding that social support independently predicts survival supports proponents who suggest moving away from a “biomedical” model of successful aging (Glass, 2003; Young, Frick, & Phelan, 2009).

One limitation to the study is that no measure for cognitive status is included in the data set, as high cognitive functioning is a component of Rowe and Kahn’s model of successful aging (Rowe & Kahn, 1997). Participants had to pass an initial cognitive status test known as the Mini Mental State Examination (MMSE; Folstein, Folstein, & McHugh, 1975) to be admitted into the study. This could also be an issue with restriction of range, or selection bias, by not including individuals with cognitive impairments. A second limitation of the study is the use of single variables indicators, as opposed to latent variables, to represent the different components of successful aging. The lack of options for different variables partly contributed to this limitation; however, it is interesting to see the individual link to survival for each indicator. Another potential limitation is the kurtotic nature of functional limitations and social support. The higher value indicates that there is not a lot of variability in functional limitations and perceived support for older adults in the sample. This is not necessarily a negative aspect as it means the majority of older adults in this sample tend to have fewer functional limitations and higher levels of social support. A larger and more diverse sample size would possibly influence these statistics and add to the generalizability of the results. Finally, a potential limitation is that survival is determined as an outcome against all-cause mortality. Determining survival against disease-specific
mortality (i.e., certain cancers, myocardial infarction, etc.) could also influence the relative importance of different predictors of successful aging and provide better insight on creating interventions for those individuals.

Factors related to the health and survival of older adults are complex. For instance, older adults may report multiple chronic diseases and disability, but survive into very old age (Campbell, Diep, Reinken, & McCosh, 1985; Marangoni, Von Strauss, Rizzuto, Winblad, & Fratiglioni, 2008), suggesting that physical health is not a sole determinant of survival. Different predictors of survival may also be significant at varying time points. For instance, factors such as self-rated health may be predictive of short-term (4 years) compared to long-term (9 years or more) survival (Benyamini, Blumstein, Lusky, & Modan, 2003). This could be due to sex differences in mortality rates, and that self-rated health is a “more inclusive and accurate measure” than physical health and functioning (Benyamini et al., 2003).

Future research might include dimensions of cognition and personality, which have been found to influence mental health outcomes such as depression (Margrett et al., 2010) and indirectly influence perceived social support through network characteristics (Russell, Booth, Reed, & Laughlin, 1997). Also, the finding that physical limitations and chronic illnesses (objective), as well as perceived social support (subjective) independently predict survival suggests the importance of including both objective and subjective measure of successful aging. As Pruchno et al. (2010) suggest including both objective and subjective measures of subjective aging is important for the accurate measurement of successful aging. This also supports P. B. Baltes and M. M. Baltes’ (1990) theory of “Selective Optimization
and Compensation” in that individuals may still be aging successfully, even though they might be “accruing” more functional limitations and chronic conditions.

Two important long-term outcomes of such interventions are improving older adults’ quality of life and reducing the financial burden associated with care giving and increased healthcare. Though not all factors (i.e., sex, age) are modifiable, it is still worthwhile to understand the potential links or mediating relationships with long-term survival. For instance, previous research has linked social support to physical health (Berkman, Glass, Brissette, & Seeman, 2000; House, Landis, & Umberson, 1988), but there other factors might also explain the importance of perceived social support and survival, such as sex (Schumacher & Vilpert, 2011). Investing these non-modifiable factors may also help explain how specific elements of support, including the type of support (Lyyra & Heikkinen, 2006; Uchino, 2009) and source of support (Gurung, Taylor, & Seeman, 2003) are predictive of survival. Understanding and identifying predictors of survival and successful aging is important for creating appropriate intervention strategies for older adults.

References


Table 2.1 Number of Deceased Individuals from Baseline Interview (N = 278).

<table>
<thead>
<tr>
<th>Time (Years)</th>
<th># Deceased</th>
<th>% of sample</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Men</td>
<td>Women</td>
</tr>
<tr>
<td>5</td>
<td>9</td>
<td>10</td>
</tr>
<tr>
<td>10</td>
<td>28</td>
<td>28</td>
</tr>
<tr>
<td>15</td>
<td>62</td>
<td>82</td>
</tr>
<tr>
<td>20</td>
<td>80</td>
<td>97</td>
</tr>
<tr>
<td>25</td>
<td>101</td>
<td>128</td>
</tr>
</tbody>
</table>
Table 2.2. Descriptive Statistics of Predictor Variables Arranged by Rowe and Kahn’s Theory of Successful Aging.

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Physical Health &amp; Functioning</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td># Functional Limitations</td>
<td>18-40</td>
<td>22.60</td>
<td>3.48</td>
<td>12.09</td>
<td>1.92</td>
<td>5.36</td>
</tr>
<tr>
<td><strong>Low Probability of Disease</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>and Disability</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td># Chronic Illnesses</td>
<td>0-9</td>
<td>2.85</td>
<td>1.88</td>
<td>3.54</td>
<td>0.64</td>
<td>0.11</td>
</tr>
<tr>
<td><strong>Depressive Symptoms</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Active Engagement with Life</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Social Provisions Scale</td>
<td>24-72</td>
<td>68.00</td>
<td>4.89</td>
<td>23.88</td>
<td>-1.98</td>
<td>4.72</td>
</tr>
<tr>
<td>Volunteer Work</td>
<td>0-1</td>
<td>No=193</td>
<td>Yes=85</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Religious Attendance</td>
<td>1-7</td>
<td>3.58</td>
<td>1.91</td>
<td>3.67</td>
<td>0.52</td>
<td>-1.23</td>
</tr>
</tbody>
</table>

*Note:* $M$ = mean; $SD$ = Standard Deviation; Var. = variance; Skew. = Skewness; Kurt. = Kurtosis.
Table 2.3. Correlation Table for Variables Included in the Survival Analysis.

<table>
<thead>
<tr>
<th></th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
<th>8</th>
</tr>
</thead>
<tbody>
<tr>
<td>Survived 25 yrs</td>
<td>-</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sex (M = 0, F = 1)</td>
<td>.13*</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Education Years</td>
<td>-.09</td>
<td>.04</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td># Funct. Limits</td>
<td>.27**</td>
<td>.07</td>
<td>.04</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td># Chron. Illnesses</td>
<td>.16**</td>
<td>.02</td>
<td>.01</td>
<td>.33**</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Depressive Symp.</td>
<td>-.02</td>
<td>.01</td>
<td>-.08</td>
<td>.25**</td>
<td>-.22**</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Social Support</td>
<td>-.19</td>
<td>-.07</td>
<td>-.09</td>
<td>-.15*</td>
<td>-.23**</td>
<td>-.22**</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Volunteer (Y =1, N = 0)</td>
<td>.13*</td>
<td>.02</td>
<td>-.21*</td>
<td>.09</td>
<td>.04</td>
<td>.09</td>
<td>-.17**</td>
<td></td>
</tr>
<tr>
<td>Church Attend.</td>
<td>-.03</td>
<td>-.18**</td>
<td>-.10</td>
<td>.03</td>
<td>.00</td>
<td>.05</td>
<td>-.12*</td>
<td>.25**</td>
</tr>
</tbody>
</table>

Note: ** p < .01, * p < .05. (2-tailed)
<table>
<thead>
<tr>
<th>Measure</th>
<th>Model 1</th>
<th>Model 2</th>
<th>Model 3</th>
<th>Model 4</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Demographics</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Age</td>
<td>.11 (.01)***</td>
<td>.10 (.01)***</td>
<td>.10 (.01)***</td>
<td>.09 (.01)***</td>
</tr>
<tr>
<td>Sex (1 = male, 0 = female)</td>
<td>.48 (.14)***</td>
<td>.53 (.14)***</td>
<td>.53 (.14)***</td>
<td>.55 (.14)***</td>
</tr>
<tr>
<td><strong>Physical Functioning</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td># Functional Limitations</td>
<td>.09 (.03)**</td>
<td>.07 (.03)*</td>
<td>.07 (.03)*</td>
<td></td>
</tr>
<tr>
<td><strong>Low Disease &amp; Disability</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td># Chronic Illnesses</td>
<td>.08 (.04)*</td>
<td>.08 (.04)*</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Depressive Symptoms(^a)</td>
<td>.00 (.02)</td>
<td></td>
<td>-.03 (.02)</td>
<td></td>
</tr>
<tr>
<td><strong>Active Engagement</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Social Support</td>
<td></td>
<td></td>
<td>-.17 (.02)*</td>
<td></td>
</tr>
<tr>
<td>Volunteer (1 = yes, 0 = no)</td>
<td></td>
<td></td>
<td>-.04 (.04)</td>
<td></td>
</tr>
<tr>
<td>Church Attendance</td>
<td></td>
<td></td>
<td>-.04 (.04)</td>
<td></td>
</tr>
<tr>
<td>(^a) measure was standardized; (N = 279).</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

| \(\chi^2\) change                  | 6.69 *      | 4.85 \(^t\) | 6.83 \(^t\) |
| \(R^2\)                            | .13         | .13         | .15         | .16         |

**Commonality Analysis**

| Unique \(R^2\)                      | 0.001       | 0.014       | 0.032       |

*Note: ***\(p < .001\), **\(p < .01\), *\(p < .05\), \(^t\)\(p < .10\). \(^a\) = measure was standardized; \(N = 279\).*
Table 2.5. The Relationship between Baseline Status and Mortality over 25 Years: Hazard Ratios and 95% Confidence Intervals for Full Model and Individual Predictors.

<table>
<thead>
<tr>
<th></th>
<th>Hazard Ratio Full Model</th>
<th>95% CI</th>
<th>Hazard Ratio Individual</th>
<th>95% CI</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age</td>
<td>1.10***</td>
<td>1.07-1.13</td>
<td>1.10***</td>
<td>1.08-1.13</td>
</tr>
<tr>
<td>Sex (1= male, 0 = female)</td>
<td>1.72***</td>
<td>1.31-2.28</td>
<td>1.38**</td>
<td>1.06-1.79</td>
</tr>
<tr>
<td># Functional Limits</td>
<td>1.07*</td>
<td>1.00-1.14</td>
<td>1.12***</td>
<td>1.06-1.19</td>
</tr>
<tr>
<td># Chronic Illnesses</td>
<td>1.08*</td>
<td>1.00-1.17</td>
<td>1.14***</td>
<td>1.06-1.23</td>
</tr>
<tr>
<td>Depressive Symptoms(^a)</td>
<td>0.99</td>
<td>.96-1.02</td>
<td>1.07</td>
<td>0.93-1.23</td>
</tr>
<tr>
<td>Social Support</td>
<td>0.97*</td>
<td>.94-.99</td>
<td>0.76***</td>
<td>0.67-0.86</td>
</tr>
<tr>
<td>Volunteer (1 = yes, 0 = no)</td>
<td>0.91</td>
<td>.67-1.24</td>
<td>0.75*</td>
<td>0.56-0.99</td>
</tr>
<tr>
<td>Church Attendance</td>
<td>0.07</td>
<td>.89-1.04</td>
<td>0.94(^t)</td>
<td>0.88-1.01</td>
</tr>
</tbody>
</table>

Note: ***\(p < .001\), **\(p < .01\), *\(p < .05\), \(^t\)<.10; \(^a\)= standardized measure.
CHAPTER 3
MARITAL STATUS, SEX, AND SURVIVAL: THE MEDIATING EFFECT OF SOCIAL SUPPORT IN OLDER ADULTS

A paper to be submitted to the American Journal of Epidemiology

Kate Small, Jennifer Margrett, Daniel Russell, Carolyn Cutrona

Iowa State University

Abstract

The aims of the current study were to investigate the relationship between perceived social support, sex, marital status and long-term survival, as well as the mediating effect of social support on marital status and sex in relation to 25-year survival. Data were derived from a Midwestern sample of adults aged 65 and older. Baseline data were collected in 1985 and survival was tracked until 2010. Discrete time survival analyses were conducted to test the relationship between marital status, sex, social support, and survival over 25 years. The results indicate that both sex and social support directly affected survival, and marital status indirectly influenced survival through social support. The results indicated that the relationship between being married and survival is due to the impact that marital status has on the level of social support.

Introduction

Social support is important for predicting both mortality and morbidity in older adults (Avlund & Damsgaard 1998; Blazer, 1982; Cerhan & Wallace, 1997; Lyrra & Heikkinen, 2006). One hypothesis to this relationship is the “main effects” prediction, suggesting that social support directly influences physical and mental health, which in turn, influences survival (e.g., Cutrona & Russell, 1990; Loucks, Berkman, Gruenewald, &
Seeman, 2006). Although many studies have supported this hypothesis (e.g., Berkman & Syne, 1979, Cutrona, Russell, & Rose; 1986; Norris & Kaniasty, 1996; Cohen, 2004), there are several studies that indicate social support does not always have a positive influence on health and survival (Antonucci & Akiyama, 1995; Antonucci, Birditt, & Webster, 2010). In fact, negative social outcomes for older adults were found to be a stronger influence on well-being than positive social outcomes (Rook, 1984). Additionally, even reports of positive social support are not always associated with successful aging and survival. Walter-Ginzburg, Blumstein, Chetrit, and Modan (2002) found an increased risk of mortality for oldest-old individuals who reported more positive emotional support. Therefore, the exact mechanisms through which social support affects health outcomes, such as survival, remain unclear (Uchino, 2009).

There are several reasons that explain the inconsistent results between social support and survival. These reasons include: how social support was conceptualized (e.g., number of people in social network, frequency of contact, perceived social support), sample characteristics (e.g., sex differences), and the length of the study. To gain a better understanding of the relative importance of social support and survival among older adults, I first reviewed the literature regarding social support measurement, sex differences in social support, and how marital status and age influence social support and survival.

**Measuring Social Support**

One reason that the link between social support and survival is not clearly defined may be due to the inconsistent measurement of social support among older adults. In reviewing the literature, researchers have used a diverse range of “social” variables. A meta-analysis by Holt-Lundstad, Smith, and Layton (2010) identified three major components of social
relationships that have been consistently evaluated: “1) the degree of integration within social networks (i.e., how actively involved are individuals), 2) received social interactions that are intended to be supportive, and 3) perceived availability of support”. Even though each component of support is important to the overall well-being of individuals, research indicates that what may be most important is perceived, rather than received support (Uchino, 2004).

Research on social support and outcomes successful aging indicate that the type of support matters. For instance, Randall, Martin, McDonald, and Poon (2010) found that not all measures of social support were predictive of nursing home admission in centenarians. Specifically, individual reports of social resources (i.e., number of visits from someone in the past week), but not social provisions (a type of received support) were predictive of nursing home admission (Randall et al., 2010). In addition, there was a significant difference in the level of both social resources and social provisions reported by octogenarians and centenarians (Randall et al., 2010). Another study that examined mortality up to 20 years after baseline found that several indicators of social participation, but not social support, significantly reduced the hazard ratio (or likelihood) of mortality. (Bowling & Grundy, 2009). However, it should be noted that social support was a represented as dichotomous measure, which may not be an accurate reflection of overall support. Therefore, it is important to differentiate between the dimensions of social support and how factors such as sex and marital status influence the relative importance of social support on survival.

In order to depict unique dimensions of social support Weiss (1974) proposed a model, identifying six “relational provisions”: “(1) attachment, which provides a sense of
security and place, (2) social integration, a network of relationships in which individuals share common interests and concerns, (3) opportunity for nurturance, wherein the person feels responsible for another person, (4) reassurance of worth, acknowledgement of a person’s skills and abilities in a relationship, (5) reliable alliance, in which a person can count on assistance from others, and (6) guidance from trustworthy and authoritative individuals who provide advice and assistance.”

This framework was analyzed by Russell et al. (1984) and Cutrona and Russell (1990) in creating the Social Provisions Scale. Assessing social support using a multidimensional measure, such as the Social Provisions Scale, allows for a better understanding of the relationship between social support and survival. Identifying the specific aspects of perceived support, as indicated by the different provisions, may indicate how social support is important to long-term survival (25 years) in older adults.

Sex differences and social support

Besides the measurement of social support, it is important to consider sex differences, given the variation in social support patterns between males and females described in the literature (Shye et al., 1995). For instance, studies have documented older females’ social networks are often larger and more diverse than the networks of older adult males (Antonucci, 1985; Stephens, Alpass, Towers, & Stevenson, 2011). The literature also suggests that males generally receive more emotional support from their spouses, whereas females report receiving more emotional support from friends, relatives, and children (Gurung, Taylor, & Seeman, 2003; Lynch, 1998). Furthermore, older females are more likely than males to report that the support they received from their social networks improved their feelings of personal control or mastery (Krause & Keith, 1989).
However, sex differences in social support are not always consistent and may depend on the type of support that is measured. Stokes and Wilson (1984) reported that although females and males did not differ in overall social support, females reported that receiving more emotional support. Research also suggests that having a greater number of social ties (i.e., structural support) was more beneficial for females (Shye et al., 1995), whereas functional support (i.e., specific functions of relationships) may be more beneficial for males (Rowe & Kahn, 1998). On the other hand, a study by Lyyra and Heikkinen (2006) found that indicators of perceived assistance-related social support (e.g., reports of guidance, reliable alliance) were not predictive of mortality in females over a span of ten years. Conversely, ratings on non-assistance-related social support appeared to be protective for females, with the risk of death being 2.5 times higher for females in the lowest tertile compared to those in the highest tertile (Lyyra & Heikkinen, 2006). For males, neither assistance-related or non-assistance related social support were associated with an increased risk of mortality (Lyyra & Heikkinen, 2006). These inconsistent findings regarding sex differences in social support indicate the need for further research using appropriate measurements, as well as how social support might influence the mortality differentials. Exploring these differences may also help explain sex differences in mortality rates. In addition, it may be useful to examine other factors that have also been linked to social support and survival in older adults, such as marital status.

Marital status and social support

Previous research has indicated that married adults are generally healthier and have a reduced mortality risk compared to those who are not married (Hu & Goldman, 1990; Lillard & Waite, 1995; Lillard & Panis, 1996). According to the marital resource model,
marriage promotes survival because it provides “social, psychological, and economic resources”, and may promote social integration (Umberson, 1992). However, research suggests that this “marital advantage” for survival is not consistent across all social groups, and that a stronger advantage exists for males (Shye, 1995; Schumacher & Vilpert, 2011).

One explanation as to why marital status influences survival differently for males and females could be due to sex differences in the structure of social relationships. Research suggests that females are more apt to draw on children, friends, and relatives to get the emotional support they need if it is not available from a spouse (Gurung, Taylor, & Seeman, 2003). Seeking more support is likely a protective factor for females, and marital status may therefore not be predictive of mortality. Males who lose a spouse, on the other hand, may have fewer resources (e.g., social support) to “fall back on” (Shumaker & Hill, 1991). This idea is further supported in a study by Shye et al. (1995), which found that unmarried males had a significantly greater risk of mortality over 15 years compared to married men. However, once social support was controlled in the analysis this association was no longer significant. Similarly, results from the Alameda County Study (Seeman, Kaplan, Knudsen, Cohen, & Guralnik, 1987) found that marital status was a main predictor of mortality over 17 years for individuals under age 60. Social contact (with close friends and relatives) was more important than marital status for those aged 60 and older (Seeman et al., 1987). The authors propose that one reason for this difference in predictors may be due to a shift in the focus of social support to family and friends, with marriages being more central in middle age (Seeman et al., 1987). Therefore, social support does seem to become increasingly important in older adulthood, and more research is needed to understand how both perceived support and marital status influence survival for both males and females.
The aims of the current study were to investigate the relationship between perceived social support, sex, marital status and long-term survival, as well as the mediating effect of social support on marital status and sex in relation to 25-year survival. The hypotheses were that: 1) perceived social support, sex, and marital status are important predictors for long-term (25-year) survival, and 2) social support mediates the relationship between marital status and survival and sex and survival.

METHOD

The analyses for this paper utilized the Linn County data set (Russell & Cutrona, 1991) as described in Paper 1.

Online and public records were used to determine survival status and age of death as of December 2010. Of the 301 participants, a confirmed status could not be determined for 23 individuals due to inconsistent names or birthdates, leaving 278 participants (115 males, 183 females) in the final analyses. A total of 32 participants (8 males, 24 females) were still living in December 2010. The average age of participants at the time of the baseline interviews was 71.71 years (range 65-97) and the average age at death was 87.77 years (range 67-106).

Measures

Survival was calculated in years starting from the baseline interview in 1985 and tracked until 2010 (25 years), with either the participants’ date of death or their survival. Each year the participant survived was coded as “0” whereas the interval year that they died was coded as a “1”. Every subsequent year after a participant died was then coded as “missing”.
Independent variables. *Sex* was coded as male (0) and female (1). *Marital status* was categorized as currently married at initial interview (1) or not married (e.g., divorced, widowed, or never married) (0).

*Perceived social support* was assessed using the Social Provisions Scale (Cutrona & Russell, 1987; Russell, Cutrona, Rose, & Yurko, 1984), which was designed to assess the six relational provisions identified by Weiss (1974): guidance, reliable alliance, reassurance of worth, attachment, social integration, and opportunity for nurturance. The scale consists of 24 questions, with four questions assessing each provision. Half of the statements were positively worded and half were negatively worded. The negative items were recoded prior to creating the total scores. Answers were scored as yes (1), not sure (2), and no (3). Possible scores ranged from 24-72 ($\alpha = .72$).

Analyses

Independent sample *t*-tests were used to compare male and female participants on overall social support as well as the individual social provisions. Next, Cox survival regressions were used to test the association between the predictor variables (social support, sex, and marital status) and survival using SPSS version 19 (SPSS Inc., 2010), including the hazard ratios for sex, marital status, and social support in relation to survival. Discrete time survival analyses were conducted in Mplus version 6 (Muthén & Muthén, 1998-2011) to test whether or not social support mediated the effects of marital status and sex on survival. Mplus uses full-information maximum likelihood estimation that allows missing data (Muthén and Muthén, 2004). I compared the fit of the mediation and fully recursive models using a chi-square difference test (Satorra & Bentler, 2001) to determine whether or not the
mediation model provided an adequate fit to the data. All tests were two-tailed and $P < .05$ was considered statistically significant.

RESULTS

Independent sample $t$-tests indicated significant differences on overall social support between married and non-married individuals, $t (267) = 11.97, p < .001$, with married individuals reporting higher levels of social support ($M = 69.36, SD = 5.59$) than non-married ($M = 65.72, SD = 5.35$) individuals ($p < .001$). There was no significant difference in overall social support for males and females in the study [$t (276) = 0.96, p = .226$], although males reported slightly greater perceived social support ($M= 68.39, SD = 4.46$) than females ($M = 67.72, SD = 5.12$). In terms of individual dimensions of social support, males reported significantly more nurturance ($M = 3.42, SD = 0.83$) than females ($M = 3.01, SD = 1.12; t (267) = 1.15, p < .001$).

Individual Cox survival analyses indicated that both sex (hazard ratio [HR] = 1.37, 95% Confidence Interval [CI] = 1.06-1.75) and social support (HR = 0.95, 95% CI = 0.92-0.97) were significantly associated with 25-year survival, but marital status was not a significant predictor (HR = 1.24, 95% CI = 0.96-1.60). Interestingly, when adding sex as a predictor to the hierarchical Cox regression analysis, the risk of marital status
Table 3.1. Statistics for Age and Social Support for Males and Females.

<table>
<thead>
<tr>
<th></th>
<th>Males</th>
<th></th>
<th>Females</th>
<th></th>
<th>t-test</th>
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<tbody>
<tr>
<td></td>
<td>n = 115</td>
<td></td>
<td>n = 163</td>
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<td></td>
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<td></td>
<td></td>
<td></td>
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<tr>
<td>Mean</td>
<td>70.80</td>
<td>65-97</td>
<td>72.35</td>
<td>65-92</td>
<td>*</td>
<td></td>
</tr>
<tr>
<td>Range</td>
<td></td>
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</tr>
<tr>
<td>St. Dev.</td>
<td>5.35</td>
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<td>5.16</td>
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<tr>
<td>Social Provision Scale</td>
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<tr>
<td>Guidance</td>
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<td>2-4</td>
<td>1-4</td>
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<td></td>
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<tr>
<td>Mean</td>
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<td>0.28</td>
<td>3.86</td>
<td>0.48</td>
<td></td>
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</tr>
<tr>
<td>Range</td>
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<td>4.51</td>
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<tr>
<td>St. Dev.</td>
<td>5.72</td>
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<td>5.72</td>
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<td></td>
</tr>
<tr>
<td>Worth</td>
<td></td>
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<td>0-3</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mean</td>
<td>68.39</td>
<td>4.64</td>
<td>67.72</td>
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<tr>
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<td>47-72</td>
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<tr>
<td>St. Dev.</td>
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<td>4.51</td>
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<tr>
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<tr>
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<td>0-3</td>
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<tr>
<td>St. Dev.</td>
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<td>0.70</td>
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<tr>
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<td>0-3</td>
<td></td>
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</tr>
<tr>
<td>Mean</td>
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<td>3.85</td>
<td>0.42</td>
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</tr>
<tr>
<td>St. Dev.</td>
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<td>0.42</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
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<td>0-3</td>
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<td></td>
<td></td>
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<tr>
<td>Mean</td>
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<td>3.69</td>
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<td></td>
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<tr>
<td>St. Dev.</td>
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<td></td>
<td>0.71</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
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<td></td>
<td>0-4</td>
<td>0-3</td>
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<td></td>
</tr>
<tr>
<td>Mean</td>
<td>3.42</td>
<td>0.83</td>
<td>3.01</td>
<td>1.12</td>
<td>**</td>
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<tr>
<td>Range</td>
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<tr>
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<td>1.12</td>
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<td></td>
</tr>
<tr>
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<td>0-3</td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Mean</td>
<td>3.98</td>
<td>0.11</td>
<td>3.96</td>
<td>0.34</td>
<td>0.57</td>
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<tr>
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<td></td>
<td>0-4</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>St. Dev.</td>
<td>0.83</td>
<td></td>
<td>0.34</td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Alliance</td>
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<td></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Married</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yes(n)</td>
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<td>59</td>
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<tr>
<td>Yes (n)</td>
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<td>35</td>
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<tr>
<td>No (n)</td>
<td>101</td>
<td></td>
<td>128</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Note: t-tests for sex differences, **P < .01, *P < .05
Initially, two discrete time survival analyses were conducted using Mplus 7.0 to test for mediation effects of social support on sex and marital status in relation to survival. The fully recursive model (Figure 3.1) included direct paths to social survival from marital status, sex, and social support, as well as indirect paths from sex and marital status to social support. All direct paths to survival were significant; including social support, sex, and marital status. The path from marital status to social support was also significant, but not the path from sex to social support.

Next, a mediation model (Figure 3.2) was tested with the direct effects of sex and marital status to survival fixed at “0”. The path coefficient between marital status and social support was significant, as well as the path between support and survival. However, the path between sex and support was non-significant. Results of a chi-square difference test (comparing the fit of the mediation model compared to the fully recursive model) indicated that the mediation model did not fit the data better than recursive model $\chi^2 (2) = 13.52, p < .001$.

As a result, the mediation model was modified. In the modified model, the path between marital status and survival remained fixed at “0” and the path between sex and social support was also fixed at “0”. Finally, the path between sex and survival was allowed to be free (see Figure 3.3). The results of this modified model’s analysis indicated that the direct path between marital status and support still remained significant, as well as the direct paths between support and survival and sex and survival. Although the chi-square difference test indicated that this modified model was still not a better fit than the fully recursive model $\chi^2 (2) = 7.18, P = .032$, this model was closer to being significantly different
than the fully recursive model. These results indicate that social support at least partially mediated the indirect effect of marital status on survival.

DISCUSSION

The focus of this study was to investigate the relationship between sex, marital status, and social support with 25-year survival, as well as the mediating effect of social support on the relationship between marital status and survival and between sex and survival. There were no significant sex differences for overall perceived social support, however, males reported greater perceived support than females. For individual components of perceived support, the only significant difference was that males reporting greater nurturance than females. Separate Cox regression analyses indicated that both social support and sex significantly influenced survival over 25 years, supporting one of the research hypotheses. There was not significant relationship between marital status and 25-year survival. This is surprising given the previous research showing that being married is often associated with lower risks of mortality. However, the results from both the hierarchical Cox regression and discrete time survival analysis show a significant relationship between marital status and survival with sex added to the model. Therefore, sex may have an influence on the relationship between marital status and survival.
Table 3.2. Hazard Rates (HR) and 95% Confidence Intervals (CI) for Predictors Related to 25-Year Survival using a Hierarchical Cox Regression Analysis.

<table>
<thead>
<tr>
<th>Predictor</th>
<th>Model 1 (Single Predictor)</th>
<th>Model 2 (Two predictors)</th>
<th>Model 3 (Two Predictors)</th>
<th>Model 4 (3 predictors)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>HR 95% CI</td>
<td>HR 95% CI</td>
<td>HR 95% CI</td>
<td>HR 95% CI</td>
</tr>
<tr>
<td>Marital Status</td>
<td>1.24 (0.96-1.60)</td>
<td>1.54 (1.16-2.06)</td>
<td>1.07 (0.82-1.41)</td>
<td>1.34 (0.99-1.81)</td>
</tr>
<tr>
<td>Sex</td>
<td>1.65 (1.24-2.19)</td>
<td>-</td>
<td>-</td>
<td>1.62 (1.24-2.19)</td>
</tr>
<tr>
<td>Social Support Total</td>
<td>-</td>
<td>-</td>
<td>0.95 (0.92-0.98)</td>
<td>0.95 (0.93-0.98)</td>
</tr>
</tbody>
</table>

*Note:* Each model represents a different combination of predictors entered into hierarchical survival regressions. Model 2 excludes social support while model 3 excludes sex as a predictor of survival.
Discrete time survival analyses also indicated that sex and marital status directly affect survival net of social support. When comparing the model fit of the fully recursive and mediation model, significant chi-square values indicated that the model did not fit the data as well as the fully recursive model. Although the adjusted mediation model also did not fit the data as well as the fully recursive model, it was a much closer fit than the first mediation model. This suggests at least a partial mediation effect of social support on the relationship between marital status and survival, and that much of the relationship between being married and survival is due to the impact that marital status has on one’s perceived social support.

Although the direct affect of sex to mortality was significant, the indirect relationship through social support was not significant. Therefore, social support appears to be important for both males and females. This finding contradicts previous findings regarding the differences in social support. For example, Shye et al. (1995), found that the risk of mortality was lowered only for females with high levels of social networks (20 + people), whereas lower levels (14 + people) were more protective for males.

There are several strengths of this study. First, it uses a very in-depth and reliable assessment of social support. Many studies use dichotomous measures of support, such as marital status or group involvement, which may not always be an accurate assessment. Second, a large percentage of the participants were identified as either deceased or surviving 25 years after the initial interview. Third, the study investigated the influences of marital status, sex and support on survival over 25 years; many studies do not look at these factors over such a long period of time. Finally, this study adds to the literature on the role of social support for long-term survival. Specifically, the findings indicate that perceived support
partially mediates the role of marital status on survival and that social support is important for survival for both males and females.

This study also has several limitations. One limitation is that the data set we used does not have continuous tracking of social support, or changes in marital status, throughout the 25 year period. Yet, it is interesting to note that social support does remain predictive over 25 years even though it is likely that many people have experienced changes in their marital status over this period of time. A separate study focusing on a similar demographic population found that lower levels of social ties at baseline interviews was associated with increased mortality risk for both men and women, but there was no association between a change in social ties and risk of mortality over three years (Cerhan & Wallace, 1997). Therefore, baseline social support appears to be a very useful predictor of survival in older adults.

A second limitation to the study is that a large majority of the males in this study were married, whereas a greater percentage of women were not married (mostly widowed). Other studies also report a similar demographic distribution (Lyyra & Heikkinen, 2006). The small proportion of unmarried men in the study could possibly explain the non-significant mediation of social support on the relationship between sex and survival. However, it is likely that this sample is representative of the older adult population in that a larger proportion of males are married. Selecting for unmarried males could indicate a survivor effect in that these individuals are resilient due to already higher levels of perceived support.

A third potential limitation is that the outcome of survival is based on all-cause mortality. Knowing the specific cause of death may have an influence on the predictors
most related to survival. The use of all-cause vs. disease specific (i.e., cardiovascular disease, cancer) mortality as an outcome may influence the significance of sex, marital status, and social support in relation to survival. For instance, one study found that socially isolated men (not married, fewer than six people in their social network) had an increased risk for mortality as a result of cardiovascular disease or suicide, but not for other causes of death (Kawachi et al., 1996).

In conclusion, social support and sex were strongly linked to survival over 25 years and much of the relationship between marital status and survival may be explained by social support. Also, social support appears to be important for both males and females in relation to survival. It is important to highlight the importance of social relationships in regards to successful aging. Future research should investigate other potential variables that might influence individuals’ perceived support over time. Efforts should be directed to encouraging the development of social relationships throughout the lifespan, as well as creating interventions for those individuals who may indicate low levels of perceived social support.

References


doi:10.1371/journal.pmed.1000310


Umberson (1992). Gender, marital status, and the social control of health behavior. Social Science and Medicine, 34, 907-917.

Figure 3.1. Fully Recursive Model

Marital Status

-0.35*

0.41**

Sex

0.08a

-0.57***

Social Support

-0.06***

Survival

Figure 3.2. Complete Mediation Model

Marital Status

0.41***

Social Support

-0.07***

Survival

Sex

0.08a

Comparison to Full Model

\( \chi^2 (2) = 13.52, p = .001 \)

Figure 3.3 Mediation Model 2

Marital Status

0.36***

Social Support

-0.07***

Survival

Sex

-0.42**

Comparison to Full Model

\( \chi^2 (2) = 7.18, p = .032 \)
Figure 3.4. Cumulative Hazard Rate for Combined Sex and Marital Status
CHAPTER 4

SPOUSAL CONCORDANCE ON COGNITIVE TRAJECTORIES:
AN EXPLORATORY LATENT CLASS APPROACH WITH MEXICAN AMERICAN OLDER ADULTS

Kate Small, Jennifer Margrett, Daniel Russell

Iowa State University

A paper to be presented to the Journal of Gerontology: Social Sciences

Objective. The aims of this study are to describe the nature and number of latent classes that best fits cognitive trajectories for Hispanic husbands and wives over seven years, as well as determine congruence of spousal membership on latent class trajectories.

Method. Exploratory latent class analyses were conducted using data from the Hispanic Established Populations for Epidemiologic Studies (H-EPSE). Chi-square analyses were used to determine whether or not spouses were similar on latent class membership.

Results. Results determined that the best fitting model for both husbands and wives consisted of four latent classes. Chi-square analyses showed significant spousal congruence on latent class membership for cognitive trajectories.

Discussion. We discuss the importance of spousal influence on cognitive status. Future research should explore the mechanisms for which spouses influence each other on cognitive functioning and other domains of successful aging.

Key Words: Spousal Influence-Cognition-Successful Aging- Hispanic Elders
Cognition is an important contributor to quality of life for older adults (Logsdon, Gibbons, McCurry, & Teri, 2002) and is considered a component of successful aging (Rowe & Kahn, 1997). Community-dwelling older adults who have mild to moderate cognitive impairment (Bassuk, Wypij, & Berkman, 2000; Sachs et al., 2011) or show significant decline in their cognitive status (e.g., 4 points on the Mini-Mental State Examination within 2 years) have a decreased chance of survival (Nguyen et al., 2003). This phenomenon of a declining cognitive status preceding mortality has been referred to as “terminal decline” and “terminal drop”; the former referring to a steady decrease in function before death, and the latter referring to a sudden “curvilinear” decrease in functioning before death (MacDonald, Hultsch, & Dixon, 2011; Palmore & Cleveland, 1976). Both terms are not synonymous and have different theoretical implications (Berg, 1996; MacDonald, Hultsch, & Dixon, 2011), yet highlight the importance of measuring change over time. Identifying individuals who exhibit a terminal drop (e.g., steeper decline) or exhibit “non-normative cognitive aging” (MacDonald et al., 2011), may benefit from interventions. Therefore, measuring cognitive change (or stability) over time is essential to identifying successful aging in older adults.

The existing literature on cognitive status among older adults shows that little research focuses on minority groups, including Hispanics (Rose, 2005). The Hispanic elder population is of particular relevance, as this group possesses the highest projected growth rate of any older adult population (i.e., 202% by the year 2030; Administration on Aging, 2010). When assessing indicators of cognitive status among the population, statistics show a higher prevalence of cognitive impairment in the Hispanic population compared to non-Hispanic Whites based on performance of the Mini-Mental State Examination (MMSE; Folstein, Folstein, & McHugh, 1975; Black, et al. 1999). One study focusing on older adults over age 75 found
that, compared to non-Hispanic whites, Hispanics had almost triple the risk of cognitive decline over two years (Black & Rush, 2002). Other research that has looked at factors influencing cognitive status in Hispanic older adults found that education, illiteracy, marital status, immigrant status, and high levels of depressive symptoms were related to lower cognitive status scores (Black et al., 1999).

**Assessing Cognitive Status**

In terms of measuring change in cognitive status, one of the most common measures is the Mini Mental State Examination (Folstein, Folstein, & McHugh, 1975). However, there is concern regarding the reliability and validity of traditional cognitive testing instruments for use with Hispanics. First, measures that are developed and standardized with non-Hispanic participants (Mahurin, Espino, & Hollifield, 1992) may not take into account the “cultural nuances” of the Hispanic population (Rose, 2005). Additionally, lower average test scores may result from lack of formal education; one of the most common questions missed on the MMSE for Hispanics relate to serial subtraction and backward spelling (Hohl et al., 1999), which is not necessarily indicative of cognitive impairment.

Although culturally sensitive tests are ideal when gauging the mental status of minority older adults, popular methods (e.g., MMSE) may still be appropriate for non-clinical assessment. Taussig et al. (1996) found a high correlation among scores for the MMSE and other cognitive assessments taken by Hispanic older adults. Moreover, it has been noted that “ethnic and socioeconomic disparities” are associated with differences in cognitive performance earlier in life rather than declines in later life (Karlamangia et al., 2009). Therefore, it may be more advantageous to identify deviations in cognitive status over time rather than initial levels, which are more likely to be influenced by education or cultural differences. Observing a steep decline
over time may also indicate an underlying physical condition or environmental influence (MacDonald, Hultsch, & Dixon, 2011), which then could directly or indirectly influence successful aging.

**Spousal Influences on Cognitive Status**

Given the many developmental pathways that married couples share, it is salient to consider spousal influences when examining outcomes of successful aging (Hoppmann & Gerstorf, 2009). For instance, research has found that spouses of persons with specific diseases have an increased risk of developing the same disease (Hippisley-Cox et al., 2002; Meyler, Stimpson, Peek, 2007), specifically among Hispanic older adults (Peek & Markides, 2003; Stimpson & Peek, 2005). One study found that individuals who had a spouse with the onset of dementia were six times more likely to develop dementia ($HR = 6.0, 95\% CI = 2.2$-$16.2$) than individuals whose spouse did not have dementia over a 12-year period (Norton et al., 2010).

In terms of spousal concordance on cognition performance, cross sectional research has found significant correlations on individual performance for global measures of cognitive performance using the MMSE ($r = .28$; Dufoi & Alperovitch, 2000) as well as specific mental abilities including verbal meaning (Gruber-Baldini, Schaie, & Willis, 1995), perceptual speed (Dufoi & Alperovitch, 2000; Gerstorf, Hopfmann, Antsey, & Luszcz, 2009), and memory (Gerstorf, Hopfmann, Antsey, & Luszcz, 2009). Research has also found the effect of spousal concordance on certain cognitive abilities to increase over time. For instance, Gruber-Baldini et al. (1995) found that spousal correlations on all traits except psychomotor speed and social responsibility increased over time.

Longitudinal research has also suggested that changes in individuals’ cognitive status may directly or indirectly influence spouses’ cognitive status over time. A report from the
Seattle Longitudinal Study (Gruber-Baldini et al., 1995) indicated that, although overall partner influences on cognitive status were not significantly different, sex differences emerged for spousal influences on specific cognitive abilities. That is, husbands’ scores on inductive reasoning predicted wives’ scores 7 years later, but wives’ scores did not significantly influence husbands’ scores. Another longitudinal study of Australian older adults found that husbands’ perceptual speed predicted wives’ perceptual speed decline over 11 years (Gerstorf, Hoppmann, Antsey, & Luszcz, 2009), suggesting a stronger husband influence on wives’ cognitive status. In addition, Gerstorf, Hoppmann, Kadlec, and McArdle (2009) found that for adults age 70 and older, better memory performance among husbands was a protective factor against their wives’ memory decline over 12 years. However, this disproportionate sex difference in spousal influence is not always consistent throughout the literature. In a hierarchical regression analysis using couples from the Hispanic EPESE (Established Populations for the Epidemiologic Studies of the Elderly), individual and spousal cognitive status at baseline predicted cognitive status scores for both husbands and wives seven years later (Daugherty, Margrett, & Caskie, 2008). Additionally, a study by Norton et al. (2010) found that husbands whose spouse was diagnosed with dementia had a greater risk of developing dementia over a 12-year period (HR = 11.0, 95% CI = 1.7-85.5, p = .01) than wives with a spouse that developed dementia (HR= 3.7, 95% CI = 1.2-11.6, p = .03). These results indicate that spouses affect cognitive development throughout the lifespan. Further research needs to map how these spousal trajectories look over time, as well as document concordance rates for these patterns of change.

**Study Rationale**

Few studies have examined spousal influences on trajectories of cognitive status over time. Furthermore, previous research regarding dyadic influences on cognitive status has focused on
non-Hispanic whites, not examining the importance of cultural context (Peek et al., 2006). Despite increased cognitive risks among Hispanics, including Mexican Americans, little research has examined spousal influence on cognitive status over time. From a review of the literature, there is a further need to a) document Hispanic elders' cognitive trajectories over time and b) investigate spousal concordance on cognition over time. Based on previous findings, our hypothesis is that spouses will demonstrate a high level of concordance on cognitive trajectories over time.

**Method**

**Procedures**

This study utilized data from the Hispanic Established Populations for Epidemiologic Studies of the Elderly (H-EPESE; Markides, 1999, 2001, 2004, 2005), which includes four waves of data collected over seven years. The Hispanic EPESE data are available through the National Archive of Computerized Data on Aging (NACDA) housed at the Inter-University Consortium for Political and Social Research (ICPSR). Participants provided oral informed consent and were interviewed in their home by trained, professional personnel employed by an outside agency, who collected data via interview, questionnaire, and physical assessments, with assessments conducted in either English or Spanish (Markides, Rudkin, Angel, & Espino, 1997).

**Participants**

The first wave of the data (1993-1994) included 3050 individuals, of which there were 553 spousal pairs (30% of the households; Stimpson & Peek, 2005). All participants were over the age of 65 ($M_{male} = 73.82, M_{female} = 70.8$) and approximately 80% of participants resided in 5 southwestern states (Markides, Rudkin, Angel, & Espino, 1997). The average formal education...
level for the participants was completion of 5th grade. Subsequent data were obtained at 2-year (1995-1996), 5-year (1998-1999), and 7-year (2004-2005) follow-ups.

For purposes of examining spousal concordance over time, the current study included only spouses with both partners present at all four time points. Therefore, the current analyses used data collected from 179 spousal pairs. Table 4.1 displays the differences between husbands and wives for the final sample (N = 179 couples) and the excluded sample (N = 374 couples). T-tests were conducted to identify any significant differences between the original and final sample.

Measures

Mental Status. The Mini-Mental State Exam (MMSE; Folstein, Folstein, & McHugh, 1975) was used to assess cognitive status. This measure includes 30 items assessing performance areas including orientation, memory, and attention. Each question was scored as correct (1) or incorrect (0). Total scores ranged from 0-30 with lower scores indicating greater cognitive impairment (see Table 4.2).

Results

The initial proposal for this paper was to perform simultaneous lagged growth curve models over time. However, the increased variance in cognitive scores on the MMSE over time overwhelmed the model and it would not run. In order to accommodate the variance, latent class analyses for husbands and wives were performed instead. In addition, a chi square analysis was computed to determine the rate of spousal congruence on latent class membership. This allowed the examination of longitudinal trajectories over time, while still taking into account spousal congruence.
The primary research questions focus on: 1) describing the nature and number of latent classes for both husbands’ and wives’ cognitive trajectories and 2) examining the congruence of latent classes between husbands and wives. For the first step, Confirmatory Latent Class Analyses were conducted in Mplus version 7 (Muthén & Muthén, 1998-2011) to determine the number of classes for that best fit the data for both husbands and wives. The second step of the analyses was to compare the congruence for husbands and wives on latent classes and then categorical variables based on “group membership” were assigned.

**Exploratory Latent Class Analyses**

Exploratory latent class analyses for 2, 3, and 4 latent classes were performed separately for husbands and wives. From these exploratory analyses, the best-fitting model for the number of classes to be used for husbands and wives was determined. For wives, the model with the lowest Adjusted Bayesian Information Criterion (ABIC) and Lo-Mendell-Rubin (LMR) values was 4 classes (ABIC = 3789; LMR = 32.98; See Table 3.3). For husbands, the best fitting model was also 4 classes (ABIC = 3758; LMR = 20.39).

After determining the number of classes for both husbands and wives, each participant was assigned a “class” based on his or her cognitive trajectory over time. Then, the mean MMSE scores for each class were plotted for both husbands and wives to identify qualitative patterns for each latent class over time. Figures 4.1 and 4.2 illustrate these patterns for husbands and wives. Qualitatively, the groups were differentiated as “High Functioning”, “Late Declining”, “Early Declining”, and “Low Functioning”.

**Spousal Congruence**

Spouses demonstrated fairly high association on MMSE scores for each wave ($r_{wave 1} = .52, p < .001; r_{wave 2} = .23, p < .01; r_{wave 3} = .32, p < .001; r_{wave 4} = .44, p < .001$). For the latent
class analysis, spousal congruence was recognized as having both husbands and wives assigned the same latent class category in cognitive status over 4 waves. A chi square analysis was performed to test for a significant relationship among husband and wife latent class membership. A statistically significant relationship was observed between spouses for latent class membership ($\chi^2 (9) = 41.55, p < .001$) with a fair strength agreement (kappa $= 0.23, p < .000$; Cramer’s V $= 0.28, p < .000$). Table 4.4 illustrates the number of spousal pairings for each respective latent class category. Of the 179 total couples, 76 couples (or 43%) were classified in similar (congruent) latent classes. Specifically, 22 couples were high functioning, 24 were classified as having later decline, 15 couples showed early decline, and 15 couples were low functioning.

Discussion

The primary objectives of this study were to identify cognitive latent class trajectories among a sample of older Hispanic spouses and to explore spousal congruence of latent class membership in order to determine how spouses might influence each others’ cognitive health. Cognitive test scores were not used to identify individuals with cognitive impairment, rather it serves as a means to examine patterns of stability or change over time. For husband and wife models, four latent classes had the best fit indices for examining cognitive status over time. The patterns identified were High Functioning (an individual starts with relatively high cognitive status and maintains or experiences a slight decrease over time), Late Declining (an individual starts high and exhibits a steeper decline later), Early Declining (an individual shows a steep decline early) and Low Functioning (an individual appears to be have a low-functioning cognitive status across all waves). The latent class trajectory models for husbands and wives appeared similar when plotted over time.
The spouses in this study demonstrated relatively high intraclass correlations on cognitive status (MMSE) at each wave of the study; the highest correlation was at wave 1 ($r = .52, p < .001$). Few studies have specifically examined the rate correlation over time, however this finding contradicts the findings of Gruber-Baldini, Schaie, and Willis (1995) in that couples became more similar in terms of verbal meaning and intellectual ability over time. A chi square analysis revealed a significant relationship between spouses on cognitive trajectories, with 76 out of 179 spousal pairs (43%) having similar latent class membership. Although the strength of the association was considered low (yet significant), it is worthwhile to acknowledge that (to my knowledge) no studies exist to compare these results. However, the significance of spousal congruence for cognitive trajectories over time supports the idea that spouses have an influence on each other’s cognitive development in later life. It is also important to note that spousal congruence is not always ideal. For instance, there would be particular concern for spouses who are both considered “Low functioning” or “Early Declining”.

Multiple theories exist to explain the possible mechanisms for spousal concordance in cognitive status. One idea is that the social interaction between spouses is altered in that cognitive decline in one spouse provides less cognitive stimulation in the other spouse, thereby accelerating cognitive decline (Salthouse, 2006). Another plausible explanation is that married couples share similar resources and environments, which could influence spouses in several ways. Spouses may share similar health and lifestyle behaviors that contribute to risk of cognitive decline. Mexican American spouses in particular have been shown to have high concordance in chronic conditions such as hypertension and late-onset diabetes (Stimpson & Peek, 2005). These conditions are also linked to an increased risk of cognitive decline (Dregan,
Stewart, & Gullford, 2012; Luchsinger, Reitz, Patel, Tang, Manly, & Mayeux, 2007; Yaffe et al., 2004).

Shared environments may also mean that couples receive similar levels of cognitive stimulation (Tower & Kasl, 1996). Additionally, there could be extraneous or third variables that explain the concordance among spouses. For instance, several longitudinal studies have found that both individual and spousal depressive symptoms are associated with cognitive performance over time (Gerstorf, Hoppmann, Kadlec, & McArdle, 2009; Hinton et al., 2009). Further exploring these cross-domain effects may also help to explain the mechanisms through which spouses influence each other’s cognitive trajectories.

The aim of this study was not to examine the asymmetrical sex influences on spousal cognitive status. However, it is interesting to note the couples that may be considered “at risk”, which in this case might be couples where either one or both spouses belonging to a latent class of “early decline or low functioning”. If one spouse is in the early declining or low functioning category, this may potentially influence cognitive decline (Norton et al., 2010), as well as other health related problems (Connell, 1994). For this study, 82 of the 179 wives were considered “at risk”, whereas 71 of the 179 husbands fell into this category, but the difference in relative risks was not significant.

As mentioned in the literature review, there are inconsistent findings regarding the degree of influence that husbands and wives have on cognitive status. Future research should focus on whether or not patterns exist, specifically for individuals who are most “at risk”, or display an early or steep decline in their cognitive health. Spousal correlations on cognitive abilities and their relative influence on any trait is an important concept for any professional dealing with older adult couples, as older adult spouses share many developmental pathways.
(Hoppmann & Gerstorf, 2009). Subsequently, if cognitive status for both spouses declines together, it could have a substantial effect on the planning and structure of long-term care. In addition, future research might look at possible social and cultural differences that influence changes in cognitive status for older Hispanic spouses.

The strengths of this study include the focus on Hispanic older adults, a fast-growing population, and the evidence of spousal congruence on cognitive trajectories over time. These findings propel future research to understand the mechanisms for which spouses influence each other in multiple domains. Specifically, identifying spousal trajectories for physical, psychological, and socio-demographic indicators may lead to a better insight on dyadic influences on cognitive change. Utilizing other indicators of successful aging, such as distance to death, may also be useful in understanding subsequent rates of cognitive decline over time. For instance, knowing that women live longer on average may indicate that cognitive decline typically sets in later for wives than husbands (Gerstorf, Hoppmann, Anstey, & Luszcz, 2009); therefore the influence on which spouse is the first to show cognitive decline may be influenced by sex differentials in survival.

One limitation to the study is that the sample was limited to couples with both partners present at all four waves. This reduced the size of the baseline sample of 553 couples to 176 couples. There were significant baseline differences between the final and excluded sample in that the final sample were significantly older, reported greater problems with activities of daily living (ADLs), and had higher levels of depressive symptoms (CES-D). This may not be a surprise as higher depressive symptoms, greater functional problems, and older age have been associated with an increased risk of mortality. Another limitation was that this dataset did not include an in-depth measure of perceived support for all waves. Previous studies suggest that
changes in social support are linked with changes in cognitive functioning (Yeh & Liu, 2003). In terms of spousal influence, several studies suggest a transactional association between factors such as depression and emotional distress with cognition (Gerstorf, Hoppmann, Kadlec, & McArdle, 2009; Hinton et al., 2009; Lee, Paddock & Feeney, 2012). For couples who might be “at risk”, social support may be a protective factor against cognitive decline. Future studies should consider these variables when examining spousal congruence on cognitive status over time.

As previously mentioned, terminal drop and terminal decline have different clinical and theoretical implications for older adults (Berg, 1996; MacDonald, Hutch, & Dixon, 2011). Knowing that non-normative declines in cognitive functioning in individuals may also effect their spouses’ cognitive functioning is extremely important for researchers, practitioners, family members, and caregivers in promoting successful aging for older adults.

References
Mental State Examination in older Mexican-Americans: Findings from the Hispanic EPESE. *Journal of Clinical Epidemiology*, 52(11), 1095-1102.


Table 4.1 Comparisons Between Included vs. Excluded Participants.

<table>
<thead>
<tr>
<th></th>
<th>Included Wives</th>
<th>Excluded Wives</th>
<th>Included Husbands</th>
<th>Excluded Husbands</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>$M$</td>
<td>$M$</td>
<td>$M$</td>
<td>$M$</td>
</tr>
<tr>
<td>Age</td>
<td>69.61***</td>
<td>71.38</td>
<td>72.30***</td>
<td>74.55</td>
</tr>
<tr>
<td>Education (years)</td>
<td>5.05</td>
<td>5.10</td>
<td>5.41</td>
<td>5.20</td>
</tr>
<tr>
<td>MMSE (0-30)</td>
<td>26.19***</td>
<td>24.80</td>
<td>25.47*</td>
<td>24.75</td>
</tr>
<tr>
<td>CES-D score (0-30)</td>
<td>8.90**</td>
<td>11.27</td>
<td>7.10*</td>
<td>8.63</td>
</tr>
<tr>
<td>ADL difficulties (0-7)</td>
<td>0.19***</td>
<td>0.47</td>
<td>0.21***</td>
<td>0.67</td>
</tr>
<tr>
<td>Body Mass Index</td>
<td>28.27</td>
<td>28.87</td>
<td>27.22</td>
<td>27.08</td>
</tr>
<tr>
<td>Satisfaction with Life (1-9)</td>
<td>1.60</td>
<td>1.79</td>
<td>1.55</td>
<td>1.69</td>
</tr>
</tbody>
</table>

*Note:* $M =$ Mean, MMSE = Mini-Mental State Exam, CES-D = Center for Epidemiologic Studies Depression Scale, IADL = Instrumental Activities of Daily Living; $t$-test between final and excluded sample ($***$ $p <.001$; $**$ $p <.01$, $*$ $p < .05$).
Table 4.2. Descriptive Statistics and Intraclass Correlations for Wives and Husbands across Four Waves (N = 179 couples).

<table>
<thead>
<tr>
<th></th>
<th>Wives</th>
<th></th>
<th>Husbands</th>
<th></th>
<th>Intraclass</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>M</td>
<td>Range</td>
<td>SD</td>
<td>M</td>
<td>Range</td>
</tr>
<tr>
<td>Age</td>
<td>69.65</td>
<td>65-83</td>
<td>4.14</td>
<td>72.42</td>
<td>65-91</td>
</tr>
<tr>
<td>Education</td>
<td>5.38</td>
<td>0-16</td>
<td>3.73</td>
<td>4.95</td>
<td>0-17</td>
</tr>
<tr>
<td>W1 MMSE</td>
<td>26.18</td>
<td>16-30</td>
<td>3.63</td>
<td>25.47</td>
<td>14-30</td>
</tr>
<tr>
<td>W2 MMSE</td>
<td>25.17</td>
<td>18-30</td>
<td>3.46</td>
<td>24.38</td>
<td>10-30</td>
</tr>
<tr>
<td>W3 MMSE</td>
<td>23.83</td>
<td>0-30</td>
<td>4.75</td>
<td>23.12</td>
<td>0-30</td>
</tr>
<tr>
<td>W4 MMSE</td>
<td>23.46</td>
<td>0-30</td>
<td>4.77</td>
<td>21.82</td>
<td>0-30</td>
</tr>
</tbody>
</table>

*Note:* Age and education reflect baseline assessment. W= Wave.

MMSE = Mini-mental State Exam;

Intraclass Correlation: ***p <.001, ** p <.01 (2-tailed).
Table 4.3. Exploratory Latent Class Statistics for Husbands and Wives.

<table>
<thead>
<tr>
<th>Latent Classes</th>
<th>N class 1</th>
<th>N class 2</th>
<th>N class 3</th>
<th>N class 4</th>
<th>ABIC</th>
<th>Entropy</th>
<th>LMR</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Wives</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4 Classes</td>
<td>41</td>
<td>62</td>
<td>37</td>
<td>39</td>
<td>3789</td>
<td>0.82</td>
<td>32.98</td>
</tr>
<tr>
<td>3 Classes</td>
<td>35</td>
<td>67</td>
<td>78</td>
<td>-</td>
<td>3813</td>
<td>0.85</td>
<td>51.98</td>
</tr>
<tr>
<td>2 Classes</td>
<td>59</td>
<td>121</td>
<td>-</td>
<td>-</td>
<td>3857</td>
<td>0.78</td>
<td>157.49</td>
</tr>
<tr>
<td><strong>Husbands</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4 Classes</td>
<td>37</td>
<td>54</td>
<td>29</td>
<td>49</td>
<td>3758</td>
<td>0.77</td>
<td>20.38</td>
</tr>
<tr>
<td>3 Classes</td>
<td>83</td>
<td>65</td>
<td>32</td>
<td>-</td>
<td>3970</td>
<td>0.71</td>
<td>28.96</td>
</tr>
<tr>
<td>2 Classes</td>
<td>90</td>
<td>90</td>
<td>-</td>
<td>-</td>
<td>3990</td>
<td>0.72</td>
<td>121.73</td>
</tr>
</tbody>
</table>

*Note: ABIC = Adjusted Bayesian Information Criterion and LMR = Lo-Mendell-Rubin.*
Table 4.4. Spousal Congruence on Latent Class Cognitive Trajectory (N = 179).

<table>
<thead>
<tr>
<th>Latent Class</th>
<th>High Function $^H$</th>
<th>Later Decline $^w$</th>
<th>Early Decline $^w$</th>
<th>Low Function $^w$</th>
</tr>
</thead>
<tbody>
<tr>
<td>High Function $^H$</td>
<td>22</td>
<td>16</td>
<td>5</td>
<td>6</td>
</tr>
<tr>
<td>Later Decline $^H$</td>
<td>11</td>
<td>24</td>
<td>13</td>
<td>11</td>
</tr>
<tr>
<td>Early Decline $^H$</td>
<td>3</td>
<td>6</td>
<td>15</td>
<td>6</td>
</tr>
<tr>
<td>Low Function $^H$</td>
<td>2</td>
<td>13</td>
<td>11</td>
<td>15</td>
</tr>
</tbody>
</table>

Note: $^H$=Husband Latent Class Assignment, $^w$= Wife Latent Class Assignment. The bold diagonal represents the number of spouses in the same latent class.
Figure 4.1 MMSE Latent Class Patterns for Husbands.

Figure 4.2. MMSE Latent Class Patterns for Wives.
CHAPTER 5: GENERAL CONCLUSIONS

The papers in this dissertation centered on successful aging within social contexts. This discussion ties in the findings from the three studies presented in this document. As previously mentioned, “successful aging” is a term coined by researchers to define the process by which older adults age well. While the debate remains regarding how to define and conceptualize successful aging, the findings contribute to this timely discussion (Table 5.1 briefly summarizes the main findings of the three studies). First, the finding that perceived social support is significant in predicting long-term survival makes it clear that definitions of successful aging needs to move beyond a “biomedical model”, which focuses on high levels of physical functioning and remaining disease-free (Bowling, 2005; Glass, T.A., 2003; Young, Frick, & Phelan, 2009), and incorporate social dimensions. Second, marital status is not a reliable proxy for perceived support, as perceived support was found to partially mediate the relationship between marital status and survival. Third, the high concordance on patterns of cognitive trajectories over time stresses the importance of looking at spousal influence on outcomes of successful aging.

Paper 1 utilized Rowe and Kahn’s well-known model of successful aging, and encompassed consequential dimensions of health, functioning, and social contexts. Some criticisms from studies utilizing Rowe and Kahn’s model have found that a very low percentage of the older adult population meet the criteria for aging successfully, despite subjective reports to the contrary (McLaughlin, Connell, Heeringa, Li., & Roberts, 2010; Strawbridge et al., 2002). However, the goal may not always be to classify percentages of the population that meet criteria for successful aging. Rather, understanding the specific aspects of each dimension that are most related to outcomes of successful aging.
## Table 5.1 Main Findings for Papers 1-3.

<table>
<thead>
<tr>
<th>Main Findings</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Paper 1</strong></td>
</tr>
<tr>
<td>- Individual predictors of high physical functioning, low chronic illness, and higher ratings of perceived social support were significantly related to long-term survival.</td>
</tr>
<tr>
<td>- In relation to Rowe and Kahn’s model, Active Engagement with Life had the most uniquely explained variance in predicting 25-year survival.</td>
</tr>
<tr>
<td><strong>Paper 2</strong></td>
</tr>
<tr>
<td>- Males, on average, had greater overall support than females, but no significant links between each dimension of social support and survival.</td>
</tr>
<tr>
<td>- Sex and social support were independently associated with 25-year survival, but not marital status.</td>
</tr>
<tr>
<td>- The indirect path from marital status to survival through social support was significant, suggesting a possible partial mediation of social support on marital status and survival.</td>
</tr>
<tr>
<td><strong>Paper 3</strong></td>
</tr>
<tr>
<td>- For both husbands and wives, the best fitting model consisted of 4 latent classes for cognitive status trajectories: high functioning, early declining, late declining, and low functioning.</td>
</tr>
<tr>
<td>- There was a statistically significant relationship among latent class membership for husbands and wives in the sample, with just under 50% of spouses belonging to the same latent class.</td>
</tr>
<tr>
<td>- Spouses have significant congruence on cognitive status over time.</td>
</tr>
</tbody>
</table>
(e.g., survival) may be informative to researchers and clinicians for targeting individuals who may benefit from interventions. Kahn (2003) clarified that the intention was not to “neglect or blame those less fortunate” (p. 725), but to “encourage people to make lifestyle choices that would maximize their own likelihood of aging well” (p. 726). Additionally, Rowe and Kahn’s model is multi-dimensional and encompasses both subjective and objective indicators (Rowe & Kahn, 1997), which is important to consider when measuring successful aging (Pruchno, Wilson-Gunderson, & Cartwright, 2010). Also, the fact that social support predicted survival even after controlling for indicators of physical health and chronic disease supports the idea of Selective Optimization with Compensation (Baltes & Baltes, 1990) in that even though older adults may not meet all “criteria” for successful aging, they are still aging well. Therefore, some researchers prefer the term “optimal” aging over “successful” aging.

In addition to the matter of deciding what constructs are useful for defining successful aging, it is important to take into consideration the mechanisms through which levels of functioning, chronic conditions, and social engagement influence successful aging. Paper 2 looked further at the dimension of social engagement, specifically social support, and assessed two demographic factors that are commonly associated with survival: sex and marital status. Being female and being married are commonly related to increased chances of long-term survival, however research is still unclear as to the mechanisms that enhance survival for these individuals. The results from paper 2 suggest that social support explains the relationship between marital status and survival. Even though no mediating relationship of social support was found between sex and survival, the low number of unmarried men in the study may have affected the significance of the results. Understanding how social support and marital status influence survival for men and women may also help researchers understand how individuals age
successfully. Moreover, researchers and clinicians need to use accurate assessments when considering successful aging in older adults. For instance, using marital status as a proxy for social support may not always be an accurate assessment of social support, as social support was found to partially mediate the relationship between being married and survival.

Finally, evidence exists to support the consideration of the unique social context of marriage when examining predictors of successful aging in older adults. Married couples exemplify a unique social context as they share many life experiences (Antonucci & Akiyama, 1991) and therefore may influence successful aging outcomes in later life. Older adult couples may have a mutual influence on individual development and important aging outcomes such as cognitive functioning (Hoppmann & Gerstorf, 2009). The results from chapter 4 (paper 3) indicate that Hispanic spouses were significantly congruent on trajectories of cognitive status over time. Examining transactional influences of spouses on outcomes of successful aging (i.e., cognitive status) also sheds light on social contexts that influence successful aging in older adults. In addition, future research should integrate the role of perceived support within marital relationships as a possible mediator of spousal influence on these outcomes. Previous research has found that perceived quality of social interactions significantly reduced the risk of dementia for up to 15 years (Amieva et al., 2010) and greater baseline emotional support is predictive of better cognitive functioning in high-functioning older adults (Seeman, Lusiagnolo, Albert, & Berkman, 2001). Understanding how spouses influence each other (especially those “at risk”) will also assist researchers, policy makers, and practitioners in identifying targets for appropriate prevention and intervention.

Throughout the chapters in this dissertation, it is evident that social context is important when determining successful, or optimal, aging. The findings from these studies stress the
importance of maintaining social relationships throughout the lifespan. According to the bioecological theory of human development (Bronfenbrenner, 1979), both individual and social environments impact developmental trajectories. Thus, microsystem factors (e.g., sex and marital status), exosystem factors (e.g., social support systems), and macrosystem factors (e.g., ethnicity) may ultimately influence the determinants for successful aging.

In addition to the strengths identified in each paper, potential limitations were addressed. Examples of these limitations include the identification of cause-specific mortality, follow-up assessments over 25 years (papers 1 and 2) and including variables that measuring stress and support in conjunction with cognitive status (paper 3). Even though these limitations are beyond the control of the researcher, acknowledging these limitations can provide direction for future studies to investigate successful aging within social contexts. One direction might be focusing on whether or not subjective measures of successful aging predict outcomes (e.g. mortality) better than objective measures like social support. Another direction is further examining the mediating relationship of social support on marital status and survival. Knowing that social context makes a difference, a study could examine whether individuals perceive their spouses as an important source of support and how that influences successful aging. Finally, future research should address spousal influences on additional indicators related to successful aging, and how perceived support “protects” or is a “risk” for individuals whose spouse declines.

The implications from this research are to promote the maintenance of social relationships throughout adulthood and to focus on social interventions for at-risk individuals, such as those reporting low levels of perceived support. For instance, researchers could be interested in how technology is used as a tool for increasing the perceived support of these individuals, especially individuals who may be in rural locations or have limited access to
resources. On the other hand, the reliance on technology in lieu of physical connections could also decrease perceived support for older adults. Previous research that has evaluated the effectiveness of social interventions in older adults is limited, but stresses the utilization of existing community resources and building community capacity for greater chances of optimization (Findlay, 2003). In addition, interventions should not focus solely on social contact but opportunity for social reciprocity and are more likely to be effective if “older adults take part in planning, developing, and delivering activities” (p. 62, Cattan, White, Bond, & Learmouth, 2005). Ultimately, identifying ways to increase perceived support will benefit of social support in older adults and aid in the process of successful aging.

**References**

Amieva H, Stoykova R, Matharan F, Helmer C, et al. (2010). What aspects of social network are protective for dementia? Not the quantity but the quality of social interactions is protective up to 15 years later. *Psychosomatic Medicine, 72*(9), 905-911.


APPENDIX: IRB APPROVAL

IOWA STATE UNIVERSITY
OF SCIENCE AND TECHNOLOGY

Date: 1/31/2011
To: Kate Daugherty
88 LeBaron

CC: Dr. Daniel Russell
1085 Elm Hall

From: Office for Responsible Research

Title: Linn County Study
IRB Num: 10-491

Approval Date: 1/28/2011
Continuing Review Date: 1/27/2012
Submission Type: New
Review Type: Expedited

The project referenced above has received approval from the Institutional Review Board (IRB) at Iowa State University. Please refer to the IRB ID number shown above in all correspondence regarding this study.

Your study has been approved according to the dates shown above. To ensure compliance with federal regulations (45 CFR 46 & 21 CFR 56), please be sure to:

- Use only the approved study materials in your research, including the recruitment materials and informed consent documents that have the IRB approval stamp.
- Obtain IRB approval prior to implementing any changes to the study by submitting the “Continuing Review and/or Modification” form.
- Immediately inform the IRB of (1) all serious and/or unexpected adverse experiences involving risks to subjects or others; and (2) any other unanticipated problems involving risks to subjects or others.
- Stop all research activity if IRB approval lapses, unless continuation is necessary to prevent harm to research participants. Research activity can resume once IRB approval is reestablished.
- Complete a new continuing review form at least three to four weeks prior to the date for continuing review as noted above to provide sufficient time for the IRB to review and approve continuation of the study. We will send a courtesy reminder as this date approaches.

Research investigators are expected to comply with the principles of the Belmont Report, and state and federal regulations regarding the involvement of humans in research. These documents are located on the Office for Responsible Research website http://www.compliance.iastate.edu/irb/forms/ or available by calling (515) 294-4566.

Upon completion of the project, please submit a Project Closure Form to the Office for Responsible Research, 1138 Pearson Hall, to officially close the project.
INSTITUTIONAL REVIEW BOARD (IRB)
Application for Approval of Research Involving Humans

SECTION I: GENERAL INFORMATION

Principal Investigator (PI): Daughtery, Kate
Phone: 563-599-0718
Fax:
Degrees: M.S.
Correspondence Address: 88 LeBaron, Ames, Iowa
Department: Human Development and Family Studies
Email Address: kate22@iastate.edu
Center/Institute: College: College of Human Sciences
PI Level: Faculty [ ] Staff [ ] Postdoctoral [x] Graduate Student [ ] Undergraduate Student
Alternate Contact Person: [ ] Email Address:
Correspondence Address: Phone:
Title of Project: Linn County Study
Project Period (Include Start and End Date): [mm/dd/yy]10/01/2010 to [mm/dd/yy]5/30/2012

FOR STUDENT PROJECTS

Name of Major Professor/Supervising Faculty: Dr. Daniel Russell
Signature of Major Professor/Supervising Faculty: [Signature]
Phone: 515-294-4187
Campus Address: 1085 Elm Hall
Department: HDFS
Email Address: drussell@iastate.edu
Type of Project: (check all that apply)
[ ] Research [ ] Thesis [x] Dissertation [ ] Class project
[ ] Independent Study (490, 590, Honors project) [ ] Other. Please specify:

KEY PERSONNEL

List all members and relevant experience of the project personnel. This information is intended to inform the committee of the training and background related to the specific procedures that each person will perform on the project.

<table>
<thead>
<tr>
<th>NAME &amp; DEGREE(S)</th>
<th>SPECIFIC DUTIES ON PROJECT</th>
<th>TRAINING &amp; EXPERIENCE RELATED TO PROCEDURES PERFORMED. DATE OF TRAINING</th>
</tr>
</thead>
<tbody>
<tr>
<td>Kate Daughtery, M.S.</td>
<td>Search public records for information regarding death dates and causes of death, data analyses and write-up</td>
<td>3 years experience as a research assistant, previous projects have also included using public files to look up death dates</td>
</tr>
<tr>
<td>Daniel Russell, Ph.D.</td>
<td>Advise on data collection methods, data management, and data analyses</td>
<td>Original P.I. of Linn County Study (1985); extensive research background including over 150 published articles and more than $10 million in external funding.</td>
</tr>
</tbody>
</table>

Office for Responsible Research: IRB 9/13/10
FUNDING INFORMATION

[ ] Internally funded, please provide account number:
[ ] Externally funded, please provide funding source and account number:
[ ] Funding is pending, please provide OSPA Record ID on GoldSheet:
[ ] Title on GoldSheet if different from above:
[ ] Other: (e.g., funding will be applied for later)
[ ] Student Project—no funding or funding provided by student

SCIENTIFIC REVIEW

Although the assurance committees are not intended to conduct peer review of research proposals, the federal regulations include language such as “consistent with sound research design,” “rationale for involving animals or humans” and “scientifically valuable research,” which requires that the committees consider in their review the general scientific relevance of a research study. Proposals that do not meet these basic tests are not justifiable and cannot be approved. If an assurance review committee(s) has concerns about the scientific merit of a project and the project was not competitively funded by peer review or was funded by corporate sponsors, the project may be referred to a scientific review committee. The scientific review committee will be an ad hoc and will consist of your ISU peers and outside experts as needed. If this situation arises, the PI will be contacted and given the option of agreeing that a consultant may be contacted or withdrawing the proposal from consideration.

☐ Yes ☒ No Has or will this project receive peer review?

If the answer is “yes,” please indicate who did or will conduct the review:

If a review was conducted, please indicate the outcome of the review:

COLLECTION OR RECEIPT OF SAMPLES

Will you be: (Please check all that apply.)

☐ Yes ☒ No Receiving samples from outside of ISU? See examples below.
☐ Yes ☒ No Sending samples outside of ISU? See examples below.

Examples include: genetically modified organisms, body fluids, tissue samples, blood samples, pathogens.

If you will be receiving samples from or sending samples outside of ISU, please identify the name of the outside organization(s) and the identity of the samples you will be sending or receiving outside of ISU. If the outside organizations have not been identified, please check no for both questions above.

Please note that some samples may require a USDA Animal Plant Health Inspection Service (APHIS) permit, a USPHS Centers for Disease Control and Prevention (CDC) Import Permit for Etiologic Agents, a Registration for Select Agents, High Consequence Livestock Pathogens and Toxins or Listed Plant Pathogens, or a Material Transfer Agreement (MTA) EH&S Website.
ASSURANCE

- I certify that the information provided in this application is complete and accurate and consistent with any proposal(s) submitted to external funding agencies.
- I agree to provide proper surveillance of this project to ensure that the rights and welfare of the human subject or welfare of animal subjects are protected. I will report any problems to the appropriate assurance review committee(s).
- I agree that I will not begin this project until receipt of official approval from all appropriate committee(s).
- I agree that modifications to the originally approved project will not take place without prior review and approval by the appropriate committee(s), and that all activities will be performed in accordance with all applicable federal, state, local and Iowa State University policies.

CONFLICT OF INTEREST

A conflict of interest can be defined as a set of conditions in which an investigator’s or key personnel’s judgment regarding a project (including human or animal subject welfare, integrity of the research) may be influenced by a secondary interest (e.g., the proposed project and/or a relationship with the sponsor). ISU’s Conflict of Interest Policy requires that investigators and key personnel disclose any significant financial interests or relationships that may present an actual or potential conflict of interest. By signing this form below, you are certifying that all members of the research team, including yourself, have read and understand ISU’s Conflict of Interest policy as addressed by the ISU Faculty Handbook (http://www.provost.iastate.edu/faculty/) and have made all required disclosures.

☐ Yes ☑ No Do you or any member of your research team have an actual or potential conflict of interest?

☐ Yes ☑ No If yes, have the appropriate disclosure form(s) been completed?

SIGNATURES

\[\text{Signature of Principal Investigator} \quad 12-06-10\]

\[\text{Signature of Department Chair} \quad 12-13-10\]

The Major Professor/Supervising Faculty member must sign the cover page in the section entitled “For Student Projects”.

PLEASE NOTE: Any changes to an approved protocol must be submitted to the appropriate committee(s) before the changes may be implemented.

Please proceed to SECTION II.
SECTION II: IRB SECTION - STUDY SPECIFIC INFORMATION

Please complete all of the following questions.

STUDY OBJECTIVES

Briefly explain in language understandable to a layperson the specific aim(s) of the study.

The aims of this study are to examine the influence of health-related and social-related factors that influence mortality. Data will be used to determine demographic and other individual risk factors related to mortality.

BENEFITS TO SOCIETY AND PARTICIPANTS

Explain in language understandable to a layperson how the information gained in this study will advance knowledge, and/or serve the good of society. Please also describe the direct benefits to research participants; if there are no direct benefits to participants, indicate that. Note: monetary compensation cannot be considered a benefit to participants.

The benefit to society is that we hope to learn more about which health-related and social-related factors are predictors of “distance to death”, identifying factors that are associated with increased longevity, as well as shortened lifespans. Additionally, we may find how social relationships may mediate the relationship between physical health indicators and mortality. There will be no benefit to participants (as most are currently deceased).

PART A: PROJECT INVOLVEMENT

1) ☑ Yes ☐ No Is this project part of a Training, Center, Program Project Grant?
   Director Name: Overall IRB ID:
2) ☑ Yes ☐ No Is the purpose of this project to develop survey instruments?
3) ☑ Yes ☐ No Does this project involve an investigational new drug (IND)? Number:
4) ☑ Yes ☐ No Does this project involve an investigational device exemption (IDE)? Number:
5) ☑ Yes ☐ No Does this project involve existing data or records?
6) ☑ Yes ☐ No Does this project involve secondary analysis?
7) ☑ Yes ☐ No Does this project involve pathology or diagnostic specimens?
8) ☑ Yes ☐ No Does this project require approval from another institution? Please attach letters of approval.
9) ☑ Yes ☐ No Does this project involve DEXA/CT scans or X-rays?

PART B: MEDICAL HEALTH INFORMATION OR RECORDS

10) ☑ Yes ☐ No Does your project require the use of a health care provider’s records concerning past, present, or future physical, dental, or mental health information about a subject? The Health Insurance Portability and Accountability Act established the conditions under which protected health information may be used or disclosed for research purposes. If your project will involve the use of any past or present clinical information about someone, or if you will add clinical information to someone’s treatment record (electronic or paper) during the study, you must complete and submit the Application for Use of Protected Health Information.
PART C. ANTICIPATED ENROLLMENT

<table>
<thead>
<tr>
<th>Estimated number of participants to be enrolled in the study Total: 300</th>
<th>Males: 100</th>
<th>Females: 200</th>
</tr>
</thead>
<tbody>
<tr>
<td>Check if any enrolled participants are:</td>
<td>Check below if this project involves either:</td>
<td></td>
</tr>
<tr>
<td>□ Minors (Under 18)</td>
<td>√ Adults, non-students</td>
<td></td>
</tr>
<tr>
<td>□ Age Range of Minors:</td>
<td>□ Minor ISU students</td>
<td></td>
</tr>
<tr>
<td>□ Pregnant Women/Fetuses</td>
<td>□ ISU students 18 and older</td>
<td></td>
</tr>
<tr>
<td>□ Cognitively Impaired</td>
<td>□ Other (explain)</td>
<td></td>
</tr>
<tr>
<td>□ Prisoners</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

List estimated percent of the anticipated enrollment that will be minorities if known:

- American Indian: NA
- Alaskan Native: NA
- Asian or Pacific Islander: NA
- Black or African American: NA
- Latino or Hispanic: NA

PART D. PARTICIPANT SELECTION

Please use additional space as necessary to adequately answer each question.

11. Explain the procedures and rationale for selecting participants, including the inclusion and exclusion criteria (e.g., where will names come from, what persons will be included or excluded and why, etc.).

Participants have already been selected. Original Data was collected in 1985-1986. Individuals were identified as community-dwelling older adults living in Linn County and Johnson County, Iowa.

12. Describe the procedures for contacting participants (e.g., letter, email, flyer, advertisements, phone call, etc.) Attach copies of any letters, scripts, flyers, or advertisements that will be used. Recruitment materials should include a statement of the voluntary and confidential nature of the research.

Participants will not be contacted.

PART E. RESEARCH PLAN

Include sufficient detail for IRB review of this project independent of the grant, protocol, or other documents.

13. The information needed here is similar to that in the "methods" or "procedures" sections of a research proposal—it should describe the flow of events that will occur during your interactions with subjects. Please describe in detail your plans for collecting data from participants, including all procedures, tasks, or interventions participants will be asked to complete during the research (e.g., random assignment, any conditions or treatment groups into which participants will be divided, mail survey or interview procedures, sensors to be worn, amount of blood drawn, etc.). This information is intended to inform the committee of the procedures used in the study and their potential risk. Please do not respond with "see attached" or "not applicable."

The project will be using the Linn County Data, which as already been collected. The method for the continuation of this study will include using public records (i.e. Social Security Death Index, peopleresearch.com, online obituaries) to determine approximate death dates of individuals who were involved in the study.

14. For studies involving pathology/diagnostic specimens, indicate whether specimens will be collected prospectively and/or already exist "on the shelf" at the time of submission of this review form. If prospective, describe specimen procurement procedures; indicate whether any additional medical information about the subject is being gathered, and whether specimens are linked at any time by code number to the participant's identity. If this question is not applicable, please type N/A in the response cell.
15. For studies involving deception or where information is intentionally withheld from participants, such as the full purpose of the study, please explain how persons will be deceived or what information will be withheld. Additionally, a waiver of the applicable elements of consent will be needed. Please complete the "Waiver of Elements of Consent" form (available at the IRB website). If this question is not applicable, please type N/A in the response cell.

NA

PART F: CONSENT PROCESS

A copy of any translated informed consent documents and an English version should be submitted with the application. Provide the name of the individual who translated the consent documents, their qualifications for translating documents, and in particular informed consent documents, below.

If the consent process does not include documented consent, a waiver of documentation of consent must be requested. If any information about the study is intentionally withheld or misleading (i.e., deception is used), a waiver of the elements of consent must be requested. Forms for requesting waivers are available at the IRB website.

16. Describe the consent process for adult participants (those who are age 18 and older).

We will not be contacting the participants for additional consent.

17. If your study involves minor children, please explain how parental consent will be obtained prior to enrollment of the minor(s).

NA

18. Please explain how assent will be obtained from minors (younger than 18 years of age), prior to their enrollment. Also, please explain if the assent process will be documented (e.g., a simplified version of the consent form, combined with the parental informed consent document). According to the federal regulations as sent "...means a child’s affirmative agreement to participate in research. More failure to object should not, absent affirmative agreement, be construed as assent."

NA

PART G: DATA ANALYSIS

19. Describe how the data will be analyzed (e.g., statistical methodology, statistical evaluation, statistical measures used to evaluate results).

Data will be analyzed using SPSS and M-plus. Statistical methodology that will be used include survival curve analyses and structural equation modeling.

PART H: RISKS

The concept of risk goes beyond physical risk and includes risks to participants' dignity and self-respect as well as psychological, emotional, legal, social or financial risk.
PART K: REGISTRY PROJECTS

26. To be considered a registry, (1) the individuals must have a common condition or demonstrate common responses to questions; (2) the individuals in the registry might be contacted in the future; and (3) the names/data of the individuals in the registry might be used by investigators other than the one maintaining the registry.

☐ Yes  ☒ No Does this project establish a registry?

If “yes,” please provide the registry name below.

Checklist for Attachments

Listed below are the types of documents that should be submitted for IRB review. Please check and attach the documents that are applicable for your study:

☐ A copy of the informed consent document OR ☐ Letter of introduction containing the elements of consent
☐ A copy of the assent form if minors will be enrolled
☐ Letter of approval from cooperating organizations or institutions allowing you to conduct research at their facility
☐ Data-gathering instruments (including surveys)
☐ Recruitment fliers, phone scripts, or any other documents or materials participants will see or hear

The original signed copy of the application form and one set of accompanying materials should be submitted for review. Federal regulations require that one copy of the grant application or proposal be submitted for comparison with the application for approval.

FOR IRB USE ONLY:

Action by the Institutional Review Board (IRB):

☐ Project approved. Date: 1-27-2011
☐ Project is exempt. Date: __________________________
☐ Project not approved. Date: __________________________
☐ IRB approval is not required. Date: __________________________

☐ Project is not research according to the federal definition.

☐ Project does not include human subjects as defined by the federal regulations.

Kerry A. Rippe apparent January 25, 2011
IRB Approval Signature Date
SECTION III: ENVIRONMENTAL HEALTH AND SAFETY INFORMATION

☐ Yes ☒ No Does this project involve human cell or tissue cultures (primary OR immortalized), or human blood components, body fluids or tissues?

PART A: HUMAN CELL LINES

☐ Yes ☒ No Does this project involve human cell or tissue cultures (primary OR immortalized cell lines/strains) that have been documented to be free of bloodborne pathogens? If the answer is "yes," please answer question 1 below and attach copies of the documentation.

1) Please list the specific cell lines/strains to be used, their source and description of use.

<table>
<thead>
<tr>
<th>CELL LINE</th>
<th>SOURCE</th>
<th>DESCRIPTION OF USE</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Add New Row

2) Please refer to the ISU "Bloodborne Pathogens Manual," which contains the requirements of the OSHA Bloodborne Pathogens Standard. Please list the specific precautions to be followed for this project below (e.g., retractable needles used for blood draws):

Anyone working with human cell lines/strains that have not been documented to be free of bloodborne pathogens is required to have Bloodborne Pathogen Training annually. Current Bloodborne Pathogen Training dates must be listed in Section I for all Key Personnel. Please contact Environmental Health and Safety (294-5359) if you need to sign up for training and/or to get a copy of the Bloodborne Pathogens Manual (http://www.ehs.purdue.edu/cmr/default.asp?action=article&ID=2114)

PART B: HUMAN BLOOD COMPONENTS, BODY FLUIDS OR TISSUES

☐ Yes ☒ No Does this project involve human blood components, body fluids or tissues? If "yes," please answer all of the questions in the "Human Blood Components, Body Fluids or Tissues" section.

1) Please list the specific human substances used, their source, amount and description of use.

<table>
<thead>
<tr>
<th>SUBSTANCE</th>
<th>SOURCE</th>
<th>AMOUNT</th>
<th>DESCRIPTION OF USE</th>
</tr>
</thead>
<tbody>
<tr>
<td>E.g., Blood</td>
<td>Normal healthy volunteers</td>
<td>2 ml</td>
<td>Approximate quantity, assays to be done.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Add New Row

2) Please refer to the ISU "Bloodborne Pathogens Manual," which contains the requirements of the OSHA Bloodborne Pathogens Standard. Specific sections to be followed for this project are:

Office for Responsible Research: IRB 9/13/10

10
2. Not obtaining consent from participants or not including all elements of consent will not adversely affect the rights and welfare of the subjects.

| Justification: We will not be contacting individuals directly, as we will use public records to death dates. Also, most participants are presumed to have passed away and therefore would not be able to sign a waiver of consent. Also, names of individuals will not be kept with the actual data, so there will be no identifying variables in the actual data set. |

3. The research could not be practically carried out without this waiver.

| Justification: We do not have identifying information for individuals, other than first and last names and approximate birth years; therefore contacting these participants would be extremely difficult. Also, most participants are presumably deceased and therefore we would not be able to obtain consent. |

4. Subjects will be provided with additional pertinent information after participation (e.g., a debriefing). If this is not appropriate or necessary, please explain why.

| Justification: This is not necessary or appropriate as individuals will not be contacted regarding the additional information that we need and we would not be able to debrief them if they are not alive. |
REQUEST FOR WAIVER OF SOME OR ALL ELEMENTS OF CONSENT

<table>
<thead>
<tr>
<th>Principal Investigator Name:</th>
<th>Kate Daugherty</th>
</tr>
</thead>
<tbody>
<tr>
<td>Phone Number:</td>
<td>563-599-0718</td>
</tr>
<tr>
<td>E-mail Address:</td>
<td><a href="mailto:Kated22@jastate.edu">Kated22@jastate.edu</a></td>
</tr>
<tr>
<td>Title of Study:</td>
<td>Linn County Study</td>
</tr>
</tbody>
</table>

Iowa State University's Institutional Review Board (IRB) may approve a consent procedure which does not include, or which alters, some or all of the elements of informed consent that are required by the regulations. The IRB may also waive the requirement to obtain informed consent altogether. For either waiver, the investigator must request a waiver and provide sufficient project-specific justification that all criteria listed below are met. The IRB will make the final determination as to whether or not a waiver is appropriate based on the information provided by the investigator. Please note that the IRB can only approve a waiver if the study is not under the authority of the FDA (e.g., dietary supplement studies).

**Type of Waiver Requested** (Place an "X" in the appropriate cell)

<table>
<thead>
<tr>
<th>X</th>
<th>Waiver of All Elements of Consent</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Waiver of Some Elements of Consent</td>
</tr>
</tbody>
</table>

Specify Elements to be Waived:

Please describe with details specific to your research how your study satisfies all four of the following conditions. If you are requesting a waiver of some of the elements of consent, be sure to explain how waiving each of the specified elements meets the following conditions in your study. The space will expand as you type.

1. All of the research plans present no more than minimal risk to participants.

Justification: Individuals will not be contacted as public records (i.e., whitepages.com, obituaries, National Death Index) will be used to determine when participants have passed away. Also, identifying information only consists of reported names and approximate birth years. No other identifying information, such as a social security number or address, is available. The names of individuals will not be used in the data analyses and kept in a separate of the actual data.
Dear Kate,

Thanks for sending a new IRB application for your study, "Linn County Study" (IRB ID 10-491). We need a bit more information before we can proceed with the review. Please address each item as follows:

1. When existing private data is used for research purposes, the primary source of risk to participants is harm from a breach of confidentiality. In order to assess this risk, we need information about the type of information you will analyze. The IRB application refers to "the Linn County Data", but does not describe what information is included in the dataset. Please send a list or description of variables that you plan to use from the Linn County Data.

Variables that will be used:

- Demographics (Gender, Highest grade of education, Marital Status, Length of Marital Status, Do you rent or own your residence, etc).
- Church attendance
- Do you have pets
- Hours per week working
- Life Events
  - Retirement
  - Death of a Spouse
  - Financial Pressure
  - Divorce
  - Friend moves away
  - Sudden illness of a close family member
- Social Provisions Scale (Do you have someone to turn to?)
- Zung Depression Scale
- Life Satisfaction Scale
- UCLA Loneliness scale
- Daily Hassles (upsetting and non-upsetting)
- Functional Status (Able to do housework, take a shower)
- Self-rated health
- Number of chronic illnesses:
  - Arthritis, glaucoma, asthma, kidney disease, Parkinson's, etc.
- Social network size (how many friends, relatives, etc)
  - Frequency of contact
  - Relationship of contact (spouse, friend, relative, etc)
  - Proximity
- Number of prescription drugs
Date: 1/31/2012

To: Kate Daugherty

CC: Dr. Daniel Russell

From: Roxanne Bappe, IRB Coordinator

Project Title: Linn County Study

IRB Approval Expired: 1/27/2012

Because approval has lapsed, this project is administratively closed.

In accordance with Federal regulations, all research activity, including enrollment of subjects, must cease pending the receipt, review, and approval of a new Application for Approval of Research Involving Humans or Continuing Review Form, as appropriate.