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Understanding health in very late adulthood: The role of personal, social, and community-care resources

Neha Deshpande

Iowa State University

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Understanding health in very late adulthood:

The role of personal, social and community-care resources

by

Neha Deshpande-Kamat

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:

Peter Martin, Major Professor
Jacques Lempers
Carolyn Cutrona
Daniel Russell
K. A. S. Wickrama

Iowa State University
Ames, Iowa
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CHAPTER 1. INTRODUCTION

Significance of the Study

In response to the steady increase in the life expectancy over past few decades (Oeppen & Vaupel, 2002), public policy programs in the United States such as Healthy People 2010 (U.S. Department of Health and Human Services, 2000) have prioritized healthy aging as one of the focus areas. One of the major aims of Healthy People 2010 is to advance the length of life and improve its health-related quality (U.S. Department of Health and Human Services, 2000). Although living longer may be perceived as a desirable life outcome, there are challenges attached to longevity. Especially in very old age, health problems compound and significantly impair the quality of everyday life (Dychtwald, 1999). Results suggest functional limitations (Gondo et al., 2006; Hitt, Young-Xu, Silver, & Perls, 1999), high levels of co-morbidities and chronic diseases in very old age (Andersen-Ranberg, Schroll, & Jeune, 2001; Evert, Lawler, Bogan, & Perls, 2003) although some segments of the oldest-old population are reported to be in good health (Perls & Terry, 2003).

Evidence therefore suggests that living long may not necessarily indicate living well (Dychtwald, 1999) and that health-related quality of life in very late years may be a critical antecedent to overall well-being in extreme old age (Buono, Urciuoli, & Leo, 1998, Parker & Thorslund, 2007; Rowe & Kahn, 1997). Therefore, in congruence with the national health priorities (Healthy People 2010, U.S. Department of Health and Human Services, 2000), and research needs, the present study has two main research objectives: (a) to gain a deeper understanding of the multi-dimensionality of health in very late life and (b) to understand the different mechanisms by which psychosocial and community-care resources influence multiple health outcomes in very late life.
Rapidly declining health status among oldest-old adults could have serious implications for health-service needs, health-care costs as well as caregiving (Lubitz, Cai, Kramarow, & Lentzn, 2003; Young 2003). As mentioned earlier, there is also a general consensus about health being a critical antecedent in determining late life outcomes such as well being and quality of life (Parker & Thorslund, 2007) making it important to pay careful attention to mechanisms of healthy aging. Therefore, the first aim of the present study was to gain a holistic understanding of health profiles in very old age by examining different dimensions of health.

Research on oldest-old adults has accepted the biopsychosocial approach to study the several determinants of healthy aging such as genetic, environmental, biomedical and psychosocial determinants (Christensen & Vaupel, 1996; Martin 2002; Perls & Terry, 2003). Consistent with the biopsychosocial approach, the second aim of the present study was to examine the effects of psychosocial resources as determinants of health in later life (Martin 2002; Quinn, Johnson, Poon, & Martin, 1999). Past studies examining the effects of resources on health have focused extensively on resources such as personality characteristics (Diener, Suh, Lucas, & Smith, 1999; Martin, 2002; Martin et al., 2006; Pierce, Lakey, Sarason, Sarason, & Joseph, 1997) and social resources (Berkman, 1984; García, Banegas, Pérez-Regadera, Cabrera, & Rodriguez-Artaidejo, 2005; Sarason, Sarason, Potter, & Antoni, 1985). The present study attempts to add another dimension to the psychosocial resource paradigm by incorporating a community perspective. Classic studies on community health have listed a range of community-based assistive services such as personal care, nursing care, home maker chores, and meal preparation as necessary factors to enhance the health-related quality of life of older adults (Cutler & Coward, 1988). Further, sources of community-based care services have been broadly categorized as informal services (i.e., services received from family and friends) and formal
services (i.e., services received from paid caregivers) (Emanuel et al., 1999). However, most studies on community health have used the availability of community-care services from various sources to measure outcomes such as health service utilization (Andersen & Newman, 1979). In the context of oldest-old adults, the present study recognizes the critical role of community-based care services and views them as essential resources to enhance the quality of life for people with lower functioning and high dependency (Gallagher & Truglio-Londrigan, 2004; Martin, 2002).

Despite the need, very few studies involving the oldest-old adults have incorporated the availability of community-care services as a determinant of health-related quality of life. Independent effects of community services on age-related outcomes have been previously studied (Goins & Hobbs, 2001; Mathias & Benjamin, 2008; van Bilsen, Hamers, Groot & Spreeuwenberg, 2008), however, no study to my knowledge has looked at the combined effects of psychosocial and community-care resources on health outcomes in very late life. Therefore, the present study will comprehensively examine the effects of multiple resources such as demographic characteristics, personal, social, and community-care resources on different dimensions of health among oldest-old adults.

In order to gain a better understanding of health, four different dimensions of health such as global ratings of overall health (Jang, Poon, & Martin, 2004; Quinn et al., 1999), functional health (Gondo et al., 2006; Takayama et al., 2007), the number of chronic diseases, and number of health problems (Andersen-Ranberg et al., 2001; Evert et al., 2003) commonly identified in the oldest-old literature were used as health indicators in this study. Next, health profiles of the oldest-old adults were examined by studying the association between different health domains. Specifically, differences in the proxy ratings of overall health based on the presence of certain health conditions and on functional health status were studied.
In order to understand the mechanisms by which psychosocial and community-care resources influence multiple health outcomes in very late life, four structural equation models were tested to examine the effects of demographic characteristics (i.e., age, gender, ethnicity, and residence), personality characteristics (i.e., Neuroticism and Extraversion), community-care resources (i.e., services received from family, friends, and paid services), and social support on four health outcomes (i.e., proxy-rated health, proxy-rated functional health, chronic diseases, and health problems). In addition, the study also examined the specific role of social support in explaining the mechanisms through which multiple resources influence health in very late life.

Data from Phase III of the Georgia Centenarian Study (2001-2009) were used to test the hypotheses. The data included information on demographic, health, and psychosocial resource domains of oldest-old adults (i.e., centenarians and octogenarians) meeting the requirements to investigate the major objectives of this study. Centenarians were chosen as the sample for this study on healthy aging for several reasons. First, centenarians have lived much beyond the average life expectancy of their generation and are considered a unique source of valuable information that may contribute to understanding the determinants of health in very late life (Darviri et al., 2008). Second, prior research points at interesting health outcomes among centenarians such as abilities to survive or escape chronic illnesses (Evert et al., 2003) and to maintain a sense of autonomy (Hitt et al., 1999) until very late life arguably making them good models to study determinants of healthy aging. Third, the ability of the centenarians to draw on their personal and social resources to adapt to health-related challenges in very late life have been discussed in the literature (Martin, 2002). Centenarians exhibit unique personality traits such as low levels of neuroticism, high competence and high extraversion which may be linked to health and longevity (Martin et al., 2006).
Examination of centenarian health profiles is expected to make a valuable contribution to the existing knowledge of health-related quality of life at the limit of longevity. Further, using differential health indicators and studying associations between them is expected to expand our understanding of the multi-dimensionality of health in later life. A comprehensive investigation of multiple pathways of demographic factors, personal, social, and community-care resources to various health outcomes will be useful in understanding the mechanisms that may play a crucial role in maintaining and improving health in very late life. The findings of the present study are likely to enable policy-makers, health care professionals, and other individuals who directly work with older adults to provide explanations and solutions that improve health-related quality of life.

Chapter 2 provides background literature, theoretical perspectives, and conceptual models consistent with the research objectives. The present study borrows in part from (a) the integrated resource theories (b) the socio-ecological perspective, and (c) Evans and Stoddart’s health field model. Specific hypotheses tested in the present study are also presented. Chapter 3 describes the sample characteristics, methods, procedure, and data analyses. Chapter 4 presents results of descriptive statistics, correlations, cross tabulations, and the four structural equation models testing the direct and indirect effects of resources on health. Lastly, Chapter 5 provides an overview of findings, discussion and conclusions.
CHAPTER 2. LITERATURE REVIEW

Background

In the 21st century, the industrialized nations have reported increasingly lower levels of mortality and fertility (Kinsella & Phillips, 2005). Mortality reduction implies an increase in the aging population. A vast number of studies point out that the fastest growing segment of the population is the oldest-old adults (i.e., men and women aged 85 years and older) (Kinsella & Phillips, 2005; Oeppen & Vaupel, 2002). These demographic studies illustrate that more people will survive to extreme old age in the coming years and will live much longer than the preceding generations.

In the backdrop of these demographic changes, researchers in the past have waged an open debate concerning the need to live healthy versus to live long (Légaré & Carrière, 1999). The critical question posed by Légaré et al. is whether decreased mortality automatically implies a healthier society. Managing the process of aging and maintaining health until late life is a critical concern in longevity studies (Ferrini & Ferrini, 1993). In congruence with the concern raised in the literature about health-related quality of life at the limit of longevity, the present study seeks to (a) examine health profiles in very late life and (b) identify the factors that contribute towards maintaining health and vitality in very old age.

A range of theories have tried to explain and predict the health status among oldest-old populations. As mentioned previously, the study of health in very late life has yielded contradictory findings and various debates in the past. The theory of compression of morbidity (Fries, 1989, 2003) predicts an overall rise in population morbidity if the increase in life expectancy takes place at a greater rate than the decline in morbidity. The expansion of
morbidity theory (Gruenberg, 1977) states the added years of increased life expectancy as years of increase in morbidities. The theory of dynamic equilibrium (Manton, 1982) agrees with the premise of an increase in total morbidity but maintains that medical and scientific progress will decrease the progression of disease and disability causing positive improvements in the lifestyle of oldest-old adults.

Rapidly declining health and depleting resources go hand in hand with the issue of increased life expectancy (Dychtwald, 1999; Martin, 2002) and also have implications for long-term health care costs. In order to fully understand these debates regarding health-related quality of life in very old age, a number of researchers in the past have differentiated between life expectancy and disability-free life expectancy (Cambois, Robine, & Hayward, 2001; Crimmins & Saito, 2001; Robine, Romieu, & Cambois, 1999). Crimmins et al. reported a disparity in healthy and unhealthy life expectancy of older adults in the United States. Though disability measures show improvement, chronic disease and functional indicators have shown a consistent health decline. The literature has provided evidence for expansion in morbidity reporting decreased proportion of health with increasing life expectancy (Bone, Bebbington, & Nicolaas, 1998; Crimmins & Saito, 2001; Crimmins, Saito, & Ingegneri, 1997; Doblhammer & Kytir, 2001). Crimmins et al. also found that older adults often reported extra years of life achieved as years of disability.

A substantial amount of centenarian literature has focused on health (Andersen-Ranberg et al., 2001; Hitt et al., 1999; Perls & Terry, 2003) and psycho-social resources (Martin, 2002). Community-care services have been recognized as a resource influencing health status in late life (Hertzman, Frank, & Evans, 1994). Hertzman et al. in their model describing determinants of health list access to care, availability of services or resources and characteristics that may
influence the effectiveness of care. Given the evidence, the present study in addition to the psychosocial resource framework, also lists community-care resources as factors that may directly or indirectly influence health outcomes among oldest-old adults.

It is expected that through the use of multiple indicators a more integrated understanding of centenarian health and available resources will be obtained through this study. The study also expects policy implications for interventions related to various psychosocial resources, especially community-care services available in extreme old age that may emerge as significant determinants of health-related quality of life during the course of the study.

The following sections will seek to understand the process of aging as a complex blend of environmental, psychological, and social influences that occur at the individual as well as the community level (Satiriano, 2006). Theoretical perspectives that link the psychosocial and community contexts as determinants of health in later life are discussed.

**Theoretical Perspectives**

The present study borrows loosely from the following theoretical perspectives: (a) the integrated resource theories (b) the socio-ecological perspective, and (c) Evans and Stoddart’s health field model.

**The integrated resource theories.** A conceptual model by Hendricks and Hendricks (1986) offered a conceptual framework to understand the role of psychosocial resources including (i) physiological resources or the physical and mental ability to perform everyday life tasks (ii) personal or psychological resources related to individuals’ internal coping ability (iii) social-familial resources, which include social support networks such as family, friends and community or neighborhoods, and (iv) economic resources such as income and assets (Hendricks &
Hendricks, 1986). Martin (2002) through the developmental adaptation model re-emphasized the critical role of personal and social resources in predicting developmental outcomes such as functional health and subjective well-being.

The integrated resource theories emphasize the interactive nature of the resources and define their relevance in the larger scheme of things (Hobfoll, 2002). French, Caplan, and Van Harrison (1982) provided an innovative perspective in classic resource theories by proposing the relevance of resources against the ecological backdrop emphasizing the role of environment. Holahan and Moos (1991) highlighted the causal contribution of resources suggesting that resources tend to generate other resources. The present study in part borrows from the integrated resource theories to study the dynamic interplay between personal resources, social resources and community resources in an environmental context.

**Socio-ecological perspective.** The ecological model has a long history in social, behavioral and health sciences (Bronfenbrenner, 1979; Green & Kreuter, 2005). Over time, the model has taken different forms with some forms highlighting the biological, behavioral and social factors, whereas other forms highlight the social and physical environments or the “context” (Satariano, 2006). In a broad sense, the ecological model states that patterns of health and well-being are an outcome of a dynamic interplay between biological, behavioral and environmental factors (Smedley & Syme, 2000). In addition, the model also maintains that demographic influences such as age, gender, residence or ethnicity may shape the context and therefore directly or indirectly influence the environmental resources and health outcomes (Satariano et al.). The ecological model has had a number of versions and, whether referred to as “eco-epidemiology,” “ecosocial,” or “social ecology,” the underlying idea of a multi-dimensional dynamic interplay between the person and the environment still remains constant (Krieger, 2001; Stokols, 1992).
The present study draws from the field of social ecology that emerged during the mid-1960s and early 1970s and was instrumental in causing the shift from a person-focused to an environmentally-oriented and community-based approach to studying health (McLeroy, Bibeau, Steckler, & Glanz, 1988; Stokols, 1996). Stokols, in his article on community health, summarized the “environment” dimension within the socio-ecological perspective as consisting of multiple social, physical and personal dimensions and their cumulative effects on a range of health outcomes. The socio-ecological paradigm also maintains that human health is not affected by environment alone but also by a variety of individual factors such as psychological predispositions and personal attributes (Stokols et al.). Consistent with this paradigm, the present study maintains that health in very late life is affected by multiple factors such as demographic, personal, social, and community-care resources.

**Health field model.** Consistent with the socio-ecological paradigm, Evans and Stoddart (1994) presented a comprehensive framework highlighting the ways in which different individual and social factors interact to have effects on different conceptualizations of health. The field model views health from an encompassing biomedical as well as a psychosocial perspective and includes functional capacity and well-being as health outcomes along with the total number of diseases (Evans & Stoddart, 1994). The model conceptualizes the broad nature of pathways that affect health by emphasizing the multiple influences that may affect the health of individuals rather than specific factors that account for health at the individual level. The model takes a multidisciplinary approach by uniting individual characteristics as well as social environments as contributing towards health status. Although the model is not an entirely new paradigm, its approach of conceptualizing health in a multi-dimensional perspective and the multiple
influences (particularly the individual and social environments) that affect health deserve attention.

One of the highlights of the health field model is that it differentiates between disease, health and function, and well-being in order to understand and operationalize health in a testable manner. The model also reinforces the interrelatedness of multiple influences on health. Health outcomes in the field model are likely to be the result of complex interactions of multiple influences rather than specific factors operating in isolation. The present study borrows from the multi-dimensional perspective of the health field model, focusing on the health effects of personal and social environments in very late life.

Figure 1 presents the full model of the determinants of health proposed by Evans and Stoddart also known as the “health field model,” which provides a broad conceptual framework for considering the social and environmental factors that influence health within a community context (Evans & Stoddart, 1994).
The present study borrows from the existing model focusing largely on community-care resources, personality characteristics and social support. Consistent with the original health field model, the resource model in the present study emphasizes multiple influences on health. Like the health field model, the present study will test different indicators of health. Figure 2 represents an adaptation of the health field model used in this study highlighting community-care resources, personality characteristics and social support as interacting environmental components and their effect on multiple dimensions of health (i.e., proxy-rated health, proxy-rated functional health, chronic diseases and health problems).

*Figure 2. Adaptation of the health field model: psychosocial resources and health.*

The social environment in this model is interpreted as social support available to the individual. Research suggests that personality traits should be seen as important personal resources and are likely to affect a range of outcomes including adaptability, health and vitality of an individual (Martin, 2002; Smith & MacKenzie, 2006). Because the focus of the present study is on psychosocial environments, the genetic endowment component is not considered. Personality characteristics of centenarians were added to the model because the centenarian literature has noted the importance of personality as predisposing factor in predicting health outcomes (Martin et al., 2006).
Oldest-old adults with rapidly depleting physical and functional health may need adequate family and community support to maintain optimal levels of autonomy, independence, and well-being (Martin, 2002). Physical environments are replaced with community-care services (such as personal care and supportive services) as community resources relevant to the oldest-old population which would help to increase autonomy, minimize dependence and build a conducive physical environment for the centenarians.

Consistent with the health field model, health is measured using subjective and objective indicators of health. Functional health refers to the basic capabilities of individuals to carry out those tasks essential to independent and self-sufficient living (e.g., the ability to run errands, cook, and do housework, Fillenbaum, 1988). Subjective well-being will be replaced by proxy-rated centenarian health, keeping the focus on overall health-related quality of life. Proxy-rated centenarian health indicates health status of participants as perceived by the proxy respondents and may include overall subjective measurements based on functioning and chronic conditions (Strawbridge, Shema, Balfour, Higby, & Kaplan, 1998; Strawbridge & Wallhagen, 2003). The objective measure of health includes presence of health conditions present at the time of inquiry (Andersen-Ranberg et al., 2001). However, the literature points out a need to distinguish between health conditions based on their level of seriousness (Wyler, Masuda, & Holmes, 1970). The distinction may be especially relevant for oldest-old adults as health in very late life may have a different meaning and expectations. For example, chronic diseases such as diabetes, heart disease, cancer may be life threatening and not having exposure to these diseases may explain why oldest-old adults survive into very late life. Other compounding health problems such as visual and hearing problems, arthritis, and urinary incontinence may not be directly associated with survivorship but may be associated with very old age and severely debilitate the individual
and hamper the quality of everyday life (Takayama et al., 2007). Consistent with the literature, the present study examines health profiles of the oldest old adults by distinguishing between potentially life threatening chronic diseases and lifestyle affecting health problems to gain a deeper insight into the meaning of health in very old age.

In the present study, the proposed model is a conceptual integration of all the three theoretical frameworks (i.e., integrated resource theories, socio-ecological framework, and health field model) mentioned above in order to design an integrated model to investigate the role of psychosocial and community-care resources in influencing multiple dimensions of health in later life.

**Health in Very Late Life**

Studies focusing on health of oldest-old adults have been inconsistent in the measurement used. For instance, Everts et al. (2003) used a health history questionnaire answered by the centenarians or their proxies to measure the diagnoses of 10 major lethal illnesses, whereas Andersen-Ranberg et al. (2001) used a clinical examination to assess health profiles. Clinical examinations such as blood sampling are highly sensitive objective indicators of health when compared to self reports of health which may lead to differential results. In addition, differences based on different scales and constructs used to measure health have also been cited (Johnson & Wolinsky 1993). Taking into consideration these methodological concerns, the present study focused on examining health in very late life and health indicators used to define health.

Proxy-rated health measures overall centenarian health as perceived by a proxy informant. This global rating of health is often used to predict other health outcomes as well as mortality among older adults (Johnson & Wolinsky, 1993) and is proven to be predictive of a range of developmental outcomes in later life including physical health and functional status.
(Pinquart, 2001). Functional status of the centenarians directly relates to the level of activity and independence among centenarians and is thereby associated with critical outcomes such as health and well-being in very old age (Gondo et al., 2005; Takayama et al., 2007; Yi & Vaupel, 2003). Prior research has also investigated individual capacity of the centenarians to delay, overcome, or completely escape disease as a pathway to achieve extreme longevity (Andersen-Ranberg, Scroll, & Jeune, 2001; Evert, Lawler, Bogan, & Perl, 2003). Consistent with the previous literature, prevalence rates of chronic conditions and health problems present at the time of inquiry were used in this study to measure objective health outcomes among centenarians (Andersen-Ranberg et al.; Evert et al.). Because the main aim of the study was to understand health and determinants of health in very late life, the present study did not take into account the onset of diseases but only the presence of diseases at the time of the inquiry.

Based on the previous literature, global ratings of health (Jang et al., 2004; Quinn et al., 1999), functional health (Gondo et al., 2006; Takayama et al., 2007), and the number of acute or chronic health conditions (Andersen-Ranberg et al., 2001; Evert et al., 2003) emerged as significant health domains commonly used in the oldest-old literature. Consistent with the literature, the present study chose to examine four health outcomes (i.e. proxy-rated overall health, proxy-rated functional health, chronic conditions, and health problems) and their associations to gain a deeper understanding of the multi-dimensionality of health in very late life.

**Proxy-rated health.** Proxy-rated health reflects a global measure that depicts a holistic picture of health of the participant as perceived by the proxy informant (Parker & Thorslund, 2007). Global ratings of health reflect dimensions of health that are perhaps most meaningful to the individual (Idler, Hudson, & Leventhal, 1999). Some studies indicate proxy-rated health as a reliable measure predicting self-ratings of health as well as physical functioning among oldest-
old adults (Schönemann-Gieck et al., 2003). A number of studies in the past have used subjective ratings of health to predict objective health indicators as well as mortality (Idler & Benyamini, 1997; Lee, 2000; Liu & Zhang, 2004; Quinn et al., 1999). The present study evaluated the relationship of proxy-rated health to presence of chronic conditions and functional health status. Thus, the present study is expected to add to the existing knowledge about the predictive power of proxy-ratings of overall health in determining functional and objective health status of the oldest-old adults.

**Functional health.** Functional capacity of oldest old adults has been described as the basic capability of individuals to carry out tasks that are essential to independent and self-sufficient living (e.g., the ability to run errands, cook and do housework) (Fillenbaum, 1988). Functional dependency has predicted both institutionalization and mortality (Fried et al., 1998; Inouye et al., 1998; Ogawa, Iwasaki, & Yasumura, 1993; Sonn, 1996; Worrall, Chaulk, & Briffett, 1996) in the past, making it a significant indicator of health-related quality of life. Oldest-old adults are particularly vulnerable to decline in functional health (Martin et al., 1996; Poon et al., 2007). Buono et al. (1998) found that centenarians reported a loss of a higher number of physical functions (ADL and IADLs) than younger participants, suggesting that functional impairment could be directly related to increase in age. Interestingly, despite reporting poorer functional ability, centenarians complained less spontaneously about their overall health when compared to their younger counterparts suggesting better adaptation to the loss of functioning. Yi and Vaupel (2003) found that the percent of active and cognitively intact individuals dropped dramatically from age 80-84 to 100-105 years suggesting an age-related functional decline. Gondo et al. (2006) also studied centenarian health by categorizing centenarians based on their functional capacity. Results indicated that 2% of centenarians were exceptional (i.e., with their functions
graded as excellent), 18% were normal (i.e., exhibiting maintenance of fine cognitive and physical functions), 55% were frail (i.e., those exhibiting impairment of either cognitive or physical functioning) and 25% were fragile (i.e., exhibiting deterioration of both cognitive and physical functioning), thus indicating variation in physical functioning even at the limit of longevity.

**Chronic diseases.** The compression of morbidity hypothesis (Fries, 2003) predicts that centenarians are likely to delay or even escape diseases that are otherwise considered life-threatening at younger ages in order to achieve their status of extreme old age. Consistent with the compression of morbidity hypothesis, Evert et al. (2003) examined the ages of onset for ten age-associated diseases for centenarians categorizing them into survivors, delayers, and escapers based on their morbidity profiles. Results indicated that 38% centenarians were survivors (i.e., centenarian participants diagnosed with an age-associated illness before the age of 80), 43% were delayers (i.e., centenarian participants diagnosed with an age-associated illness at or after the age of 80) and 19% were reported as escapers (i.e., centenarians who attained their 100th birthday without the diagnosis of ten common age-associated diseases), indicating variation in morbidity profiles of centenarians.

Andersen-Ranberg et al. (2001) also assessed health and autonomy among centenarians and found high levels of morbidity and autonomy among centenarians with 72% reporting cardiovascular disease, 54% reporting osteoarthritis, 52% reporting hypertension and 28% reporting heart disease. Co-morbidities were reported equally in autonomous as well as non-autonomous centenarians.
**Health problems.** Literature cites the need to differentiate between diseases based on their level of seriousness (Wyler et al., 1970). Takayama et al. (2007) conceptually classified diseases based on their association with age or survivorship (i.e., heart disease, diabetes, cancer) and their ability to affect the quality of life in very old age (i.e., fractures). They reported that both age-related or life-threatening diseases as well as health conditions affecting quality of life were significantly related to other health outcomes such as physical functioning. Consistent with this approach, the present study differentiated health problems from chronic conditions to study their possible association with other health outcomes such as proxy-rated health as well as functional health. Health problems (i.e., arthritis, visual problems, hearing problems, general weakness, urinary incontinence) in the present study refer to health conditions which may not be directly associated with survivorship but may be associated with very old age and may compound to debilitating everyday quality of life among oldest-old adults. In the past, studies have cited high prevalence of health problems such as arthritis and poor vision in old age (Andersen-Ranberg et al., 2001; Evert et al., 2003). Thus, the studies that included only chronic or life-threatening diseases have been criticized for producing biased morbidity profiles (Andersen-Ranberg et al., 2001).

Past research has noted high prevalence rates of health problems such as poor vision and hearing (Vaillant & Mukamal, 2001), and arthritis (Krishnan, Fries, & Kwoh, 2007). Andersen-Ranberg et al. (2001) found that the top two most prevalent health problems among centenarians in their study were urinary incontinence (60%) and arthritis (54%). Further, research suggests a measurable decrease in the ability of the older adults to initiate and maintain sleep with marked deterioration in the quality and quantity of sleep (Espiritu, 2008). Research also suggests a significant association between sleep and physical health (Uezu et al., 2000). Given the high
prevalence rates, health problems among centenarians were examined in the present study to gain a deeper understanding of health-related quality of life in very old age.

Researchers in the past have tried to assess objectively whether it is possible to reach one hundred years and still be healthy. However, knowledge about the health status of centenarians is still contradictory. Although some studies reported centenarians as frail individuals with high levels of morbidity (Andersen-Ranberg et al., 2001) other studies report centenarians as individuals in relatively good health conditions without specific diseases (Hitt et al., 1999; Motta, Bennati, Ferlito, Malaguarnera, & Motta, 2005; Perls & Terry, 2003). By including subjective as well as objective measures of health, the present study aims to study the associations between different health indicators and gain a deeper understanding of the multidimensionality of the domain.

A vast amount of literature has affirmed multiple routes to study the determinants of health in very late life including genetic predisposition, environmental factors, biomedical processes and psychosocial resources (Andersen-Ranberg et al., 2001; Buono et al., 1998; Evert et al., 2003; Hitt et al., 1999; Martin et al., 1996; Perls & Terry, 2003). The effect of psychosocial resources as determinants of health and functioning in later life has been extensively studied (Anstey, Luszcz, & Andrews, 2002; Baltes, Staudinger, & Lindenberger, 1999; Hobfoll, 2002; Martin, 2002). However, research has emphasized the need to study the complex and overlapping psychosocial pathways that influence health (Evans & Stoddart, 1991; Grundy & Sloggett, 2003). Knowledge of psychosocial resources that promote health and functioning would permit development of effective interventions that maintain and improve health-related quality of life in very old age. The next section will focus on the role of psychosocial and community-care resources in influencing health in later life.
Determinants of Health in Late Life

Better resources increase the probability of availability and accessibility of support, services and interventions needed in very late life to cope with health-related challenges (Satariano, 2006). Psychosocial resources may enhance one’s autonomy and positively influence health behaviors and decision-making among oldest-old individuals. Lack of resources, on the other hand, may put older adults at a health disadvantage and may leave them socially and physically isolated.

Age-related changes in psychosocial resources on health and functioning have been studied in the literature (Baltes et al., 1999; Hobfoll, 2002). Hobfoll (2002) defines resources as centrally valued entities in their own right (e.g., personal characteristics, health) or to obtain centrally valued means (e.g., social support, community support, and health behaviors). Lawton and Nahemow (1973) proposed one of the first theories pertaining to resources in later life and emphasized the importance of resources in meeting social and environmental demands for adaptation in later life. Consistent with resource theories, Martin (2002) pointed out the crucial role of rapidly depleting personal and social resources among oldest-old adults in order to cope with challenges posed such as deteriorating health, functional limitations and loss of social network.

Personality characteristics. The role of personality in predicting health and longevity has been widely acknowledged (Martin et al., 2006). Literature has attributed the strong sense of autonomy and independence among centenarians to their “robust” personality characteristics (Martin et al., 2006; Masui, Gondo, Inagaki, & Hirose, 2006). Martin (2002; 2006) further argued that these unique personality characteristics of centenarians also serve as valuable personal resources which may help in adapting to challenges of extreme longevity such as
decreased physical functioning, death of a sibling, child or spouse and diminished health. Numerous studies have used the Big-5 typology (i.e., Neuroticism, Extraversion, Agreeableness, Openness to Experience, and Conscientiousness) to assess the role of personality characteristics in various subjective health outcomes (Watson & Pennebaker, 1989). Hobfoll (2002) listed personality characteristics such as Neuroticism and Extraversion as important personal resources which may influence human behavior. Research suggests that personality characteristics are also associated with objective health measures such as age-related diseases, survival from serious illness and longevity (Lahey, 2009; Smith & MacKenzie, 2006).

Particularly neuroticism, a personality trait characterized by irritability, anger, sadness, anxiety, worry, hostility, self-consciousness, and vulnerability (Costa & McCrae, 1994; Lahey, 2009), has been associated with physical health problems such as cardiovascular diseases (Shipley, Weiss, Der, Taylor, & Deary, 2007; Suls & Bunde, 2005), diabetes (Brickman, Yount, Blaney, Rothberg, & De-Nour, 1996), cancer (Nakaya et al., 2006), higher levels of co-morbidity, and a greater need for health services (Baune, Adrian, & Jacobi, 2007). The present study examined the effect of neuroticism on health in very late life.

Extraversion is characterized by energy, positive emotions, urgency, and the tendency to seek stimulation in the company of others (Costa & McCrae, 1994). Higher extraversion is attributed to lesser stress impact and increase in help-seeking behavior (Swickert, Rosentreter, Hottner, Mushrush, 2002). Better stress management among extraverted individuals has predicted better health outcomes (Siegler & Brummett, 2000). The evidence for the role of extraversion in predicting health is, however, contradictory. Friedman (2000) found no association between extraversion and health outcomes. Research on extraversion has focused
mainly on subjective measures of health (Watson & Pennebaker, 1989). The present study examined the effect of extraversion on subjective as well as objective measures of health.

**Community-care resources.** Availability and accessibility of community-care services have been recognized as a resource influencing health status in late life (Hertzman, Frank, & Evans, 1994). Oldest-old adults are particularly at risk of becoming physically and/or functionally dependent, which may lead to greater need for community-based support and services (Krach, DeVaney, DeTurk, & Zink, 1996; Muller et al., 1989). Community-based care, such as availability of in-home care services and other social assistance, may not only act as a form of tangible support but also lower the risk of dependency among oldest-old adults (Martin 2002). Oldest-old adults in particular need a range of supportive and home-based care services within the community such as personal care services, nursing care services, continuous supervision and help with household chores due to increased incidence of illness or frailty (Emanuel et al., 1999; Wacker, Roberto, & Piper, 1999).

Past research has emphasized the importance of formal community support such as personal assistance, housekeeping chores, and transportation (Matthias & Benjamin, 2008) in order to enable older adults to lead an independent and functional life (Gallagher & Truglio-Londrigan, 2004; Plochg & Klazinga, 2002) but empirical research on the role of community-care resources as a source of support in influencing late life outcomes in oldest-old adults is limited. Services offered by family members, friends, and paid professionals have been listed as sources of support in a number of studies (Emanuel et al., 1999; Schulz & Martire, 2004; Mittelman et al., 1995). Further, a direct positive relationship between support received from family, friends, and paid professionals and health outcomes such as better mental health,
subjective well-being (Mittelman et al.), and functional health (Stoller, 1983) was reported among terminally ill patients (Emanuel et al.).

The majority of studies on formal community support has focused on utilization of community-based health-care services by older adults (Goins & Hobbs, 2001) but the relationship between community-based services and subjective ratings of overall perceived support has not been explored. Community-care resources in this study are thereby viewed as tangible support tools available to oldest-old adults that would supplement their existing social provisions and would be expected to positively affect health and functioning. Therefore, it may be argued that psychosocial and community-care resources are important to create an environment that is conducive for maintaining health and vitality in very old age (Cutler, 1975; Martin, 2002; Martin et al., 1996; Perls & Terry, 2003).

**Social support.** Social resources include contact with others and receipt of social support (Martire, Schulz, Mittelmark, & Newsom, 1999). Previous literature indicates an important link between psychosocial resources and health-related outcomes among older adults (Oxman, Berkman, Kasl, Freeman, & Barrett, 1992). In this study, social resources and personality characteristics are treated as separate influences on health due to evidence related to distinct main effects of social resources (García et al., 2005; Gottlieb & Green, 1984; Grundy & Sloggett, 2003; Sarason, Sarason, & Shearin, 1986) and personality (Grundy & Sloggett, 2003; Masui et al., 2006; Smith & MacKenzie, 2006) on health and longevity.

Previous studies have emphasized the role of social support in explaining subjective (Sarason et al. 1986) as well as objective health outcomes (Uchino, Cacioppo, & Kiecolt-Glaser, 1999). Social support has proven to improve physiological indicators of health such as cardiovascular function and the immune system (Uchino et al.). Uchino, Kiecolt-Glaser, and
Cacioppo (1992) explained psychosocial mechanisms linking social support to physiological processes. Behavioral mechanisms linked higher social support to better health behaviors as well as help-seeking behaviors. In the same study, protective functions of social relationships were observed in moderating the relationship between psychosocial stressors and physiological indicators such as cardiovascular function. The potential role of social support in mediating and moderating the relationship between personality and community-care resources and differential health outcomes will be examined in the present study.

Prior research has acknowledged the need to study multiple and complex pathways through which psychosocial resources affect health outcomes in later life (Grundy & Slogett, 2003). For example, particular dimensions of support may be more important in predicting health when there is a reasonable match with specific needs (Cutrona, Russell, & Rose, 1986; Uchino, Cacioppo, & Kiecolt-Glaser, 1999). In the context of the present study, these could be viewed as age-related needs for tangible assistive support such as community-care services as well as emotional needs for qualitative support through social provisions. Long-term care residence may also offer support. Further, social support could be viewed as a situational variable or may be influenced by individual differences in personality characteristics (Sarason et al., 1986).

The present study explored the pathways between demographic, psychosocial and community-care resources and health by testing four parallel models measuring differential health outcomes (i.e., proxy-rated health, proxy-rated functional health, chronic diseases, and health problems) among oldest-old adults (Figure 3). Consistent with resource theories, community-care resources, personal resources, demographic characteristics and social support are conceptualized as resources that play a significant role in influencing health outcomes. Consistent with the socio-ecological approach, the model seeks to study the dynamic interplay
between resources representing the individual, social, and physical environments surrounding the individual. Lastly, the model differentiates between subjective and objective health indicators as conceptualized in the health field model.

Figure 3. Conceptual model: The relationship between personal, social, and community-care resources and differential health outcomes

Consistent with the literature, personal resources, community-care resources and demographic factors in the present model are conceptualized as predisposing factors that influence social environments in very late life. The present study captures these relationships by specifying paths from psychosocial and community-care resources to social support. It is,
however, important to note that the argument regarding the effect of social support on health in later life is somewhat cyclic. Research suggests better health outcomes such as lower incidence of disease (Carstensen, Fung, & Charles, 2003; Cutrona, Russell, & Rose, 1986; House, Landis, & Umberson, 1988; Shaw, Krause, Liang, & Bennett, 2007) and lower functional impairments (Seeman, Bruce, & McAvay, 1996) for older adults with high quality and quantity of social support. The literature also indicates a reverse causal relationship where social support is a function of physical and functional health. For instance, Logan and Spitze (1994) found evidence that older adults with poor functional health received more formal as well as informal support. It is therefore important to consider the possibility of reverse causality between support and health for oldest-old adults.

Based on the conceptual model presented above, this study explored three main research questions:

1) Whether centenarians in the present study are considered to be healthy,

2) Whether demographic characteristics, personal resources, community-care resources and social support affected health outcomes directly (paths 1b, 2b, & 3b),

3) Whether social support mediates the relationship between community-care resources, demographic characteristics, personal resources and health outcomes, i.e., community-care resources, demographic characteristics, and personal resources affect social support and social support directly affects the four health outcomes (1a, 2a, 3a, & 4b),

4) Whether social support moderates the relationship between personal as well as community-care resources and health outcomes (4a & 4c).

It is expected that community-care resources, personal resources and demographic characteristics will predict health outcomes directly and will also be mediated through social
support. Specifically, it is expected that availability of services from family, friends, and professionals will predict higher proxy-ratings of social support. It is expected that higher social-support levels will predict better health outcomes. It is further hypothesized that social support will moderate the relationship between community-care resources, personal resources, and residence and health outcomes. Specifically, when social support is low, higher neuroticism will lead to poor health. For those living independently, higher social support will lead to better health outcomes. Overall, it is expected that the present study will provide an integrated approach to understand the mechanisms through which psychosocial and community resources affect multiple dimensions of health in very old age.
CHAPTER 3. METHODOLOGY

Participants and Procedure

Data from Phase III of the Georgia Centenarian Study (Poon et al., 2007) were used in the present study. Institutional Review Board (IRB) approval to analyze the data was obtained (Appendix I). The Georgia Centenarian Study collected data from centenarians and near centenarians (98 years and older), octogenarians (80 years and older) as well as their proxy informants. The proxy data for octogenarians were used only for direct comparison with centenarian health. Voter registration rolls from the state of Georgia were used to obtain the names of participants. In addition, calls to a random subset of care facilities were used to identify participants. Participants across 44 counties in Northeast Georgia were recruited via phone and mail followed by face-to-face interviews. Questionnaires were left for or mailed to the proxy informant of the interviewed centenarian participants.

Proxy reports were provided by proxy informants. The majority of the centenarian proxies were their adult children (61.1%). Additional proxies included nieces and nephews (13.9%), granddaughters (9.9%), and miscellaneous informants, such as spouses, siblings, or friends (15.1%).

The present study used proxy information for several reasons: First, centenarians’ self reports may not be accurate or complete due to high levels of cognitive impairments (Loewenstein, Argüelles, Bravo, Freeman, Argüelles, Acevedo, & Eisdorfer, 2001; Yi, Poston, Vlosky, 2009). Second, proxy reports minimize the rates of missing data and non-response (Yi et al.); third, proxy reports avoid bias towards oversampling healthy older adults (Yi et al.); fourth, literature supports high reliability and validity for proxy reports for data on oldest-old adults if the information collected is concrete and observable (Yi et al.). The health data were collected.
with the help of self reports or medical reports of the centenarians, whereas data for personal, social and community resources came from proxy reports.

Data were collected from a total of 287 proxy informants out of which 242 proxy informants provided data on resources and adaptation. Eight cases were dropped due to low Mini Mental Status Examination (MMSE) scores of proxy respondents accounting for 234 valid cases. Thirty-seven proxy informants did not provide information about health data leaving a final sample size of 197 proxy informants who provided data on health measures as well as resources and adaptation. The data selection for 197 proxy informants is presented in Figure 4.

![Figure 4. Data selection flow chart for centenarians](image)

The average age of the centenarian participants in this study was 100.50 years. Fourteen percent were men and 86% were women. Ethnicity of the participants indicated that 78.2% centenarians were Caucasian and 21.8% were African Americans. Thirty-seven percent of the centenarian participants lived in private homes or apartments, 42% in care facilities and 20.8% in
personal care homes. Number of years of education for the centenarians indicated that 41.3% had some high school education, 21% had completed high school, 21% had some post high school/college education, 8.6% had completed a four-year college degree, and 8.1% had completed a graduate degree. Sample characteristics are presented in Table 1.

Eighty-two proxy informants provided data on resources and adaptation of octogenarians. The average age of the octogenarian participants in this study was 84.42 years. Out of the total participants, 35.4% were men and 64.6% were women. Eighty-two percent of the octogenarians were Caucasian and 18% were African Americans. Eighty-five percent of the octogenarians lived in private homes or apartments, 14% in care facilities and 1% in personal care homes.

**Measures**

**Demographic variables.** Age, gender, ethnicity, and residential status were used as demographic characteristics in the analyses.

**Personal resources.** Personal resources were measured using proxy reports of two personality characteristics (i.e., Neuroticism and Extraversion). The Neo Personality Inventory (NEO PI-R, Costa & McCrae, 1994) was administered to obtain the participant’s personality assessment by caregiver proxies. The measure consisted of 48 total items for Neuroticism and Extraversion each. Some of the questions asked were, “sometimes she/he feels completely worthless” (Neuroticism), and “she/he really likes most people she/he meets” (Extraversion). Cronbach’s alphas for the Big Five personality traits were .94 (Neuroticism), and .93 (Extraversion). The proxies used a five-point scale to indicate the extent to which personality traits described the participants which ranged from SD = strongly disagree (=1), D= disagree (=2), N=neutral (=3),
A=agree (4), and SA = strongly agree (=5). The total score on Neuroticism and Extraversion ranged from zero to 240. Higher scores indicate higher levels of a particular personality trait.

Table 1

Summary of Centenarian Characteristics (N=197)

<table>
<thead>
<tr>
<th>Demographic Characteristics</th>
<th>M (SD)</th>
<th>n</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age</td>
<td>100.5 (2.07)</td>
<td>197</td>
<td></td>
</tr>
<tr>
<td>Gender</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Female</td>
<td>169</td>
<td>85.8</td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>28</td>
<td>14.2</td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>197</td>
<td>100.0</td>
<td></td>
</tr>
<tr>
<td>Ethnicity</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>White/Caucasian</td>
<td>154</td>
<td>78.2</td>
<td></td>
</tr>
<tr>
<td>Black/African American</td>
<td>43</td>
<td>21.8</td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>197</td>
<td>100.0</td>
<td></td>
</tr>
<tr>
<td>Education</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Some high school</td>
<td>77</td>
<td>41.3</td>
<td></td>
</tr>
<tr>
<td>High school complete</td>
<td>39</td>
<td>21.0</td>
<td></td>
</tr>
<tr>
<td>Some college</td>
<td>39</td>
<td>21.0</td>
<td></td>
</tr>
<tr>
<td>College Degree</td>
<td>16</td>
<td>8.6</td>
<td></td>
</tr>
<tr>
<td>Graduate Degree</td>
<td>15</td>
<td>8.1</td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>186</td>
<td>100.0</td>
<td></td>
</tr>
<tr>
<td>Type of Residence</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Private Home</td>
<td>73</td>
<td>37.1</td>
<td></td>
</tr>
<tr>
<td>Nursing Home</td>
<td>83</td>
<td>42.1</td>
<td></td>
</tr>
<tr>
<td>Personal Care Home</td>
<td>41</td>
<td>20.8</td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>197</td>
<td>100.0</td>
<td></td>
</tr>
</tbody>
</table>
Community-care resources. Community-care services were measured using proxy reports of six supportive services received by the centenarians (Older Americans Resources Survey – OARS Multidimensional Functional Assessment Questionnaire, Fillenbaum, 1988). The six services included personal care services (i.e., to aid in performing personal physical activities of daily living), nursing care services (i.e., to coordinate, implement, and monitor the health-care plan), continuous supervision (i.e., to supervise an individual who cannot be left alone), checking services (to monitor an individual periodically), homemaker-household chores services (aid in necessary homemaker and household activities), and meal preparation. The index indicating the receipt of the above six services was aggregated to form three scores summarizing the three domains indicating the source from which the service was received. These included unpaid services received from family members (α = .88), unpaid services received from friends (α = .85), and paid services (α = .67).

Social support. In order to examine the degree to which the participants’ social relationships provide various dimensions of social support, the 12-item version of the Social Provisions Scale (Cutrona & Russell, 1987) was used. The proxies indicated on a 4-point scale the extent to which each statement described the centenarian’s current social network. Responses ranged from 1 (strongly disagree) to 4 (strongly agree). High scores indicated higher social support. Two items measured each of the six support dimensions, namely alliance, guidance, integration, attachment, worth and nurturance. Some of the items included, “he/she feels that no one would come to his/her assistance” (Alliance), “is there a trustworthy person he/she could turn to for advice” (Guidance), “does he/she know people who enjoy the same social activities” (integration), “does he/she share a feeling of intimacy with another” (Attachment), “He /she feels that other people respect his/her skills and abilities” (Worth), and “he/she feels that they are personally
responsible for well-being” (Nurturance). Reliability analysis indicated a Cronbach’s alpha of .72 for the Social Provisions Scale. A global score of social support ranging from zero to 48 was computed by adding all the 12 items on the scale. A high score indicated high levels of social support.

**Proxy-rated centenarian health.** Proxy-rated health was measured using a single item “How would you rate the overall health of the centenarian at the present time?” (0 = Poor 1 = Fair 2 = Good 3 = Excellent) from the Older Americans Resources Survey – OARS Multidimensional Functional Assessment Questionnaire (Fillenbaum, 1988). Higher score indicated higher proxy-rated health.

**Proxy-rated functional health.** Proxy-rated functional health was measured using the proxy reports of the activities of daily living (physical activities of daily living and instrumental activities of daily living) of the centenarians using the scale from the Older Americans Resources Survey – OARS Multidimensional Functional Assessment Questionnaire (Fillenbaum, 1988). A summary score of 14 items measuring IADLs measuring capacity to telephone, travel, shop, do housework, take medicine, and handle personal finances were computed. Some of the questions asked included, “Can the centenarian use the telephone,” “Can the centenarian get to places out of walking distance,” “Can the centenarian do his/her housework,” “Can he/she take his/her own medicine,” “Can he/she handle personal money,” and “Can he/she get in and out of bed?” The reliability alpha for the 14 items was 0.94. Scores ranged from 0-2 (0= completely unable, 1= with some help, 2= reports no problem). A high score indicated high functional status and a low score indicated functional impairment. A summary score was calculated by adding the 14 items ranging from 0-28 with zero indicating complete dependence for all tasks and a score of 28 indicating ability to complete all tasks.
independently. Centenarians were then divided into four groups of functional health based on the summary score (0 = completely dependent, 1-14 = predominantly dependent, 15-27 = predominantly independent, 28 = completely independent).

**Chronic diseases.** Six chronic diseases present at the time of the inquiry were selected based on the high prevalence rates among the centenarian population and in the present study. The six chronic diseases (i.e., congestive heart failure, heart disease, diabetes mellitus, hypertension, anemia, and non-skin cancer) were measured by asking whether the participants presently had any of the diseases provided on the list (0= No, 1= Yes). Morbidity and co-morbidity was calculated by adding together the number of present chronic diseases and categorizing them into “no morbidity” (no disease), “low co-morbidity” (1-2 diseases), and “high co-morbidity” (3 or more diseases). Information about all diagnosed health conditions and prescription medications was collected for the participants from all the available sources such as medical records and information from the proxies. All medical information was reviewed immediately after the interview to resolve any discrepancy. The best source out of all the available sources was then chosen and coded to be included in the data. Higher score indicated more chronic diseases.

**Health problems.** Six health problems present at the time of the inquiry and likely to affect everyday quality of life were selected based on the high prevalence rates among the centenarian population and in the present study. These included arthritis, visual problems, hearing problems, poor sleep, general weakness, and urinary incontinence. Health problems were measured by asking whether the participants presently had any of the health problems provided on the list (0= No, 1= Yes). Morbidity and co-morbidity was calculated by adding together the number of present health problems reported by the centenarian and categorizing them into “no morbidity”
(no health problems), “low co-morbidity” (1-2 health problems), and “high co-morbidity” (3 or more health problems). The best available source of information was chosen including self-reports, proxy-reports, medical records, care facility records or any other source to collect the objective health data. Higher score indicated more health problems.

**Design and Analysis**

First, descriptive analyses and bivariate correlations were computed for all the study variables. The data analyses for the present study were then conducted in four steps corresponding to the research questions.

To answer whether centenarians in the present study are considered to be healthy, prevalence rates of chronic diseases and health problems were calculated. Cross-tabulations were computed to evaluate the joint distribution of the chronic diseases, health problems, and functional health with proxy-reports of centenarian health. T-tests were conducted to examine the mean differences in the prevalence rates of chronic diseases and health problems between centenarians and octogenarians.

To examine the role of social support, four structural models that tested the pathways through which demographic characteristics (i.e., age, gender, residence, and ethnicity), Neuroticism, Extraversion, services received from family, services received friends, paid services, and social support affected the four health outcomes. Four parallel models tested the meditational effects of support between resources and the four health outcomes by specifying the indirect effects using the bootstrap method (Shrout & Bolger, 2002). Finally, the moderating effect of social support in determining the relationship between personality and health as well as the relationship between community-care resources and health were tested using simple interactions (Aiken & West, 1991).
Missing data were treated by using individual-based missing data replacement (Downey & King, 1998) of the personality dimensions, using the formula:

\[
\text{Adjusted score} = \frac{\text{unadjusted summary score}}{\text{total no. of valid responses}} \times \frac{\text{total no. of items}}{},
\]

where the unadjusted summary score = addition of the raw scores on the valid responses of the participants, total number of valid responses = number of responses answered by the participants, total number of = maximum possible responses on the questionnaire. For the structural equation models (SEM), the full-information maximum likelihood (FIML) method (Abraham & Russell, 2004) was used to adjust for missing data.

Chi-square tests, the comparative fit index (CFI), the root mean square error of approximation (RMSEA), and the standardized root and mean square residual (SRMR) were used as the goodness of fit indices in Mplus (Muthén, L. K., & Muthén, 2004). As recommended, values of CFI higher than .90 (ranging from 0 to 1.00) indicate an acceptable fit to the data (Byrne, 1998). For RMSEA and SRMR, values lower than .05 (ranging from 0 to 1.00) suggest an acceptable fit (Byrne, 1998).
CHAPTER 4. RESULTS

This section systematically addresses the four research questions. First, descriptive statistics and bivariate correlations of all study variables are presented. Next, prevalence rates of morbidities and co-morbidities and mean group differences in proxy-ratings of health are presented for centenarians and the comparison group (i.e., octogenarians). Health profiles of the centenarians are presented using cross tabulations that indicate significant differences in proxy-ratings of centenarian health based on presence of chronic diseases, health problems and functional impairment. The four proposed models and their fit indices are examined next. Results of the four modified models testing specific paths from resources to health are presented. Lastly, mediation and moderation effects of social support are presented.

Descriptive Statistics and Correlation

Centenarians received an average score of 151.55 on Extraversion on a range of 61-184.42 and a score of 120.40 on Neuroticism on a range of 92-199. On average, centenarians reported relatively low levels of Neuroticism and relative in high levels of Extraversion, the presence of one chronic disease and three health problems. Centenarians on an average reported high levels of social support \((M = 37.53)\), received paid services \((M = 2.41)\) and services from family \((M = 1.78)\) and a lower number of services from friends \((M = 0.32)\). A summary of the descriptive analyses is presented in Table 2.
Table 2

*Descriptive Statistics of Study Variables*

<table>
<thead>
<tr>
<th>Study Variables</th>
<th>N</th>
<th>%</th>
<th>M</th>
<th>SD</th>
<th>Range</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Neuroticism</td>
<td>191</td>
<td>120.40</td>
<td>22.00</td>
<td>61.00</td>
<td>184.42</td>
</tr>
<tr>
<td>Extraversion</td>
<td>191</td>
<td>151.77</td>
<td>19.71</td>
<td>92.00</td>
<td>199.00</td>
</tr>
<tr>
<td>Social support</td>
<td>174</td>
<td>37.53</td>
<td>4.89</td>
<td>22.00</td>
<td>47.00</td>
</tr>
<tr>
<td>Services from family</td>
<td>189</td>
<td>1.78</td>
<td>1.89</td>
<td>0.00</td>
<td>6.00</td>
</tr>
<tr>
<td>Services from friends</td>
<td>189</td>
<td>0.32</td>
<td>0.91</td>
<td>0.00</td>
<td>6.00</td>
</tr>
<tr>
<td>Paid services</td>
<td>189</td>
<td>2.41</td>
<td>2.10</td>
<td>0.00</td>
<td>6.00</td>
</tr>
<tr>
<td>Proxy-rated centenarian health</td>
<td>197</td>
<td>2.01</td>
<td>0.80</td>
<td>0.00</td>
<td>3.00</td>
</tr>
<tr>
<td>Proxy-rated functional health</td>
<td>182</td>
<td>14.24</td>
<td>7.68</td>
<td>0.00</td>
<td>28.00</td>
</tr>
<tr>
<td>Chronic diseases</td>
<td>182</td>
<td>1.09</td>
<td>0.99</td>
<td>0.00</td>
<td>4.00</td>
</tr>
<tr>
<td>Health problems</td>
<td>176</td>
<td>2.87</td>
<td>1.98</td>
<td>0.00</td>
<td>6.00</td>
</tr>
</tbody>
</table>

Table 3 presents the bivariate correlations for all the study variables. Older age was significantly correlated with lower social support. Higher levels of Neuroticism were associated with living in nursing homes. Living independently was associated with more social support, more services from family members, better proxy-rated health, and proxy-rated functional health. Living independently was also associated with more diseases and fewer health problems. Women had higher levels of Neuroticism than men. Lower levels of Neuroticism were associated with higher degrees of Extraversion, social support, proxy-rated centenarian health, and proxy-rated functional health.
Table 3

*Bivariate Correlations of Personal, Social, and Community-Care Resources and Health*

<table>
<thead>
<tr>
<th>Variable</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>
<th>9</th>
<th>10</th>
<th>11</th>
<th>12</th>
<th>13</th>
<th>14</th>
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</thead>
<tbody>
<tr>
<td>1. Age</td>
<td>1.00</td>
<td>.16*</td>
<td>.25**</td>
<td>.18*</td>
<td>.08</td>
<td>-.12</td>
<td>-.22**</td>
<td>-.10</td>
<td>-.10</td>
<td>.04</td>
<td>-.05</td>
<td>-.44**</td>
<td>.09</td>
<td>.09</td>
</tr>
<tr>
<td>2. Gender</td>
<td>1.00</td>
<td>.01</td>
<td>.07</td>
<td>.18*</td>
<td>.04</td>
<td>-.10</td>
<td>-.05</td>
<td>-.12</td>
<td>-.03</td>
<td>.04</td>
<td>-.13</td>
<td>.05</td>
<td>-.11</td>
<td></td>
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<tr>
<td>3. Residence</td>
<td>1.00</td>
<td>.05</td>
<td>.19*</td>
<td>.01</td>
<td>-.24**</td>
<td>-.48**</td>
<td>-.12</td>
<td>.14</td>
<td>-.22**</td>
<td>-.51**</td>
<td>.26**</td>
<td>-.22**</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4. Ethnicity</td>
<td>1.00</td>
<td>.01</td>
<td>.05</td>
<td>-.13</td>
<td>.04</td>
<td>-.05</td>
<td>.01</td>
<td>.01</td>
<td>.13</td>
<td>-.04</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5. Neuroticism</td>
<td>1.00</td>
<td>-.45**</td>
<td>-.44**</td>
<td>.01</td>
<td>-.04</td>
<td>.06</td>
<td>-.22**</td>
<td>-.24**</td>
<td>.12</td>
<td>.05</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6. Extraversion</td>
<td>1.00</td>
<td>.40**</td>
<td>-.05</td>
<td>.06</td>
<td>.12</td>
<td>.12</td>
<td>.17*</td>
<td>.02</td>
<td>-.03</td>
<td></td>
<td></td>
<td></td>
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<td></td>
</tr>
<tr>
<td>7. Social provisions</td>
<td>1.00</td>
<td>.17*</td>
<td>.09</td>
<td>.04</td>
<td>.17*</td>
<td>.28**</td>
<td>-.11</td>
<td>.09</td>
<td></td>
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<td></td>
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<tr>
<td>8. Family support</td>
<td>1.00</td>
<td>.34**</td>
<td>.15*</td>
<td>-.06</td>
<td>.05</td>
<td>-.09</td>
<td>.19*</td>
<td></td>
<td></td>
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<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>9. Friends support</td>
<td>1.00</td>
<td>.19**</td>
<td>.03</td>
<td>.11</td>
<td>.05</td>
<td>.02</td>
<td></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>10. Paid support</td>
<td>1.00</td>
<td>-.10</td>
<td>-.21**</td>
<td>.09</td>
<td>.04</td>
<td></td>
<td></td>
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<td></td>
<td></td>
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<td></td>
</tr>
<tr>
<td>11. Proxy-rated health</td>
<td>1.00</td>
<td>.50**</td>
<td>-.17*</td>
<td>-.19*</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>12. Functional health</td>
<td>1.00</td>
<td>-.07</td>
<td>-.01</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>13. Chronic diseases</td>
<td>1.00</td>
<td>-.01</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>14. Health problems</td>
<td>1.00</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
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<td></td>
<td></td>
</tr>
</tbody>
</table>

*Note.* *p < .05. **p < .01. ***p < .001.
Higher levels of Extraversion were associated with more social support as well as better functional health. Higher social support was associated with more services received from unpaid family members, better proxy-rated health and better proxy-rated functional health. More services from family members was associated with more services from friends as well as more paid services. Better functional health was associated with fewer paid services received by the centenarians. Better proxy-reported centenarian health was related to better proxy-reported functional health of the centenarians. Better proxy-rated centenarian health was also associated with fewer chronic conditions as well as fewer health problems.

**Health Status of Centenarians**

This section addresses the first research question (i.e., whether centenarians in the present study are considered to be healthy). In congruence with the study objective and ease of comparison with previous literature (Andersen-Ranberg et al., 2001; Evert et al., 2003; Takayama et al. 2007), prevalence rates of diseases and health problems present at the time of inquiry were used to understand disease profiles of the centenarians. Prevalence rates of diseases among centenarians are presented and compared with a younger age group (octogenarians) in Table 4.

The disease profiles of the Georgia Centenarian Study when compared to their younger counterparts indicated that centenarians reported a higher prevalence rate of anemia, $\chi^2 (1, N = 266) = 6.42, p < .05$ as well as congestive heart failure, $\chi^2 (1, N = 263) = 3.38, p < .05$ when compared to octogenarians. Prevalence rate of non-skin cancer was higher among octogenarians when compared to centenarians, $\chi^2 (3, N = 269) = 18.28, p < .001$. A statistical trend was
observed for diabetes, with octogenarians reporting higher prevalence rate of diabetes, $\chi^2 (1, N = 271) = 2.72, p = .10$ when compared to centenarians.

Table 4

*Prevalence of Chronic Diseases among Centenarians and Octogenarians (N = 279)*

<table>
<thead>
<tr>
<th>Chronic Diseases</th>
<th>Centenarians</th>
<th>Octogenarians</th>
<th>$\chi^2$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total % (N = 197)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Congestive heart failure</td>
<td>18.0 (35)</td>
<td>8.7 (6)</td>
<td>3.38$^+$</td>
</tr>
<tr>
<td>Heart disease</td>
<td>28.3 (53)</td>
<td>24.6 (16)</td>
<td>0.34</td>
</tr>
<tr>
<td>Hypertension</td>
<td>44.0 (86)</td>
<td>43.8 (32)</td>
<td>0.00</td>
</tr>
<tr>
<td>Diabetes mellitus</td>
<td>8.1 (16)</td>
<td>14.9 (11)</td>
<td>2.72$^+$</td>
</tr>
<tr>
<td>Anemia</td>
<td>11.3 (22)</td>
<td>1.4 (1)</td>
<td>6.42**</td>
</tr>
<tr>
<td>Non-skin cancer</td>
<td>3.1 (6)</td>
<td>14.9 (11)</td>
<td>18.28***</td>
</tr>
</tbody>
</table>

*Note.* $^+p < .10. *p < .05. **p < .01. ***p < .001.*

Next, comparisons were also computed for prevalence rates of health problems between centenarians and octogenarians (Table 5). Octogenarians reported a significantly higher prevalence rate of arthritis $\chi^2 (1, n = 250) = 4.64, p < .05$ than centenarians, whereas centenarians reported a higher prevalence rate of general weakness when compared to octogenarians, $\chi^2 (1, N = 250) = 3.32, p < .05$. A statistical trend was observed for differences between centenarians and octogenarians for prevalence rate of urinary incontinence. Centenarians reported a higher prevalence rate of urinary incontinence than octogenarians, $\chi^2 (1, N = 249) = 2.56, p < .10$.

Independent groups $t$-test was used to test the mean group differences in proxy-ratings of overall health as well as functional impairment between centenarians and octogenarians.
Table 5

Prevalence of Health Problems among Centenarians and Octogenarians

<table>
<thead>
<tr>
<th>Health Problems</th>
<th>Centenarians</th>
<th>Octogenarians</th>
<th>( \chi^2 )</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Total % (N = 197)</td>
<td>Total % (N = 82)</td>
<td></td>
</tr>
<tr>
<td>Visual problems</td>
<td>56.2 (100)</td>
<td>54.2 (39)</td>
<td>0.08</td>
</tr>
<tr>
<td>Hearing Problems</td>
<td>57.6 (102)</td>
<td>55.6 (40)</td>
<td>0.09</td>
</tr>
<tr>
<td>Arthritis</td>
<td>48.9 (87)</td>
<td>63.9 (46)</td>
<td>4.64*</td>
</tr>
<tr>
<td>Weakness</td>
<td>29.2 (52)</td>
<td>18.1 (13)</td>
<td>3.32*</td>
</tr>
<tr>
<td>Poor Sleep</td>
<td>25.3 (45)</td>
<td>28.2 (20)</td>
<td>0.22</td>
</tr>
<tr>
<td>Urinary Incontinence</td>
<td>40.4 (72)</td>
<td>29.6 (21)</td>
<td>2.56*</td>
</tr>
</tbody>
</table>

Note. *p < .10. **p < .05. ***p < .01. ****p < .001.

Results indicated significant differences in proxy-ratings of functional health between octogenarians (\( M = 24.33, SD = 6.19 \)) and centenarians (\( M = 14.71, SD = 7.50 \)), \( t(274) = 9.51, p < .001 \), suggesting that proxies rated functional health of the octogenarians better than centenarians. No differences were found in the proxy-ratings of overall health between centenarians (\( M = 1.97, SD = .79 \)) and octogenarians (\( M = 1.92, SD = .77 \)), \( t(274) = 9.51, p = .47 \).

Comparisons were also computed between overlapping disease profiles of centenarians in the Georgia Centenarian Study (GCS) to available data from a previous centenarian study that examined morbidity profiles in the United States (Evert et al., 2003) as well as nationally available statistics from Center for Disease Control (Table 6). Results suggested lower rates of congestive health failure, heart disease and anemia for centenarians in the Georgia Centenarian...
Study when compared to the Evert et al. study. GCS centenarians reported higher prevalence rates of diabetes and hypertension when compared to the Evert et al. (2003) study. Rates for congestive heart failure, heart disease, and arthritis were higher in the research studies when compared to the national prevalence rates. Prevalence rate for diabetes in the GCS was very similar to the national prevalence rate.

Table 6

*Comparison of Prevalence Rates of Six Diseases among Centenarians with Evert et al. (2003) and National Data from the Center for Disease Control*

<table>
<thead>
<tr>
<th>Chronic Diseases</th>
<th>Prevalence among centenarians</th>
<th>National prevalence rates of United States</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>GCS (%)</td>
<td>Evert et al. (%)</td>
</tr>
<tr>
<td></td>
<td>( N = 197 )</td>
<td>( N = 424 )</td>
</tr>
<tr>
<td>Congestive heart failure</td>
<td>18.0</td>
<td>25.0</td>
</tr>
<tr>
<td>Heart disease</td>
<td>28.3</td>
<td>42.0</td>
</tr>
<tr>
<td>Hypertension</td>
<td>44.1</td>
<td>19.0</td>
</tr>
<tr>
<td>Diabetes mellitus</td>
<td>8.1</td>
<td>4.0</td>
</tr>
<tr>
<td>Arthritis</td>
<td>48.9</td>
<td>NA</td>
</tr>
</tbody>
</table>


The next aim was to specifically understand health profiles in extreme old age by taking into account different dimensions of centenarian health. Health profiles of the centenarians were organized based on the prevalence rates of diseases, health problems, categories of functional health and their association with the proxy-rated centenarian health. Considering that subjective health is predictive of a range of developmental outcomes in later life including physical health
and functional status (Pinquart, 2001; Quinn et al., 1999), the present study chose to determine
how a global dimension of health was related to other subjective and objective dimensions of
centenarian health. Specifically, cross-tabulations and chi-square tests were used to understand
the joint distribution of disease profiles and functional health with proxy-rated centenarian
health.

Table 7 summarizes the distribution of proxy-rated centenarian health based on the
prevalence of six chronic diseases (i.e., congestive heart failure, heart disease, hypertension,
diabetes mellitus, anemia and non-skin cancer) at the time of the investigation. Data
demonstrated no significant differences except for congestive heart failure, $\chi^2 (3, N = 197) =
12.91, p < .01. Proxy-ratings of centenarians with congestive heart failure were different based
on the presence of congestive health failure. For heart disease, 53 centenarians (28.3%) reported
having some kind of heart disease out of which 27 (50.9%) centenarians were rated as being in
good health and 12 centenarians (22.6%) were reported in excellent health. The prevalence rate
of diabetes mellitus was 8.1% with 16 centenarians reporting the presence of diabetes. For those
with diabetes mellitus, 43.8% were rated as being in good health, and 12.5% in excellent health.
A total of 22 centenarians (11.3%) were reported being anemic with 2 centenarians (9%) in poor
health, 6 (27.3%) centenarians rated as being in fair health, 10 centenarians (45.5%) in good
health and 4 centenarians (18.2%) in excellent health.

Six centenarians had some type of non-skin cancer at the time of data collection. Out of
these, none were rated as being in poor or excellent health. Five centenarians (83.3%) were
reported as being in good health and 1 (16.7%) centenarian being in fair health. No significant
association was observed between level of co-morbidity of the six chronic diseases and proxy
ratings of centenarian health.
Table 7

Association between Chronic Diseases and Proxy Reports of Centenarian Health (N =197)

<table>
<thead>
<tr>
<th>Chronic Diseases</th>
<th>% (n) Proxies Reporting Centenarians Health</th>
<th>( \chi^2 )</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Total % (n)</td>
<td>Poor</td>
</tr>
<tr>
<td>Congestive heart failure</td>
<td>Absent</td>
<td>82.0 (159)</td>
</tr>
<tr>
<td></td>
<td>Present</td>
<td>18.0 (35)</td>
</tr>
<tr>
<td>Heart disease</td>
<td>Absent</td>
<td>71.7 (134)</td>
</tr>
<tr>
<td></td>
<td>Present</td>
<td>28.3 (53)</td>
</tr>
<tr>
<td>Hypertension</td>
<td>Absent</td>
<td>55.9 (109)</td>
</tr>
<tr>
<td></td>
<td>Present</td>
<td>44.1 (86)</td>
</tr>
<tr>
<td>Diabetes mellitus</td>
<td>Absent</td>
<td>91.9 (181)</td>
</tr>
<tr>
<td></td>
<td>Present</td>
<td>8.1 (16)</td>
</tr>
<tr>
<td>Anemia</td>
<td>Absent</td>
<td>88.7 (173)</td>
</tr>
<tr>
<td></td>
<td>Present</td>
<td>11.3 (22)</td>
</tr>
<tr>
<td>Non-skin cancer</td>
<td>Absent</td>
<td>96.9 (189)</td>
</tr>
<tr>
<td></td>
<td>Present</td>
<td>3.1 (6)</td>
</tr>
<tr>
<td>Co-morbidity</td>
<td>No disease</td>
<td>31.9 (51)</td>
</tr>
<tr>
<td></td>
<td>1-2 diseases</td>
<td>59.3 (108)</td>
</tr>
<tr>
<td></td>
<td>3 or more diseases</td>
<td>8.8 (16)</td>
</tr>
</tbody>
</table>

*Note.* *p* < .05. **p** < .01. ***p*** < .001.
A total of 51 (31.9%) centenarians were reported to be free from any of the chronic diseases at the time of data collection, 108 centenarians (59.3%) reportedly had one to two of the six chronic diseases, and 16 centenarians (8.8%) were reported to have three or more out of the six diseases. Out of those centenarians without any of the chronic diseases, none were reported to be in poor health, 24 (42.1%) centenarians in good health and 22 (38.6%) centenarians in excellent health. A majority of 108 (59.8%) centenarians reported prevalence of one or two chronic diseases. Out of these, nearly half were rated as being in good and 28 (26%) centenarians in excellent health condition. Only 16 centenarians reported the presence of three or more chronic diseases out of which only one centenarian (5.9%) was rated as being in poor health, 12 (70.6%) reported being in good health and 2 (11.8%) being in excellent health condition.

Further, health conditions such as arthritis, visual problems, hearing problems, poor sleep, general weakness, and urinary incontinence were assessed in a separate analysis (see Table 8). No association was found between the prevalence rate for health conditions and proxy reports of centenarian health except for general weakness, $\chi^2 (3, N = 197) = 18.32, p < .001$. Centenarians with high prevalence rate of health problems such as arthritis, visual problems and hearing problems still were rated as being in good or excellent health. For example, out of 87 (48.9%) centenarians who reported the presence of arthritis, 45 centenarians (51.7%) were rated as being in good health and 24 centenarians (27.6%) in excellent health. No centenarian without hearing problems was rated as being in poor health. A total of 45 (25.3%) centenarians reported poor sleep but only one out of those was reported as being in poor health as opposed to 20 (44.4%) in good health and 14 (31.1%) in excellent health. General weakness was prevalent in 52 centenarians (29%), out of which 22 (42.3%) centenarians were rated as being in good health and 9 (17.3%) in excellent health.
<table>
<thead>
<tr>
<th>Health Problems</th>
<th>% (N) Proxies Reporting</th>
<th>Centenarians’ Subjective Health</th>
<th>( \chi^2 )</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Total % (N)</td>
<td>Poor</td>
<td>Fair</td>
</tr>
<tr>
<td>Arthritis</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Absent</td>
<td>51.1 (91)</td>
<td>2.2 (2)</td>
<td>22.0 (20)</td>
</tr>
<tr>
<td>Present</td>
<td>48.9 (87)</td>
<td>1.1 (1)</td>
<td>19.5 (17)</td>
</tr>
<tr>
<td>Visual problems</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Absent</td>
<td>43.8 (78)</td>
<td>2.6 (2)</td>
<td>17.9 (14)</td>
</tr>
<tr>
<td>Present</td>
<td>56.2 (100)</td>
<td>1.0 (1)</td>
<td>23.0 (23)</td>
</tr>
<tr>
<td>Hearing problems</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Absent</td>
<td>42.4 (75)</td>
<td>0.0 (0)</td>
<td>17.3 (13)</td>
</tr>
<tr>
<td>Present</td>
<td>57.6 (102)</td>
<td>2.9 (3)</td>
<td>22.5 (23)</td>
</tr>
<tr>
<td>Poor sleep</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Absent</td>
<td>74.5 (133)</td>
<td>1.5 (2)</td>
<td>20.3 (27)</td>
</tr>
<tr>
<td>Present</td>
<td>25.3 (45)</td>
<td>2.2 (1)</td>
<td>22.2 (10)</td>
</tr>
<tr>
<td>General weakness</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Absent</td>
<td>70.8 (126)</td>
<td>0.0 (0)</td>
<td>15.1 (19)</td>
</tr>
<tr>
<td>Present</td>
<td>29.2 (52)</td>
<td>5.8 (3)</td>
<td>34.6 (18)</td>
</tr>
<tr>
<td>Urinary incontinence</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Absent</td>
<td>59.6 (106)</td>
<td>1.9 (2)</td>
<td>15.1 (16)</td>
</tr>
<tr>
<td>Present</td>
<td>40.4 (72)</td>
<td>1.4 (1)</td>
<td>29.2 (21)</td>
</tr>
<tr>
<td>Co-morbidity</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>No health problem</td>
<td>13.10 (23)</td>
<td>0.0 (0)</td>
<td>16.7 (3)</td>
</tr>
<tr>
<td>1-2 health problems</td>
<td>34.1 (60)</td>
<td>3.4 (2)</td>
<td>15.3 (9)</td>
</tr>
<tr>
<td>3 or more health problems</td>
<td>52.8 (93)</td>
<td>1.1 (1)</td>
<td>23.2 (22)</td>
</tr>
</tbody>
</table>

*Note. *p < .05. **p < .01. ***p < .001.*
None of the centenarians who were not rated as weak were reported to be in poor health. For urinary incontinence, 72 (40.4%) centenarians were reported to have the condition. Out of those with urinary incontinence, only one centenarian was reported being in poor health, 21 (29.2%) centenarians in fair health, 28 (29.2%) centenarians in good health and 22 (30.6%) centenarians in excellent health.

No significant association between level of co-morbidity of six health problems and proxy ratings of centenarian health was found. A total of 23 (13.1%) centenarians reported absence of all six health conditions, 60 (34.1%) reported the presence of one to two health conditions, and 93 (52.8%) centenarians reported the presence of three or more health conditions. Out of the 23 centenarians who reported absence of all six health problems, none were rated as being in poor health. However, for those with high prevalence rates of health problems, 45 (47.4%) centenarians were rated as being in good and 27 (28.4) in excellent health.

Next, I examined the associations between proxy-rated functional health (i.e., instrumental and physical activities of daily living) and proxy-rated health of the centenarians (Table 9). A significant association was found between the capacity to perform activities of daily living and proxy ratings of health of the centenarians, $\chi^2 (3, N = 197) = 39.58, p < .01$. Four (2%) centenarians were categorized as completely dependent and 2 (1%) centenarians as completely independent, 89 (48.9%) centenarians were categorized as predominantly dependent and 87 (47.8%) centenarians as predominantly independent. As expected, none of the centenarians who were completely dependent were rated as being in excellent health. For those who were predominantly dependent, 30 centenarians (33.7%) were rated as being in fair health, 40 centenarians (44.9%) in good health and 14 (15.7%) centenarians in excellent health.
Table 9

Association for Functional Health and Proxy Reports of Centenarian Health

<table>
<thead>
<tr>
<th>Functional Health</th>
<th>% (N) Proxies Reporting</th>
<th>Overall Centenarian Health</th>
<th>χ²</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Total % (N)</td>
<td>Poor</td>
<td>Fair</td>
</tr>
<tr>
<td>Completely dependent¹</td>
<td>2.20 (4)</td>
<td>25.00 (1)</td>
<td>50.00 (2)</td>
</tr>
<tr>
<td>Predominantly dependent²</td>
<td>48.90 (89)</td>
<td>5.60 (5)</td>
<td>33.70 (30)</td>
</tr>
<tr>
<td>Predominantly independent³</td>
<td>47.80 (87)</td>
<td>0.00 (0)</td>
<td>11.50 (10)</td>
</tr>
<tr>
<td>Completely independent⁴</td>
<td>1.10 (2)</td>
<td>0.00 (0)</td>
<td>0.00 (0)</td>
</tr>
</tbody>
</table>

Note. *p < .05. **p < .01. ***p < .001. On a scale of 0-28 where a lower score indicates functional impairment, 1 = score of 0, 2 = score between 1-14, 3 = score between 15-27, 4 = score of 28
For those who were predominantly dependent, 30 centenarians (33.7%) were rated as being in fair health, 40 centenarians (44.9%) in good health and 14 (15.7%) centenarians in excellent health. For centenarians in the predominantly independent category, none were rated as being in poor health, 39 (44.8%) centenarians were reported as being in good health and 38 (43.7%) centenarians in excellent health. For the two centenarians in the completely independent category, both were rated as being in excellent health by the proxies.

In summary, major findings indicated that proxy-ratings of centenarian health were significantly associated with only certain health indicators such as presence of congestive heart failure, general weakness and proxy-rated functional health. Based on the results of cross tabulations, it was found that the majority of proxies rated centenarians as being in good or excellent health irrespective of high levels of co-morbidities. Centenarians differed from octogenarians on prevalence rates of congestive heart failure, anemia, and general weakness but not other diseases. The next section of results focuses on explaining the relationships between individual, social, and community resources and their effects on health outcomes among centenarians.

The Effects of Personal, Community-Care and Social Resources on Centenarian Health

Fully recursive models and direct effects on health. A major aim of the current section was to understand the role of demographic characteristics, personal resources, social resources, and community resources in predicting differential health outcomes among centenarians. The second research question addressed whether psychosocial resources affected heath outcomes directly. Four fully recursive models using each of the four health indicators were tested in order to
understand the direct relationships between demographic characteristics, personality characteristics, community-care resources, social support and health.

**Fully recursive model testing proxy-rated health.** The first fully recursive model tested the effects of demographic characteristics, personality characteristics, community-care resources, social support on proxy-rated health. Results indicated that older age, $\beta = -0.14, p < .05$, being African American, $\beta = -0.12, p < .05$ and higher levels of Neuroticism, $\beta = -0.27, p < .01$, were associated with lower social support.

Proxy-rated centenarian health was lower for those who received more unpaid services from family members, $\beta = -0.32, p < .01$. Services received from friends, $\beta = 0.25, p < .01$ were positively related to proxy-rated health of the centenarians suggesting that proxy-rated health was better for those who received more services from friends. A statistical trend was observed suggesting a negative association between Neuroticism and proxy-rated health of the centenarians, $\beta = -0.14, p < .10$, that is, those with high levels of Neuroticism received poorer health ratings from the proxies.

**Fully recursive model testing functional health.** The second fully recursive model tested the effects of demographic characteristics, personality characteristics, community-care resources, social support on functional health. Results indicated that older age, $\beta = -0.14, p < .05$, being African American, $\beta = -0.13, p < .05$ and higher levels of Neuroticism, $\beta = -0.27, p < .01$, were associated with lower social support. More services from family members was associated with higher social support, $\beta = 0.23, p < .05$.

Older age, $\beta = -0.26, p < .001$, living in care facilities, $\beta = -0.47, p < .001$, and more services received from family, $\beta = -0.31, p < .01$ were associated with lower functional health. Those who received more services from friends were rated as being in better functional health, $\beta$
A statistical trend was observed suggesting a negative association between paid services and proxy-rated functional health of the centenarians, $\beta = -0.16, p < .10$, (i.e., centenarians who received more paid services were rated lower on functional health).

**Fully recursive model testing chronic conditions.** The third fully recursive model tested the effects of demographic characteristics, personality characteristics, community-care resources, social support on health problems. Results indicated that older age, $\beta = -0.13, p < .05$, higher levels of Neuroticism, $\beta = -0.27, p < .01$, and lower levels of Extraversion, $\beta = 0.27, p < .01$ were associated with lower social support. More services from family members was associated with higher social support, $\beta = 0.23, p < .05$.

A positive relationship between residence and the total number of chronic conditions at the time of inquiry was observed, $\beta = 0.22, p < .01$, indicating that those who lived independently were reported to have fewer chronic conditions.

**Fully recursive model testing health problems.** The fourth fully recursive model tested the effects of demographic characteristics, personality characteristics, community-care resources, social support on health problems. Results indicated that older age, $\beta = -0.13, p < .05$, higher levels of Neuroticism, $\beta = -0.27, p < .00$, and lower levels of Extraversion, $\beta = 0.27, p < .01$ were associated with lower social support. More services from the family members was associated with higher social support, $\beta = 0.23, p < .05$.

Number of health problems was negatively associated with residence, $\beta = -0.22, p < .01$, that is, those who lived independently reported more health problems. A statistical trend suggested a positive relationship between gender and health problems, $\beta = 0.09, p < .10$, with women reporting more health problems than men. Direct effects of psychosocial resources on health outcomes are presented in Table 10.
<table>
<thead>
<tr>
<th>Variables</th>
<th>Proxy-rated health</th>
<th>Proxy-rated functional health</th>
<th>Chronic diseases</th>
<th>Health problems</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>B</td>
<td>β</td>
<td>t value</td>
<td>B</td>
</tr>
<tr>
<td>Age</td>
<td>0.12</td>
<td>0.03</td>
<td>0.42</td>
<td>-0.95</td>
</tr>
<tr>
<td>Gender (1=M 2=F)</td>
<td>0.17</td>
<td>0.08</td>
<td>1.10</td>
<td>-1.09</td>
</tr>
<tr>
<td>Ethnicity (1=C 2=AA)</td>
<td>0.06</td>
<td>0.03</td>
<td>0.42</td>
<td>-0.90</td>
</tr>
<tr>
<td>Residence (1=P 2=PC 3=NH)</td>
<td>-0.23</td>
<td>-0.26**</td>
<td>-3.19</td>
<td>-4.03</td>
</tr>
<tr>
<td>Neuroticism</td>
<td>-0.01</td>
<td>-0.14+</td>
<td>-1.68</td>
<td>-0.02</td>
</tr>
<tr>
<td>Extraversion</td>
<td>0.00</td>
<td>-0.01</td>
<td>-0.13</td>
<td>0.03</td>
</tr>
<tr>
<td>Family</td>
<td>-0.09</td>
<td>-0.32**</td>
<td>-2.60</td>
<td>-0.85</td>
</tr>
<tr>
<td>Friends</td>
<td>0.10</td>
<td>0.25*</td>
<td>2.03</td>
<td>1.41</td>
</tr>
<tr>
<td>Paid support</td>
<td>-0.01</td>
<td>-0.04</td>
<td>-0.38</td>
<td>-0.40</td>
</tr>
<tr>
<td>Social support</td>
<td>0.02</td>
<td>0.12</td>
<td>1.34</td>
<td>0.15</td>
</tr>
</tbody>
</table>

*Note.* Family = services received from family members; Friends = services received from friends; Paid support = services received from paid professionals; M= males, F= Females, C= Caucasians, AA = African Americans, P = Private Home, PC = Personal Care Home, NH = Nursing Home. ***p < .001. **p < .01. *p < .05. +p < .10.
To test the third research question of whether social support mediated the relationship between psychosocial resources and health outcomes, the fully recursive models were reduced based on the conceptual model and the significance of paths. Non-significant paths were deleted retaining the significant effects using the criterion of parsimony. The reduced models tested the effects of demographic characteristics (i.e., age, gender, residence, and ethnicity), through social support on the four health indicators (i.e., proxy-rated centenarian health, proxy-rated functional health, chronic diseases, and health problems). The fit indices for the four fully recursive and reduced models are summarized in Table 11.

Table 11

*Fit Indices for Nested Sequence of Cross-Sectional Models (N=197)*

<table>
<thead>
<tr>
<th>Model</th>
<th>$\chi^2$(df)</th>
<th>p-value</th>
<th>CFI</th>
<th>RMSEA</th>
<th>SRMR</th>
</tr>
</thead>
<tbody>
<tr>
<td>M1. Proxy-rated centenarian health</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>M1.1: Fully Recursive Model</td>
<td>0.00 (0)</td>
<td>0.00</td>
<td>1.00</td>
<td>0.00</td>
<td>0.00</td>
</tr>
<tr>
<td>M1.2: Reduced Model</td>
<td>5.65(10)</td>
<td>0.84</td>
<td>1.00</td>
<td>0.00</td>
<td>0.02</td>
</tr>
<tr>
<td>M2. Proxy-rated functional health</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>M2.1: Fully Recursive Model</td>
<td>0.00 (0)</td>
<td>0.00</td>
<td>1.00</td>
<td>0.00</td>
<td>0.00</td>
</tr>
<tr>
<td>M2.2: Reduced Model</td>
<td>8.01(9)</td>
<td>0.53</td>
<td>1.00</td>
<td>0.01</td>
<td>0.02</td>
</tr>
<tr>
<td>M3. Chronic diseases</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>M3.1: Fully Recursive Model</td>
<td>0.00 (0)</td>
<td>0.00</td>
<td>1.00</td>
<td>0.00</td>
<td>0.00</td>
</tr>
<tr>
<td>M3.2: Reduced Model</td>
<td>9.30(13)</td>
<td>0.74</td>
<td>1.00</td>
<td>0.00</td>
<td>0.02</td>
</tr>
<tr>
<td>M4. Health conditions</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>H4.1: Fully Recursive Model</td>
<td>0.00 (0)</td>
<td>0.00</td>
<td>1.00</td>
<td>0.00</td>
<td>0.00</td>
</tr>
<tr>
<td>H4.2: Reduced Model</td>
<td>13.27(13)</td>
<td>0.43</td>
<td>0.99</td>
<td>0.01</td>
<td>0.03</td>
</tr>
</tbody>
</table>

Note. *p < .05. Values of the fully recursive model indicate saturation, $H_1=H_0$. Fully recursive models are just-identified indicating full use of all parameters and degrees of freedom.
The Four Reduced Models.

**Proxy-rated health.** The fit indices for the reduced model 1.1, $\chi^2 (10) = 5.65$, $p = .84$, CFI = 1.00, RMSEA = .00, SRMR = .02 indicated that the model fit the data well. The non-significant paths from gender, residence, friends support and paid support to social support as well as from age, ethnicity, extraversion, family support, friend support and paid support to proxy-rated health were deleted from the model using the criterion of parsimony.

Figure 5 represents the reduced model examining the effects of psychosocial resources on proxy-rated centenarian health. Results indicated that older age, $\beta = -.15, p < .05$ was associated with lower social support and centenarians with higher levels of Neuroticism received lower social support, $\beta = -.28, p < .001$. Caucasians received more social support than African Americans, $\beta = -.12, p < .05$. A significant positive association was found between Extraversion, services received from family, and social support. Higher level of Extraversion was associated with greater degree of social support, $\beta = .27, p < .001$. Those who lived independently were reported to be in better health, $\beta = -.31, p < .001$. Centenarians with higher family support reported to be in poor health, $\beta = -.33, p < .01$ and those with more support from friends were reported to be in better overall health, $\beta = .26, p < .05$. The modified model accounted for 8% of the variance in proxy-rated centenarian health and 36% of the variance in social support.

**Proxy-rated functional health.** Next, the effects of demographic characteristics, personal resources, community-care resources, and social support on proxy-rated functional health of the centenarians were examined (Figure 6). The fit indices for the reduced model 2.1, $\chi^2 (9) = 8.01$, $p = .53$, CFI = 1.00, RMSEA = .01, SRMR = .02 indicated that the model fit the data well.
Figure 5. Reduced model testing the effects of personal, social, and community resources on proxy-rated centenarian health.

Ethnicity: 1 = Caucasians 2= African Americans
Figure 6. Reduced model testing the effects of personal, social, and community resources on proxy-rated functional health. Ethnicity: 1 = Caucasians 2 = African Americans, Residence: 1 = Private Home 2 = Personal Care Home 3 = Nursing Home
The non-significant paths from gender, residence, friends support and paid support to social support as well as from gender, ethnicity, Neuroticism, Extraversion, and paid support to functional health were deleted from the model using the criterion of parsimony. Older age was associated with lower social support, $\beta = -.15, p < .05$, Caucasians received more social support than African Americans, $\beta = -.12, p < .05$, and centenarians with higher levels of Neuroticism received lower social support, $\beta = -.29, p < .001$. A significant positive association was found between residence, Extraversion, services received from family, and social support. Higher level of Extraversion was associated with greater degree of social support, $\beta = .27, p < .001$. More services from family indicated higher social support, $\beta = .29, p < .001$.

Older individuals had poorer proxy-rated functional health, $\beta = -.31, p < .001$. Those who lived in care facilities reported poorer functional health $\beta = -.52, p < .001$. Those who received more services from family members had poorer proxy-rated functional health, $\beta = -.37, p < .001$, and centenarians who received more services from friends reported better functional health, $\beta = .33, p < .01$. The modified model accounted for 40% of the variance in proxy-rated functional health and 36% of the variance in social support.

**Chronic diseases.**

The third reduced model assessed the effects of psycho-social resources on the number of chronic diseases (Figure 7). The fit indices for the reduced model $3.1, \chi^2 (13) = 9.30, p = .74$, CFI $= 1.00$, RMSEA $= .00$, SRMR $= .02$, indicated that the model fit the data well. The non-significant paths from gender, ethnicity, residence, friends support and paid support to social support as well as from age, gender, ethnicity, Neuroticism, Extraversion, family support, friend support and paid support to chronic diseases were deleted from the model using the criterion of parsimony.
Figure 7. Reduced model testing the effects of personal, social, and community resources on chronic diseases

Residence: 1 = Private Home 2 = Personal Care Home 3 = Nursing Home
Results indicated that age and Neuroticism were negatively associated with social support. Older individuals had lower social support, $\beta = -.16$, $p < .01$. Centenarians with higher levels of Neuroticism received less social support, $\beta = -.29$, $p < .001$. Centenarians with higher levels of Extraversion received more social support, $\beta = .26$, $p < .001$ and those who received more services from family members were reported as receiving more social support, $\beta = .29$, $p < .001$. Residence was positively associated with chronic conditions indicating that those who lived in care facilities had more chronic conditions, $\beta = .26$, $p < .001$. The modified model accounted for 6% of the variance in chronic diseases and 36% of the variance in social support.

**Health problems.**

Next, the effects of psychosocial resources on health problems were tested (Figure 8). The fit indices for the reduced model $4.1$, $\chi^2 (13) = 13.27$, $p = .43$, CFI = 0.99, RMSEA = .01, SRMR = .03 indicated that the model fit the data well. The non-significant paths from gender, ethnicity, residence, friends support and paid support to social support as well as from age, gender, ethnicity, Neuroticism, Extraversion, family support, friend support and paid support to health problems were deleted from the model using the criterion of parsimony. Age, ethnicity, and Neuroticism were negatively associated with social support. Older age was associated with lower social support, $\beta = -.16$, $p < .05$. Centenarians with higher degree of Neuroticism were reported as receiving less social support, $\beta = -.29$, $p < .001$. Extraversion and family support were positively related to social support. Higher levels of Extraversion were associated with greater social support, $\beta = .26$, $p < .001$. Centenarians who received more services from family members were rated as having more social support, $\beta = .29$, $p < .001$. Those who lived in care facilities had fewer health problems, $\beta = -.22$, $p < .01$. The model accounted for 6% of the variance in health problems and 36% of the variance in social support.
Figure 8. Reduced model testing the effects of personal, social, and community resources on health problems. Ethnicity: 1 = Caucasians 2 = African Americans, Residence: 1 = Private Home 2 = Personal Care Home 3 = Nursing Home.
Role of social support as a mediator. The four reduced models tested the meditational effects of support between resources and health outcomes by specifying the indirect effects using the bootstrap method (Shrout & Bolger, 2002). Indirect effects of social support in determining the relationship between demographic characteristics, personality characteristics, and community-care resources and all the health outcomes were expected, however social support only predicted functional health, $\beta = .17, p < .05$ and not the other three health outcomes. The decomposition of effects from resources to functional health through social support is presented in Table 12. Results indicated that age yielded significant total effects, $\beta = -.27, p < .001$ and direct effects, $\beta = -.26, p < .001$ on functional health but no significant indirect effects were found. Significant total effects, $\beta = -.47, p < .001$ and direct effects, $\beta = -.47, p < .001$ of residence on functional health were also found but no indirect effects. Finally, significant direct and total effects were found for support from family ($\beta = -.31, p < .001$ and $\beta = -.29, p < .001$, respectively) and friends ($\beta = .38, p < .001$ for direct and total effect) but the indirect effects were not significant. Overall, analyses suggested direct effects of psychosocial resources on functional health but not mediating effects through social support.

Overall results indicated that demographic characteristic, personality, and community-care characteristics were stronger determinants of social support than of health in very late life. Residence directly influenced all four indicators of health. The model predicting the effects of psychosocial resources on functional health accounted for most of the variance highlighting the important association between psychosocial resources and functional health in very late life. The present findings suggest that more family support is associated with lower functional health. It is plausible to assume a bi-directional relationship between support and health. That is, centenarians with lower functional health receive more support.
Table 12

*Decomposition of Mediating Effects of Social Support Between Resources and Functional Health*

<table>
<thead>
<tr>
<th>Variables</th>
<th>Total Effects</th>
<th></th>
<th></th>
<th>Direct Effects</th>
<th></th>
<th></th>
<th></th>
<th>Indirect Effects</th>
<th></th>
<th></th>
</tr>
</thead>
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<tr>
<td></td>
<td>( \beta )</td>
<td>( S.E. )</td>
<td>( t )</td>
<td>( \beta )</td>
<td>( S.E. )</td>
<td>( t )</td>
<td>( \beta )</td>
<td>( S.E. )</td>
<td>( t )</td>
<td></td>
</tr>
<tr>
<td>Age</td>
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<td>0.07</td>
<td>-4.12</td>
<td>-0.26***</td>
<td>0.07</td>
<td>-3.89</td>
<td>-0.01</td>
<td>0.01</td>
<td>-1.00</td>
<td></td>
</tr>
<tr>
<td>Gender (1=M 2=F)</td>
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<td>0.06</td>
<td>-0.86</td>
<td>-0.05</td>
<td>0.06</td>
<td>-0.84</td>
<td>-0.00</td>
<td>0.01</td>
<td>-0.20</td>
<td></td>
</tr>
<tr>
<td>Ethnicity (1=C 2=AA)</td>
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<td>0.06</td>
<td>-1.06</td>
<td>-0.05</td>
<td>0.06</td>
<td>-0.85</td>
<td>-0.01</td>
<td>0.01</td>
<td>-0.89</td>
<td></td>
</tr>
<tr>
<td>Residence (1=P 2=PC 3=NH)</td>
<td>-0.47***</td>
<td>0.06</td>
<td>-7.52</td>
<td>-0.47***</td>
<td>0.06</td>
<td>-7.44</td>
<td>-0.01</td>
<td>0.01</td>
<td>-0.54</td>
<td></td>
</tr>
<tr>
<td>Neuroticism</td>
<td>-0.08</td>
<td>0.06</td>
<td>-1.25</td>
<td>-0.05</td>
<td>0.07</td>
<td>-0.81</td>
<td>-0.03</td>
<td>0.02</td>
<td>-1.14</td>
<td></td>
</tr>
<tr>
<td>Extraversion</td>
<td>0.11*</td>
<td>0.06</td>
<td>1.70</td>
<td>0.08</td>
<td>0.07</td>
<td>1.20</td>
<td>0.03</td>
<td>0.02</td>
<td>1.70</td>
<td></td>
</tr>
<tr>
<td>Family</td>
<td>-0.29**</td>
<td>0.10</td>
<td>-2.83</td>
<td>-0.31**</td>
<td>0.10</td>
<td>-3.07</td>
<td>0.02</td>
<td>0.02</td>
<td>0.98</td>
<td></td>
</tr>
<tr>
<td>Friends</td>
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<td>0.13</td>
<td>2.98</td>
<td>0.38**</td>
<td>0.13</td>
<td>2.97</td>
<td>0.00</td>
<td>0.02</td>
<td>-0.00</td>
<td></td>
</tr>
<tr>
<td>Paid support</td>
<td>-0.16+</td>
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<td>-1.67</td>
<td>-0.16+</td>
<td>0.09</td>
<td>-1.71</td>
<td>0.00</td>
<td>0.01</td>
<td>0.36</td>
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</tr>
</tbody>
</table>

*Note.* Family = services received from family members; Friends = services received from friends; Paid support = paid services, M= males, F= Females, C= Caucasians, AA = African Americans, P = Private Home, PC = Personal Care Home, NH = Nursing Home

*+p < .10. *p < .05. **p < .01. ***p < .001*
**Role of social support as a moderator.** In order to further test the role of social support in influencing health outcomes, it was also hypothesized that social support would moderate the relationship between personal and community health-care resources and health outcomes. Considering that residence directly influenced all four health outcomes, the present study additionally explored the role of residence as a source of support for oldest-old adults. Specifically, it was hypothesized that residence may drive the level of services that are available to very old adults and may therefore moderate the relationship between community-care resources and health outcomes. Eight simple interactions terms were computed in Mplus as indicated below (Aiken & West, 1991).

1. Neuroticism* Social Support
2. Extraversion * Social Support
3. Services from family * Social Support
4. Services from friends * Social Support
5. Paid services * Social Support
6. Services from family * Residence
7. Services from friends * Residence
8. Paid services * Residence

Each regression analyses tested the effects of demographic characteristics (i.e., age, gender, ethnicity, and residence), personality (i.e., Neuroticism and Extraversion) and community-care characteristics (i.e., services from family, friends and professionals) and a single the interaction term on health outcomes. Results indicated two significant interaction effects of social support in explaining the relationship between personality and health outcomes (i.e., proxy-
rated health and health problems). Table 13 represents the regression analyses testing moderating effects.

**Table 13**

*Regression Equations Testing Moderating Effects of Social Support (N = 197)*

<table>
<thead>
<tr>
<th>Variables</th>
<th>Proxy-rated health</th>
<th>Health problems</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>B</td>
<td>B</td>
</tr>
<tr>
<td>Age</td>
<td>0.01</td>
<td>0.04</td>
</tr>
<tr>
<td>Gender</td>
<td>0.18</td>
<td>0.08</td>
</tr>
<tr>
<td>(1=M 2=F)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ethnicity</td>
<td>0.07</td>
<td>0.03</td>
</tr>
<tr>
<td>(1=C 2=AA)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Residence</td>
<td>-0.25</td>
<td>-0.28**</td>
</tr>
<tr>
<td>(1=P 2=PC 3=NH)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Neuroticism**</td>
<td>-0.01</td>
<td>-0.15*</td>
</tr>
<tr>
<td>Extraversion</td>
<td>0.00</td>
<td>0.00</td>
</tr>
<tr>
<td>Family</td>
<td>-0.10</td>
<td>-0.34**</td>
</tr>
<tr>
<td>Friends</td>
<td>0.09</td>
<td>0.23</td>
</tr>
<tr>
<td>Paid support</td>
<td>-0.00</td>
<td>-0.01</td>
</tr>
<tr>
<td>Social support**</td>
<td>0.02</td>
<td>0.10</td>
</tr>
<tr>
<td>SS</td>
<td>0.00</td>
<td>0.17*</td>
</tr>
</tbody>
</table>

*Note.* Family = services received from family members; Friends = services received from friends; Paid support = paid services, M= males, F= Females, C= Caucasians, AA = African Americans, P = Private Home, PC = Personal Care Home, NH = Nursing Home N*SS = Neuroticism * Social Support, **m** = mean centered***p < .001. **p < .01. *p < .05. †p < .10.
The first significant interaction effect was obtained for social support moderating the relationship between Neuroticism and proxy-rated health (Figure 10). First, the relationship between Neuroticism and proxy-rated health of the centenarians was negative for both groups; those with higher social support, $B = -0.001$ and those with lower social support, $B = -0.010$. However the negative relationship between Neuroticism and proxy-rated centenarian health was stronger for those who received less social support indicating a significant moderating effect of social support on the relationship between Neuroticism and proxy-rated health (Figure 9).

Centenarians with higher levels of Neuroticism and lower social support were reported having poor overall health when compared to centenarians with high levels of Neuroticism and receiving more social support.

Centenarians with higher levels of Neuroticism and lower social support were reported having poor overall health when compared to centenarians with high levels of Neuroticism and receiving more social support.

*Figure 9.* Moderating effects of social support between Neuroticism and proxy-rated health
Further, simple slope analysis was conducted using SPSS (Aiken & West, 1991) to test if the slopes were different from zero. The first step in the three step procedure included creation of two new variables (social support + 4.89 or 1 SD above the mean) and (social support -4.89 or 1 SD below the mean. Second, crossproducts of the new variables with the mean-centered predictor (Neuroticism) were computed. Third, proxy-rated health was regressed on Neuroticism, the new variable measuring social support above the mean and the crossproduct of the two. Results indicated that the simple slopes of proxy-rated health on Neuroticism were not significantly different from zero. A similar procedure was conducted to test the slopes when the value of social support was 1 SD below the mean. However, the difference was not significant. Next, t-test of significance (t = 2.26, p = .02) indicated that the regression of proxy-rated health on Neuroticism varied across the levels of social support, thus proving that the simple slopes were different from one another (Aiken & West, 1991).

The second significant interaction effect was obtained for social support moderating the relationship between Neuroticism and health problems. The relationship between Neuroticism and health problems was negative, B = -.005 for those with higher social support and positive, B = .033, for those with lower social support indicating a significant moderating effect of social support on the relationship between Neuroticism and health problems (Figure 10).
Figure 10. Moderating effects of social support between Neuroticism and health problems

Centenarians with high Neuroticism and low social support reported more health problems when compared to those with low Neuroticism and low social support. Results indicated that the simple slopes of health problems on Neuroticism were not significantly different from zero. Further, $t$-test of significance ($t = -2.68, p = .007$) indicated that the regression of health problems on Neuroticism varied across the levels of social support, thus proving that the simple slopes were different from one another (Aiken & West, 1991).

To summarize, results suggested that social support moderated the relationship between Neuroticism and proxy-rated centenarian health and also moderated the relationship between Neuroticism and health problems. Overall, social support did not act as a link between resources and health but it did play an important role in determining the strength of the relationship between personality characteristic of Neuroticism and health outcomes such as proxy-rated health and health problems.
CHAPTER 5. DISCUSSION

The present study is an attempt to address some of the limitations cited in previous research such as inconsistencies based on instruments and differential definitions of health in very old age. The present study used a multi-dimensional approach to study centenarian health by examining four different health outcomes (i.e., proxy-rated centenarian health, proxy-rated functional health, chronic diseases, and health problems). Both subjective and objective health indicators were used based on their predictive power in influencing a range of developmental outcomes (Pinquart, 2001; Uchino et al., 1999). By evaluating the four parallel models, the present study examined how psychosocial and community-care resources affected health outcomes differently. The first research objective of the present study was to gain a deeper understanding of health in very old age by examining four different health outcomes (i.e., proxy-rated centenarian health, proxy-rated functional health, chronic diseases, and health problems).

Are Centenarians Healthy?

Consistent with the literature, findings of the present study suggest that centenarians are fairly healthy and that there are variations in morbidity profiles (Andersen-Ranberg et al., 2001; Darviri et al., 2008; Evert et al., 2003). Thirty-one percent of the centenarians in our study were free from any of the six chronic diseases, and 8% of centenarians reported high levels of co-morbidity (three or more chronic diseases). Similar profiles were observed for health problems with 13% of all centenarians reporting absence of any of the six health problems but the majority reporting high levels of multiple morbidities. These variations are important in suggesting that the absence of physiological disease and health problems may not be the only essential survivorship characteristic but other health mechanisms may also be important to capture an encompassing
perspective on determinants of longevity. The groups that reported the absence of any of the six chronic conditions and health problems in the present study may be considered conceptually similar to the ‘escaper’ category in the Evert et al. study (i.e., the group who attained their 100th year of life without the diagnosis of common age-associated illnesses). It is also possible that centenarians may have acquired diseases and health problems very late in life, however, since the focus of the present study was understanding health at one hundred years of age, the age of onset of past diseases was not taken into account.

Centenarians reported higher prevalence rates of congestive heart failure, anemia and general body weakness but lower rates of diabetes, cancer, and arthritis when compared to octogenarians. Proxies rated functional health of the octogenarians significantly better when compared to centenarians but no differences were found in ratings of overall health between the two age groups. These findings in part support the literature suggesting a decline in physical and functional health with increasing age (Long & Pavalko, 2004; Ormel, Rijsdijk, Sullivan, van Sonderen, & Kempen, 2002). Past literature has indicated high prevalence rates of congestive heart failure (Andersen-Ranberg et al., 2001) and anemia (Carmel, 2001) among oldest-old adults and attributed it to age-related bodily decline. However, no differences in the prevalence rates of other chronic diseases and ratings of overall health between centenarians and octogenarians also indicate that centenarians are not necessarily reported being in poorer health as compared to younger age groups on all dimensions of health. Both lifestyle factors and advances in medical treatments could contribute to survivorship as well as differences in health profiles when comparing different age groups and cohorts. Thus, age-differences obtained in the present study may be due to cohort differences based on lifestyle factors. Age and cohort differences however, were not the focus of this research and may be difficult to explain systematically within the
limitations of the present study. Further, literature also provides explanations for genetic
predispositions and environmental factors as determinants of exceptional longevity (Perls &
Terry, 2003). As a consequence, reaching the age of 100 today may not be limited to being
disease free (Andersen-Ranberg et al.; Perls & Terry, 2003) or necessarily indicate poorer health
when compared to younger counterparts. Higher ratings of overall health for centenarians in spite
of functional impairments may suggest a possible bias in subjective health ratings due to lower
health expectations from oldest-old adults by proxy respondents.

This study also contrasted the prevalence rates of the common diseases reported in other
centenarian studies. For example, in the present study nearly 44% of the centenarians reported the
presence of hypertension at 100 years. This proportion was similar to 49% of the centenarians
diagnosed with moderate hypertension in the study by Andersen-Ranberg et al. (2001). The
proportion of those reporting the presence of diabetes mellitus (around 8%) was close to that
reported by the Japanese centenarians (9-11%) (Takayama et al., 2007). About 95% of Japanese
centenarians reported co-morbidities including diabetes mellitus, hypertension, heart disease,
stroke, fractures, and cataracts when compared to 68.1% in the present study, thus confirming a
fairly high prevalence of multiple chronic conditions among centenarians (Takayama et al.).

Functional health status of centenarians also indicated considerable variations. Only 2% of
all centenarians were categorized as completely dependent indicating that our centenarians were
fairly functional. These findings were consistent with the literature (Andersen-Ranberg et al.,
2001; Gondo et al., 2005; Willcox, Shimajiri, Kurechi, & Suzuki, 2007) where centenarians
reported to be fairly autonomous and functioning normally. Most literature on centenarian health
including the present one reported strikingly low levels of extreme disability or complete
dependency (Andersen-Ranberg et al., 2001; Gondo et al., 2005; Takayama et al., 2007; Willcox
et al.) indicating that some degree of autonomy and good functional status may be considered an important antecedent of longevity and health-related quality of life.

In order to understand centenarian health further, presence of chronic diseases, health problems and functional health were compared with proxy-ratings of centenarian health. Interestingly, no associations were found in proxy-ratings of centenarian health with specific diseases except for congestive heart failure, general weakness, and functional health of the centenarians. These findings suggest that health may have a different meaning at the limit of longevity. Proxy reports of centenarian health may not be based entirely on objective health indicators but be based on low expectations of health relative to the remaining life expectancy. Thus, from the proxy perspective, aspects of health related to daily functioning and quality of life may be more important when one has already lived to one hundred years of age than physiological aspects directly related to survivorship. This was further evident in the lack of association between multiple morbidities and proxy-rated centenarian health where proxies rated centenarian health highly in spite of high levels of co-morbidities.

**Effects of Psychosocial and Community-Care Resources on Health Outcomes in Late Life**

Services received from family were predictive of lower proxy-ratings of centenarian health and functional health. The negative relationship between family support and health may imply a need-based reverse causation indicating that centenarians who are thought to be in poor health may in turn receive more support from family members based on the health-related need. This is consistent with previous research indicating that family may serve as the most important social support among community-dwelling older adults in poor health (Schulz & Martire, 2001). Services received from friends on the other hand, predicted better functional health. This finding
is consistent with previous findings indicating positive health outcomes as a consequence of support from friends (Adams & Blieszner, 1995). These findings may provide important insights into the nature and scope of support provided by different sources such as family versus friends. Results suggest that support provided by family may be broader in scope including support in poor health as compared to services received from friends which may be limited in scope with reference to health-related needs.

Consistent with the literature (Uchino, Cacioppo, & Kiecolt-Glaser, 1996), it was expected that social support would directly predict both subjective as well as objective health outcomes. However, social support did not predict health outcomes except functional health. It was also expected that Neuroticism would affect health negatively (Shipley et al., 2007; Suls & Bunde, 2005). However, only a statistical trend suggested lower proxy-rated health for those with high levels of Neuroticism. No other effects of personality were found on centenarian health. The present study found relatively low levels of Neuroticism and high levels of social support on average for the centenarians. Low variations in the levels of the two variables under examination could also have accounted for lack of relationship.

When considering the lack of effects of personality and social support on health outcomes, it is important to understand that the participants of the present study are a sample of centenarians. Research indicates that physiological processes may largely vary based on their individual biological adaptability among oldest-old adults (Perls & Terry, 2003). Centenarian health may also be influenced by age-related physical decline over time (Long & Pavalko, 2004) thus providing alternative explanations for determinants of health in very late life. Thus, physical health among centenarians may be independent of the amount of social support received from their surroundings. After one hundred years of age, it is possible that health status determines the
amount of support received rather than a converse causal relationship which may be true for other younger age groups. It may also be necessary to examine alternative personality traits or facets such as conscientiousness which may influence health in very old age through characteristics such as discipline which may be related to better health-behaviors (Bogg & Roberts, 2004). Further, it is important to understand that reports of health in very old age may be based on the acceptance and low expectations of one’s health in extreme old age and health outcomes and may be independent of personal influences or social surroundings as predisposing factors.

The present study found important direct influences of residence on all four health outcomes. Living independently was related to better proxy-rated health, better functional health, fewer chronic diseases and more health problems. Results of the present study suggest the possibility of reverse causality indicating that poor health may be an antecedent to living in nursing homes and receiving more support rather than a consequence (Schulz et al., 2001). Residence directly predicted all four health outcomes. These findings indicate a significant role of residential characteristics in influencing health outcomes. Considering that participants in the present study were institutionalized as well as non-institutionalized oldest-old adults, health effects of residence may directly point towards the differences in the level of care received when living independently versus living in a residence. Services received in residences may represent a form of functional support and other community-based health and social resources but may not necessarily be viewed as informal support from the proxy perspective. Nonetheless, it should be mentioned that irrespective of the quality, support received in institutions may be important in influencing health outcomes among oldest-old adults. In order to capture the effects of residence, the present study tested the moderating effects of residence in determining the relation between resources and health but no moderating effects were found.
The four reduced structural models tested the effects of demographic factors, personality, community-care characteristics, and social support on four health outcomes (i.e., proxy-rated centenarian health, proxy-rated functional health, chronic diseases, and health problems) through social support. All four reduced models fit the data well but the model predicting the effects of psychosocial resources on functional health overlapped significantly with the conceptual model suggesting an important link between resources and functional health. The models testing objective health outcomes did not yield predictors of psychosocial resources. These findings suggest that the dynamics between psychosocial and community-care resources differ based on the nature of the health outcome. Newsom et al. (2008) also found that negative social exchanges affected subjective ratings of health but not objective measures such as diseases.

For all the four models, older age was associated with lower social support. This finding is consistent with the literature indicating diminished support networks among older adults (Carstensen et al., 2003). Neuroticism and Extraversion predicted social support in all four models. These findings are also consistent with the literature which suggests that satisfaction with social support is negatively correlated with Neuroticism (Sarason et al., 1987) and extraversion affects social support through higher help-seeking behavior (Swickert et al., 2002). As expected, services received from family predicted perceptions of social support positively. These results are consistent with the literature that support services received from family are a significant source of social support for older adults (Schulz & Martire, 2001). This might be especially relevant for oldest-old adults where support from family may serve a dual role of providing situation-based measurable support in terms of services provided (Uchino et al., 1999) which in turn affects the broader aspects of perceived social provisions, a more qualitative function from the perspective of the proxies as well as the centenarians. These results could, however, be biased if family members
as primary caregivers to the centenarians also reported their own perceptions of social support received by the centenarians.

All the four models tested the direct effect of social support on health outcomes. It was expected that social support would predict both subjective as well as objective health outcomes but social support only predicted functional health among centenarians. No relationship was found between social support and other health outcomes. These findings were contrary to previous research suggesting the role of social support in predicting self-rated health (Idler & Benyami, 1997). However, it is important to understand that the present data are based on proxy-reports of perceived health and social support. Proxies may rate social support received by the centenarians based on the instrumental services needed. After controlling for the amount of services received, the relationship between socials support and proxy-rated health may not be significant.

Although past research indicated that social support can significantly predict physiological processes (Uchino et al., 1999), the present study did not support this finding. The fact that social support did not influence disease outcomes but only functional health among centenarians highlights the important role of social support as a determinant of health-related quality of life in very old age. Though the role of social support in predicting health across the four models was limited, the significant role of social support in predicting functional health was consistent with the literature (MacDonald, 2007) suggesting that social support among centenarians may be most relevant in determining everyday functioning as a late life outcome. Out of the four health outcomes, lower Neuroticism was directly associated with better proxy-rated health. This finding was consistent with the literature that lists Neuroticism as a significant predictor of global rating of health (Svedberg, Bardage, Sandin, & Pedersen, 2006). Literature suggests that psychosocial
resources play an important role in adaptation and other late life outcomes (Martin, 2002). Social resources therefore may relate to longevity but are not directly related to health in very late life. However, age, residence, personality characteristics and receipt of community-care services appear to be important for mobilization of social support thus making social support an important late life outcome in itself.

Results indicated that older age, ethnicity, and living in care facilities were associated with lower functional health. These effects were consistent with previous research suggesting age-related functional decline (Willcox et al., 2007) and lower functional status for older African Americans (Smith & Kington, 1997). Services received from family were predictive of lower proxy-ratings of functional health. As previously mentioned, the negative relationship between family support and health may imply a need-based reverse causation indicating that dependent centenarians received more support from the family members based on the health-related need. This is consistent with previous research indicating an important role of family as a social support system especially among older adults in poor health (Schulz & Martire, 2001).

To summarize, functional health emerged as the most relevant health outcome and most representative of the conceptual model designed to examine the influences of multiple psychosocial and community-care resources on health outcomes. Psychosocial resources in very late life were least predictive of disease outcomes among oldest-old adults consistent with the premise that physiological processes may largely vary based on their individual biological predisposition and adaptability among oldest old adults (Perls & Terry, 2003).

**Moderating Role of Social Support**

The present study found significant interaction effects between neuroticism and social support on proxy-rated centenarian health as well as health problems. Previous literature has
attempted to study the effect of Neuroticism and social support on various health outcomes. For example, Lauver and Johnson (1997) found that Neuroticism was directly related to health outcomes but no interaction between Neuroticism and social support on health outcomes such as pain was found. In the present study, centenarians with high levels of support received high ratings on proxy-rated health irrespective of the levels of Neuroticism. However, when social support was low, those with high levels of Neuroticism were most likely to be rated as being in poor health. The second interaction found that higher social support was associated with more health problems regardless of personality. Though the findings of the second interaction effect are somewhat puzzling, the possibility of a reverse causation (i.e., high support as a response of more health problems) cannot be ruled out. However, when social support was low, higher Neuroticism was associated with more health problems. In both moderation effects, centenarians with high levels of Neuroticism and less social support were prone to poor health outcomes.

Overall, social resources and community-care resources were found to affect functional dimensions of centenarian health directly. Tests and variances for all the four models supported the finding that the paths specified in the conceptual model best predicted proxy-rated functional health among centenarians when comparing the four health outcomes. The overall findings support the notion that psychosocial determinants affected various dimensions of health differently.

Limitations of the Study

Several important limitations of the present study need to be considered. The foremost consideration is that centenarians may be prone to selection bias (Andersen-Ranberg et al., 2001). They may have been relatively healthier than their fellow birth cohort members who did
not reach the age of 100. Such demographic selection would imply relatively less variation in centenarian profiles. However, the results of the present study indicate that centenarians can still be heterogeneous leading to variations in health and functional status. Though it was not the focus of the present study, genetic and biological contributions to health were not included in this study.

The second drawback involved the source of information. Proxy reports were used as the primary source of data collection in the present study. Given the high rates of non-response among centenarian participants (Yi et al., 2009), obtaining information from a proxy informant is preferable to obtaining no outcome information at all (Williams et al., 2006). The literature suggests that proxies often rate others worse on health-related quality of life than the individuals rate themselves (Williams et al.). The agreement between self-reports and proxy-reports of more observable measures such as instrumental functioning is reported to be greater than non-observable traits such as depression (Magaziner, Zimmerman, Gruber-Baldini, Hebel, & Fox, 1997). In general, agreement and bias between self-reports and proxy-reports differ based on the health domain studied and how it was measured (Magaziner et al.). Although the present study did not test for discrete differences between proxy reports, self-reports and actually physical examination data, a certain amount of bias for non-observable measures such as personality characteristics cannot be ruled out. Further, proxy-ratings may also influence relationships among variables. For instance, given that proxy informants in the present study may also be the primary caregivers of the centenarians, ratings of social support may be influenced by the personal perceptions of the care and services provided to the centenarians and may be independent of the health status of the participants. Proxy-reports of social support may thus explain the lack of relationship between social support and health outcomes except functional health.
Third, the measurement of health outcomes, such as number of chronic diseases and health problems, was also a limitation. In the present study, health information was collected from the best available sources which included multiple sources of data such as physician’s records, proxy-reports, self-reports or nursing home records which may have different degrees of accuracy and measurement criteria. Also, the centenarians were not clinically diagnosed for the presence of any disease to be included in the study. Literature suggests that recall of diagnosis is accurate for well-defined diseases but not for health problems (Evert et al., 2003). Moreover, it is uncommon that extremely old people undergo high-level clinical examinations, so underlying pathological conditions tend to be under diagnosed (Andersen-Ranberg et al., 2001). For example, it is difficult to measure the accuracy of reports of general weakness among centenarians as reported by self or proxies when compared to diabetes or hypertension. Other studies have reported that under reporting of some life-threatening diseases can occur as a result of denial (Evert et al., 2003) but among centenarians this be may be due to frequent physical examinations or physician visits. Thus, some diagnosed diseases could also have been missed. A direct comparison of the present study to other centenarian studies is difficult due to different instruments used to measure variables.

Another limitation points at the inclusion of institutionalized as well as community-dwelling centenarians in the same health study. Although it was not the focus of the study, it is important to understand that for oldest-old adults, residence may drive a number of important variables included in the study such as number of services received and perceived support. Further, residential status may also be a function of their health status which may influence the results of the present study. However, the present study does contribute effectively in understanding the mechanisms of support and its influences on health by conceptually isolating
the sources of support by relating the actual services received by centenarians to the broader informal support received as reported by the proxies. Limited sample size did not allow studying these effects separately for institutionalized versus non-institutionalized centenarians.

The literature suggests that there is an effect of social support on health over time (Unicho et al. 1999). However, the present study is limited due to a cross-sectional design. This finding suggests a need to use longitudinal and cross-sequential designs to understand the long-term effects of support on health in very late life as well as to test the bi-directional relationships between resources and health more optimally. Although previous literature suggests that presence or lack of cognitive impairment among centenarians did not affect which morbidity profiles subjects fell into (Evert et al., 2003), it must be acknowledged that the prevalence rates of diseases reported in the present study did not include dementia or cognitive impairment, and possible associations with other health indicators cannot be ruled out. There are several additional limitations of this study. For example, findings are based on a sample of the Georgia Centenarian Study which is limited to data collected in the state of Georgia and may not be representative of a national sample. Further, the community-care variables available in the secondary data may not adequately capture the community context as conceptualized in the theoretical model. The community variables in the present study did not necessarily report the total number of services available to all the participants. Services received from the family members and friends signified situation-based community support which may be available differently to participants based on the individual needs and context whereas paid services in the community indicated community resources which may be available to all participants.
Practical Implications

The results of the present study make an important contribution by identifying several determinants of health in very late life. The significant association between residential status and health in later life provides important explanations for health-related reasons for the choice of residence in late life. For example, those in good functional health choose to live at home.

Further, significant effects of community-based services on social support have policy implications. Higher ratings of social support for those who receive more services indicates a need to encourage more policies and programs that aid availability and accessibility of health-related services for the older adults in the community. For example, literature cites the important role of community-based programs such as Meals-on-Wheels targeted towards community-based older adults at nutritional risk (Coulston, Craig, Voss, 1996). Findings of the present study encourage the dissemination of such programs and suggest positive effects on health-related quality of life of oldest-old adults. Different resources indicate different needs for interventions. For example, the present study indicates an important role of social support on functional health. This is a major finding of the current study suggesting the need for interventions that provide structural as well as functional social support to oldest-old adults.

Findings suggesting the effects of neuroticism on social support and proxy-rated health are useful to health professionals, caregivers or individuals directly working with older adults in order to identify those with high levels of Neuroticism and low levels of Extraversion as at-risk groups for lesser social support. The Health service literature views factors influencing health outcomes based on their degree of mutability, that is their ability to be altered or changed (Andersen & Newman, 1973). Based on the categorization by Andersen and Newman (1973), demographic characteristics as well as personality traits can be categorized as low in mutability as they cannot
be easily altered, whereas enabling factors such as community-care services or social support can be considered as highly mutable since these can be easily changed. In the present study, services received from family and friends are associated with higher social support and better functional health. These findings indicate important practical implications to introduce interventions that pay attention to altering mutable characteristics by increasing services available in the community of the oldest-old adults to bring about a positive change in health and functioning.

The findings of this study elaborate on resources as determinants of health-related quality of life and provide insights into factors that reduce the health risks such as functional limitations, chronic disease and health problems in very late life. As a result of this study, a better understanding of the relative importance of resources in influencing health may help in the formation and effective implementation of physical and functional health promotion programs for older adults with the goal of enabling very old adults to maintain an independent and healthy life.
REFERENCES


Coulston, A. Craig, L., & Voss, A. Meals-on-wheels applicants are population at risk for poor nutritional status. *Journal of American Dietetic Association, 96* (6), 570-573.


Plochg, T., & Klazinga, N. S. (2002). Community-based integrated care: myth or must?


APPENDIX A

DEMOGRAPHIC QUESTIONS

1. Age of the centenarian (in years)

2. Gender
   0 = Male      1 = Female

3. Residential Status of the centenarian
   1 = Private Home
   2 = Nursing Home
   3= Personal Care Home

4. Ethnicity
   1 = White/Caucasian
   2 = Black/African American

5. Education
   1 = Some high school
   2 = High school complete
   3 = Some college
   4 = College Degree
   5 = Graduate Degree
APPENDIX B

PERSONAL RESOURCES

Revised Neo Personality Inventory (Neo Pi-R) (Costa & Mccrae, 1992)

1 = Strongly Disagree  2 = Disagree  3 = Neutral  4 = Agree  5 = Strongly Agree

* Indicates items should be reverse scored before computing the scale total.

NEUROTICISM

1. Feels easily frightened
2. Often feels tense and jittery
3. Often worries about things
4. Frightening thoughts come to him/her
5. Feels fearful or anxious
6. Worrier
7. Seldom apprehensive about future*
8. Fewer fears than most people*
9. Gets angry at way treated
10. Known as hot-blooded and quick-tempered
11. Often gets disgusted with people
12. Even-tempered person*
13. Not considered as touchy or temperamental*
14. Takes a lot to get him/her mad*
15. Feels completely worthless
16. Sometimes experiences sense of guilt or sinfulness
17. Low opinion of herself
18. Pretty bleak and hopeless
19. When things go wrong gets discouraged
20. Rarely feels lonely or blue*
21. Seldom sad or depressed*
22. Dreads making social blunder
23. Feels inferior to others
24. Hardly bear to face them - if done wrong things
25. Gets embarrassed for other people
26. Seldom feels self-conscious*
27. Doesn’t embarrass him/her if people ridicule*
28. Feels comfortable in presence of authorities*
29. Trouble resisting his/her cravings
30. Having her favorite food - tends to eat too much
31. Sometimes eats himself/herself sick
32. Does things on impulse
33. Rarely over indulges*
34. Little difficult resisting temptation*
35. Seldom gives in to him/her*
36. Keep feelings under control*
37. Feels capable of coping*
38. Feels helpless
39. Under great deal of stress
40. Often hard to make up his/her mind

41. Keeps a cool head in emergencies*

42. Can handle himself/herself pretty well in crisis*

43. Still can make a good decision*

44. Pretty stable emotionally*

45. Felt bitter and resentful

46. Minor annoyances can be frustrating

47. Dreads making social blunder

48. So ashamed that wanted to hide

**EXTRAVERSION**

1. Likes most people

2. Known as warm and friendly

3. Really enjoys talking to people

4. Finds it easy to smile

5. Strong emotional attachments

6. Takes personal interest in people

7. People think of him/her as somewhat cold and distant*

8. Doesn’t get much pleasure from chatting*

9. Likes to have a lot of people around

10. Feels the need for other people

11. Rather vacation on beach

12. Enjoys parties with lots of people
13. Social gatherings are usually boring*
14. Prefers to work on jobs alone*
15. Usually prefers to do things alone*
16. Shies away from crowd*
17. Dominant, forceful and assertive
18. Fails to assert himself/herself*
19. People look to him/her to make decisions
20. People look to her to make decisions
21. Lets others do the talking in meetings
22. Do most of the talking
23. Rather go one way than be a leader*
24. Doesn’t find it easy to take charge
25. Does things vigorously
26. Often feels she is bursting with energy
27. Seems to be in a hurry
28. Life is fast-paced
29. Very active person
30. Leisurely style in work and play
31. Work is likely to be slow but steady
32. Not as quick and lively*
33. Often craves excitement
34. Sometimes done things for kicks and thrills
35. Likes to be where the action is
36. Loves the excitement of roller coaster
37. Is attracted to bright and flashy styles
38. Being part of crowd at sporting events
39. Believes that laws and social policies should change*
40. Tends to avoid movies that are shocking or scary*
41. Sometimes experiences intense joy or ecstasy
42. Bubbles with happiness
43. Is cheerful and high-spirited
44. Laughs easily
45. Never jumped for joy*
46. Not a cheerful optimist*
47. Doesn’t consider himself/herself light hearted*
48. Rarely uses words like fantastic experience*
APPENDIX C
COMMUNITY-CARE RESOURCES

PERSONAL CARE SERVICES

1. In the past six months, did someone have to help him/her with personal care, for example helping to bathe, dress, feed or toilet care?  
   1 = Yes  
   0 = No
   If yes, 1a. who helped in this way?

<table>
<thead>
<tr>
<th>1= Yes</th>
<th>0=No</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Unpaid family member</td>
</tr>
<tr>
<td></td>
<td>Unpaid friend</td>
</tr>
<tr>
<td></td>
<td>Someone hired to help</td>
</tr>
</tbody>
</table>

NURSING CARE SERVICES

2. In the past six months, did she/she have any nursing care, for example treatments or medications prescribed by a doctor?  
   1 = Yes  
   0 = No
   If yes, 2a. who helped in this way?

<table>
<thead>
<tr>
<th>1= Yes</th>
<th>0=No</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Unpaid family member</td>
</tr>
<tr>
<td></td>
<td>Unpaid friend</td>
</tr>
<tr>
<td></td>
<td>Someone hired to help</td>
</tr>
</tbody>
</table>
CONTINUOUS SUPERVISION

3. During the past six months, was there any period that someone had to be with him/her all the time to look after?  
   1 = Yes  0 = No

   If yes, 3a. who helped in this way?

<table>
<thead>
<tr>
<th>1 = Yes</th>
<th>0 = No</th>
</tr>
</thead>
<tbody>
<tr>
<td>Unpaid family member</td>
<td></td>
</tr>
<tr>
<td>Unpaid friend</td>
<td></td>
</tr>
<tr>
<td>Someone hired to help</td>
<td></td>
</tr>
</tbody>
</table>

CHECKING SERVICES

4. In the past six months, did someone regularly check on him/her by phone or in person?  
   1 = Yes  0 = No

   If yes, 4a. who helped in this way?

<table>
<thead>
<tr>
<th>1 = Yes</th>
<th>0 = No</th>
</tr>
</thead>
<tbody>
<tr>
<td>Unpaid family member</td>
<td></td>
</tr>
<tr>
<td>Unpaid friend</td>
<td></td>
</tr>
<tr>
<td>Someone hired to help</td>
<td></td>
</tr>
</tbody>
</table>
**HOMEMAKER-HOUSEHOLD SERVICES**

5. During past six months did someone have to help him/her with routine household chores such as cleaning, washing clothes? 

1 = Yes  
0 = No

If yes, 5a. who helped in this way?

<table>
<thead>
<tr>
<th>1= Yes</th>
<th>0=No</th>
</tr>
</thead>
<tbody>
<tr>
<td>Unpaid family member</td>
<td></td>
</tr>
<tr>
<td>Unpaid friend</td>
<td></td>
</tr>
<tr>
<td>Someone hired to help</td>
<td></td>
</tr>
</tbody>
</table>

**MEAL PREPARATION**

6. During past six months did someone regularly have to prepare meals for you?

1 = Yes  
0 = No

If yes, 6a. who helped in this way?

<table>
<thead>
<tr>
<th>1= Yes</th>
<th>0=No</th>
</tr>
</thead>
<tbody>
<tr>
<td>Unpaid family member</td>
<td></td>
</tr>
<tr>
<td>Unpaid friend</td>
<td></td>
</tr>
<tr>
<td>Someone hired to help</td>
<td></td>
</tr>
</tbody>
</table>
APPENDIX D

SOCIAL SUPPORT


Use the following scale to indicate your opinion

1  2  3  4

Strongly Disagree  Disagree  Agree  Strongly Agree

1. People he/she can depend on for help if she really needs it.
2. There is no one he/she can turn for guidance in times of stress. *
3. There are people who enjoy the same social activities he/she does.
4. He/she feels personally responsible for well-being of another person.
5. He/she does think other people respect his/her skills and abilities. *
6. If something went wrong, no one would come to his/her assistance. *
7. He/she has close relationships that provide him/her with a sense of emotional security and well-being.
8. He/she has relationships where his/her competence and skill are recognized.
9. There is no one who relies on him/her for their well-being. *
10. There is no one who shares his/her interests or concerns. *
11. There is a trustworthy person he/she could turn to for advice if he/she were having problems.
12. He/she lacks the feeling of intimacy with another person. *

* Indicates items should be reverse scored before computing the scale total.
APPENDIX E

CENTENARIAN HEALTH

Older Americans Resources Survey – OARS Multidimensional Functional Assessment Questionnaire (Fillenbaum, 1988).

1. How would you rate his/her overall health at the present time?

   3. Excellent      2. Good       1. Fair       0. Poor
APPENDIX F

FUNCTIONAL HEALTH

Activities of Daily Living- Older Americans Resources Survey – OARS Multidimensional Functional Assessment Questionnaire (Fillenbaum, 1988).

2 Without help 1 With some help 0 Unable

1. Can he/she use the telephone?
2. Can you get to places out of walking distance?
3. Can you go shopping for groceries or clothes?
4. Can you prepare your own meals?
5. Can you do your housework?
6. Can you take your own medicine?
7. Can you handle your own money?
8. Can you eat?
9. Can you dress and undress yourself?
10. Can you take care of your own appearance?
11. Can you walk?
12. Can you get in and out of bed?
13. Can you brush your teeth?
14. Do you ever have trouble getting to the bathroom on time?
### APPENDIX G

#### CHRONIC DISEASES

<table>
<thead>
<tr>
<th>No.</th>
<th>Illness/Disease</th>
<th>Present</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Congestive Heart Failure</td>
<td>$1 = \text{Yes}$</td>
</tr>
<tr>
<td></td>
<td></td>
<td>$0 = \text{No}$</td>
</tr>
<tr>
<td>2.</td>
<td>Other Heart Problems</td>
<td>$1 = \text{Yes}$</td>
</tr>
<tr>
<td></td>
<td></td>
<td>$0 = \text{No}$</td>
</tr>
<tr>
<td>3.</td>
<td>Hypertension</td>
<td>$1 = \text{Yes}$</td>
</tr>
<tr>
<td></td>
<td></td>
<td>$0 = \text{No}$</td>
</tr>
<tr>
<td>4.</td>
<td>Anemia</td>
<td>$1 = \text{Yes}$</td>
</tr>
<tr>
<td></td>
<td></td>
<td>$0 = \text{No}$</td>
</tr>
<tr>
<td>5.</td>
<td>Diabetes Mellitus</td>
<td>$1 = \text{Yes}$</td>
</tr>
<tr>
<td></td>
<td></td>
<td>$0 = \text{No}$</td>
</tr>
<tr>
<td>6.</td>
<td>Non-skin Cancer</td>
<td>$1 = \text{Yes}$</td>
</tr>
<tr>
<td></td>
<td></td>
<td>$0 = \text{No}$</td>
</tr>
<tr>
<td>7.</td>
<td>Co-morbidity</td>
<td>$0 = \text{No Disease}$</td>
</tr>
<tr>
<td></td>
<td></td>
<td>$1 = 1 - 2 \text{ Diseases}$</td>
</tr>
<tr>
<td></td>
<td></td>
<td>$3 = 2 \text{ or more Diseases}$</td>
</tr>
</tbody>
</table>
# APPENDIX H

## HEALTH PROBLEMS

<table>
<thead>
<tr>
<th>No.</th>
<th>Health Problem</th>
<th>Present</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Visual Problems</td>
<td>1 = Yes</td>
</tr>
<tr>
<td></td>
<td></td>
<td>0 = No</td>
</tr>
<tr>
<td>2.</td>
<td>Hearing Problems</td>
<td>1 = Yes</td>
</tr>
<tr>
<td></td>
<td></td>
<td>0 = No</td>
</tr>
<tr>
<td>3.</td>
<td>Sleep Problems</td>
<td>1 = Yes</td>
</tr>
<tr>
<td></td>
<td></td>
<td>0 = No</td>
</tr>
<tr>
<td>4.</td>
<td>Arthritis</td>
<td>1 = Yes</td>
</tr>
<tr>
<td></td>
<td></td>
<td>0 = No</td>
</tr>
<tr>
<td>5.</td>
<td>General Weakness</td>
<td>1 = Yes</td>
</tr>
<tr>
<td></td>
<td></td>
<td>0 = No</td>
</tr>
<tr>
<td>6.</td>
<td>Urinary Incontinence</td>
<td>1 = Yes</td>
</tr>
<tr>
<td></td>
<td></td>
<td>0 = No</td>
</tr>
<tr>
<td>7.</td>
<td>Co-morbidity</td>
<td>0 = No Health problems</td>
</tr>
<tr>
<td></td>
<td></td>
<td>1 = 1-2 Health Problems</td>
</tr>
<tr>
<td></td>
<td></td>
<td>3 = 2 Health Problems</td>
</tr>
</tbody>
</table>
APPENDIX I

The Co-Chair of the Institutional Review Board of Iowa State University has conducted the annual continuing review and approved the modification of the protocol entitled; “Resources and Adaptation in Centenarians.” Your study has been approved for a period of one year. The continuing review date for this study is no later than 12 October 2010.

Based on the information you provided in Section II of the documents submitted for continuing review, we have coded this study in our database as being permanently closed to the enrollment of new subjects, where all subjects have completed all research related activities and the study remains open only for data analysis. To open enrollment or initiate research-related interaction with subjects you must submit a modification and receive IRB approval prior to contacting subjects.

Even though enrollment of subjects has ended, federal regulations require continuing review of ongoing projects. Please submit the form with sufficient time (i.e. three to four weeks) for the IRB to review and approve continuation of the study, prior to the continuing review date.

Failure to complete and submit the continuing review form will result in expiration of IRB approval on the continuing review date and the file will be administratively closed. As a courtesy to you, we will send a reminder of the approaching review prior to this date.

Any changes in the protocol or consent form should not be implemented without prior IRB review and approval, using the “Continuing Review and/or Modification” form. These documents are located on the Office for Responsible Research website or available by calling (515) 294-4566, www.compliance.iastate.edu.

You must promptly report any of the following to the IRB: (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.

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.