

THE EFFECT OF COGNITIVE RESERVES ON THE RELATIONSHIP
BETWEEN LIFE HABITS AND LIFE SATISFACTION IN THE VERY OLD

by

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ABSTRACT OF DISSERTATION

The Influence of Cognitive Reserves on the Relationship between Life Habits and Life Satisfaction

In the Very Old

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The purpose of this study was to examine the relationship of life habits and life satisfaction with the influence of a moderating variable, cognitive reserves, in a group of older individuals ranging from 75 to 101 years old. Low to moderate levels of cognitive reserves moderated the relationship between life habits and life satisfaction, but at levels of higher cognitive reserves, the relationship did not achieve significance.

The final sample consisted of 137 participants who were residents of one of five New Jersey continuing care retirement communities (CCRC) in central and northern New Jersey. Participants were interviewed and completed three surveys: 1) Assessment of Life Habits (LIFE-H 3.1); 2) Life Satisfaction Index for the Third Age-Short Form (LSITA-SF); and 3) Cognitive Reserves Index Questionnaire (CRIQ). They also completed a general social demographic questionnaire.

Findings indicated that males (55%) rated their health as compared to women (36%), while females (22%) rated their health as compared to men (10%). Significant differences in life satisfaction appeared across age groups ($X^2(2, N=131) = 5.665, p = .05$). Participants were divided into three groups for age: 75-83 years ($M=27.17, SD=9.53$), 84-86 years ($M=29.44, SD=11.0$), and 86 and older ($M=30.8, SD=8.54$). Results indicated older participants reported less life satisfaction than younger participants. Simple linear regression was used to

predict life satisfaction based on the subscale of cognitive reserves-working. Cognitive reserves--working was found to be a significant predictor of life satisfaction ($F(1,136) = 4.793, p < .05$) with an R^2 of .034.

In performing moderation analysis, low to moderate levels of cognitive reserves were found to significantly influence the relationship between life habits and life satisfaction. However, this relationship did not hold for high levels of cognitive reserves. Life habits were significant predictors of life satisfaction in this sample ($F(1,135) = 5.211, p < .05$) with an R^2 of .037.

These findings may have implications for geriatric and adult health nursing. Nurses can monitor for changes in perceptions of life habits, or abilities, that may signal a decreased capacity to carry out common activities of daily living. Additionally, nurses can identify elder adults at risk for cognitive decline and related safety issues and for possible decline in health status.

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DEDICATION

To find the proper dedications would be difficult, for there are so many people I would like to thank. To my professors who stuck with me, and to my children who were really annoyed with my procrastination.

But I guess the biggest dedication is to my parents, who lead me to my question of how cognition alters your life. For my mom, it was the influences of depression and a life not meeting its fullest.

And to my dad, who fought with all his might to not be like the old people who lost their minds in later life. "Shoot me if I ever get like that," he would say. When the time came and cognition was failing, it was apparent that he didn't have a choice of who he was going to be like. He became one of them: speaking to the stars, howling at the moon, or staring at the giant lights in the sky; or hearing music in his head. I hope it was beautiful because it consumed him. He orchestrated every piece he heard.

His eventual unfounded mistrust of me was based on his perceived threat to his loss of independence. I became the one person who could imprison him in an inner world of hell, filled with confusion and mistrust.

Thank you, Mom and Dad, for letting me live my concept. Yup, cognitive reserves are significant, and it eventually is gone.

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CHAPTER 1

Introduction: The Problem

According to the United States Census Bureau (2018), the fastest growing segment in the United States population is “65 and older.” It is expected that by the year 2056 this segment will outnumber those younger than 18 years of age (Colby & Ortman, 2014). What makes this group so unique is that, despite living with chronic illnesses, it comprises, in terms of age, an increasingly large group of individuals characterized as the “very old.” Life span expectancies are being recalibrated due to a tenfold increase in the global number of centenarians expected between 2010 and 2050 (National Institute on Aging [NIA], 2011). This new age-defined segment of the population is classified as the “third age” and consists of adults between the ages of 70 and 100 years (Laslett, 1989). Today, survival curves reflect a decline in mean age death, allowing third age individuals to engage in society in a manner impossible for previous generations of similar seniority (Rossi et al, 2013). Unfortunately, however, lengthened survival with long-term chronic illness does not necessarily lend itself to contentment in life. Many elder adults endure long-standing illnesses that require custodial care and medical interventions. Poor health (Medley, 1976) and lack of independence (Rudinger & Thomae, 1993) greatly reduce life satisfaction.

Challenges to the Third Age Interactions in Society

The study of success in the elderly is a challenging one, as it assumes that mentally competent individuals wish to maximize their potentials to remain independent and functional, which may not be true of all individuals. Making this study more complicated is that the data is drawn from various geographical regions and cultures, creating results that are often non-generalizable. In addition, health levels and socioeconomic standing vary among individuals and these variables should be included in the criteria of successful aging. Despite these considerations, it is to be hoped that

trends identified in these studies may have a positive impact on the availability of future services and funding entitlements.

According to researchers (Baltes, 1997; Li, 2003), third age individuals benefit from accumulated cultural resources in order to prevent age-related losses. These accumulated cultural resources include education, occupational status, and the ability to establish habits and routines (Li, 2003). An individual's cultural resources impact the way an individual utilizes a given set of environmental resources when uninterrupted by a health challenge (Gauvain, 1998). Unfortunately, health is often interrupted by age-related disability (World Health Organization [WHO], 2001), which diminishes the benefits of these resources.

Disability itself is not a personal characteristic, but it represents a gap between the person's capabilities and environmental demands (Verbrugge & Jette, 1994). Resource challenges created by physical barriers limit access to public spaces, reduce continuity of medical care and social interactions (Noreau et al., 2002), and ultimately reduce quality of life and independence (Williams & Kemper, 2010). Reduced social support and ineffective coping strategies increase the risk of depressive illnesses (Dean et al., 1990) and intensify dependency (WHO, 2003) among the elderly. In addition, the loss of social connections and social disengagement are associated with a risk of cognitive decline (Zunzunegui et al., 2003).

Despite low prognostications and diminishing resources, aging adults may be able to anticipate the loss of autonomy and the effects of cognitive decline. Researchers have suggested that individuals with higher levels of education and those who maintain intellectual pursuits later in life (elements of cognitive reserves) may have a buffer against any cognitive impairment (Kliegel et al., 2004). For example, there is evidence that individuals with higher levels of cognitive reserves can suppress clinical symptoms and remain functional (Stern, 2002, 2003; Whalley et al., 2000).

Individuals can adapt to life challenges by utilizing available resources (Baltes & Baltes, 1990). These abilities develop over a lifetime of experiences. If an aging

individual has physical and emotional competence, a person's own experience of earlier environmental challenges and solutions can help to procure resilient outcomes in the face of aging (Golant, 2015). The ability to maintain competent functioning in the face of major life stressors is a helpful definition of resilience. Resilience is a protective factor that enables individuals to reduce stress (Kaplan et al., 1966). To maintain resiliency, some elder individuals will rely on preexisting coping strategies, while others must produce new forms of adaptive capacity (Baltes, 1987). It is important to understand that dealing with change may include coping with loss, which might be just as important as regaining previous levels of functioning (Greve & Staudinger, 2006). In a study by Tomas et al. (2012), resilience was correlated with well-being ($\beta = 0.742, p < 0.001$). Beutal et al. (2009) demonstrated that resilience was positively associated with life satisfaction ($r = 0.41, p < 0.001$) which was shown to decline in aging men. Successful adaptation related to aging is explained in the theoretical model of "Selection, Optimization, and Compensation" (SOC) (Baltes & Baltes, 1999) (see Appendix A). SOC occurs at all ages but takes on greater significance for seniors. In the elderly, SOC describes the environmental adjustments needed to remain in society. In order to compensate for losses, seniors rely on skill sets, biological capacity, and a certain degree of motivation to reduce the amount of goal-related losses by selecting alternatives. Selecting alternatives is based on available options, as in *elective selection*, or based on loss of resources, defined as *loss-base selection*. Freund and Baltes (2002) define selection as both the increase in restrictions and the loss of adaptive potential caused by functional losses. Elective selection allows seniors to weigh available choices to meet their needs and motives, whereas in loss-base selection, loss of physical function may restrict opportunities, causing deviation from a goal (Freund & Baltes, 2002).

Optimization refers to the extent of engagement in behaviors designed to enrich choices and goals. Optimization allows for an allocation of resources to achieve higher levels of functioning specific to a domain. Through optimization, the ability to find specific encapsulated experiences may help promote use of fluid intelligence in

maximized memory domains (Rybash et al., 1986). Compensation results from a loss in adaptive potential that requires the use of substitution in psychological and technological resources. It suggests using resiliency as a coping tool, utilizing multiple selves, changing expectations, and replacing social references as necessary age-management skills.

Identifying and understanding the influences of these life-management skills may lead to higher levels of successful aging. More specifically, optimization and compensation may become predictors of aging well. Subjective outcomes on aging may help to recognize and deal with stressors to assist in aging successfully. Unfortunately, fewer resources are associated with less use of SOC (Jopp & Smith, 2006).

Life Satisfaction

Interactions in society, as well as restoring or maintaining psychological well-being, are important goals of life satisfaction. Psychological well-being, however, may be difficult to obtain due to the unpredictability of the aging process. Life satisfaction is premised on biological, social, and physiologic correlates (Adams, 1971). For example, biology relates to good health in terms of the absence of physical disability. Social correlates of life satisfaction include personal characteristics and social relations, while physiological correlates are self-perceptions of age and self-esteem, and perceptions of deprivation and contracting life space. Yet in the presence of disability, correlates of life satisfaction can be compromised.

Life habits are defined as the daily activities and social roles that ensure the survival and development of a person in a society throughout his or her life (Noreau et al., 2004). Measurement of life habits operationalizes social participation. The ability to perform the activities associated with life habits (such as meal preparation, personal hygiene, maintaining a household, planning and budgeting, and social participation) is the best predictor of quality of life (Levasseur et al., 2008) and life satisfaction (Maguire, 1983). Unfortunately, social participation can be difficult to maintain in the aging adult (Fees et al., 1999).

Many aging adults are unable to participate in activities due to physical limitations caused by acute and chronic illness (Verbrugge et al., 1996). Participation in activities is the result of interactions between an individual's health and contextual factors that include personal organic factors (such as aptitude) and environmental factors, defined as obstacles or facilitators within their life situation (WHO, 2001). Lack of participation reduces necessary social interactions (Holmes et al., 2009; NCHS Data Brief, 2009) suggested for healthy aging. Barriers to participation also result in lower levels of autonomy and negative behavioral coping strategies (Demers et al., 2009).

Disabling situations result in the reduced realization of life habits, i.e., of daily activities, or social roles specific to a socio-cultural context, and vary according to specific characteristics such as age, sex, and socio-cultural identity. Fortunately, these patterns are modifiable, fluctuating over time, gender context, and environment. These patterns can be modified by reducing impairment or improving aptitude (Fougeyrollas et al., 1999).

Cognitive Changes

A further challenge to the third age individual, is the development of illness and cognitive decline resulting from aging oxidative and inflammatory damage (McEwen, 2006). This cellular damage targets cognitive centers, promoting the expression of cognitive diseases (Cummings & Cotman, 1995). According to the Rand Report (March 2013), 3.8 million people (15% of those aged 71 years or older) have dementia. By 2040, that number is expected to increase to 9.1 million people. Alzheimer's disease alone effects one in eight people aged 65 years and older and an estimated 50% of those aged 85 years and older (Alzheimer's Disease Facts and Figures, 2011). Consequences of cognitive impairment include loss of independence and increased demands on social services and entitlements. Medicaid payments for Alzheimer's or other cognition related diseases were 23 times higher than Medicaid payments of non-cognition related diseases according to 2011 data. Based on 2018 dollars, out of pocket expenses were approximately 11,000 annually for cognition related illnesses (Alzheimer's Disease Facts

and Figures, 2010). Alzheimer's and cognitive related diseases are the costliest condition in society (Hurd et al,2013).

Role of Cognition on Life Satisfaction

Cognition's association with life satisfaction manifests itself in life purpose. According to Erickson (1982), congruence between past feeling and accomplishments relative to present life circumstances elicits a sense of life satisfaction in later life. Having a strong sense of life purpose has been associated with a decreased incidence of Alzheimer's disease and mild cognitive impairment.

Alzheimer's disease is a leading cause of death among adults and is the fifth leading cause of death for those 65 years and older (Alzheimer's Association, 2015). Although many will not experience the ravages of Alzheimer's, as lifespan increases cognitive decline contributes to feelings of unhappiness and negativity, thereby reducing life satisfaction (Bishop et al., 2010; Rabbitt et al., 2008). Manifestations of cognitive decline, such as memory issues, compromise community participation (Iwasha et al., 2012). Aging reveals the brain's vulnerability, perpetuating the inability to sustain cognitive health. This decline appears to be more consistent in ages beyond 85 years (Jorm, 1998). Cognitive health is dependent upon an adaption processes and a strong commitment to maintain self (Roodin & Rybash, 1985). Understanding how the brain maintains or alters modifiable features when faced with cognitive illness is imperative to the healthy survival of organisms.

Cognitive Reserves

Cognitive Reserves, as defined by Stern (2002) is the ability to recruit an individual's alternative neural networks, developed from a lifetime buildup of experiences including education, occupation and participation, to resist the damage related to brain pathology. Cognitive reserves are a multifaceted concept involving research into genetics (Lee, 2003), environmental stressors (Stern, 2009), and socioeconomic status (Karp et al., 2004). Stern (2002) likens cognitive reserves to software, suggesting that the brain can use alternate paradigms to approach a problem. The concept of cognitive reserves is

consistent with the idea that individuals of the same genotype can have different neural and behavioral outcomes, depending on the dissimilarity of their relevant life experiences. Therefore, it is impossible to study anything specific about these outcomes without looking for the presence or absence of intervening life experiences (Gottlieb, 2007).

Research into life environments, in particular, the engagement in cognitively stimulating environments, may help to provide cognitive maintenance throughout the lifespan (Tesky et al., 2011). Research continues into the protective effects of enriched environments on cognition and cognitive health, and how lifelong habits may produce similar effects on the structural or process changes in the brain (Squire & Kendel, 1999).

Research Question

The following proposed research question is based on the gap in literature regarding the theoretical relationship among variables to be studied: Does life satisfaction improve when cognitive reserves and beneficial life habits are maximized?

Aims

1. Examine the life habits of subjects that allow them to live in the community:
H_{1A1}: Alterations of life habits of community-dwelling seniors will predict life satisfaction as measured by the LSITA (Barrett & Murk, 2006).
2. Explore the influence of life habits on life satisfaction:
H_{1A1}: Alterations in life habits will predict life satisfaction.
3. Explore the influence of cognitive reserves on the third age individual:
H_{1A1}: Alterations in cognitive reserves will predict life satisfaction as measured by the LSITA (Barrett and Murk, 2006).
4. Explore the influence of cognitive reserves on the relationship between life habits and life satisfaction in community-dwelling third age individuals:
H_{1A1}: Cognitive reserves will significantly influence the relationship between life habits and life satisfaction.

Delimitations

The community studied included five New Jersey continuing care retirement communities (CCRC). These communities are designed with amenities for senior living. Residents volunteered to participate following health presentations given by the PI. Most participants have lived at their location for at least one year. Individuals with debilitating dementia or depression were excluded from participation.

Significance of the Study Related to Challenges of the Third Age

A significant challenge to the third age is the need for the aging individual to remain functionally independent (Vallejo et al, 2017), not only physiologically but cognitively. Maintaining cognitive health, according to Hendrie et al (2006), could prevent social isolation and dependency, and could produce healthier life outcomes. An outcome of the research is to understand the predictors that can influence the ability to remain independent, despite many potentially threatening situations. We know that life satisfaction is associated with better health outcomes, and that the inability to maintain life habits leads to lower participation in social activities, lower life satisfaction, and lower health outcomes (Turcotte et al., 2015). The ability to optimize brain reserves to resist the onset of brain pathology could preserve cognition and allow individuals to maintain life habits.

Yaffe et al. (2010) found that seniors who maintained their cognitive abilities beyond the age of 80 years were less at risk for disability and death. However, limited research is available on the influence of cognitive reserves and the connection between life habits and life satisfaction. The purpose of this study will be to investigate theorized relationships between cognitive reserves and the achievement of life satisfaction in the oldest adults. Such relationships would presumably indicate that without adaptive measures, chronic health conditions coupled with cognitive decline would absolutely limit the independence of community-dwelling elders.

CHAPTER 2

Review of the Literature

This chapter presents a discussion of the theoretical framework that guides this study, as well as a synthesis of the empirical literature related to the determinants of life satisfaction (LS), cognitive reserves (CR), and life habits (LH) in the very old. The theoretical discussion in this chapter provides an overview of the Selection, Optimization, and Compensation Model (SOC) (Baltes & Carstensen, 1996; Baltes, 1987; Baltes & Baltes, 1980, 1990; Baltes, Dittmann-Kohli & Dixon, 1984; Carstensen, Hanson, & Freund, 1995; Marsiske et al., 1995) and its theoretical constructs and determinants of life satisfaction. Following a discussion of the SOC, a review of the empirical literature and gaps in the literature that support the proposed relationships among the concepts of life satisfaction, cognitive reserves, and life habits will be presented.

Theoretical Framework

Selection, optimization, and compensation.

The SOC model provides a general framework for understanding developmental change and resilience across the lifespan (Baltes & Carstensen, 1996; Baltes, 1997). (See Appendix A). The SOC is a model of psychological and behavioral management for adaptation to change while compensating for gains and losses (Grove et al., 2009). The SOC model provides a method for helping a person deal with the multitude of changes that occur throughout the lifespan (Baltes & Baltes, 1990). The model helps to explain why people who are cognitively able can also address and adjust to changes in their lives. The end goal of SOC is life satisfaction, which includes being able to maintain and restore psychological well-being despite all the related biological, social, and psychological crises (Kuypers & Bengston, 1973). According to Baltes and Baltes (1990), depending on the environmental demand and context opportunities available to an individual, the SOC model is a process that allows for the successful

development and aging from an intra-individual perspective. Freund and Baltes (1998) have found evidence to support the relationship between life management skills with SOC and higher levels of functioning.

A basic premise of the use of SOC is that it is a lifelong phenomenon in which increasing limits are accentuated in old age (Baltes & Baltes, 1990). It is the goal of successful development to optimize developmental potential and minimize losses (Baltes & Baltes, 1990; Freund & Baltes, 2000). The SOC assumes that normal aging results in increased vulnerability and reduction in general adaptive or reserve capacity that is positively related to satisfaction with aging (Baltes & Baltes, 1990). Baltes and Baltes (1990) suggest that aging is a biological process subject to the transgressions of time. The aging individual must recognize and outwit the constraints of aging.

The SOC consists of three adaptation processes: 1) selection; 2) optimizing tasks and improving efficiencies; and 3) compensation. These processes enable successful community living. The first process, selection, consists of goal development that focuses resources on either specific guiding behaviors or on the removal of unattainable goals, with a redirection to or focus on other attainable goals (Baltes et al., 1999). Participation in the most attainable goal to assure safety may be a more reasonable option, especially when health is threatened. The second component, optimizing tasks and improving efficiencies, describes the means of achieving higher levels of a selected domain (Baltes & Baltes, 1990). Compensation, the last component, may include assistance required to help an individual remain independent (see Appendix A). It reflects the creative means with which the initial goal is met, despite capacity limitations (Jopp & Smith, 2006). The SOC model proposes that a person selects available strategies as he or she adapts to the changing environmental or physiologic conditions (Baltes & Baltes, 1990).

Literature Review

The focus of this section is to describe the related attributes of the concepts of life satisfaction, cognitive reserves, and life habits. A review of key

correlates is discussed in the research. Studied correlates related to life satisfaction include psychological disposition, effect of healthy cognition on lifetime achievements, and the availability of resources. In studies of cognitive reserves, the influence of cognitive reserves was examined in relation to specific disease progression and outcomes, reported health advantages, and later-life lifestyle. Life habits studies explored quality of life, physical activity, and social participation in elderly subjects with disabilities.

Method

CINAHL, PubMed, Eric, and Social Work Abstract were used to search the literature between 2006 and 2015. An initial review of the search-related term “life satisfaction” from 2006 to present included 7088 articles in relation to third age or oldest old. Keywords and phrases were Positive Life Orientation (PLO), successful aging, and quality of life. Predictors such as loss of social connectedness, current activity levels, health and fear related to loss of spouse, and loss of sensorium all appeared in the search of life satisfaction. Life satisfaction is discussed in the literature in relation to degrees of disability, because even with certain disabilities, people rely on of social connectedness and life skills for life satisfaction (Miller & Chan, 2008).

The search term of “cognitive and reserves” in CINAHL review revealed just 147 articles, of which only 15 were studies of elderly adults. The influences of cognitive reserves on neurological diseases and physiological pathologies as well as life satisfaction were searched in the research. With regards to community-dwelling seniors, the community itself was cited as being a source of cognitive nurturing which may help ward against cognitive decline (Clarke et al., 2012).

Using the search term “life habits” and aging and disability-related terms such as “family” and “social activities” revealed 99 relevant articles from 2006-2016. Life habits were discussed as being contributory to life satisfaction, with increasing levels of debility eventually influencing life satisfaction and quality of life, especially regarding mobility and recreation. According to Levasseur et al. (2008), higher levels in family relationships and responsibility were associated with higher levels of satisfaction. Restoring life habits

after disability resulted in restored quality of life. Gagnon et al. (2007) reported higher levels of perceived quality of life when rehabilitation was tailored to areas of reported satisfaction loss.

Results of Literature Search

Life Satisfaction

Life satisfaction reflects the perceptions of self-concepts, such as degree of enthusiasm, meaningfulness, goal achievement, and feelings of optimism (Neugarten et al., 1961). It reflects the degree to which an individual judge the overall favorable quality of his or her life as a whole (Veenhoven, 1993). Life satisfaction is critically important and shares a link to better health outcomes and improved quality of life. Low levels of life satisfaction can manifest in feelings of burden, depression, and illness exacerbation (Ho et al., 2003; Sarkisian et al., 2002). As the number of aging Americans continues to grow, the importance of identifying trends can alert families, healthcare workers, and community developers about increasing areas of concern.

Life satisfaction shares many defining characteristics with “quality of life.” Life satisfaction is a person’s psychological or spiritual connectedness and sense of purpose (Flood, 2002). Similarly, Browne et al. (1994) stated: "Quality of Life (QoL) is (the product) of the dynamic interaction between external conditions of an individual's life and the internal perceptions of those conditions" (p.235). It is defined by its relation to the main goal of life in old age: maintaining and/or restoring psychological well-being in a situation implying many biological, social, and psychological crises and risks (Adams, 1969). Havinghurst (1961) defines life satisfaction through successful aging as a self-appraisal of one’s mental, physical, and spiritual elements as adaptation to crisis and risk, to help minimize the negative self-appraisal of the crisis-risk outcome. Life satisfaction is a measure of reestablished homeostasis or of adjustment (Hoyt & Creech, 1983).

Influences on Life Satisfaction

There are many influences on life satisfaction. Health, as a predictor of life satisfaction, has been studied with mixed findings. For example, Girzadas et al. (1993) and Rogers (1999) perceived physical health and locus of control in frail elders as

associated with life satisfaction. Debilitating health changes, indicating a significant negative effect on life satisfaction. Berg et al. (2006) suggest that this could be gender specific, as women tend to report more chronic illnesses with longer periods of impaired health. However, research has also shown that physical health plays less of a role in reducing life satisfaction even when chronic illness is present, so long as baseline functionality is maintained (Adu-Bader et al., 2002; Berg et al., 2006). Not surprisingly, Rogers (1999) indicated that better-perceived health was significantly associated with higher life satisfaction scores; a positive personal health appraisal is a significant predictor of high levels of life satisfaction, along with social support and locus of control (Chipperfield, 1992; Idler & Kasl, 1991; Maddox & Douglas, 1973). Blace (2012) suggested that participation in interpersonal activities and formal support networks yielded moderate levels of life satisfaction. In the area of resolution, fortitude, and self-concept, findings of acceptance of the current place in life with the potential of a brighter future increased the level of life satisfaction. (See Appendix C for results of the search).

Aging

Changing demographic circumstances can cause further challenges among the elderly. These circumstances include the loss of a friend or spouse, or the change of economic status or living accommodations. These factors affect the perception of security, comfort, and self-worth and can have a negative effect on health outcomes. Understanding the relationship between these factors and their impact on successful health outcomes may help us understand and promote life satisfaction.

Life satisfaction explores the sociological, social, and psychological correlates (Adams, 1969) associated with the homeostatic maintenance that relates to successful aging. According to Blace (2012), functional ability is predictive of life satisfaction. Research that focuses on life satisfaction comes out of many longitudinal studies, including the MacArthur Studies (Albert et al., 1995), the Berlin Aging Studies (BASE) from the Max Plank Institute for Human Aging, and the Canadian Longitudinal Study of

Aging, plus the Health Aging and Retirement (HART) study in Thailand, and the Bonn Longitudinal Study of Aging (BOLSA) (Rudinger & Thomae, 1993).

Cognitive Reserves

The concept of “cognitive reserves” arose from the study of neuro-pathologies associated with Alzheimer’s disease (Katzman et al., 1988). Postmortem brain studies reveal that some individuals with brain pathology manifest cognitive dysfunction, while others with seemingly more pathological damage display greater cognitive function (Katzman et al., 1988). Compensating or coping with pathology was displayed in certain individuals, while other subjects were unsuccessful in compensation ability. Cognitive reserves are the “software of the brain” and allow for active compensation (Depp et al., 2011, p. 41). Reserves vary from person to person in that they appear to be dependent on education, occupational experience, and leisure activities (Stern, 2007). Reserves appear to have a potentially strong influence on a person’s quality of life and satisfaction with life. Intact cognitive function is a critical dimension to quality of life. Cognitive difficulties can be disruptive to an individual’s sense of well-being (Waldstein, 2003). Cognitive reserves are influenced by demographics, genetics, and environmental influences (Stern,2007). In a study of subjects with multiple sclerosis (N = 1142), Schwartz et al. (2012) stated that individuals with high cognitive reserves reported having a purpose in life, self-acceptance, and life satisfaction.

In a study of 130 elder patients, Manly et al. (2005) found that memory decline was more rapid among those with low reading levels and that literacy is a strong predictor of high cognitive reserves. Alternatively, literacy may be associated equally with all cognitive domains and could therefore be a general marker of cognitive reserves (Stern, 2012; Katzman, 1993). Literacy can be defined as the ability to use printed and written information to function in society, to achieve one's goals, and to develop one's knowledge and potential (National Center for Educational Statistics, 2003). Skills needed for literacy are complex and include successful use of printed material, including word-level reading skills and higher-level literacy skills (White & McCloskey, 2003).

Literacy does not include one single skill and can be viewed in various levels and corresponding abilities (National Assessment of Adult Literacy [NAL], 2003).

Research related to literacy suggests that low reading levels are associated with higher rates of cognitive decline (Manly et al., 2003). It also reveals that subjects with greater reading skills can engage in cognitively challenging activities, a process that protects against cognitive decline (Wilson et al., 2003; Scarmeas et al., 2001). Research further reveals that subjects with fewer years of education are almost 1.7 times more likely to experience incident dementia (95% CI [1.1-2.6]) (Qiu et al., 2001). (See Appendix D for results of the search).

Life habits

Life habits are the habits that ensure survival and development of a person in society throughout one's life (Noreau, 2014). They include activities ranging from the activities of daily living (ADL) to social roles (Fougeyroillas et al., 1999). The satisfaction related to performing these activities is associated with perceived quality of life. The natural aging process can lead to disruptions of personal accomplishments due to impairments, disabilities, or environmental factors. The ability to maintain life satisfaction is also dependent on physical activity, since sedentary individuals are more likely to report disease or social disengagement with life (Meisner et al., 2010). These studies indicate that there is no causative element that promotes life satisfaction, but rather conditions of the psyche that influence a trajectory into either satisfaction or dissatisfaction with life. A large study of older adults ($N = 38497$) reported that functional limitations were responsible for more mentally unhealthy days in subjects that had physical limitations and engaged in less leisure time (Thompson et al., 2012).

When function limitations exist, adaptations to the environment are needed to maintain a perception of quality of life. Reintegration of stroke patients into the community setting requires balance self-efficacy, without which life satisfaction is greatly reduced, along with reduced health outcomes (Pang et al., 2007). According to Anaby et al. (2009), mobility, and positive balance confidence, were essential for

participation in daily activities, with balance explaining 37% ($p = 0.00$) and mobility 22% ($p = 0.01$) of the variance. In a study of 7609 people, Freedman et al. (2014) found that maintaining participation after successful accommodations is associated with moderate well-being independent of age, and that, when assistance is required, mean well-being diminished from 18.4% to 18% ($p < .001$) (see Table 1).

Other factors may play a role in participation, including behavioral coping strategies. These strategies include actions—not emotions—for handling a problem (Fried et al., 1991). Although behavioral coping strategies were the strongest to explain the highest correlation with Life-H, in a study of 346 people, Demers (2009) suggested that higher perceived level of activity was associated with higher participation. In addition, higher levels of schooling were a predictor of higher social engagement ($r = 0.23, p = .02$). (See Appendix E for results of the search).

Hypotheses

The following hypotheses will be examined in older adults between the ages of 70 and 100 years:

1. Social demographics, including gender, age, presence of illness, marital status, perceptions of illness and levels of education will predict life satisfaction.
2. Perceived high levels of life habits (participation in social roles) are associated with improved levels of life satisfaction.
 - a. Life habits are associated with participation in routine, necessary accomplishments.
3. Reductions in life habits (participation in self-care) are associated with poorer levels of life satisfaction.
4. After controlling for depression, high levels of cognitive reserves are associated with greater participation in life habits and therefore improved levels of life satisfaction.

Theoretical and Operational Definitions

Life Satisfaction of the Third Age: Laslett (1989) uses the term “third age” to describe individuals between 70-100 years old. The term describes the emerging group of older individuals who, because of their health and employment status, possess the unique capacity for engaging in society in a way that was not accessible to previous generations of older adults. As third age individuals reach their 80’s, 90’s, and 100’s their expectations include a reasonable quality of life.

Cognitive Reserves: Cognitive reserves has been defined as the body’s ability to withstand external stresses revealed by individual differences in the functional and behavioral responses to neuronal disease or injury (Jones et al., 2011). Cognitive reserves have been further described as active and passive. Active cognitive reserves are the activities used to keep the brain active and fit including compensatory mechanisms used to cope with damage (Stern, 2002). Passive reserves are primarily determined by genetics and the antecedents to brain disease onset, which include intelligence and brain reserve capacity (Valenzuela & Sachdev, 2005; Small et al., 2007). CRs are the brain’s active attempt to compensate for the challenges of brain damage. Stern (2002) suggests that they serve as mental “software,” and that the brain has the ability to use alternate paradigms to approach a problem. Individuals with higher levels of educational attainment (higher cognitive reserves) display better memory performance (Bastin et al., 2012). Additional research appears to show an impact on perceptions of health. Patient reported outcomes indicate that subjects with higher levels of cognitive reserves have lower levels of perceived disability and higher levels of well-being (Schwartz et al., 2012).

Life Habits (Life-H): Life habits is theoretically defined as the participation in the daily activities and social roles that ensure the survival and development of a person in society throughout his or her life (Fougeryrollas et al., 1988). Participation includes learning and applying knowledge, performing general tasks and handling demands, communication skills, mobility self-care, domestic life, interpersonal

interactions and relationships, major life areas and community, and social and civic life (World Health Organization, 2001). Life-H was designed to look at the participation of disabled subjects in daily activities. Unfortunately, populations over 85 years are at the highest risk for disease and disability (NIH, 2010), and disability prevalence increases rapidly with age (He & Muenchrath, 2011). Disability arises from health conditions and environmental and personal factors (Leonardi et al., 2006), with 41.5% of those aged 85 years and older likely to report three or more types of disabilities. Despite this, social participation of people with disabilities occurs regardless of underlying impairment. Persons with disabilities include those who have physical, mental, intellectual, or sensory impairments, which, in interaction with various barriers, may hinder their full and effective participation in society on an equal basis with others ((Fougeryrollas et al., 1988).

CHAPTER 3

Methodology

The first section of this chapter describes the study design, research setting, sample, and sampling method. The instruments and procedure for data collection and analysis used for this study are discussed in the second half of this chapter. This study uses a cross-sectional design to examine the relationships among three basic concepts: life satisfaction, cognitive reserves, and life habits. The study addressed the impact of previously acquired and continued cognitive development on the activities of daily living and improved life satisfaction.

The Research Setting

The research setting included five sites of a Central New Jersey based CCRC. Participants were recruited from these senior community complexes. The communities house over 2000 seniors, 80% of which are over the age of 75 years. The surrounding geographical area is affluent, which was consistent with the socioeconomic status of most of the participants in this study, with higher levels of education and higher income. Many of the participants reported having pensions and long-term health insurance policies, making the living situation achievable. Several of the participants reported they had relocated to the area to be near family and children. Interviewing was completed in the participant's apartment or in a location connected with the complex, including the cafés, library, or sitting rooms.

Sample

All subjects were English speaking. A few of the participants had accommodations including walkers or oxygen. Sample size was achieved through invitation for all seniors who met the following inclusion criteria: (a) over 75 years of age, and (b) living independently or with minimal assistance. Exclusion criteria included severe cognitive loss or psychological deficits. A total of N=137 subjects participated in the study. Participants were not given any time constraints to fill in the survey. Most

participants preferred having the Principal Investigator (PI) read each question, possibly related to convenience or availability of eye wear.

An a-priori power analysis using G-Power 3.1 software was performed using *F*-test (Linear Multiple Regression: Fixed Model R^2 deviation from zero) with a significance level of $\alpha = 0.05$, statistical power $1 - \beta = 0.95$, and a medium effect size of ($f^2=.47$) (Faul et al., 2013). With five predictors, it was determined that a convenience sample of 100 total subjects would be needed for the study. On these assumptions, the desired sample size was $N=137$.

Measures

Dependent Variables

The purpose of this study was to explore the influence of cognitive reserves on the relationship between life habits and life satisfaction. The dependent variable was life satisfaction, explored using the LSITA-SF. Interest in life satisfaction, as a quality of life indicator, is derived from the findings that higher levels are associated with protective factors and conditions that foster health (U.S. Department of Health and Human Services, Office of Disease Prevention and Health Promotion [HHS ODPHP], 2010). The LSITA-SF was calculated based on summative calculations of a 6-point Likert Scale including reversed scoring of four items, named LSITA-SF, with higher scores indicating less satisfaction with life. Life satisfaction scores are included in Table 1.

Table 1
Classification Levels of LSITA-SF

	Score
Most Life Satisfied	12
Normal Range Life Satisfaction	42-59
Low Levels Life Satisfaction	60-72

The LSITA-SF (Barrett & Murk, 2009) was used to identify patterns related to perceived life satisfaction (Neugarten et al., 1961). The LSITA-SF, a 12-item scale, was developed from a preexisting scale, the Life Satisfaction Index (LSIA), which was a

derivation of the original Life Satisfaction Rating (LSR) (Neugarten, Havinghurst, & Tobin, 1961). The LSITA-SF is scored on a 6-point Likert-type scale with options ranging from strongly disagree (1 point); disagree (2 points); disagree somewhat (3 points); somewhat agree (4 points); agree (5 points); and strongly agree (6 points). Total scores can range from 12 to 72. The total score represents the respondent's life satisfaction. The lower the score in this version, the higher the level of life satisfaction will be. The instrument consists of a measurement of the construct of life satisfaction. This instrument has been shown to be reliable and valid (Havighurst, 1963).

The LSITA-SF stems from the LSR, which was the original work of Neugarten, Havinghurst, and Tobin (1961). It was derived from the Kansas City Studies of Adult Life to measure successful aging. The LSR achieved high Spearman Brown coefficient of attenuation ($\alpha = .87$). The original LSR continued to evolve throughout the years in response to reports of being "cumbersome." It became a validating instrument for Neugarten and fellow researchers in the development for further life satisfaction instruments. The LSITA-SF showed excellent reliability ($\alpha = .90$) and proved to be highly correlated to the LSITA long form. It serves only as a measure of the concept of life satisfaction, no longer having sub scales.

Content validity studies were used to determine how well the LSI-TA reflected the theoretical framework. Content validity was established by a team of eight doctoral prepared professors in the field of gerontology. Construct validity was determined utilizing confirmatory factor analysis (CFA). The final comparative fit index (CFI) of .94 demonstrated an adequate goodness of fit (Barrett & Murk, 2006).

Criterion validity was explored using two additional instruments, the Salamon-Conte Life Satisfaction in the Elderly Scale (SCLES) and the Satisfaction with Life Scales (SWLS). Each of these instruments reported high reliability ($\alpha = .93$; $\alpha = .85$). Five variables in the SCLES corresponded to the same five variables of the LSI-TA ($\alpha = .78$). Each independent factor's correlation ranged from $r = .56$ to $.75$. The SWLS demonstrated a good correlation with the LSI-TA ($r = .70$) (Barrett & Murk, 2006).

In conclusion, the LSITA-SF has a well-established reliability construct and criterion validity. For this study, all items of the scale were used to determine total life satisfaction of third age individuals.

Independent Variables

In this study, perceived level of accomplishments was measured through the Assessment of Life Habits Scale (LIFE-H). The Life-H is a two-part instrument used to study the functional ability of subjects who engage in social activities and their level of satisfaction regarding the level of participation in activities (Noreau et al, 2002). This instrument assesses the perceptions of adults over the age of 65 years who have at least one complex activity limitation. These limitations include physical, mental, intellectual, or sensory impairments that may hinder an individual's full and effective participation in society on an equal basis with others. The scale contains 77 items, including 12 categories: 1) nutrition; 2) fitness; 3) personal care; 4) communication; 5) housing; 6) mobility; 7) responsibilities; 8) interpersonal relationships; 9) community life; 10) education; 11) employment; and 12) recreation. The Life-H survey gives an item score ranging from 0 – 9. A score of 0 = total handicapped, meaning that the activity or social role is not accomplished or achieved). A score of 9 = optimum social participation, that is, the activity is performed without difficulty and without assistance (Noreau et al., 2004). The second part of the scale is the individual's satisfaction regarding the accomplishment of life habits. It is scored from 1 (very unsatisfied) to 5 (very satisfied). The exam score is determined by the subject's response to each item and 1) its degree of difficulty, and 2) the type of assistance needed. The person's level of satisfaction in relation to the accomplishment of the habit is scored per each item.

In order to test reliability of the instrument, Noreau et al. (2004) utilized inter-rater reliability. The inter-rater reliability proved highly reliable ($ICC \geq .89$). Utilizing test retest, Poulin & Desrosiers (2009) also reported a high reliability for the instrument ($ICC \geq .84$). To test discriminate validity of the Life-H, the Functional Autonomy

Measurement System (SMAF) (Herbert et al., 2001) was used. Functionally impaired elder adults ($n = 87$) living in three separate living environments were recruited as subjects to establish the instrument's ability to discriminate between resident's functional ability in private nursing homes, their own homes, and a long-term care unit. Discriminant validity of the Life-H was verified using an ANOVA two-by-two comparison test. The variation in scores of the individuals' three living environments (7.6,6.8,6.1, $p < 0.001$) were compared to the total disability scores of the SMAF (14.9,19.6,49.2, $p < 0.001$). The results supported an interpretation of the influence of environment on differences in the disability level of the SMAF. In addition, convergent validity was examined using the SMAF and Life-H tests with a moderate correlation reported ($r = 0.70$). For social roles, Life-H responsibility showed strong association with SMAF-mental function and IADL ($r = 0.43$ and $r = 0.49$) (Desrosiers et al., 2004).

Independent Variable: Cognitive Reserves (CR)

CR are a measure of the accumulation of experiences, abilities, knowledge, and changes that occur throughout a lifespan (Mondini et al., 2014). The Cognitive Reserve Questionnaire (CRIq) is a twenty-four-item survey used to quantify the amount of CR accumulated by individuals throughout their lifetime. The CRIq consists of three subscales: CRI-Education, CR-Working Activity, and CRI-Leisure Time. Geographical data is obtained along with the initial data collection of the subject. Additional questions involving education, working activity, and leisure time are also included. Education points are assigned based on completed structured classroom experiences. Points are awarded for each school year (0.5) and for guided facilitated classroom experiences. Working activity points are based on the National Institute for Statistics ISAT (2008) job classification categories. Job categories are broken down by level of cognitive acuity required and include low skilled manual work, skilled manual work, skilled non-manual, professional occupation, highly responsible, or intellectual occupation. The raw score of this section is the product of the cumulative years score, multiplied by the cognitive level score of the job. Each year of work is awarded a point. Jobs must be held for

approximately a year. Leisure time activities are classified as activities outside of a job. Time is recorded as Never/Rarely, Often/Always. Scores are accumulated; low CR ≤ 70 , medium-low 70-84, medium 85-114, medium-high 115-130, and high ≥ 130 . The reliability of the answers is dependent on the cognitive ability of the participant, but many of the life situation questions can be answered by a relative or someone who has shared the participant's life experience (Nucci et al., 2011).

Nucci et al. (2011) has reported acceptable reliability for the CRIq. In a sample of 588 people, the reliability ($\alpha = 0.62$, CI [0.56,0.97]) of the instrument was shown to be adequate. Each subscale showed satisfactory correlations among CRI-Education, CRI-Working Activity, and CRI-Leisure Time ($r = 0.77$, $r = 0.78$, $r = 0.72$). CRI-Leisure Time performed appropriately ($\alpha=0.73$, CI [0.70,0.76]). Validity studies that attempted to use IQ scores are ineffective. Concurrent validity was measured using the vocabulary portion of the Wechsler Adult Intelligence Scale (WAIS) and the Test d'Intelligenza Breve (TIB) and was shown to be highly correlated ($r = 0.42$ and $r = -0.45$). A description of the three instruments used in the study is included in Table 2.

Table 2

Description of the Study Instruments

Variable	Instrument	Level of Measurement	Number of Items
Life Satisfaction	Life Satisfaction Index for the Third Age-Short form (LSITA-SF)	Continuous variable	12 item Likert scale (ranging from 1 to 6) When reversed scored 1= strongly disagree to 6= strongly agree. Normal scoring 1= Strongly agree to 6= strongly disagree Items approaching 12 are most life satisfied. Levels of 72 are least life satisfied.
Life Habits	Assessments of Life Habits (Life-H 3.1)	Continuous variable	77 items with 2 response categories; Level of accomplishment and Type of assistance needed. 12 sub scales. Composite score on subscales and all 77 items
CR	Cognitive Index questionnaire (CRIq)	Continuous variable	20 item-3 subscales education-working activity and leisure time. Composite score on all 20 items

Participants' Social-Demographic Information

In this study, actual health and perceptions of health were analyzed using a 3-item health perception questionnaire. In order to determine if subjects acknowledged existing illness, individuals were asked: (1) "Do you have any chronic illness(es)?" To determine the perceptions of their health, subjects were asked: (2) "How would you rate your overall health?" To establish if subjects were perceiving any memory issues, subjects were asked: (3) "Do you feel you have limitations to your memory?" Answers to perceptions of health were scored with a 5-point Likert type question. Questions regarding actual and perceptions of health were asked in order to determine any conflict that may exist between perceived and actual health experiences and the potential influence on life satisfaction. These questions were based on the results of a literature review on the influence of health perceptions. Rudinger & Thomae (1993) in the Bonn Longitudinal study (N= 222) concluded that cognitive representation of specific aspects of the present situation are more effective in the explanation and prediction of behavior and feeling, including wellbeing, than objective conditions such as health, income, and education.

Demographic characteristics of the sample, including health perceptions, are noted in Table 3. Participants were mostly female (70%), have graduated from high school, and most have achieved bachelors level education, master's degree, and PhD level education. Of the sample, 25% of the participants had achieved a master's degree or higher. More females remained at the "high school only" level (34%), having acquired lower educational levels than men. A large percentage (72%) of the sample were widowed.

Health status is a report of the presence of illness. Seventy percent of the participants reported some physical ailment, with arthritis most frequently noted. Approximately five participants reported "no" to presence of illness, despite the use of

portable oxygen or walking accommodations. Only one person reported poor health. Most participants (63%) reported no perceived memory issues.

Human Subjects Protection

Approval to conduct this study was obtained from the Institutional Review Board (IRB) at Rutgers, The State University of New Jersey. Expedited review was requested, as there were minimal risks to the participants. The University IRB and the Corporate Board of the CCRC granted approval before data collection began. Informed consent was obtained from all participants prior to any data collection.

Participants were informed there were no direct benefits to the individuals who participated in this study. There were, however, several potential benefits to the research. One benefit is gaining knowledge about older adult life satisfaction. Risks of participation were minimal but included the potential for an emotional response to questions asked in the life satisfaction survey and the open-ended qualitative questions. If the subjects did develop emotional distress during or after completing the survey, they would have been referred to the site's medical clinic for evaluation. No problems arose.

Procedure for Data Collection

The collection process started in 2017 and extended into early January 2019. Five sites throughout central and northern New Jersey were used. Each site required approval from the respective facility administrator.

At each study site, participants were introduced to the PI, a registered nurse with 25-years of experience in geriatric nursing, and the purpose of the study during residence meetings, health related seminars, and club gatherings. A sign-up sheet was provided, and further snowballing occurred. The consent process provided information containing the purpose of the study and individuals' rights as participants. The initial participants were introduced to the PI by corporate-based activity coordinators employed at each of the senior living communities. Eligible

participants were then contacted by phone. Each participant was asked to schedule a time for a meeting to complete the surveys. The data collection took place in a location most convenient to the participants, such as their residence or in a private gathering room. When participants consented to a face-to-face survey, they were given a choice to complete the forms by themselves or to have the forms read aloud by the researcher. The subjects were informed that they were not required to answer any questions they chose not to answer. All participants were given a complete survey packet including the Life Satisfaction Index Survey, the Life Habits Questionnaire, and the Cognitive Reserve Questionnaire. Each meeting lasted approximately 75 minutes.

The PI maintained an electronic list of deidentified coded subjects. No information is traceable to any participant, as that information has been destroyed. The computer and database files were password protected. Only the PI retained the password. Computer files were backed up to an external drive and secured in a locked file, to which only the PI had access. It was agreed that data would only be reported in aggregate and not reported per location. Following the mandatory three-year IRB data-maintenance period, all associated electronic files will be deleted.

Data Analysis Plan

All data was entered by the PI and reviewed for inconsistencies, outliers, and omissions. Descriptive analysis was used to describe and summarize all study variables. The descriptive data included the continuous verifiable age, a dichotomous variable gender and self-reported depression levels, and categorical variables, race, marital status, and level ratings of overall health. Independent and dependent variable scores were assessed for normality. It was determined that life satisfaction scores were non-normally distributed, as assessed by a Shapiro-Wilk test ($p=.000$), skewness of 1.110 ($SE=.207$) and kurtosis 1.522 ($SE=.411$). Life habits scores were non-normally distributed using Shapiro-Wilk test ($p=.000$), skewness 1.602 ($SE = .207$) and kurtosis 2.329 ($SE=.411$). Cognitive reserves

scores were also non-normally distributed with a Shapiro Wilk's test ($p=.008$), skewness .48 ($SE=.207$) and kurtosis $-.260$ ($SE=.411$).

Bivariate analysis methods, specifically simple linear regression, were used to test hypotheses 1 through 3. Simple linear regression was used to explain the relationship between two variables.

Hypothesis 1: Characteristics of the sample will predict life satisfaction. The Mann-Whitney U was used to test differences in LS of males and females. The Kruskal-Wallis test was used to explore the significance of marital status and age. Simple linear regression was used to explore the predictive experience of health perception.

Hypothesis 2: Alterations in life habits of community-dwelling seniors will predict life satisfaction. Simple linear regression was used to investigate the relationship between life habits and LS.

Hypothesis 3: The influence of CR on LS. Simple linear regression was used to assess the relationship between CR and their sub scores with LS.

Hypothesis 4: CR will significantly influence the relationship between life habits and LS. Hayes's moderation analysis (Hayes, 2013) was used to investigate whether cognitive reserves affects the direction and/or strength of the relation between life habits effect and life satisfaction. To test for moderation, SPSS PROCESS, Model 1, was utilized. 5000 bootstrap samples were utilized for bias correction and established 95% confidence intervals.

Moderation analysis is referred to by Hayes (2013) as a statistical interaction and is an ordinal least squared (OLS) regression-based analysis. Unlike regression, moderation analysis allows the effect of the independent variable (X) to be dependent on dependent variable (Y), for all the different values of moderator (M). A moderation effect could be: (a) enhancing, where increasing the moderator would increase the effect of the X on the Y; (b) buffering, where increasing the moderator would decrease the effect of the X on the Y; or (c)

antagonistic, where increasing the moderator would reverse the effect of the X on the Y.

Traditional moderation analysis heavily relies on the null hypothesis testing technique (Baron & Kenny, 1986), but Hayes's method depends on the bootstrapping significance testing, and the normality of the data is not the assumption of the statistical test. Using bootstrapping, no assumptions about the shape, a.k.a. normality, are necessary (Preacher et al., 2007). In addition, Johnson Neyman technique in Hayes moderation analysis model can identify regions of significance by displaying present cases in the data with values of the moderator above or below points of transition in significance (Hayes & Matthes, 2009). In this study, since CRs were used as a moderator, moderation allowed analysis of the specific conditions under which cognitive reserves influences the relationship between life habits and life satisfaction

CHAPTER 4

Analysis of Data

The purpose of the study was to explore the influence of cognitive reserves on the relationship of life habits and life satisfaction and to understand the extent of the moderating influence of cognitive reserves. Data was collected from third age individuals between the ages of 75 and 100 years old at five CCRC locations throughout Central New Jersey. A subject profile questionnaire was used to collect data on perceptions of health. Cognitive reserves were measured using the CRIq Index, life habits were measured using the Life-H 3.1 instrument, and life satisfaction was measured using the Life Satisfaction Index for Third Age Individuals (Short Form). The analysis of the data is presented in this chapter.

Descriptive Results

The data was analyzed using the Statistical Package for Social Sciences (IBM SPSS Statistics for Windows, Version 26.0, 2019). All data was entered by the PI and reviewed for inconsistencies, outliers, and omissions. Mann-Whitney U and Kruskal-Wallis testing was used for examining the effect of gender in age group, marital status, and levels of education and perceived health. Linear regression was used to establish the relationship between life habits and cognitive reserves, and for hypothesis four, moderation analysis was used to determine the influence of cognitive reserves over the relationship between life habits and life satisfaction. The characteristics of the sample are described in Table 3.

Participants' Social Demographic Information

Approximately 160 individuals responded, and 139 subjects were interviewed but two participants were unable to complete the interview. The final sample size was 137 ($N = 137$). Participants ranged from 75-100 years of age ($M = 86.36$ $SD = 5.64$). The sample consisted of 29% ($n = 40$) males and 70.8% ($n = 97$) females, with 72.3% ($n = 99$) indicating they were widowed. Health status was generally reported

as very good to excellent 70% ($n=82$). In this study, marital status did not yield any significant correlations.

Table 3

Characteristics of Sample (N=137)

	N	Percentage	
Gender			
Male	40	29%	
Female	97	70.8%	
Age			
<83 years	28	20.4%	
84-86 years	35	25.5%	
>86 years	74	54%	
Marital Status			
Married	31	22%	
Widowed	99	72.3%	
Divorced	4	2.9%	
Single	3	2.2%	
Perceptions of Illness			
Excellent	25	18.2%	
Very Good	57	41.6%	
Good	54	39.4%	
Poor	1	1.0%	
Level of Education			
	<u>Female</u>	<u>Male</u>	<u>Female</u> <u>Male</u>
High School	33	3	34% 7.5%
Bachelors	40	26	41.2% 65%
Masters	16	4	16.5% 10.0%
PhD	8	7	8.2% 17.5%

Men were more likely to report their health as very good (55%), as compared to women (36%), while more women (22%) rated their health as excellent as compared to men (10%). In examining the differences in perceived health based on age, it was noted that younger participants (<83 years old) reported perceived health as good to very good (87%). Elder participants (>85 years old) reported their health as good or very good (77.8%). More males 65% ($n=26$) than females 41.2% ($n=40$) completed a four-year college education.

Kruskal-Wallis tests were used to examine differences in perceptions of health according to gender, marital status, and level of education. For each test, participants were divided into four groups according to their perception of health (poor, good, very good, excellent). Results indicated there was no statistically significant difference on perceptions of health based on gender ($X^2(3, n=137) = 5.23, p=.15$) and marital status ($X^2(3, n=137) = .239, p=.971$). However, there was a significant difference in perception of health based on level of education $X^2(3, n=137) = 22.18, p=.003$.

Life Satisfaction

Responses to the Life Satisfaction Index for the Third Age Individual-Short Form (LSITA-SF) for the sample were non-normally distributed with a skewness of 1.110 ($SE=.207$) and kurtosis of 1.522 ($SE=.411$), and a Shapiro-Wilk value of .930 ($p=.000$). Mean score for life satisfaction was 29 ($SD=9.8$), with a range of 12-65.

Statistical tests were conducted to examine the differences in life satisfaction by age, perceptions of health, marital status and level of education. Using the Kruskal-Wallis test, there were significant differences in life satisfaction across age ($X^2(2, N=131) = 5.665, p=.05$). Participants divided into three groups for age: 75-83 years, ($M=27.17,$

$SD=9.53$), 84-86 years ($M=29.44$, $SD=11.0$), and 86 and older ($M=30.8$, $SD=8.54$).

Results indicated older participants reported lower life satisfaction. No significant differences were found in life satisfaction across education levels ($p=.378$).

Again, using the Kruskal-Wallis test, no significance was found initially in the differences in life satisfaction by perceptions of health ($\chi^2(3, n=137) = 6.308, p=.09$). Perceptions of levels of health included: Poor ($n=1$) ($M=30$, $SD=ns$); good ($n=54$) ($M=31.1$, $SD=10.26$); very good ($n=57$) ($M=28$, $SD=90.5$); and excellent ($n=25$) ($M=29$, $SD=26.4$). An outlier in health perceptions included one response as poor. Excluding that result, a significant difference was found in life satisfaction across perceptions of health ($\chi^2(3, N=130) = 6.103, p=.04$), suggesting that individuals who report better perceived levels of health are more likely to report high life satisfaction. Adu-Bader et al. (2002) report findings that life satisfaction is a function of physical health $\beta=.26, p < .001$, and that physical health had the strongest contribution effect on the variance in life satisfaction (14%).

Life Habits

Responses to the life habits scores for the sample were also non-normally distributed with a skewness of -1.602 ($SE=.21$) and kurtosis of 2.329 ($SE=.41$), and Shapiro-Wilk $.796$ ($p=.000$). Scores on the main life habits scale and subscales were consistently high ($M=9.0$, $SD=1.01$), suggesting that the sample was more homogenous. The mean score and standard deviation for the life habits scale and its subscales are represented in Table 6. The subscale LH-Community Life scored relatively low (8.9) next to other categories reporting over 9.0. This subscale assessed the participant's ability to access facilities outside the main residence, such as government office buildings, churches, and

commercial establishments. The ability to perform the task most likely required more accommodations. The LH- Communication subscale had the highest perception of achievability (9.6), which included more in-place activities. LH- Edu scores were consistent with most sampled seniors who were no longer participating in formal or vocational education.

A Kruskal-Wallis test was performed to determine if there were differences in life habits across age groups: Grp 1, $N=40$, <83 yrs. ($M=9.326$ $SD=.997$); Grp 2, $N=52$, $84-86$ yrs. ($M=9.151$, $SD=1.03$); Grp 3, $N=45$, >86 yrs. ($M=8.7p$, $SD=1.23$). The results indicated that there were statistically significant differences in life habits LH according to age [$X^2(2, N=137) = 9.26, p = 0.01$]. The older groups reported lower mean scores on perception of performance of life habits ($M=8.8$), and the younger participants reported higher mean scores ($M=9.36$). In addition, when a Mann-Whitney was used to determine differences in life habits according to the presence of illness, the results showed significant differences in life habits in the presence of illness ($U = 1562, N_1 = 93, N_2 = 44, Z = -2.247, P = 0.025$). Those who report presence of illness reported lower perceptions of life habit performance. Differences in life habit performance based upon perceptions of health and levels of education were not significant, ($[X^2(3, N=137) = 4.328, p=0.237]$ and $[X^2(3, N=137) = .535, p=.91]$, respectively).

Table 4

Performance of LH

	M (SD)	95% CI
LH-Communication	9.6981 (.7588)	[9.57-9.82]
LH-Nutrition	9.4866 (1.022)	[9.31-9.65]
LH-Responsibilities	9.4487 (1.435)	[9.20-9.69]
LH-Fitness	9.3911 (1.221)	[9.18-9.57]
LH-Interpersonal	9.2953 (1.331)	[9.07-9.50]
LH-Personal Care	9.1465 (1.490)	[8.89-9.35]
LH-Community Life	8.9193 (1.541)	[8.68-9.08]
LH-Housing	8.7966 (1.726)	[8.50-9.08]
LH-Mobility	8.7370 (1.932)	[9.06-8.41]
LH-Recreation	8.0270 (2.944)	[7.52-8.52]
LH-Employment	7.8954 (3.233)	[7.35-8.44].
LH-Education	.7934 (2.60)	[0.35-1.23]

Cognitive Reserves

Cognitive reserves total scores in the sample were non-normally distributed with a skewness of .48 ($SE = .21$) and kurtosis of $-.21$ ($SE = .411$) and a Shapiro-Wilk test ($p = .008$). Utilizing the cognitive reserves sub-score of education, the sample's scores were normally distributed with a skewness of .005 ($SE = .207$) and kurtosis of $-.300$ ($SE = .411$) and a Shapiro-Wilk test ($p = .112$).

The cognitive reserves scale was analyzed using the three subscales: education, working activity, and leisure time. (Mean values of CRs appear in Table 7). Much of the sample (56%) reported a "medium" level of cognitive reserves. CR-Education ($M = 127.3$, $SD = 9.5$) had the greatest influence on total cognitive reserves with the lowest standard deviation.

A Mann-Whitney U test was used to test for differences in cognitive reserves scores by gender, and a Kruskal-Wallis test analyzed differences in cognitive reserves by age. The analysis revealed a statistically significant difference in CR levels by gender. Men ($M = 117.9$, $SD = 15.4$) reported a higher level of CR than women ($M = 108.4$, $SD = 16.3$) (Mann-Whitney $U = 1276$, $n_1 = 40$, $n_2 = 97$, $P = 0.002$). There were no statistical significances in cognitive reserves scores by age ($\chi^2 (2, n = 137) = 5.219$, $p = .074$). Grp 1, $N = 40$, < 83 yrs. ($M = 9.326$, $SD = .997$); Grp 2, $N = 52$, 84-86 yrs. ($M = 9.151$, $SD = 1.03$); Grp 3, $N = 45$, > 86 yrs. ($M = 8.7$, $SD = 1.23$), or CR on perceptions of health ($\chi^2 (3, n = 136) = .747$, $p = .688$). Levels of health included: good ($n = 54$) ($M = 31.1$, $SD = 10.26$); very good ($n = 57$) ($M = 28$, $SD = 90.5$); and excellent ($n = 25$) ($M = 29$, $SD = 26.4$). Descriptive statistics of CR Scale are presented in Table 5.

Table 5

Descriptive Statistics of Subscales - Cognitive Reserves Scale

Cognitive Reserves (CR) (n=137)	Mean	SD
CR-Edu	127	9.5
CR-Work	100	23.6
CR-Leisure	96	21.0
CR-Total	111	16.8

Psychometric Properties of the Instruments**Reliability**

Internal consistency. Cronbach's alpha was selected as a measure of internal consistency for the three instruments. Measurements of internal consistency are a function of the number of test items, the average intercorrelations among the test items (Murphy & Davidshofer, 2005), and how well the concept is being measured. Life Satisfaction of the Third Age Index is a highly reliable 12 item scale ($\alpha=.87$). There are no subscales in the short form of this instrument. The CRI-Q Index (20 Items, 3 subscales) was likewise found to be reliable ($\alpha=.73$). The three subscales as well, reported adequate reliability: Cri- Edu ($\alpha=.67$), CRI Working ($\alpha=.84$), and CR- Leis ($\alpha=.80$). According to Nunally, acceptable Cronbach's alpha is $>.70$. In the CRI-Q Index, education consists of fewer items than the other sub-scores, resulting in lower reliability (Briggs & Cheek, 1986). The Life Habits Scale (LH) has 77 items and 12 subscales with an adequate Cronbach's Alpha ($\alpha=.84$) (Fields, 2005).

Inter-item correlation. Inter-item correlation is another method used to analyze internal consistency. The life habits instrument demonstrated satisfactory correlations with 11 out of the 12 subscales: Nutrition, Fitness, Personal Care, Communication, Housing, Mobility, Responsibilities, Interpersonal Relationships, Community Life, Employment, and Recreation. All items correlated with each other in a positive and small to moderate range ($r = .07-.78$) (Dancey &Reidy, 2011) except for LH-education ($r = .05$). LH-Education performed poorly in this age group, as most elders are no longer pursuing education. The item, however, was not deleted, as it did not greatly influence the overall Cronbach's Alpha.

The CRI index showed a satisfactory correlation with the three sub scores of Cognitive reserves: CRI-Education, CRI-Working Activity, and CRI-Leisure, $r = .594$, $r = .770$, $r = .686$, respectively. In the creation of the cognitive reserves scale, assumptions included that the sub scores were all proxies of the same construct, which would make correlations high, but poor economic times caused contradictions within the results related to CR-Education and CR- Working, resulting in weakened correlations between the subgroups CR-Education and CR Working $r = .361$; CR-Education and CR-Leisure $r = .245$; and CR-Work and CR-Leisure $r = .124$ (Nucci et al., 2011).

In this version of the Life Satisfaction Index of the Third Age-Short form (LSITA-SF) Cronbach's alpha achieved good levels ($\alpha = .87$), consistent to the performance of Barrett & Murk (2009) study ($\alpha = .90$). Scoring of the LSITA-SF include a range from 12-72, with lower levels (those approaching 12) indicating high levels of life satisfaction, and those approaching 72 indicating low levels of life satisfaction, and all items with moderate correlations. (See Tables 8 and 9).

Hypotheses

Hypothesis 1: Participants' social demographic characteristics will predict life satisfaction.

Simple linear regression was used to test the predictive relationship of various social demographic characteristics on life satisfaction, including age, gender, perceptions of health, education, and marital status. Two significant predictors were identified. Results indicated that lower life satisfaction is associated with increased age $R^2=.030$, $F(1,135) = 4.133$, $p = .04$). Life satisfaction is equal to $3.22 + .301(\text{age})$ when age is measured in years, and life satisfaction is worsened by $.030$ for each year of age. Results also indicated that perceptions of health were predictive of life satisfaction ($F(1,135) = 4.657$, $p = .03$.) in that higher levels of perceived health predicted improved life satisfaction. Thus, Hypothesis 1 was partially supported. These results are summarized in Table 6 and 7

Table 6

Regression Analysis Summary for Social Demographic Age Predicting Life Satisfaction

Variable	B	95% CI	β	t	p
(Constant)	3.22	[-22.12, 28.57]		.251	.80
Age	.30	[.008, .594]	.301	2.033	.04

Note R^2 adjusted=.030, CI- confidence interval for B

Table 7

*Regression Analysis Summary for Social Demographic perceptions of health
predicting Life Satisfaction*

Variable	B	95% CI	β	t	p
(Constant)	35.90	[29.56, 42.24]		11.204	.000
Perceptions of Health	-2.24	[-4.615, -.201]	-.18	-2.158	.033

Note R^2 adjusted=.030, CI- confidence interval for B

Hypothesis 2: Alterations in life habits of community-dwelling seniors will predict life satisfaction.

A simple linear regression was calculated to predict life satisfaction based on life habits (LH-weighted). Life habits were significant predictors of life satisfaction in this sample ($F(1,135) = 5.211, p = .024$ with an R^2 of .037). Data suggests life satisfaction is improved by 1.71 points for each unit of LH increase and explained 4% of the variation in life satisfaction. Thus, Hypothesis 2 was partially supported.

Using sub-scales of life habits, significance was found in seven of the twelve sub scales, including fitness, personal care, communications, responsibility, interpersonal, employment, and recreation. For all other life habits sub scales, no significance was found.

Table 8

Linear Regression- Life Habits and Life Satisfaction

Variable	B	95% CI	β	t	p
(Constant)	44.78	[31.20, 58.37]		11.204	.000
Perceptions of Health	-1.71	[- 3.193, -.229]	-.19	-3.193	.229

Note R^2 adjusted=.030, CI- confidence interval for B

Hypothesis 3: Cognitive reserves will predict life satisfaction.

Linear regression was used to investigate the relationship between cognitive reserves and the subscales CR-Work, CR-Leisure, and CR-Education and life satisfaction. No significance was found in the relationship of cognitive reserves (total) and life satisfaction ($p=.568$), nor with CR-Education and life satisfaction ($p=.265$) or CR-Leisure and life satisfaction ($p=.108$).

Table 9

Predictive relationship of CR on LS

Variable	B	95% CI	β	t	p
(Constant)	26.01	[14.80, 37.23]		4.59	.000
Cognitive Reserve- total	-1.71	[-3.193, -.229]	-.19	.572	.568

Note R^2 adjusted=.005, CI- confidence interval for B

Simple linear regression was used to predict life satisfaction based on the subscale of CR-Working. CR-Working was found to be a significant predictor of life satisfaction ($F(1,136) = 4.793$ $p = .030$ with an R^2 of .034. Life satisfaction is equal to $21.4 + .08$ (CR-Working).

Table 10

Predictive relationship between CR-work and LS

Variable	B	95% CI	β	t	p
(Constant	21.42	[14.18, 28.66]		11.204	.000
Cognitive	.08	[.007,.147]	.18	2.189	.030
Reserve- work			5		

Note R^2 adjusted=.030, CI- confidence interval for B

Surprisingly, higher levels of life satisfaction-working were associated with poorer levels of life satisfaction consistent with possibly negative associations with retirement or work termination. Therefore, Hypothesis 3 was partially supported.

Hypothesis 4: Cognitive reserves will significantly influence the relationship between life habits and life satisfaction.

To test the hypothesis that cognitive reserves moderate the relationship between life habits and life satisfaction, a Hayes's moderation analysis (2013) was conducted. The overall model results showed the main effect life habits did account for a significant amount of variance in life satisfaction, ($R^2 = .07$, $F(3, 133) = 3.08$, $p = .03$). After the CR and LH interaction term (CR*LH) were added to the model, their conditional effect also accounted for a significant proportion of the variance in LS $\Delta R^2 = .03$, $\Delta F(1, 133) = 3.88$, $p = 0.05$. The interaction was probed by testing the conditional effects of LH at particular values of CR, one standard deviation below the mean, at the mean, and one standard deviation above the mean. As shown in Table 14, LH was significantly

related to life satisfaction when cognitive reserves were one standard deviation below the mean and when at the mean ($p=.003, p=.008$, respectively), but not when cognitive reserves were one standard deviation above the mean ($p = .50$). Results showed that the relationship between life habits and life satisfaction was significant when cognitive reserves was less than .66 standard deviations of the mean and greater than .34 standard deviations of the mean. Examination of the interaction plot showed an enhancing effect that with medium and high-level CR, LS improved, but with low level CR, LS diminished. At high and medium levels of cognitive reserves, as life habits improved level LS, LS were similar for CR with medium or high level, and good LH with high CR had high level LS.

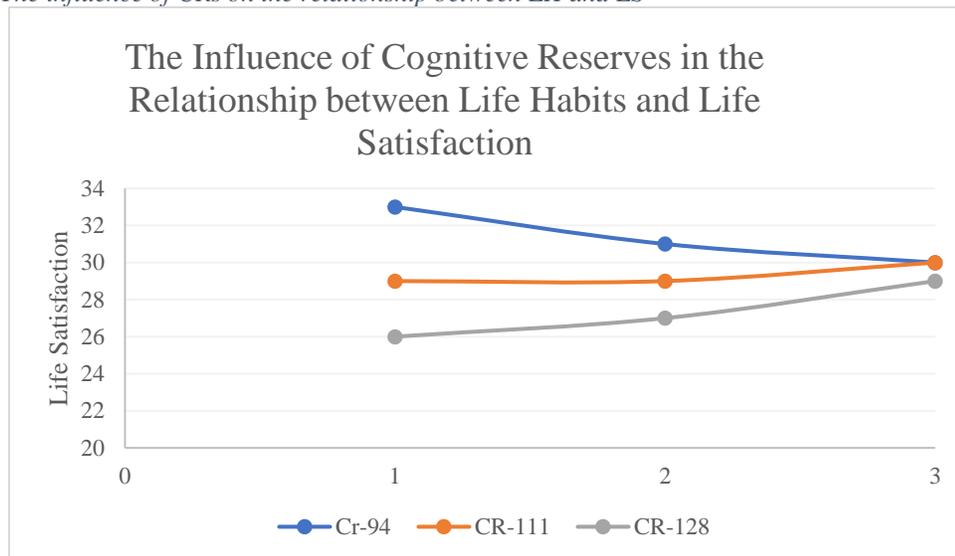
Table 11
Life Satisfaction Predicted from Life Habits and Cognitive Reserves

	β	p	95% CI	
Life Habits	11.63	.024	21.7	1.53
Cognitive Reserves	-.76	.057	-1.5	.02
Life Habits *Cognitive Reserves*	.09	.05	0.0	.17

* $p \leq .05$

Figure 1.

The influence of CRs on the relationship between LH and LS



Using moderation analysis (Hayes) to test the hypothesis that CR-Edu can moderate the life satisfaction and LH Inter, the overall model results show the main effect LH-Inter significantly predicted the LS $R^2 = .09$, $F(3, 133) = 4.28$, $p > .01$. After the CR-Edu and LH-Int interaction terms were added to the model, the conditional effect (CR-Edu * LH-Int) also accounted for a significant proportion of the variance in LS $\Delta R^2 = .03$, $\Delta F(1, 133) = 4.83$, $p = 0.03$. The interaction was probed by testing the conditional effects of LH-Int at particular values of CR-Edu, one standard deviation below the mean, at the mean, and one standard deviation above the mean. As shown in Table 19, LH-Int were significantly related to life satisfaction when cognitive reserves were one standard deviation below the mean and when at the mean ($p = .000$, $p < .01$, respectively), but not when cognitive reserves were one standard deviation above the mean ($p = .89$).

Results showed that the relationship between LH-Int and LS was significant when CR-Edu was less than .58 standard deviations of the mean and greater than .42 of the mean. Examination of the interaction plot showed an enhancing effect between medium and high-level CR-Edu, LS increased, but with low level CR-Edu, LS decreased. At high level LH-Int, LS were similar for CR-Edu with medium or high level, and good LH-Int with high CR-Edu had high level LS.

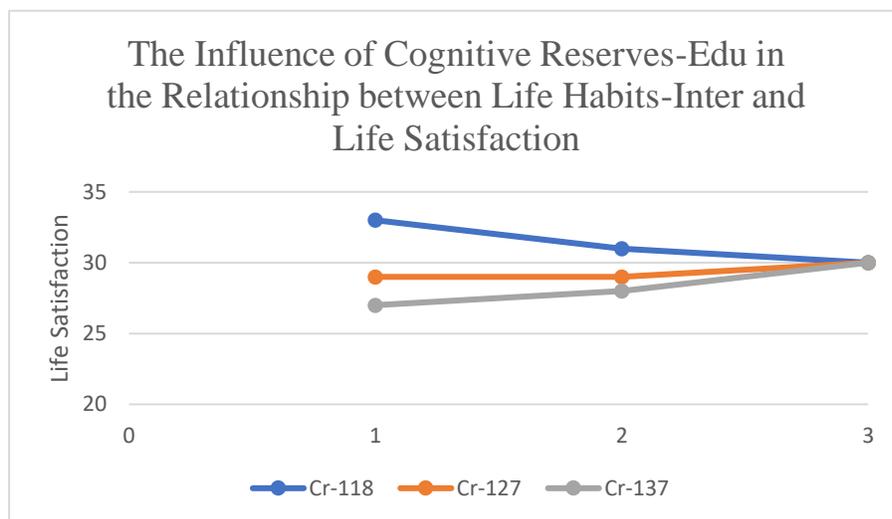
Table 12

Life Satisfaction Predicted from Life Habits-Inter and Cognitive Reserves-Edu

	β	p	95% CI	
Life Habits- Interpersonal	- 20.51	.02	- 37.57	- 3.44
Cognitive Reserves-Edu	-1.13	.04	- 2.59	.04
Life Habits-Int *	.15	.03		.28
Cognitive Reserves-Edu			0.01	

Figure 2

The Influence of CR-Edu in the relationship between LH-Int and LS



Finally, using Hayes's moderation analysis in the hypothesis that CR-Edu can moderate the life satisfaction and LH-Rec, the overall model results show the main effect that LH-Rec significantly predicted the LS $R^2 = .08$, $F(3, 133) = 3.95$, $p = .009$. After the CR-Edu and LH-Rec interaction term were added to the model, the conditional effect (CR-Edu * LH-Rec) also accounted for a significant proportion of the variance in LS $\Delta R^2 = .04$, $\Delta F(1, 133) = 6.35$, $p = 0.01$.

The interaction was probed by testing the conditional effects of LH-Rec at particular values of CR-Edu, one standard deviation below the mean, at the mean, and one standard deviation above the mean. More specifically, LH-Rec were significantly related to life satisfaction when CR-Edu was one standard deviation below the mean and when at the mean ($p = .001$, $p = .01$, respectively), but not when CR-Edu was one standard deviation above the mean ($p = .69$). Results showed that the relationship between LH-Rec and LS

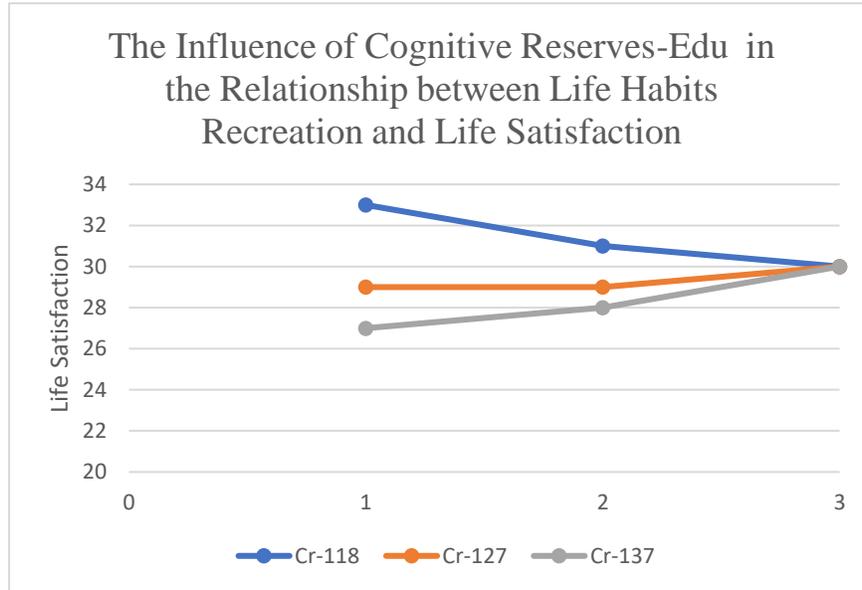
was significant when cognitive reserves was less than .56 standard deviations of the mean and greater than .43 standard deviations of the mean. Examination of the interaction plot showed an enhancing effect between medium and high-level CR-Edu, LS increased, but with low level CR-Edu, LS decreased. At high level LH-Rec, LS were similar for CR-Edu with medium or high level, and good LH-Rec with high CR-Edu had high level LS.

Table 13

LS Predicted from LH-Rec and CR-Edu

	β	p	95% CI	
Life Habits-Rec	-12.16	.003	-21.2	-3.04
Cognitive Reserves-Edu	-.66	.009	-1.2	-.05
Life Habits-Rec *Cognitive Reserves-Edu	.09	.012	0.01	.28

Figure 3
CR-EDU and relation of LH-Rec and LS



CHAPTER 5

Discussion of Findings

The purpose of this study was to explore the relationship between life habits and life satisfaction based upon the availability of cognitive reserves in later life. The study also analyzed the influence of educational, vocational, and leisure accomplishments on perceptions of physiologic conditions and life satisfaction. This chapter will discuss the results and interpretations drawn from the hypotheses based on the theoretical propositions of the Selection, Optimization, and Compensation (SOC) model (Freund, Baltes, 1997).

Findings for Hypotheses

Hypothesis 1: Selected social demographic characteristics of the sample will predict life satisfaction. Hypothesis 1 was designed to assess how life satisfaction may be influenced by general demographic conditions of an aging population. The hypothesis was derived from the overarching theory of selection, optimization, and compensation as it helps to explain how the human condition navigates changes, such as debility associated with aging, to preserve life satisfaction. Relying on the theoretical framework of SOC, available intrinsic resources allow older adults to alter pathways to achieve the best possible balance and relevance in their life. According to Baltes and Baltes (1990), this balance and relevance is considered successful aging.

The purpose of the first hypothesis was to determine if basic demographic characteristics of a sample had an influence on life satisfaction. Marital status, gender, age, perception of illness, and memory change were assessed for their influence on life

satisfaction. The hypothesis was based on Freund and Baltes's theory of Selection, Optimization, and Compensation, a framework for developmental changes that occur across a lifespan. SOC suggests that through a life span, people encounter certain opportunities such as education as well as limitations which include illness (Baltes & Carstensen, 1996; Baltes, 1997). There is substantial evidence in the literature that the relationship between age, gender, education, and signs of cognition are associated with life satisfaction (St. John & Montgomery, 2010). Hilleras et al. (2001) stated that older adults specifically were more likely to report less life satisfaction, and that education has a direct effect on life satisfaction (Meeks & Murrell, 2001). In this study, our findings were supported by the literature. Although levels of education were not part of the study's findings, the influence of continuing education in the development of cognitive reserves did have an influence on life satisfaction. In addition, in this study health perception was also found to influence life satisfaction, which was also consistent with the literature. Poor perceptions of health are associated with lower levels of life satisfaction (Borg et al., 2005).

Hypothesis 2: Alterations in life habits of community-dwelling seniors will predict life satisfaction. The purpose of Hypothesis 2 was to determine how older adults experienced functionality and how changes to functionality influenced life satisfaction. According to SOC, mastery of skills for the activities of daily living (ADL) is a desirable accomplishment. The successful performance of ADLs is a validating life experience and is predictive of levels of life satisfaction (Blace, 2011). Unsuccessful accomplishment of ADLs (functionality), according to SOC, is associated with the use of loss-based selection (Freund & Baltes, 2002), forcing the development of a new strategy or goal. Community-

dwelling alternatives, such as the CCRC, can hopefully mitigate concerns associated with loss-based selection by providing a more controlled environment.

Regardless of living arrangements, aging is associated with increased debility. As predicted, life habits did significantly predict life satisfaction. The ability to perform ADLs predicted improved life satisfaction. Many of the other subscales also predicted life satisfaction; exceptions included mobility, nutrition, responsibility, housing, and community life.

In reviewing survey questions related to the skills associated with life habits, it was noted that living in the continuing care retirement community (CCRC) did not challenge many of the elements of ADLs. "In-place" services offered conveniently by the CCRCs included communication, nutrition, responsibility, fitness, interpersonal relationships, and personal care. Paradoxically, this provision of these amenities resulted in lower activity levels and planning skills among the residents. Other life habits, including community life, recreation, and mobility, required more physical engagement, thereby requiring more accommodation. Using linear regression, the other sub-scales that required more physical activity and were found to predict life satisfaction included recreation, employment, personal care, responsibility, communication, and fitness ($p \geq .05$). (Because of the age of the subjects, elements of employment were consistent with volunteer work.)

SOC can be applied to the regulation of major loss, as well as the adaptation to everyday tasks. It helps to explain patterns of adaptation to negative changes as well as pathways to positive changes (Baltes & Cartensen, 1999). Further research is needed to explicate the influence of these threats to functionality and potentially to the loss of particular life habits.

Hypothesis 3: Cognitive reserves will predict life satisfaction. Hypothesis 3 posited that cognitive reserves would have a positive influence on life satisfaction in that greater cognitive reserves allow individuals to cope better with aging due to a greater distance from dementia (Katzman, 1993). Unfortunately, cognitive reserves can be influenced by cognitive changes such as depression, making it difficult to measure. In this sample, total cognitive reserves, as well as two of the three subscales, cognitive reserves-education and cognitive reserves-leisure, were not predictors of LS.

According to research, education does have a significant influence on reserves and likely serves as a protective factor in the delay of dementia. Education enhances the availability of cognitive strategies available for problem solving (Mortimer, 1997). However, in this study, cognitive reserves-education did not have a predictive role in life satisfaction. Supporting this finding is the Bonn Longitudinal study (n=222) (Rudinger & Thome, 1993) suggesting that objective conditions, such as education, may be less effective in the predictions of behaviors than feeling and behaviors.

The relationship between CR-Leisure and life satisfaction was not statistically significant. In the literature, leisure has been described as immediately experiential and important for its ability to build cognition and reserves. According to Brown et al. (2008), the intent and type of leisure impacts successful aging. For example, culturally defined leisure activities can be more powerful to cognition than reading or sedentary activities. Unfortunately, the decline of normal cognition associated with aging may prevent participation in leisure experiences. Loss of participation in leisure experiences may result in a marked decline in life satisfaction. Testing this relationship may require longitudinal

analysis to assess if and when life satisfaction is affected, because time associated with loss of participation may lag behind cognitive decline.

In this sample, the cognitive reserves-working subscale was a significant predictor of life satisfaction. CR-Working is an area of great importance across the lifespan. The ability to work may be an important source of pride and satisfaction. Because of the nature of work history, extending through multiple years, and requiring training and implementation, it is possible that work would have a greater propensity to have a substantial influence on neural networking, which is consistent with increasing cognitive reserves. Inclusive with the buildup of cognitive reserves, a history of positive work experiences is said to influence life satisfaction (Newman et al., 2015).

Cognitive reserves can be conceptualized as the attempt of the brain's neural network to compensate for the degree of changes that occur through aging and damage from life experiences (Satz et al., 2011). Cognitive reserves are operationalized through education, work, leisure and the overall amount of stimulation afforded to the individual. In our study, the lack of statistical significance may be explained by the use of a cross sectional analysis. Thus, longitudinal studies are needed to further explicate the relationship between cognitive reserves and life satisfaction

Hypothesis 4: Cognitive reserves will significantly influence the relationship between life habits and life satisfaction. Lastly, hypothesis 4 posited that cognitive reserves would moderate the relationship between life habits and life satisfaction. The moderation model revealed that cognitive reserves did act as a moderator. More particularly, cognitive reserves were a moderator for levels of cognitive reserves one standard deviation below the

mean and at the mean. The influence of cognitive reserves lost its effect at levels above the mean.

Exploring the results, social demographic data revealed the sample's age was proportionally above 86 years old, and that decline in life habits was related to age. According to Selection, Optimization, and Compensation, available resources declined in the aging individuals. While some elders are able to enjoy the use of compensation and brain re-networking, others may have reached the maximum level of their reserves. Cognitive reserves were no longer meaningful to consistently provide input into average daily living.

Statistical significance was found in the relationship of the moderator cognitive reserves- education, in the relationship between life habits-recreation and life satisfaction. Education seemed to have had a stronger relationship as a cognitive reserve's indicator, than cognitive reserves-work or cognitive reserves-leisure in this study. The significance was again found one standard deviation below the mean and at the mean of cognitive reserves. Recreational activities were associated with out of residence activities and those with heavy physiologic demands. Accomplishments of these activities were significant as a predictor of life satisfaction. Blace (2012) also found that participation in activities with formal support networks were significant indicators of life satisfaction ($p = 0.00$).

Finally, cognitive reserves education moderated the relationship between life habits- interpersonal life satisfaction. Scores pertaining to interpersonal relationships include the ability to maintain close personal relationships with friends and family. Again, the moderating influence only occurred one standard deviation below and at moderate levels of

cognitive reserves-education. The ability to maintain significant relationships is part of the human experience and is necessarily predictive of life satisfaction ($p >.05$).

By definition, cognitive reserves allow the brain to withstand age-related pathologies and trauma. When cognitive reserves no longer exert an influence on deferring brain pathology, cognitive decline will follow. Depending on the level of reserves and the degree of pathology, the onset of cognitive decline is inevitable. Cognitive reserves are not an indicator of time to death, but their loss is an indicator of onset of cognitive loss.

CHAPTER 6

Summary, Conclusion, and Recommendations

The purpose of the study was broadly to explore the relationships between cognitive reserves, life habits, and life satisfaction and specifically to explore the potential for cognitive reserves to serve as a moderator in the relationship between life habits and life satisfaction. There is significant evidence in the literature to suggest that life satisfaction is associated with health outcomes. Positive perceptions of life habits or abilities (consistent with ADLs) are necessary for people to engage in different categories of activities; withdrawal from these activities can cause a withdrawal from society (Atchley, 1994). In addition, cognitive reserves affect the risk for developing pathology, and failure of cognitive reserves implies the onset of neuropsychiatric syndromes (Salmond et al., 2006). The theory of Selection, Optimization, and Compensation (SOC) provided a conceptual framework for the proposed relationship. Through the use of adaptive coping strategies, seniors are able to adjust to functional decline by tapping into available resources and adjust priorities to influence goal outcomes.

Based on the conceptual frameworks of SOC, life satisfaction, cognitive reserves, and life habits, the following hypotheses were formulated:

1. Hypothesis 1: Selected social demographic characteristics of the community-dwelling third age individual will predict life satisfaction as measured by the LS.
2. Hypothesis 2: Life habits of participants will predict life satisfaction.
3. Hypothesis 3: Cognitive reserves of the third age individual will predict life satisfaction.

4. Hypothesis 4: Cognitive reserves will moderate the relationship between life habits and life satisfaction.

In a cross-sectional study of 137 third age individuals over the age of 75 years, the relationships among cognitive reserves, life habits, and life satisfaction were explored.

Three instruments were used to collect data: The Cognitive Reserve Scale, Life Satisfaction Index, and the Assessment of Life Habits. In addition, three social demographic questions, including the presence of chronic illness, ranking of overall health, and limitations to memory, were assessed. This resulted in approximately 71 questions. Overall timing of the interview process was approximately one hour.

Participants were 29% male and 71% female, with 54% older than 86 years of age. Approximately 72% of the sample were married, even though many were widowed but did not respond as widowed. Eighty-one percentage reported either good or very good health. Less than half of the women had a bachelor's degree, while 65% of males had a bachelor's degree. Seventeen percent of males had a PhD.

Hypothesis 1 was partially supported in that aging and perceptions of health were predictive of life satisfaction ($p < .05$). The cross-sectional nature of the design, small sample size, and recruitment of a homogeneous sample may have been limitations. Further studies should include aged adults living outside the confines of a community retirement center.

Hypothesis 2 was partially supported in that perceptions of life habits were not significant in areas where the retirement center provided services, such as mobility, community life, and nutrition. Mobility was accommodated for in this sample with devices such as walkers, railings, and scooter chairs, and mobility loss has a strong

connection with withdrawal. Community life is related to resident-based activities and shopping based needs. These activities are accessible through services of the residence. Nutrition is also an area addressed by the retirement facility and is delivered in social gatherings in cafes and restaurant like settings. This approach is designed to meet the nutritional and socialization needs of residents of the facility. Education is an additional life habit which was not significant. Consistent with the sample, there was no evidence of academic pursuits by residents.

Hypothesis 3 was again partially supported in that cognitive reserves-work was predictive of life satisfaction. High scores in cognitive reserves-work indicated declines in life satisfaction. Since this sample contained a high percentage of females, it is possible that work may not have had a significant influence in their life and may be negatively construed. A stronger community-based sample may provide more male participants for a better representation on the perceptions of work.

Hypothesis 4 was supported in this research. Moderation analysis showed that cognitive reserves did serve as a moderator in specific regions of the data. Moderation was focused on lower and medium levels of cognitive reserves and may have been indicative of the age-related decline. The influence of cognitive reserves may have declined due to the deleterious influences of aging.

During data collection, life habits were discussed in terms of accommodations. For some, the decline of sight required an accommodation of reading glasses. For others, reading glasses was a normal part of life and not perceived as an accommodation. For some of the participants, the use of a walker was not an accommodation. When the use of a walker was explored by the PI as an accommodation,

the subject stated that it was a “nuisance, and it wasn’t necessary.” As a result, accommodations for ADLs were often overlooked by the participants.

The life satisfaction tool we utilized was a shortened version with twelve data points. Because of the age of the participants and the cross-sectional nature of the study, factors such as fatigue had the potential to influence responses. Although use of the full scale may have permitted greater exploration of the subscales and more in-depth analysis of life satisfaction, we opted to use the short form on the instrument.

Limitations

There were several limitations to this study. The cross-sectional design was a definite restriction because many economic and political changes occurred on a relatively frequent basis during the data period. Residents’ conversations frequently focused on fluctuations in their personal financial situations, which could have impacted perceptions of life satisfaction. Measuring life satisfaction at more than one time point might shed some light on whether deviations could be found based on strong financial and political climate changes.

The composition of the sample did reflect a true picture of the makeup of the retirement centers. More women are available across the third age, making it difficult to generalize the results to males.

Suspicion of the PI’s intent among the residents caused some reluctance to participate. Despite indications of the PI’s reason for the research, some residents viewed my presence as a voice to management.

One strength of the study was the face-to-face experience, which allowed the PI to hear the “side chatter” of residents’ concerns that frequently fell outside of the parameters

of the study. Residents saw the management staff's prompt attention to the needs of the residents as both a blessing and an intrusion. Hallways cluttered with walkers and scooters were reminders to some of the related frailties of aging.

Overall Conclusion

In this study, cognitive reserves, or brain reserves, was perceived to be an important pathway through which levels of life satisfaction were associated with life habits. The cognitive reserves-education subscale also shared a pathway with life satisfaction's association with the life habits recreational and life habits interpersonal subscales. Cognitive reserves pathways affected the relationship of life habits and life satisfaction at different levels. Cognitive reserves moderated the relationship at lower and moderate levels but did not demonstrate any influence at higher levels.

Overall, SOC is employed with increasing age when possible. Higher use of SOC is positively associated with aging satisfaction when subjects are not experiencing social loneliness and SOC can buffer the impact of low resources (Jopp & Smith, 2006). In this study, subjects reporting lower to moderate levels of cognitive reserves were experiencing a predictive response of available cognitive reserves. At low to moderate levels of cognitive reserves, participants actively engaged in SOC techniques of accommodating and employing compensation mechanisms into their average daily living.

Among third age individuals with higher levels of cognitive reserves, it can be expected that job activity (cognitive reserves-work) would allow for increased availability to health services and greater socioeconomic status, providing healthier food and comfort. Higher attainment of leisure activities (CR-Lei) leads to greater life satisfaction and health outcomes. Higher levels of education (CR-Edu) allow for placement into higher

socioeconomics. In addition, higher levels of cognitive reserves allow individuals to compensate for a greater degree of neurodegenerative pathology, which is consistent to the operationalized definition of cognitive reserves. Unfortunately, the anticipated performance of the relationship at higher levels, coupled with increasing age, may have stymied expected performance. The ability to execute SOC activities themselves may have been lost due to aging debility and loss of resources and skills.

Implications for Nursing

Moderation analysis permitted exploration of the relationship between life habits and life satisfaction at specific data points. Low to moderate levels of cognitive reserves are of particular interest to health care, as they serve as a benchmark for assessing and observing appropriate age-related adaptations. Adaptation to age-related changes may predict positive health outcomes.

The achievements associated with SOC, including setting appropriate goals and extinguishing unrealistic ones, can be a baseline indication of neurologic health. Failure to achieve effective optimization of goals or failure to compensate for personal changes should place health care specialists on heightened vigilance. Because seniors may be fearful to disclose physiological or neurological changes, and due to the unpredictable nature of higher cognitive reserves, it would be careless to sidestep neurologic and cognitive health assessment in elder adults. To assume that all high cognitive reserves levels are protective of late life satisfaction would be likely to create further barriers to communication.

Consistent with this study was the failure of subjects to reveal health concerns. Disclosure of memory loss may not have been shared due to fear of upgrading placement into an assisted living facility or nursing home. Depression may not have been disclosed, and it could negate the influence of cognitive reserves and should be assessed prior to any research or assessment.

Another concern with the subjects was response bias. Most subjects would prefer to be life satisfied but are reluctant to indicate they are not. The confirmation that someone is not life satisfied may be personally humiliating.

Recommendations

Areas of future study should include the use of medical supervision in the construction of senior facilities. Facilities including Continued Care Retirement Communities (CCRC) provide lifestyle simplicity and accessibility. Home safety is improved due to handrails, cooking restrictions, and reach restrictions. Travel and itinerary development are handled by administration. But there appears to be a cost to over accommodating needs.

Unfortunately, dependency on balance bars and complex motor skills can be dulled or extinguished, potentially causing the loss of joint proprioception. Evidence in the literature suggests that activities that require movement require fine coordination of spatial and temporal efforts. These activities are needed as stimuli for motor-learning. Motor

learning is not age-related and is necessary for the improvement and maintenance of motor skills. Most often, functional simplicity provided by the facility, although necessary for some, is not physiologically required by others. The loss of available stimulation can be detrimental.

Inadvertently, the CCRC may be contributing to the loss of functioning and independence. Limiting functionality has a problematic potential to accelerate the loss of physiologic conditioning whether visible or invisible.

Final Thoughts

Aging is a journey through a life span, where anticipated and predicted declines will be evidenced as long as we live long enough. Each cell has a life span, which can be fed with stimulation of different forms. Nutrients can include educational pursuits, leisure activities, or professional pursuits. The more we engage in such pursuits, the greater the potential benefit. The objective is to live longer than these pathologies, maximize cognitive reserves, and enjoy the greatest quality of life.

REFERENCES

- Adu-Bader, S., Rogers, A & Barusch, A. (2002) Predictors of Life Satisfaction in Frail Elderly, *Journal of Gerontological Social Work*, 38:3, 3-17, DOI: 10.1300/J083v38n03_02.
- Adams, D. L. (1969). Analysis of a life satisfaction index. *Journal of Gerontology*, 24, 470-474.
- Adams, D. (1971). Correlates of life satisfaction in old age. *Gerontologist*, 11, 64-68
https://doi-org.proxy.libraries.rutgers.edu/10.1093/geront/11.4_Part_2.64.
- Albert, M., Jones, K., Savage, C.R., Berkman, L., Seeman. T.& Blazer D. (1995). Predictors of cognitive change in older persons: MacArthur Studies of Successful Aging. *Psychology and Aging*.;10:578–589.
- Alzheimer Association Alzheimer's disease facts and figures. 2015 Alzheimer's Disease Facts and Figures. 2015;11(3):332–420. Retrieved from http://www.alz.org/downloads/facts_figures_2015.pdf.
- Alzheimer's Association (2010). Alzheimer's Disease Facts & Figures, 2010. Chicago: *Alzheimer's and Dementia: the journal of the Alzheimer's Association*
Retrieved from <http://www.alz.org/facts/#quick> Facts 6(2):158-94. doi: 10.1016/j.jalz.2010.01.009.
- Alzheimer's Association (2011). Alzheimer's Disease Facts & Figures. Alzheimer's and Dementia: the journal of the Alzheimer's Association
Retrieved from https://www.alz.org/national/documents/Facts_Figures_2011.pdf

Alzheimer's Association. (2016). *Alzheimer's disease Facts and Figures*, Chicago.

Retrieved

from <http://www.alz.org/facts/#quickFacts> *Alzheimer's and Dementia: the journal of the Alzheimer's Association* 12(4):459-509 DOI: 10.1016/j.jalz.2016.03.001.

Anaby, D., Miller, W.C., Eng, J.J., Jarus T. & Noreau L. (2009). Can personal and environmental factors explain participation of older adults? *Disability and Rehabilitation*. 26:1–8. Available from:

<https://doi.org/10.1080/09638280802572940>.

Anantanasuwong, D. & Seenprachawong, U. (2012). Life Satisfaction of the Older Thai: Findings from the Pilot HART. In: National Research Council (US) Panel on Policy Research and Data Needs to Meet the Challenge of Aging in Asia; Smith JP, Majmundar M, editors. *Aging in Asia: Findings from New and Emerging Data Initiatives*. Washington (DC): National Academies Press (US). 18. Available from: <https://www.ncbi.nlm.nih.gov/books/NBK109215/>.

Atchley, R. (1994) *The social forces in later life. An introduction to social gerontology* (7th ed.) Belmont Ca: Wordsworth.

Baltes, P. B. (1987). Theoretical propositions of life-span developmental psychology: On the dynamics between growth and decline. *Developmental Psychology*, 23(5), 611–626. <https://doi.org/10.1037/0012-1649.23.5.611>.

Baltes, P. (1997). On the incomplete architecture of human ontogeny: Selection optimization and compensation as a foundation of development theory. *American Psychologist*, 52, 366-380.

- Baltes, P. & Baltes, M. (1980). Plasticity and variability in psychological aging: methodological and theoretical issues. In G.E. Girski (Ed.), *Determining the effects of aging on the central nervous system* (41-66). Berlin: Schering.
- Baltes, P., & Baltes, M. (1990). Psychological perspective on successful aging: The model of selection optimization with compensation. In P. Baltes & M. Baltes (Eds.), *Successful aging: Perspectives from the behavioral sciences* (pp. 1-34). New York, NY Cambridge University Press.
- Baltes, P. B., Baltes, M. M., Freund, A. M., & Lang, F. R. (1999). The measure of selection, optimization, and compensation (SOC) by self-report (Tech. Rep. 1999). Berlin, Germany: Max Planck Institute for Human Development.
- Baltes, M., & Carstenson, L. (1996). The process of successful aging. *Aging and Society*, 16(4), 397-421.
- Baltes, P., Dittmann-Kohl, F. & Dixon, R. (1984). New perspectives on the development of intelligence in adulthood: toward a dual-process conception and a model of selection optimization with compensation. In P.B Baltes and O.G. Brim, Jr (Eds.) *Life -span development and behavior* (6) (pp.33-76) New York: Academic Press.
- Bandura, A. (1977). Self-efficacy: Toward a unifying theory of behavioral change. *Psychological Review*, 84, 191-215.
- Barrett, A.J., Murk, P.J., editors. (2006) Life Satisfaction Index for the Third Age-Short Form (LSITA_SF): An improved and briefer measure of successful aging. University of Missouri-St. Louis; St. Louis.

- Barrett II, A & Murk, P. (2009). Life Satisfaction Index for the Third Age – Short Form (LSITA-SF): An Improved and Briefer Measure of Successful Aging. 10.13140/2.1.1937.4085.
- Barulli, D., & Stern, Y. (2013). Efficiency, capacity, compensation maintenance,plasticity Emerging concepts in cognitive reserves. *Trends in Cognitive Science*, 17(10).
- Bastin, C., Yakushev, I., Bahri, M. A., Fellgiebel, A., Eustache, F., Landeau, B., & Salmon, E. (2012). Cognitive reserve impacts on inter-individual variability in resting-state cerebral metabolism in normal aging. *NeuroImage*, 63(2), 713–722. doi:10.1016/j. neuroimage.2012.06.074.
- Berg, A., Hassing, L.B., McClearn, G.E. & Johansson B. (2006). What matters for life satisfaction in the oldest-old? *Aging and Mental Health* 10(3):257-64.
- Beutal, M., Glaesmer, H., Wiltink, J., Marian, H., & Brahler, E. (2009). Life satisfaction, anxiety, depression and resilience across the life span of men. *The Aging Male* 12(1):32-39.
- Blace, N. (2012). Functional ability, participation in activities and life satisfaction of older people. *Asian Social Science* 8(3)75-87 doi:10.5539/ass. v8n3p75.
- Billek-Sawhney, B., & Reicherter, E. (2005). Literacy and the older adult: Educational considerations for health professionals. *Topics in Geriatric Rehabilitation*, 21(4), 275–281. DOI: 10.1097/00013614-200510000-00004.
- Bishop, N.A., Lu, T. & Yankner A. (2010). Neural mechanisms of ageing and cognitive decline. *Nature*, 529-535.

- Borg, C., Hallberg, I. & Bloomquist, K. (2005). Life satisfaction among older (65+) with reduced self-care capacity: the relationship to social, health and financial aspects. *Journal of Clinical Nursing* (15),607-618.
- Brault, M. (2012). *Americans with Disabilities Household Economic Status: Current Population Report* Retrieved from <http://www.census.gov/prod/2012pubs/p70-131>.
- Browne, J., O'Boyle, H., McGee, H., Joyce, R., McDonald, N., O'Malley, K. & Hiltbrunner, B (1994) Individual quality of life. *Quality of Life Research*, 3(4) (235-244) doi:10.1007/BF00434897.
- Carstensen, L. L., Hanson, K. A., & Freund, A. M. (1995). Selection and compensation in adulthood. In R. A. Dixon & L. Bäckman (Eds.), *Compensating for psychological deficits and declines: Managing losses and promoting gains* (p. 107–126). Lawrence Erlbaum Associates, Inc.
- Clarke, P., Ailshire, J., House, J., Morenoff, J., King, K., Melendez, R., & Langa, K. (2012). Cognitive function in the community setting: The neighborhood as a source of 'cognitive reserves.' *Journal of Epidemiological Community Health*, 66(8).
- Colby, S., & Ortman, J. (2014). The Baby Boom Cohort in the United States: 2012 to 2060. Current Population Reports Population Estimates and Projections. U.S. Department of Commerce Economics and Statistics Administration U.S. Census Bureau <https://www.census.gov/content/dam/Census/library/publications/2018/acs/ACS-38.pdf>.

- Centers for Disease Control. (2013). State of Age and Health in America .Retrieved from http://www.cdc.gov/features/agingandhealth/state_of_aging_and_health_in_america_2013.pdf.
- Chipperfield, J. G., & Havens, B. (1992). A longitudinal analysis of perceived respect among elders: Changing perceptions for some ethnic groups. *Canadian Journal on Aging, 11*, 15-30. <https://doi.org/10.1177/089826439300500404>.
- Christiansen, C., & Baum, C. (1991). Occupational therapy: Intervention for life performance. In C. Christiansen & C. Baum (Eds.), *Occupational therapy: Overcoming human performance deficits* (pp. 3-43). Thorofare, NJ: SLACK Incorporated.
- Convention of the Rights of Persons with Disabilities (CRPD). (2006). United Nations, Department of Economic and Social affairs: Disability. <https://un.org/development/desa/disabilities/convention-on-the-rights-of-persons-with-disabilities.html>.
- Cummings, B.J. & Cotman, C.W. (1995) Image analysis of β -amyloid load in Alzheimer's disease and relation to dementia severity. *Lancet 346*, 1524–1528.
- Dean, A., Kolody, B., & Wood, P. (1990). Effects of social support from various sources on depression in elderly persons. *Journal of Health and Social Behavior, 31*(2).
- De Guzman, A. (2011). Correlates of geriatric loneliness in Philippine nursing homes: a multiple regression model. *Educational Gerontology, 38*: 563-572.
- Depp, C., Harmell, A., Vahia, I. (2011) Successful cognitive aging. In: Pardon M., Bondi, M (eds). Behavioral Neurobiology of Aging. *Current topics in Behavioral Neuroscience*, vol 10. Berlin: Springer.

Demers, L., Robichaud, L., Gelinas, I., Noreau, L. & Desrosiers. (2009). Coping strategies and social participation in older adults. *Gerontology* 55(2), 233-23. DOI: 10.1159/000181170.

Dogra, S., & Stathokostas, L. (2012). Sedentary behavior and physical activity are independent predictors of successful aging in middle-aged and older adults. *Journal of aging research*, 2012, 190654. doi:10.1155/2012/190654.

Elias, M., Schultz, N., Robbins, M., & Elias, P. (1989). A longitudinal study of neuropsychological test performance by hypertensive and normotensive adults. Initial Findings. *Journal of Gerontology*, 41, 25-28.

Elias, M., Elias, J., & Elias, P. (1989). Biological and health influences on behavior. In J. E. Birren & W. Schaie (Eds.), *Handbook on the Psychology of aging* (3rd ed., pp. 79-102). San Diego, CA: Academic Press.

Erickson, E. (1982). *The life cycle completed*. New York, NY: W. W. Norton Company.

Faul, F., Erdfelder, E., Buchner, A., & Lang, A.-G. (2013). G*Power Version 3.1.7 [computer software]. Universität Kiel, Germany. Retrieved from <http://www.psych.uni-duesseldorf.de/abteilungen/aap/gpower3/download-and-register>.

Fees, B.S., Martin, P., & Poon, L.W. (1999). Model of loneliness in older adults. *Journals of Gerontology: Psychological Sciences and Social Sciences*, 54B(4), 231-239.

Flood, M. (2002). Successful aging: a concept analysis. *Journal of Theory Construction & Testing*. 6(2):105–108.

- Fougeyrollas, P., Noreau, L. & St-Michel G. (2002). Life Habits Measured shortened version (LIFE-H 3.1). Lac St-Charles: International Network on the Disability Creation Process
- Fougeyrollas, P., Cloutier, H  l  ne, R., Jacques, B., & St Michel, G. (1999). The Quebec Classification: Disability creation process network on the disability creation process.
- Freedman, V. A., Kasper, J. D., Spillman, B. C., Agree, E. M., Mor, V., Wallace, R. B., & Wolf, D. A. (2014). Behavioral adaptation and late-life disability: a new spectrum for assessing public health impacts. *American Journal of Public Health, 104*(2), e88–e94. doi:10.2105/AJPH.2013.301687
- Fried, L., Herdman, S., Kuhn, K., Rubin, G. & Turano K. (1991). Preclinical disability – hypotheses about the bottom of the iceberg. *Journal of Aging Health; 3*:285-300.
- Freund, A., & Baltes, P. (1998). Selection, optimization, and compensation as strategies of life management: Correlations with subjective indicators of successful aging. *Psychology and Aging, 13*(4), 531–543. <https://doi.org/10.1037/0882-7974.13.4.531>
- Freund, A., & Baltes, P. (2000). The orchestration of selection, optimization, and compensation: An action-theoretical conceptualization of a theory of developmental regulation. In W. J. Perrig & A. Grob (Eds.), *Control of human behavior, mental processes, and consciousness* (pp. 35–5). NJ: Lawrence Erlbaum Associates.

- Freund, A. & Baltes, P. (2002). Life-management strategies of selection, optimization, and compensation: Measurement by self-report and construct validity. *Journal of Personality and Social Psychology*, 82 (4), 642–662.
- Gage, M., & Polatajko, H. (1994). Enhancing occupational performance through understanding on perceived self-efficacy. *American Journal of Occupational Therapy*, 58(5), 452-452.
- Gagnon, C., Mathieu, J., Noreau, L. (2007). Life habits in Myotonic Dystrophy Type 1. *Journal of Rehabilitative Medicine*, 39-560-566.
- Gauvain, M. (1998) Cognitive development in social and cultural context. *Current Directions in Psychological Science*.7(6) (pp.188-192).
<https://doi.org/10.1111/1467-8721.ep10836917>
- Girzadas, P., Counte, M., Gladon, G., Tancredi, D. (1993). An analysis of elderly health and life satisfaction. *Behavior, Health and Aging*,3(2),103-117.
- Golant, S. M. (2015a). Residential normalcy and the aging in place behaviors of older Americans. *Progress in Geography*, 34(12), 1535–1557.
 doi:10.1093/geront/gnu036.
- Golant, S. M. (2015b). Residential normalcy and the enriched coping repertoires of successfully aging older adults. *The Gerontologist*, 55(1), 70–82.
 doi:10.18306/dlkxjz.2015.12.00
- Gotlieb, G. (2007). Probabilistic epigenetics. *Developmental Science*.10.1-11.10.1111/j.1467-7867.2007.00556.x.
- Greve, W., & Staudinger, U. M. (2006). Resilience in later adulthood and old age: Resources and potentials for successful aging. In D. Cicchetti & D. J. Cohen

(Eds.), *Developmental psychopathology: Risk, disorder, and adaptation* (p. 796–840). John Wiley & Sons Inc.

Grove, L., Loeb, S. & Penrod, J.(2009). Selective optimization with compensation: a model for elder health programming. *Clinical Nurse Specialist*: 23(1), p 25-32.

doi: 10.1097/01.NUR.0000343080.57838.2f.

Havighurst, R. J. (1961). Successful aging. *The Gerontologist*, 1, 8–13.

<https://doi.org/10.1093/geront/1.1.8>.

Hayes, A. F. (2013). *Methodology in the social sciences. Introduction to mediation, moderation, and conditional process analysis: A regression-based approach*. Guilford Press.

Hayes, A. & Matthes, J. (2009), Computational procedures for probing interactions in OLS and logistic regression. SPSS and SAS implementations. *Behavior Research Methods*,41,924-936

He, W., and Muenchrat M.N. (2011). *90+ in the United States: 2006–2008*. Washington, DC: U.S. Census Bureau, American Community Survey Reports, AC-17, U.S. Government Printing Office.

Hendrie, H.C., Albert, M. S., Butters, M. A., Gao, S., Knopman, D. S. & Launer L. (2006). The NIH cognitive and emotional health project: report of the critical evaluation study committee. *Alzheimer's & Dementia*, 2, 12–32.

Hilleras, P, Jorm, S., Herlitz, A. & Winbald, B (2001). Life satisfaction among the very old: A survey on a cognitively intact sample aged 90 years or above. *International aging and Human Development*, 52(1),71-90.

- Ho, H. K., Matsubayasi, K., Wada, T., Kimura, M., Yano, S., Otsuka, K....Saijoh, K. (2003). What determines the life satisfaction of the elderly? Comparative study of residential care home and community in Japan. *Geriatrics and Gerontology International*, 3, 79-85.
- Holmes, J., Powell-Griner, E., Lethbridge-Cejku, M., & Heyman, K. (2009) *Aging Differently: Physical Limitations Among Adults Aged 50 years and Over: United States*, (2001-2007) NCHS Data Brief #20 Retrieved from www.cdc.gov/nchs/data/databriefs/db20.pdf.
- Holmes, C., Cunningham, C., Zotova, E., Woolford, J., Dean, C., Kerr, S. Culliford, D. & Perry, V. (2009) Systemic inflammation and disease progression in Alzheimer disease. *Neurology* 73,(10) 768-774; DOI: 10.1212/WNL.0b013e3181b6bb95.
- Hoyt, D. R., & Creech, J. C. (1983). The Life Satisfaction Index: A methodological and theoretical critique. *Journal of Gerontology*, 38(1), 111–116.
<https://doi.org/10.1093/geronj/38.1.111>
- Hurd, M.D., Martorell, P., Delavande, A., Mullen, K. & Langa. K. (2013). Monetary costs of dementia in the United States. *New England Journal of Medicine*; 368, 1326-34.
- Idler, E.& Kasl, S. (1991). Health perceptions and survival; do global evaluations of health status really predict mortality? *Journal of Gerontology*, 46(2), S55-65.
- International Classification of Functioning, Disability and Health [ICF],2011.
<https://doi.org/10.1080/09638280802572940>.
- ISTAT (Istituto Nazionale di Statistica) Rapporto annuale. La situazione del Paese nel 2008. (National Institute of Statistics. Annual report(2008)The situation of the country in 2008) retrieved from <http://www.istat.it/en/publications>.

- Iwasa, H., Yoshida, Y., Kai, I., Suzuki, T., Kim, H. & Yoshida H. (2012). Leisure activities and cognitive function in elderly community-dwelling individuals in Japan: a 5-year prospective cohort study. *Journal of Psychosomatic Research*. 72(2),159-64
<https://doi.org/10.1016/j.jpsychores.2011.10.002>.
- James, B., Boyle, P., Bennett, J., & Bennett, D. (2012). The impact of health and financial literacy on decision making in community based older adults. *Gerontology*, 58, 531–539. doi:10.1159/000339094.
- Jones, R., Manly, J., Glymour, M.M., Rentz, D.M., Jefferson, A.L. & Stern Y. (2011). Conceptual and measurement challenges in research on cognitive reserve. *Journal of International Neuropsychological Society*, 17(4), 593-601. DOI: 10.1017/S1355617710001748.
- Jorm, A., & Jolley, D. (1998). The incidence of dementia: A meta-analysis. *Neurology*, 51, 728-33. <http://dx.doi.org/10.1212/WNL.51.3.728>.
- Jopp, D. & Smith, J. (2006). Resources and life management strategies as determinants of successful aging: On the protective effect of selection, optimization, and compensation. *Psychology of Aging* 21(2), 253-265, <https://doi.org/10.1037/0882-7974.21.2.253>.
- Kaplan, G., Pamuk, E., Lynch, J., Cohen, R. & Balfour, J. (1996). Inequality in Income and Mortality in the United States: Analysis of Mortality and Potential Pathways. *British Medical Journal* (Clinical research ed.). 312, 999-1003.
 10.1136/bmj.312.7037.999.
- Karp, A., Kåreholt, I., Qiu, C., Bellander, T., Winblad, B. & Fratiglioni, L. (2004) Relation of education and occupation-based socioeconomic status to incident Alzheimer's

disease. *American Journal of Epidemiology*, 159(2),175-83.

<https://doi.org/10.1093/aje/kwh018>.

Katzman, R., Terry R., DeTeresa, R., Brown T., Davies P., Fuld P., Renbing, X.,& Peck, A. (1988). Clinical, pathological, and neurochemical changes in dementia: a subgroup with preserved mental status and numerous neocortical plaques. *Annals of Neurology*, 23(2), 138-44.

Katzman, R. (1993). Education and the prevalence of dementia and Alzheimer's disease. *Neurology*, 43, 13-20.

Kelly, C. (1990). Helping low-literacy patients: What they don't know can hurt them. *Professional Medical Assistant*, 32(1), 8–13.

Kliegel, M., Zimprich, D. & Rott, C. (2004) Life-long intellectual activities mediate the predictive effect of early education on cognitive impairment in centenarians: a retrospective study, *Aging & Mental Health*, 8:5, 430-437, DOI: [10.1080/13607860410001725072](https://doi.org/10.1080/13607860410001725072).

Kuypers, J. A., & Bengtson, V. L. (1973). Social breakdown and competence: A model of normal aging. *Human Development*, 16(3), 181–201.
<https://doi.org/10.1159/000271275>.

Laslett, P. (1989). A fresh map of life: The emergence of the third age. *Population and Development Review*, 16(2).

Lee, S., Kawachi, I., Berkman, L. & Grodstein, F. (2003). Education, other socioeconomic indicators, and cognitive function. *American Journal of Epidemiology*; 157, 712–20.

- Leonardi, M., Bickenbach, J., Ustun, T.B., Kostanjsek, N.B. & Chatterji, S.(2006). The definition of disability: what is in a name? *Lancet*, 368, 1219-21.
- Levasseur, M., Desrosiers, J., & Noreau, L. (2004). Is social participation associated with quality of life of older adults with physical disabilities? *Disability and Rehabilitation*, 26(20), 1206-1213.
- Levasseur, M., Desrosiers, J., & St Cyr Tribble, D. (2008). Do quality of life, participation and environment of older adults differ according to level of activity? *Health and Quality of Life Outcomes*, 6, 30.doi: 10.1186/1477-7525-6-30.
- Lemmens, J., van Engelen, E., Post, M., Beurskens, A., Wolters, P. & de Witte, L.P. (2007). Reproducibility and validity of the Dutch Life Habits Questionnaire (LIFE-H 3.0) in older adults. *Clinical Rehabilitation*, 21(9), 853-62.
- Li, S. (2003). Biocultural orchestration of developmental plasticity across levels: The interplay of biology and culture in shaping the mind and behavior across the life span. *Psychological Bulletin*, 129, 171-194.
- Li, S., & Freund, A. (2005). Advances in lifespan psychology: A focus on biocultural and personal influences. *Research in Human Development*, 2, 1-23.
- La Rue, A. (1992). *Aging and neuropsychological assessment*. New York, NY: Plenum Press.
- Maddox, G.L. & Douglass, E.B. (1973). Self-assessment of health: a longitudinal study of elderly subjects. *Journal of Health and Social Behavior* 14(1), 87-93.
- Maguire, G. H. (1983). An exploratory study of the relationship of valued activities to the life satisfaction of elderly persons. *Occupational Therapy Journal of Research*, 3, 164-172.

- Manly, J., Touradji, P., Tang, M., & Stern, Y. (2003). Literacy and memory decline among ethnically diverse elders. *Journal of Clinical and Experimental Neuropsychology*, 25(5), 680-690.
- Manly, J., Stumpf, N., Ming-X, T., Stern, Y (2005). Cognitive decline and literacy among ethnically diverse elders. *Journal of Geriatric Psychiatry*, 18:213 doi: 10.1177/0891988705281868.
- Marsiske, M., Lang, F., Baltes, P., Baltes, M. (1995) Selection optimization with compensation span perspectives on successful human development. In R. Dixon & L. Blackman (Eds.), *Psychological compensation: Managing losses and promoting gains*(pp35-70) Hillside, NJ: Erlbaum.
- McEwen, B. (2006). State of the art protective and damaging effects of stress mediator's central role of the brain. *Dialogues in Clinical Neuroscience* 8(4), 367-81.
- Meisner, B., Dogra, S., Logan, A., Baker, J., & Weir, P. (2010). "Do or decline? Comparing the effects of physical inactivity on biopsychosocial components of successful aging." *Journal of Health Psychology*, 15(5), 668-696.
- Medley, M. (1976) Satisfaction with life among persons sixty-five years and older. *Journal of Gerontology*, 31(4),448-455.
- Meeks, S., & Murrell,S. (2001) Contributions of education to health and life satisfaction in older adults mediated by negative affect. *Journal of Aging and health*, 16(1), 92-119.
- Miller, S. M., & Chan, F. (2008). Predictors of life satisfaction in individuals with intellectual disabilities. *Journal of Intellectual Disability Research*, 52(12), 1039–1047. <https://doi.org/10.1111/j.1365-2788.2008.01106.x>

- Mondini S., Guarino R., Jarema G., Kehayia E., Nair V., Nucci M. & Mapelli, D. (2014). Cognitive reserve in a cross-cultural population: the case of Italian emigrants in Montreal. *Aging Clinical Experimental Research*. 26, 655–659. 10.1007/s40520-014-0224-0.
- Murphy, K. & Davidshofer, C. (2001). *Psychological testing: Principles and applications* (2nd ed.). Retrieved from https://www.researchgate.net/publication/232517003_Psychological_testing_Principles_and_applications_2nd_ed.
- National Assessment of Adult Literacy. (2003). (NCES 2005-531). U.S. Department of Education. Washington, DC: National Center for Education Statistics.
- National Center for Education Statistics (2003). National Assessment of Adult Literacy 2003: Overview. Washington, DC: National Center for Education Statistics. Available at: <http://nces.ed.gov/naal/design/about02.asp>. Accessed Sept 14, 2015.
- National Institute on Aging (Oct 2011). Living longer health and aging U.S. Department of Health and Human Services Global Health and Aging. Retrieved from <https://www.nia.nih.gov/research/publication/global-health-and-aging/living-longer>.
- Neugarten, B., Havighurst, R. & Tobin, S. (1961). The measurement of life satisfaction. *Journal of Gerontology*. 16,134-143
- Noreau, L., Fougereyrollas, P., & Vincent, C. (2002). The LIFE-H: Assessment of the quality of social participation. *Technology and Disability*, 14, 113-118.
- Noreau, L. (2014). Assessment of Life Habits Scale (LIFE-H) <http://www.indcp.qc.ca/assessment-tools/introduction/life-h>

- Noreau, L., Desrosiers, J., Robichaud, L., Fougereyrollas, P., Rochette, A., & Viscogliosi, C. (2004). Measuring social participation: Reliability of the Life-H among older adults with disabilities. *Disability and Rehabilitation, 26*(6), 346-52.
- Nguyen, S. (2014). Fear as a predictor of life satisfaction in retirement in Canada. *Educational Gerontology, 40*, 102-122
- Norris, A. (2005). Path Analysis. In Munro, B. (Ed.), *Statistical Methods for Health Care Research* (4th ed., pp. 377-404). Philadelphia: Lippincott.
- Nucci, M, Mapelli, D., Mondini, S. (2012). Cognitive Reserve Index questionnaire (CRIq): a new instrument for measuring cognitive reserve. *Aging Clinical and Experimental Research, 24*(3), 218-26. doi: 10.3275/7800.
- Pang, M.Y.C., Eng, J.J. & Miller, WC. (2007). Determinants of satisfaction with community reintegration in older adults with chronic stroke: Role of balance self-efficacy. *Physical Therapy, 87*(3), 282–291. doi: 10.2522/ptj.20060142.
- Poulin., & Desrosiers, J. (2009). Reliability of the Life-H satisfaction scale and relationship between participation and satisfaction of older adults with disabilities. *Disability and rehabilitation, 31*(16),1311-1317.
- Preacher, K., Rucker, D., Hayes, A. (2007) Addressing moderated and mediation hypothesis: theory, methods and prescriptions. *Multivariate Behavioral Research*.42.10.1080/00273170701341316
- Qiu, C., Backman, L., Winblad, B., Aguero-Torres, H., & Fratiglioni, L. (2001). The influence of education on clinically diagnosed dementia incidence and mortality data from the Kungsholmen Project. *Archives of Neurology, 58*, 2034–39.

- Rabbitt, P., Lunn, M., Wong, D. & Cobain, M., (2008) Sudden declines in intelligence in old age predict death and dropout from longitudinal studies. *The Journals of Gerontology: Series B*, 63, (4), 205–P211, <https://doi.org/10.1093/geronb/63.4.P205>
- Richards, M., & Sacker, A. (2003). Lifetime antecedents of cognitive reserve. *Journal of Clinical and Experimental Neuropsychology*, 25, 614-24.
- Rogers, S. (1999). The nexus of job satisfaction, marital satisfaction and individual well-being: does marriage order matter? *Research in Sociology of Work*, 7, 141-167.
- Roodin, P., & Rabash, J. (1985). Social Cognition: A life span perspective. In T. M. Shlecker & M. P. Toglia (Eds.), *New directions in cognitive science* (pp. 116-134). Norwood, NJ: Ablex.
- Rossi, I., Rousson, V., & Paccaud, F. (2013). The contribution of rectangularization on the secular increase of life expectancy: An empirical study. *International Journal of Epidemiology*, 42(1), 250-258.
- Rudinger, G., & Thoma, H. (1993). The Bonn longitudinal study ongoing coping life adjustment and life satisfaction. In P. B. Baltes & M. M. Baltes (Eds.), *Successful aging: Perspectives from the behavioral sciences* (pp. 265-295). New York, NY: Cambridge University Press.
- Rybash, J., Hoyer, W., & Roodin, R. (1986). *Adult cognition and aging developmental changes in processing knowing and thinking*. New York, NY: Pergamon Press.
- Sachs-Ericsson, N. & Blazer, D.J. (2005). Racial differences in cognitive decline in a sample of community-dwelling older adults: The mediating role of education and literacy. *American Journal of Geriatric Psychiatry*, 13(11), 968-75.

- Salmond, C., Menon, D., Chatfield, C., Pickard, J. & Sahakian, B. (2006). Cognitive Reserve as a Resilience Factor against Depression after Moderate/Severe Head Injury. *Journal of Neurotrauma*, 23(7), 1049-58. <http://doi.org/10.1089/neu.2006.23.1049>.
- Saltz, P., Cole, M., Hardy, D., Russavosky, Y. (2011) Brain and cognitive reserves: mediators and construct validity, a critique. *Journal of Clinical and Experimental Neuropsychology*, 33(1), 120-130 doi:10.1080/13803395.2010.493151.
- Sarkisian, C., Hays, R., & Mangione, C. (2002). Do older adults expect to age successfully? The association between expectations regarding aging and beliefs regarding healthcare seeking among older adults. *Journal of the American Geriatrics Society*, 50(11), 1837-43.
- Scarmeas, N., Levy, G., Tang, M.X., Manly, J. & Stern Y. (2001). Influence of leisure activity on the incidence of Alzheimer's disease. *Neurology*, 57(12), 2236-42. DOI: 10.1212/wnl.57.12.2236.
- Schwartz, S. H., Cieciuch, J., Vecchione, M., Davidov, E., Fischer, R., Beierlein, C. & Konty, M. (2012). Refining the theory of basic individual values. *Journal of Personality and Social Psychology*, 103, 663– 688. <http://dx.doi.org/10.1037/a0029393>
- Seigler, C., & Costa, P. (1985). Health behavior relationships. In J. E. Birren & K.W Schaie (Eds), *Handbook of the psychology of aging* (pp.144-166). New York, NY: Van Nostrand Reinhold.
- Sloan, P., Zimmerman, S., Suchindran, C., Reed, P., Wang, L., Boustani, M., & Sudha, S. (2002). The Public Health Impact of Alzheimer Disease 2000-2050 Potential

Implications of Treatment Advances. *Annual Review of Public Health* 23:213-31

DOI: 10.1146/annurev.publhealth.23.100901.140525

Small, B. J., Hughes, T. F., Hultsch, D. F., & Dixon, R. A. (2007). Lifestyle activities and late-life changes in cognitive performance. In Y. Stern (Ed.), *Cognitive reserve* (pp. 173-186). New York, NY: Taylor and Francis Group.

Soper, D. S. (2016). A-priori Sample Size Calculator for Structural Equation Models.

Available from <http://www.danielsoper.com/>

Squire, L. & Kandel, E. (1999) *Memory: from mind to molecules*. New York: Scientific American Library. Freeman Company

Stern, Y. (2002). What is cognitive reserve? Theory and research application of the reserve concept. *Journal of the International Neuropsychological Society*, 8, 448–460.

Stern, Y. (2003). The concept of cognitive reserve: A catalyst for research. *Journal of Clinical and Experimental Neuropsychology*, 25, 589–593.

Stern, Y. (2009). Cognitive reserve. *Neuropsychologia*. 47(10), 2015-28. doi:

10.1016/j.neuropsychologia.2009.03.004.

St. John, P. D., & Montgomery, P. R. (2010). Cognitive impairment and life satisfaction in older adults. *International Journal of Geriatric Psychiatry*, 25(8),

814-21. <https://doi.org/10.1002/gps.2422>.

Sudore, R.L., Yaffe, K., Satterfield, S., Harris, T., Mehta, K., Simonsick, E...Schillinger, D. (2006). Limited literacy and mortality in the elderly. *Journal General Internal Medicine*, 21(8), 806-12. doi:10.1111/j.1525-1497.2006.00539.

Tesky, V. A., Thiel, C., Banzer, W., & Pantel, J. (2011). Effects of a group program to

increase cognitive performance through cognitively stimulating leisure activities in

healthy older subjects: The AKTIVA study. *The Journal of Gerontopsychology and Geriatric Psychiatry*, 24(2), 83–92.

Thompson, W. W., Zack, M. M., Krahn, G. L., Andresen, E. M., & Barile, J. P. (2012).

Health-related quality of life among older adults with and without functional limitations. *American Journal of Public Health*, 102(3), 496–502.

doi:10.2105/AJPH.2011.300500.

Tomás, J., Sancho, P., Melendez, J. C., & Mayordomo, T. (2012). Aging and Coping as predictors of general well-being in the elderly: A structural equation modeling approach. *Aging and Mental Health*, 16(3), 317-26.

Turcotte, P., Larivière, N., Desrosiers, J., Voyer, P., Champoux, N., Carbonneau, H.,

Carrier, A., & Levasseur, M. (2015). Participation needs of older adults having disabilities and receiving home care: Met needs mainly concern daily activities, while unmet needs mostly involve social activities. *BMC Geriatrics*,

15doi:10.1186/s12877-015-0077-1

U.S. Department of Health and Human Services, Office of Disease Prevention and Health Promotion. (2010). *Foundation Health Measure Report. Health Related Quality of Life and Well-Being*. In Healthy People 2020. Retrieved from

<https://www.healthypeople.gov/sites/default/files/HRQoLWBFullReport.pdf>

UNESCO, (2003) *The Plurality of Literacy and its implication for policies and programs*.

Positions Paper printed in 2004 France.

United States Census Bureau. (2011, Nov 30). Newsroom archive. Retrieved from

https://www.census.gov/newsroom/releases/archives/2010_census/cb11-cn192.html

- .Valenzuela, M. J., & Sachdev, P. (2005). Brain reserve and dementia: A systematic review. *Psychology education*, 6, 441–454.
- Veenhoven, R. 1993. Happiness in Nations: Subjective Appreciation of Life in 56 Nations 1946–1992. Rotterdam, The Netherlands: Erasmus Univ.
- Verbrugge, L., Jette A. (1994). The disablement process. *Social Science and Medicine*, 38(1), 1-14.
- Vallejo., V., Wyss, P., Chesham, A., Mitache, A. Muriu, R., Mosimann, U.& Nef, T. (2017). Evaluation of a new serious game-based multitasking assessment tool for cognition and activities of daily living: Comparison with a real cooking task. *Computers in Human Behavior*, 12(5), 500-506.
<https://doi.org/10.1016/j.chb.2017.01.021>.
- Verbrugge, L. M., Gruber-Baldini, A. L., & Fozard, J. L. (1996). Age differences and age changes in activities: Baltimore Longitudinal Study of Aging. *Journal of Gerontology: Social Sciences*, 51B, S30–S41.
- Vincent, P., C., Reinharz, D., Deaudelin, I., Garceau, M., & Talbot, L. (2006). Public Tele-surveillance for the frail elderly living at home outcomes and cost evolution: A quasi-experimental design with two follow ups. *Health and Quality of Life Outcomes*, 4,41 <https://doi.org/10.1186/1477-7525-4-41>
- Waldstein S. R. (2003). The relation of hypertension to cognitive function. *Current Directions in Psychological Science*, 12(1), 9-12.
- Whalley, L. J., Starr, J. M., Athawes, R., Hunter, D., Pattie, A., & Deary, I. J. (2000). Childhood mental ability and dementia. *Neurology*, 55, 1455–1459.

- Williams, K., & Kemper, S. (2010). Exploring interventions to reduce cognitive decline in aging. *Journal of Psychosocial Nursing and Mental Health Service*, 48(5), 42-51.
- Wilson, R. S., Boyle, P. A., Yu, L., Barnes, L. L., Schneider, J. A., & Bennett, D. A. (2013). Life-span cognitive activity, neuropathologic burden, and cognitive aging. *Neurology*, 81(4), 314–321. doi:10.1212/WNL.0b013e31829c5e8a
- World Health Organization. (2001). *International Classification of Functioning Disability and Health WHO Geneva*. <http://www.who.int/classifications/icf/en/>
- World Health Organization (2003). *The Social Determinants of Health: The Solid Facts- Second Edition*.
- White, S., & McCloskey, M. (2003). *Framework for the 2003 National Assessment of Adult Literacy* (NCES 2005-531). U.S. Department of Education. Washington, DC: National Center for Education Statistics.
- Yaffe, K., Vittinghoff, E., Lindquist, K., Barnes, D., Covinsky, K., Neylan, T. ... Marmar, C. (2010). Posttraumatic Stress Disorder and Risk of Dementia Among US Veterans. *Archives of General Psychiatry*, 67(6), 608–613.
doi://https://doi.org/10.1001/archgenpsychiatry.2010.61.
- Yin, H., Forbis, S., & Dreyer, B. (2007). Health literacy and pediatric health. *Current Problems in Pediatric and Adolescent Health Care*, 37(7), 258-86.
<http://dx.doi.org/10.1016/j.cppeds.2007.04.002>

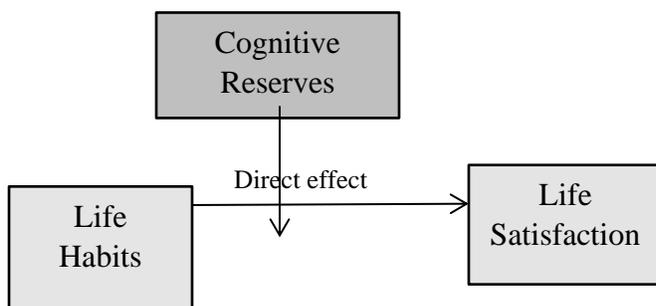
Zunzunegui, M., Alvarado, B., Del Ser, T., & Otero, A. (2003). Social networks, social integration and social engagement determine cognitive decline in community-dwelling Spanish older adults. *Journals of Gerontology*, *58B*, (2), S93–S100.

Appendix A

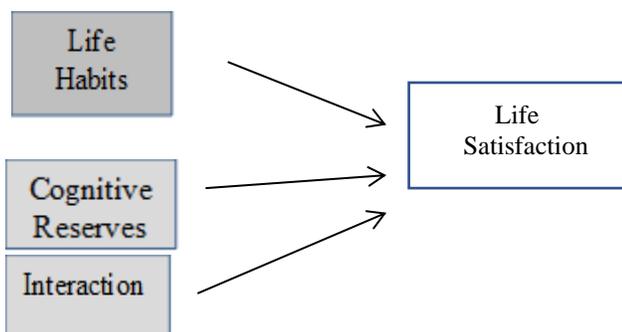
Selection, Optimization with Compensation		
Selection (goals and preferences)	Optimization (goal relevant means)	Compensation (means and resources for counteracting loss and decline in goal relevant means)
<i>Elective Selection</i>	Attentional focus	Substitution of means
Specification of goals	Seizing the right moment	Use of external aids and help of others
Contextualization of goals	Persistence	Use of therapeutic intervention
Goal commitment	Acquiring new skills and resources	Acquiring new skills and resources
<i>Loss Based selection</i>	Practice of skills	activation of unused skills and resources
Focusing on most important goal or goals	Effort and energy	Increased effort and energy
Reconstruction of goal hierarchy	Time allocation	Increased time allocation
Adaptation of standards	Modeling successful others	Modeling successful others who compensate
Search for new goals		Neglect of optimizing other means

Appendix B

Figure 2 Moderation Diagram and Statistical Diagram



Conceptual Diagram A
PROCESS for SPSS
Hayes 2013-2016



Statistical Diagram B

Appendix C

Author/Y	Study Sample	Sample Characteristics	Results	Findings
Schwartz et al. 2013	Lg sample study of the influence of CR and negative health behaviors on severity and course of disease	1142 pts of MS Mean age 54.4 75% female, community living	Hierarchical multiple regression Variance explained by model 31% Stern leisure ($\beta=-.13$, $p=0.00$) Godin ($\beta=-.22$, $p=0.00$) In the model of well-being, 10% of the variance was explained by eudemonic wellbeing ($\beta=0.1$, $p=0.00$)	High CR, low perceived disability and cognitive deficits, higher physical health mental health and well being
Blace, 2012	780 elders over 60 living in community	LSI-TA scale, the Lawton Instrument of Daily Living (IADL), and a researcher prepared survey on levels of activity	Participation on physical activity and activities with formal support networks were significant pearson correlation of $r=.705$ and $r=.734$ $p<.05$ respectively.	Functional ability of older people determines their life satisfaction. Better health allowed for better enjoyment. F 15.292, $p=0.00$. Activity participation explained 25.5% of the variance in life satisfaction. Three predictors of life satisfaction functional abilities participation in physical activities and participation in activities with support networks

St. John, P. Montgomery, P. (2010)	1620 community-dwelling older adults	Higher performers on MMSE Over 85 years old	Cognition is associated with Life Satisfaction although not particularly strong. Functional impairment and depressive symptoms and LS are strongly associated Overall LS (scored from 1-7) normal cognition 5.2 with CIND 4.9 dementia 5.0 (F2,1601=11.47, p,0.001)	Although dementia has an impact on LS, functional impairment great impact on LS. Higher LS was predicted by higher educational levels fewer depressive symptoms, less IADL impairment
Asiret et al. (2014)	65 MS Patients in clinic	Descriptive study Sample n=65	Life satisfaction in females is lower than males (p=0.038) depression scores decreased so long as education levels high (p>0.001-) Education and emotional problems explained 42% of depressive symptoms	Life satisfaction negatively correlated with depression. Increased symptoms were associated with lower life satisfaction scores, higher depression was associated with lower education

Appendix D
Cognitive reserves and literacy

Author/Yr	Study Sample	Sample Characteristics	Results	Discussion
Manly et al. (2005)	1002 English speaking Northern US WHICAP epidemiological study of dementia	Hispanic, African Americans and non-Hispanics	Wide Range Achievement Test (WRAT-3)	High Literacy groups maintained high levels of memory. Using GEE, ($\beta=15.9$, $p=.000$) executive function ($\beta=11.6$, $p=.000$) and language ($\beta=1.2$, $p=.000$) In literacy x time $\beta 3.2$ $p=.002$ Low literacy group had a steeper decline in memory
Manly et al. (2003)	136 English speaking North Americans from Washington Heights Inwood Columbia Aging Project	65 and older Hispanic, African Americans and non-Hispanic	Selective Reminding Test Wide Range Achievement Reading test	Literacy x time interaction $\beta=0.61$, $p=.025$ lower literacy group had steeper decline in delayed recall scores. Decline more rapid in low literacy.
Sachs-Ericsson, N. Blazer, D. (2005)	Probability sample of community residents, among whom 3,097 participants usable data on all the Time-1 and Time-2 variables	Duke Established Populations for Epidemiologic Studies of the Elderly (EPESE)	The 10-item Short Portable Mental Status Questionnaire (SPMSQ), Author assessed literacy set at a 6 th grade reading level.	Fewer years of education ($F [1, 3088] 8.99$; $p 0.01$; partial correlation: $r: 0.05$) and not being literate ($F [1, 3088] 13.14$; $p 0.001$; $r: 0.07$) predicted Cognitive decline.

Sudore et al. (2006)	All participants of Health Aging and Body Composition study of community- dwelling men and women	Age 71-82	Rapid Estimate of Adult Literacy in Medicine (REALM)	Limited literacy was associated with “fair to Poor health poor psychosocial status ($p > .05$) In three year follow up, % of deaths higher in limited literacy (19.7% compare to adequate literacy 10.6% $P, .001$)
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Appendix E

Life Habits

Table 3: Life Habits

Author/Yr	Purpose of study population	Sample Characteristics	Results	Discussion
Freedman et al. (2014)	Medicare enrollees over aged 65 8077 from big data National Health and Aging Study (NHAT)	4% averages over 90years old able to carry out self-care activities	Aging individuals with accommodations perceived similar rates of participation restrictions as those who were fully able 14% vs 8.7%) Well-being scores were similar for accommodators and fully able 18 vs 18.4	Blacks and Hispanics were less likely to successfully accommodate and thereby reduced level of activity
Levasseur et al. (2008)	156 older adults	Good cognitive function Recruited by activity level	Life satisfaction Quality of life Index Activity limitations	Quality of life and satisfaction with participation is greater with a higher activity level (p<.001) When activity level was more limited, participation restricted, and physical environmen

				t was perceived as having more obstacles.
Vincent et al. (2006)	38 frail elders living at home	Live at home with a permanent physical slight cognitive or motor disability or both. Disability had to hinder the accomplishment of daily living activities	MMMS, Functional Autonomy, Life Events, SF-12(qol) Life H Care giver burden Quest Quebec user evaluation of satisfaction with assistive technology	Regardless of the positive effects associated with tele-surveillance, no significant improvement was noted in qol and life habits
Gagnon et al. (2007)	Cross sectional Random Sample of 200	Adults from 20-81 years	Attempt to evaluate the perceived level of disability to the actual need for external help. Assessment of Life satisfaction is related to the perception of disability.	Life satisfaction higher when perception participation was highest, (r=0.40-0.84, p<0.001) Holding a paid job reflected the highest dissatisfaction on 40.2 % p<0.001
Demers et al. (2009)	350 random sample older adults	Older adults living at home ≥to 65years with intact cognitive function,	Social participation Coping strategies Behavioral or	

Dogra & Stathokostas (2012)	9,478 older and 10,060 middle aged From Health Aging cycle of the Canadian Community Health Survey	Healthy aging Cycle of the Community Health Survey	Cognitive Types of living environment demographics Perceived health, schooling	41% (OR1.41; CI: 1.19-1.67) and 42% (OR: 1.42; CI: 1.20-1.69) Activity and moderate activity more likely to be successfully aging. Functional Impairment categories only achieved successful aging in the first two groups
			Functional impairment classified as having no mobility problems, a problem, but requiring no aides, requiring manual support or requiring assistance from others	

Nguyen, S. (2014)	326 aged 53-96- year-olds	Mean age 72 N=103 completed elementary school n=96 received higher education	Fear of growing old correlate with life satisfaction to IV (r=-.319, p=.000)	Social support positive factors for life satisfaction. Fears of irrevocably losing something causing increased difficulty
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