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EXAMINING CROSS-DOMAIN LINKAGES BETWEEN SOCIAL SUPPORT, CONTROL BELIEFS, AND HEALTH

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ABSTRACT

Lifespan developmental psychology has long been interested in examining changes within and structural relations between domains of functioning. To explore cross-domain associations between facets of social support, control beliefs, and health, we applied a multivariate latent growth curve model to 4 waves of longitudinal data covering 15.5 years from the Americans' Changing Lives Study (mean age 54, range 25-96) to examine cross-domain linkages between emotional support, mastery, and health. Our results indicate profound associations between emotional support, mastery beliefs, and functional health not only exist in mean levels of functioning, but also that across-domain changes are moderately interrelated. Additionally, statistically nested model comparisons established that such cross-domain associations do not differ by groups of age, education, and gender. Our discussion highlights how integrative research examining cross-domain associations can inform conceptual models of lifespan development.

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Chapter 1. Literature Review

The major goal of this chapter is to review the literature relevant to examining cross-domain linkages between social support, control beliefs, and health. Specific sections include: (1) introduction to life-span developmental psychology; (2) examination of specific definitions of social support, control beliefs, and health; (3) age gradients observed in social support, control beliefs, and health; (4) examination of interplays or directional relationships, between the constructs of interest; and (5) research questions and hypotheses for the current study.

Lifespan Psychological Embedding

Life-span developmental psychology is characterized by a family of theoretical propositions designed to study behavioral development as a life-long process (P. B. Baltes, 1987; P. B. Baltes & Smith, 1999). The general approach of lifespan psychologists is to highlight the *pluralistic* (multidimensional, multilevel), *multidirectional*, *transactional* (interplay of component parts and processes), *plasticity, dynamic between gains and losses,* and *nature* of contextual influences on individual change as they unfold over time (P. B. Baltes, 1987; P. B. Baltes, Lindenberger, & Staudinger, 2006; P. B. Baltes & Smith, 2004). Life-span psychologists apply these propositions as a guiding theoretical framework to describe, explain, predict, and modify behavior across the lifespan (P. B. Baltes, Reese, & Nesselroade, 1977).

To further explicate theoretical propositions of life-span developmental psychology, I will briefly discuss each in relation to my research interests of social support, control beliefs, and health. Multidimensionality and multidirectionality are used to describe facets of plurality in the course of development that is not bound by a single criterion of growth. For example, social support consists of multiple components such as emotional, instrumental and satisfaction with support (Antonucci, 2001), which display differential trajectories in old age (Shaw, Krause,

Liang, & Bennett, 2007). In addition to examining changes within domains of functioning, life-span development psychology is interested in structural relations between domains of functioning (P. B. Baltes & Nesselroade, 1979; Brandtstädter & Lerner, 1999; Cairns, Elder, & Costello, 1996). Domains of functioning do not operate in isolation, but simultaneously influence one another such as the relationship between social support, control beliefs, and health (e.g. biopsychosocial model; House, Landis, & Umberson, 1988a; House, Umberson, & Landis, 1988b). Plasticity refers to the potential that individuals have for different forms of behavior or development. Interventions aimed at improving beliefs of control over falling have proven successful in increasing falls self-efficacy and sense of control over falls (Tennstedt, Howland, Lachman, Peterson, Kasten, & Jette, 1998). Development is not solely a process of gains, but is comprised of both gains and losses. In adulthood and old age, gains are observed in emotional support (Shaw et al., 2007), whereas general feelings of control and health decline with age (Jette, 1996; Lachman & Firth, 2004). Finally, development is occurring in the context of age-graded, history-graded, and non-normative events. Age-graded influences describe changes in development that are strongly related to chronological age, whereas history-graded influences are associated with historical time and nonnormative influences are characterized by occurrence, patterning, and sequencing that are not applicable to many individuals.

Using life-span developmental psychology as a guiding theoretical framework, the present study will examine cross-domain linkages between facets of social support, control beliefs, and health over time. More specifically, three questions will be investigated: (1) Is there intra-individual change and inter-individual differences in intra-individual change in emotional support, mastery, and health over time, (2) Are there cross-domain linkages between emotional support, mastery, and health, and (3) Do interrelationships between emotional support, mastery,

and health vary by groups of age, education and gender? To provide background information, I will define specific definitions relevant to my research interests, report age gradients and conclude with a discussion of interplays or directional relationships.

Defining Key Concepts

Social Support. Cobb (1976) conceives social support to be interactions leading individuals to believe they are cared for and loved, esteemed and valued, and belonging to a network of communication and mutual obligation. Major network properties include size, stability, homogeneity, symmetry, and connectedness, which can be defined respectively as number of network members, average duration of membership, proportion of relationships that are both support-giving and support-receiving, and proportion of network members who are acquainted with each other (Kahn & Antonucci, 1980). Researchers have coined numerous terms for categorizing social network properties. For example, House and colleagues specify social network properties are comprised of three components, integration, structure, and relational content (House et al., 1988b), whereas Antonucci and colleagues use the broader nomenclature of quantitative and qualitative dimensions (Antonucci, 2001). For the purpose of this introduction, the latter taxonomy will be referenced. Quantitative social network properties include existence of network members, size, frequency of contact, and membership in groups or organizations (House et al., 1988b; Kahn & Antonucci, 1980). Qualitative social network properties consist of more functional or relational context such as emotional, instrumental, and informational support, in addition to demands and conflicts (House et al., 1988b; Kahn & Antonucci, 1980). There are various levels and degrees of social support ranging from being unsupported and isolated to having a friend and family focused or diverse network (Fiori, Smith, & Antonucci, 2007; Litwin, 2001).

Age-related Change in Social Support. With increasing age, there are general declines in quantitative social network properties, whereas qualitative properties display gains through old age. In old age there are declines in network size and frequency of contact with more distal network members (Carstensen, 1992; Martire, Schulz, Mittelmark, & Newsom, 1999; Shaw et al., 2007; Smith & P. B. Baltes, 1999; Wagner, Schiltze, & Lang, 1999). The social convoy model proposes age-related changes in network size are driven by role-linked relationships, such as retirement (Kahn & Antonucci, 1980). Additionally, older adults experience more deaths of network members, which create the difficult task of replacing confidants, leading to a weakening of the network (Antonucci, 2001). In contrast, qualitative social network properties such as emotional, instrumental, and informational support, in addition to contact with children increase with age (Carstensen, 1992; Field & Minkler, 1988; Gurung, Taylor, & Seeman, 2003; Martire et al., 1999; Shaw et al., 2007). Increases in qualitative network properties could be the result of changes in individuals' reasons and motives for interacting with social network members. Socioemotional selectivity theory proposes that older adults selectively interact with social network members based on emotional needs and focusing more on achieving short-term versus long-term goals (Carstensen, 1992). With limited time remaining, older adults selectively choose who to interact with to achieve emotional goals (Carstensen, Isaacowitz, & Charles, 1999; Lang, 2001). Lastly, age-related changes in health lead older adults to draw closer to family and friends for support (Gurung et al., 2003).

Control Beliefs. Control beliefs have been defined and measured in numerous ways. Skinner (1996) details heterogeneous constructs related to "control" to include more than 100 associated terms. Despite the many definitions and measures, these variables share a common conceptual core; feelings of control refer to the belief that changes in an individuals' social

environment and internal qualities are responsive to and contingent upon their own choices, efforts, and actions (Antonucci, 2001; Krause, 1997). The most common conceptualizations, which will be a focus of this introduction, include self-efficacy, mastery, and locus of control (Pearlin & Pioli, 2003; Skaff, 2007). Bandura (1977, 1986) defines perceived self-efficacy as people's judgments of their capabilities to organize and execute courses of action required to attain designated types of performances. Self-efficacy is theorized to emerge from four sources: performance accomplishments, vicarious experience, verbal persuasion, and emotional arousal/physiologic state (Bandura, 1977, 1986). Similarly, locus of control is centered on individuals' beliefs they are in control of desired outcomes (Lachman, 2006; Rotter, 1966). Lachman (2006) outlines a multidirectional conceptual model, where locus of control is influenced by prior performances, which in turn influences subsequent performance and outcomes impacting health outcomes. Finally, mastery is defined as the extent to which one regards one's life chances as being under one's own control in contrast to being fatalistically ruled (Pearlin & Schooler, 1978). Pearlin and colleagues emphasize the importance of mastery in the stress process (for overview, see Pearlin, Menaghan, Lieberman, & Mullan, 1981), where disruptive life events and strains erode feelings of mastery and self-esteem leading to individuals' vulnerability to declines in health. Lastly, it is worth mentioning, albeit briefly, that control beliefs can be explicated into domain-specific manifestations. Domain-specific control consists of the amount of control individuals' exercise over conditions they encounter within specific roles and contexts in life (Lachman, 1986a; Schulz & Heckhausen, 1996).

Age-related Change in Control Beliefs. Although aging is influenced to some degree by genetic factors, there is a large component that is determined by lifestyle choices and behavioral factors; that is the nature of aging is to some extent under one's own control (P. B. Baltes & M.

M. Baltes, 1990; Lachman, 2006; Rowe & Kahn, 1987, 1997). Maintenance of control with increasing age is vital for successful aging (P. B. Baltes & M. M. Baltes, 1990; Rowe & Kahn, 1987, 1997). Generally speaking, older age is associated with declines in feelings of control and increases in perceived constraints. For example, several cross-sectional studies consisting of individuals from young adulthood and old age found older ages reported lower levels of general feelings of control (Lachman & Firth, 2004; Mirowsky, 1995; Shaw & Krause, 2001). Longitudinal studies examining general feelings of control have observed both change and stability. Significant declines in sense of control were observed in a sample of individuals with chronic conditions (Wolinsky, Wyrwich, Babu, Kroenke, & Tierney, 2003). A limit of this study was individuals were measured at three time points over a 1 year period. In contrast, several studies comprised of larger, more representative samples have observed stability over time in various constructs of control such as external locus of control and efficacy (Brandtstädter & Rothermund, 1994; Gatz, Siegler, George, & Tyler, 1986; Lachman, 1986b). Lachman (1985) found divergent results from these previous studies; results included decreases observed in personal efficacy during early middle adulthood, stability in middle age, and increases in early old age. Rodin (1986) argues three reasons for why the relationship between sense of control and health grows stronger in old age. First, experiences, such as loss of friends and family members or retirement, may affect types of outcomes attainable in old age. Second, the association between control and indicators of health status, such as the immune system are notably altered by age. Lastly, age influences the relationship between sense of control and health maintenance behaviors and the seeking of medical care.

Health. Health is a multidimensional and pluralistic construct consisting of multiple facets (i.e. functional ability, chronic illnesses, physiological mechanisms, and social well-being;

Lawton & Lawrence, 1994; Ryff & Singer, 1998; Spiro, 2001; Uchino, Cacioppo, & Kiecolt-Glaser, 1996). This introduction will focus on health conditions and functional limitations. A chronic condition can be defined as a health condition that has existed for at least three months (Jette, 1996) and some of the most commonly reported include arthritis, stroke, heart problems, lung disease, cancer, diabetes and high blood pressure. Chronic conditions represent the health of individuals, while functional limitations describe how individuals function on a day to day basis. Functional limitations involve the ability to perform important everyday activities in life (Lawton & Lawrence, 1994), which include daily tasks such as bathing, eating, dressing, using the toilet, and walking across a room (Branch, Katz, Kniepmann, & Papsiedo, 1984). Disability is defined as reporting having difficulty with an activity of daily living (ADL), while recovery from ADL disability is defined as reporting no difficulty in a task that was previously reported as difficult (Mendes de Leon et al., 1999). In addition to self-reports of physical functioning, many studies (e.g. BASE, MacArthur Studies of Successful Aging) have utilized more objective measures of functional ability, such as balance, gait, chair stands, foot taps, and manual ability (P. B. Baltes & Mayer, 1999; Li, Aggen, Nesselroade, & P. B. Baltes, 2001; Seeman et al., 1994). Finally, other indicators of health that are frequently studied include subjective health, mortality, recovery from illness, and physiological mechanisms, including cardiovascular, immunological, and metabolic functioning (for overview, see Seeman, 2001).

Age-related Change in Health. There are general declines of health status in old age (Hobbs & Damon, 1996; Jette, 1996). Declines in health status are seen in several domains of functioning. For example, cross-sectional findings from the Berlin Aging Study (BASE) show that the old-old report greater strains in six domains of health: physical health, illness, vision, hearing, functional capacity, grip strength and cognitive functioning (Smith, Borchelt, Maier, &

Jopp, 2002). Smith and colleagues (2002) found that 40% percent of people aged 70 to 74 reported no impairments in the six domains, while only two percent of individuals age 90 and older reported no impairments (Smith et al., 2002). In addition to these physical strains, there is a negative age gradient with activities of daily living; individuals report a greater number of difficulties with increasing age with women typically reporting more difficulties than men (Jette, 1996; Steinhagen-Thiessen & Borchelt, 1999). One factor contributing to the growing number of health strains in old age may be the accumulation of less desirable traits, which include social isolation and declines in locus of control and cognitive abilities (Smith & P. B. Baltes, 1997). A second factor contributing to general declines with age may be that genetically, humans are not built for longevity or old age. Evolutionary selection decreases with age and the human genome is predicted to contain an increasingly larger number of deleterious genes and dysfunctional gene expressions than in younger ages (P. B. Baltes, 1997; P. B. Baltes & Smith, 2003). In spite of views that health and aging are synonymous with declines in functioning and accumulations of disabilities and pathologies, it is theorized the time individuals are affected by chronic illnesses and disability is constrained to a shorter period of life (i.e. compression of morbidity hypothesis; Fries, 1980, 1990). Recent research on large representative samples has shown a trend towards lower prevalence of disability in older adults (Crimmins, Saito, & Reynolds, 1997). Despite losses in many domains of functioning, older adults are capable of learning and improving functioning (P. B. Baltes & M. M. Baltes, 1990), as seen in cognitive interventions and experimental settings (Kliegl, Smith, & P. B. Baltes, 1989; Schaie & Willis, 1986).

Cross-Domain Interplay between Social Support, Control Beliefs, and Health

Lifespan psychologists have long been interested in intra-individual changes within and structural relations between domains of functioning (P. B. Baltes & Nesselroade, 1979;

Brandtstädter & Lerner, 1999; Cairns et al., 1996). In this study we are interested in the transactional (i.e. interplay between components and processes) nature or structural relationships among facets of social support, control beliefs, and health. Rich conceptual frameworks link social support, mastery, and health together (Berkman, Glass, Brissette, & Seeman, 2000; House et al., 1988a; Uchino et al., 1996), but much more is known regarding linkages between social support and health, whereas little is known, about how psychological processes such as control beliefs are interrelated with social support and health. Control beliefs are typically thought of an interdisciplinary bridge between social and biological factors (Cacioppo, Berntsen, Sheridan, & McClintock, 2000; Haidt & Rodin, 1999). Our goal in this study is to examine how facets of social support, control beliefs, and health are interrelated when tested conjointly, in a longitudinal sample consisting of individuals from young adulthood to the oldest old.

Social support, control beliefs, and health contribute to and influence lifespan development. The influential nature of these constructs is not derived from their operation in isolation, but by their cross-domain associations. A schematic representation is shown in Figure 1 to conceptualize interrelationships between social support, control beliefs, and health. To borrow Bandura's term, social support, control beliefs, and health operate in *triadic reciprocality*. The term reciprocality signifies mutual action between each factor and the contribution of each factor will vary depending on the point in the lifespan. In Figure 1, reciprocal influences are represented by the bi-directional arrows. To provide empirical support for this schematic representation, the following section is devoted to reporting interplays or reciprocal influences between social support, control beliefs, and health.

Social Support-Health Associations. Various arguments have been proposed regarding how such links between social support and health variables may operate (e.g., Fiori et al., 2007).

One position argues that social support or the absence thereof, is a key precursor for physical functioning and perceptions of health. Socially embedded individuals are shown to have a decreased likelihood of accruing chronic illnesses (Medalie & Goldbourt, 1976; Orth-Gomer, Rosengren, & Wilhelmsen, 1993). Additionally, greater levels of emotional support are protective of functional decline (Mendes de Leon et al., 1999; Mendes de Leon, Gold, Glass, Kaplan, & George, 2001; Seeman et al., 1995; Unger, Jonson, & Marks, 1997). Not only are social relationships positive, but they also can be characterized by lack of support and negative exchanges (Rook, 1984, 1992). Lack of social support is associated with poor physical functioning (Bosworth & Schaie, 1997; Newsom & Schulz, 1996) and reporting a poor health status (Cacioppo, Hawkley, & Bertnsen, 2003; Krause, 1987; Melchior, Berkman, Niedhammer, Chea, & Goldberg, 2003). Negative relationships characterized by demands and conflicts can lead to an increased risk for chronic illnesses and functional limitations (Medalie & Goldbourt, 1976; Newsom, Mahan, Rook, & Krause, 2008).

Another position holds that the number of chronic diseases and poor physical functioning may directly affect levels of social support. For example, individuals with declining health may be forced to rely on their social support for help with activities of daily living (ADL; Bischop et al., 2003; Seeman et al., 1996). Additionally, physical illnesses and poor functional capacity may lead to lower levels of satisfaction with social relationships (Smith et al., 2002). Declines in health may cause individuals to draw closer to their children or confidants for help (Kahn & Antonucci, 1980; Mendes de Leon et al., 1999). When anticipating a decline in health, older adults may draw closer to more proximal, emotionally connected relationships and interact less with distal relationships (Carstensen, 1992).

A third position proposes a bi-directional association between social support and health. For example, declining health may cause an individual to rely on his or her social support for help, and in turn, the availability of social support may buffer against further decline in health (House et al., 1988a). Similarly, if an individual is faced with a cancer diagnosis, a strong social network may help them face the problem, cope, maintain a level of mastery and buffer declines in health, well-being, and improve survival (Taylor, 1990). Finally, an underlying variable or common cause may account for social support-health couplings. Candidate underlying mechanisms include self-efficacy or systemic changes associated with advanced old age (P. B. Baltes & Smith, 2003; Lang, Featherman, & Nesselroade, 1997). Each of these factors is shown to relate to social support and health making it possible for shared antecedent conditions.

Social Support-Control Beliefs Associations. A variety of propositions have been proposed regarding associations between social support and control beliefs. One position argues levels of social support or absence thereof, may be the driving force underlying changes in feelings of control. For example, individuals who receive and provide emotional support report increased feelings of control and self-esteem (Krause, 1992; Krause & Shaw, 2000). Relationships characterized by higher quality and fewer conflicts/demands, individuals report greater feelings of control (Hay & Fingerman, 2005). Longitudinal studies confirm these cross-sectional findings; greater emotional support and social integration are positively associated with feelings of control over time (Krause, 1987). In contrast, poorer levels of satisfaction with support are associated with lower feelings of mastery beliefs (Jang, Borenstein-Graves, Haley, Small, & Mortimer, 2003). Finally, links between social relationships and control beliefs have been observed in prospective studies with fewer time points, and also in studies investigating intra-individual variability with many repeated measurements over shorter periods of time. The

Cornwall Manor Study measured social relationships and social self-efficacy in 23 weekly repeated measurements and found individuals who perceive others to be available across time have stronger social self-efficacy beliefs and less fluctuation in social self-efficacy beliefs across time (Lang et al., 1997).

Other research proposes that feelings of control are the driving force influencing level and rates of change in social support. For example, individuals with a strong sense of control may utilize their support networks more effectively than people who believe that their environment is less responsive to their demands (Eckenrode, 1983; Sandler & Lakey, 1982). In sheltered care settings, Moos and colleagues have shown that higher levels of perceived control are associated with increased social interaction and more positive perceptions of the environment (Lemke & Moos, 1981; Moos, 1981; Moos & Ingra, 1980). Lastly, initial levels of mastery in a sample of low income mothers, predicted greater receipt of tangible and advice support one year later (Green & Rodgers, 2001).

A third model proposes reciprocal linkages between social support and control beliefs. For example, specific social relationships may affect perceptions of control, later influencing the nature and amount of support provided (lagged effect; Krause, 1997). Lower feelings of control may lead to excessive dependence on support networks leading to an erosion of control and competence. Social learning theory argues that individuals who rely on their social support for too much help believe they are no longer able to engage in physical behaviors and perceive they can no longer perform this activity. Seligman (1975) describes this phenomenon as learned helplessness. This leaves individuals feeling that they are no longer able to care for themselves and their support is not helpful. Within the framework of social cognitive theory, individuals with low self-efficacy obtain limited positive effects from social persuasion and support, limiting

their ability to mobilize greater sustained effort, whereas individuals with greater feelings of control and efficacy perceive verbal persuasion or sources of support more positively, boosting levels of efficacy, leading the individual to go to their support more often (Bandura, 1977, 1986). Finally, a third variable or common cause could be driving linkages between social support and control beliefs. Candidate common cause variables include health constraints and cognitive impairment (Lachman & Andreoletti, 2006; Smith et al., 2002).

Control Beliefs-Health Associations. Various models have been put forward regarding health-control beliefs couplings. One unidirectional perspective argues feelings of control influence health. For example, higher levels of perceived mastery and lower perceived constraints are predictive of better health, greater life satisfaction, and lower depressive symptoms (Lachman & Weaver, 1998a). Longitudinal studies have shown positive associations between feelings of control and health. Greater levels of self-confidence are protective of declines in cognitive and physical functioning over 20 years of follow-up (Caplan & Schooler, 2003). This protective effect of control beliefs is also seen in samples of the oldest old, where greater levels of mastery are protective of disability (Fauth, Zarit, Malmberg, & Johansson, 2007; Femia, Zarit, & Johansson, 1997). Lastly, perceptions of constraints leave individuals vulnerable to limitations with physical activity, poorer health and more psychological symptoms (Seeman & Lewis, 1995).

In addition to health influencing control beliefs, there is evidence to suggest health is predictive of feelings of control. For example, empirical evidence involving individuals from young adulthood to old age illustrates that compromised health and physical impairments are associated with lower control beliefs (Lachman, 1986a; Mirowsky, 1995). Specifically, poorer health status is inversely related with perceived constraints and associated with lower levels of

perceived mastery (Lachman & Weaver, 1998a). Work from Schieman and Campbell (2001) reveal greater physical impairment and poorer global health explain a larger proportion of the negative association between age and self-esteem. Finally, longitudinal studies reveal changes in health are associated with levels of perceived constraints. A 10 year study by Seeman and Lewis (1995) revealed decreases in health are associated with increases in powerlessness (constraints), whereas improvement of health over 10 years was associated with decreases in powerlessness.

A third point contends bi-directional associations between control beliefs and health. For example, individuals recovering from a heart attack may have lower levels of efficacy, but perceptions of support from others may boost levels of efficacy and lead to better health outcomes (Bandura, 1986; Taylor, Bandura, Ewart, Miller, & DeBusk, 1985). Furthermore, increasing age is associated with declines in health; individuals may react to health declines by enacting an adaptation process (i.e. control or mastery) to maximize gains and minimize losses to protect from further decline (SOC model; P. B. Baltes & M. M. Baltes, 1990). The SOC model developed by Baltes and Baltes argues aging is a developmental process and due to changes in old age, individuals can adapt by utilizing the SOC model to enact a greater sense of control, leading to more effective or successful aging. Finally, a third variable or common cause could be driving control beliefs-health couplings. Candidate factors that relate to both control and health include social support and cognition (Antonucci, 2001).

Studies Examining Social Support, Control Beliefs, and Health Conjointly. Few studies have examined interrelationships between social support, control beliefs, and health conjointly. Antecedent-consequent relationships between social support, control beliefs, and health have been documented in studies involving participants from across the lifespan. For example, Gerstorf, Röcke, & Lachman (submitted), using MIDUS, found reciprocal relationships between

level and changes in perceived control, social support, and health. More specifically, nine year increases in perceived control were predicted by fewer initial health constraints and more initial support and accompanied by less pronounced increases in health constraints and stronger increases in social support. Greater initial control and increases in control predicted smaller increases in health constraints and larger increases in social support. A study by McAvay et al. (1996) examined similar relationships in a sample of older adults age 62 and older. Greater number of baseline medical conditions and incident medical conditions were associated with declines in self-efficacy domains. Lack of instrumental support and social network contact were predictive of declines in self-efficacy domains and reduction in activities of daily living. Finally, availability of emotional support was predictive of improvements in self-efficacy and greater interpersonal efficacy was associated with more frequent emotional and instrumental support.

The Present Study

As this review suggests, it is evident there are cross-domain linkages between social support, control beliefs, and health. In the current study, we apply a multivariate latent growth curve model to data from the Americans' Changing Lives Study (ACL; House, Kessler, Herzog, Mero, Kinney, & Breslow, 1990; Herd, Goesling, & House, 2007) to investigate longitudinal interrelationships between emotional support, mastery, and health. Table 1 shows the research questions and hypotheses. Specifically, three questions are being investigated: (1) How do emotional support, mastery, and health simultaneously change over time (4 waves, 15.5 years) in a sample of individuals age 25-96 at T1 and are there inter-individual differences in intra-individual change, (2) Are there cross-domain associations between emotional support, mastery, and health, and (3) Do interrelationships between emotional support, mastery, and health vary by groups of age, education and gender? Based on the extant literature, we hypothesize emotional

support will increase, whereas health and mastery will decline over time. Furthermore, age, education, and gender will be associated with inter-individual differences in level and rates of change. Secondly, we hypothesize small to moderate correlations between level and rates of change between emotional support, mastery, and health. More specifically, we predict moderate associations among the mean levels of functioning between emotional support, mastery, and health, levels in emotional support and mastery to be associated with change in health and moderate correlations between rates of change in emotional support and mastery. Finally, cross-domain associations are expected to differ by groups of age, education, and gender.

There are many reasons for applying a multivariate latent growth curve model. In concordance with lifespan developmental psychology's rationale for utilizing longitudinal data (Baltes & Nesselroade, 1979), benefits to using a multivariate latent growth curve include: (1) accounts for intra-individual change, (2) accounts for inter-individual differences in level and rates of change, (3) allows for the investigation of relationships between aspects of change in more than one variable, and (4) allows for the testing of differences in interrelationships by groups of age, education, and gender. A multivariate latent growth curve model estimates the covariances between random parameters for different outcomes, which give researchers the ability to estimate covariances (e.g. correlations) between latent level and slope factors for each variable of inquiry (Grimm, 2007; MacCallum, Kim, Malarkey, & Kiecolt-Glaser, 1997; Preacher, Wichman, MacCallum, & Briggs, 2008).

Chapter 2. Method

This chapter outlines the research methods applied in the present study. Sections that comprise this chapter include, description of the participants and procedures, measures, data preparation, statistical techniques, and testing the hypotheses.

Participants and Procedure

The current study uses longitudinal data from the Americans' Changing Lives Study (ACL; Herd et al., 2007; House et al., 1990), which was collected over 15.5 years and conducted by House and colleagues at the University of Michigan. It is a stratified, multistage area probability sample of non-institutionalized civilian adults age 25 years and older living in the contiguous United States, with an oversampling of African Americans and those age 60 and older (Herd et al., 2007; House et al., 1990). The topics covered include a wide range of sociological, psychological, mental, and physical health items. The ACL study encompasses four waves of data collected in 1986, 1989, 1994, and 2001/2. Wave 1 includes 3,617 persons interviewed in 1986, representing 68 percent and 70 percent of the sampled individuals and households, respectively. Wave 2 conducted face-to-face re-interviews with 2,867 persons interviewed in wave 1, 83 percent of those still alive as of the time of the interview in 1989. Wave 3 includes 2,652 original respondents (including 164 by proxy), 83 percent of those still alive as of the time of the interview in 1994. Finally, wave 4 includes 1,787 respondents (including 95 by proxy), or 73 percent of those still alive at the time of the wave 4 interview in 2001/2002 (Herd et al., 2007). Our starting sample of 3,602 participants at T1 includes all individuals on whom we have full data for the measures and variables used in the study. This includes individuals interviewed by proxy.

Mean longitudinal selectivity for the measures under consideration was calculated using an effect size metric indicating the degree to which participants who survived and provided data at Wave 4 (15.5 years) differed from the parent sample at baseline assessment (for details, see Lindenberger, Singer, & Baltes, 2002; T. Singer, Verhaeghen, Ghisletta, Lindenberger, & Baltes, 2003). At Wave 4, total selectivity amounted to 0.03 SD units (where SD refers to that of the parent ACL sample) for emotional support, 0.11 SD for mastery, 0.32 SD for health, -0.76 SD for age, and 0.36 SD for education. This suggests younger age, better health, and greater years of education at baseline were associated with subsequently lower dropout and higher participation rates among survivors, thereby providing more data points for estimates of change over time. Implications of nonrandom attrition on interpretability of the findings will be considered in the discussion section.

Measures

Socio-demographic characteristics included chronological age, measured as a continuous variable; participants ranged in age from 25 – 96 years at T1, with a mean age of 54 years (*SD* = 17.62). Gender was coded as 0 = men (*N* = 1,333) and 1 = women (*N* = 2,269). Education was measured by years of formal education, with 63% of our sample attaining at least a high school education.

Emotional support was measured by six items, two items each from three types of relationships, including child, spouse, and friends or relatives (for details, see Fiori, Antonucci, & Cortina, 2006). The items assessed the degree to which these individuals make the respondent feel loved and cared for and how willing they are to talk about worries or problems. Each of the items were rated on a scale from “not at all” (1) to “a great deal” (5; Cronbach’s alpha = 0.64). A mean score from across all three sources of support was created from the items, with higher

scores indicating greater levels of emotional support. These items were given across all 4 waves of measurement.

Mastery was assessed using three items taken from the Pearlin Mastery Scale (Pearlin & Schooler, 1978); the same items also have been incorporated in MIDUS (see Lachman and Weaver, 1998a). The questions assessed general feelings of mastery. Individuals were asked the degree to which they feel they can do anything they set their mind to, are being pushed around in life, and one's ability to solve their problems. Items were scored on a scale from "strongly agree" (1) to "strongly disagree" (4; Cronbach's alpha = 0.42). Item 1 was reverse coded and a mean index was created with higher scores indicating greater feelings of mastery. These items were assessed over all 4 waves of measurement.

Health was assessed by asking participants how many health conditions they report being diagnosed with in the past year or currently have (for details, see Shaw & Krause, 2001). There were 10 health conditions: arthritis/rheumatism, lung disease, hypertension, heart attack and heart trouble, diabetes, cancer/malignant tumor, foot problems, stroke, fractures or broken bones, and loss of urine beyond one's control. A sum score was created and reverse coded so higher scores indicated better health or lack of health conditions. These items were assessed over all 4 waves of measurement.

Data Preparation

Measures were standardized to the T metric ($M = 50$, $SD = 10$), with the cross-sectional ACL sample ($N = 3,602$), who had complete data for emotional support, mastery, and health at T1. This transformation ensured a common metric across variables, while maintaining the psychometric properties of the scores and the longitudinal changes in means and variances.

Table 2 presents the means and standard deviations of the variables of interest in the study, in addition to age at each wave and education and gender at T1. This table illustrates that the mean scores for mastery remain relatively stable, whereas emotional support shows a slight increase across measurement waves. In contrast, health declines over subsequent waves of study. On average, individuals at T1 are in their mid- 50s and by T4 are approaching old age. Lastly, at T1 63% of our sample were women and 63% of our sample attained at least a high school education.

Statistical Procedures

A multivariate latent growth curve model[1] was applied to model simultaneous change and relationships between levels and rates of change in emotional support, mastery, and health. It should be noted that we refer to the multivariate latent growth curve model as a trivariate latent growth curve model because we are modeling three variables. A trivariate latent growth curve is a straight-forward trivariate extension of the univariate latent growth curve (for overview, see Grimm, 2007; MacCallum et al., 1997). In the trivariate latent growth curve model there is a latent process (i.e. level and slope factor) for each variable, with the variances being correlated.

In the trivariate latent growth curve model we assume we have repeatedly measured three variables (i.e. emotional support, mastery, and health). Also, the data are treated as if only a single outcome variable is measured. Let y_{itk} be a score for individual i at occasion t on outcome variable k, but consider y as if it were a single variable with aspects of its measurement defined

[1] Researchers have coined numerous terms for labeling multivariate latent growth curve models. Terms used in the literature include, parallel process model, multivariate change model, cross-domain individual growth model, multiple-domain model, fully multivariate latent trajectory model, simultaneous growth model, associate latent growth curve model (Preacher et al., 2008).

by it subscripts. We then define dummy variables δ_1, δ_2 …, δ_p, one for each outcome variable, where $\delta_k = 1$ if a given measure is on y_k and $\delta_k = 0$ otherwise. In defining the trivariate latent growth curve model, let us first represent the model for change given as,

$$y_{itk} = \delta_k (\pi_{0ik} + \pi_{1ik} \text{time}_{itk} + e_{itk}) \quad (1)$$

where π_{01ik} is the intercept for individual i on outcome variable k, π_{10ik} is the slope for individual i on outcome variable k, time_{itk} is the measure of time for individual i on occasion t for outcome variable k, and e_{itk} is the residual for individual i at occasion t for outcome variable k. The intercepts and slopes for the outcome variables are themselves random variables, with their variation across individuals modeled as follows,

$$\pi_{0ik} = \beta_{01k} + u_{01ik} \quad (2)$$

$$\pi_{1ik} = \beta_{10k} + u_{10ik} \quad (3)$$

Here β_{01k} and β_{10k} represent the fixed effects for the intercept and slope on outcome k, or the mean of those values, and u_{0ik} and u_{1ik} represent random variation of individuals around the mean intercept and slope, respectively for outcome k. Substitution of the above two equations into a combined model gives us,

$$y_{itk} = \delta_k (\beta_{10k} + \beta_{10k}(\text{time}_{itk}) + u_{01ik} + u_{10ik}(\text{time}_{itk}) + e_{itk}) \quad (4)$$

For the present study, we can insert the variables of interest, emotional support, mastery, and health into one equation,

$$y_{itk} = \delta_{ES} [\pi_{0ES} + \pi_{1ES} \text{time}_{it} + e_{itES}] + \delta_M [\pi_{0M} + \pi_{1M} \text{time}_{it} + e_{itM}] + \delta_H [\pi_{0H} + \pi_{1iH} \text{time}_{it} + e_{itH}] \quad (5)$$

The equation has the same form as equation 1, which represented the general form of a trivariate latent growth curve model for linear change. y_{itk} is the measure for individual i at time t on outcome variable k; δ_{ES}, δ_M, and δ_H are dummy variables for emotional support, mastery, and health, respectively. The variables π_{0iES}, π_{0iM}, and π_{0iH} are the random intercepts for emotional

support, mastery, and health, respectively; π_{1iES}, π_{1iM}, and π_{1iH} are the random slopes of emotional support, mastery, and health, respectively; and e_{itES}, e_{itM}, and e_{itH} are random residuals of the three outcome variables. Each part of the model is rewritten by decomposing each parameter into a fixed effect and a random effect as follows,

$$\pi_{0iES} = \beta_{01ES} + u_{01iES} \quad (6)$$

$$\pi_{1iES} = \beta_{10ES} + u_{10iES} \quad (7)$$

$$\pi_{0iM} = \beta_{01M} + u_{01iM} \quad (8)$$

$$\pi_{1iM} = \beta_{10M} + u_{10iM} \quad (9)$$

$$\pi_{0iH} = \beta_{01H} + u_{01iH} \quad (10)$$

$$\pi_{1iH} = \beta_{10H} + u_{10iH} \quad (11)$$

Substitution of these equations into equation 5 yields the combined model, which has the same general form as the trivariate latent growth curve format,

$$y_{itk} = \boldsymbol{\delta}_{\mathbf{ES}} [\beta_{01ES} + \beta_{10ES}(\text{time}_{it}) + u_{01iES} + u_{10iES}(\text{time}_{it}) + e_{itES}] + \boldsymbol{\delta}_{\mathbf{M}} [\beta_{01M} + \beta_{10M}(\text{time}_{it}) + u_{01iM} + u_{10iM}(\text{time}_{it}) + e_{itM}] + \boldsymbol{\delta}_{\mathbf{H}} [\beta_{01H} + \beta_{10H}(\text{time}_{it}) + u_{01iH} + u_{10iH}(\text{time}_{it}) + e_{itH}] \quad (12)$$

The growth factors are assumed to be normally distributed with means, variances, and covariances. The time-specific residual scores are also assumed to be normally distributed with a mean of 0, a single variance, and are allowed to covary within occasion, but not across occasions. For illustration purposes, a graphical representation of Model 1 (equation 12) is depicted in Figure 2.

Finally, to test the effects of age, education, and gender, the final equation is as follows,

$$y_{itk} = \boldsymbol{\delta}_{\mathbf{ES}} [\beta_{01ES} + \beta_{02ES}(\text{age}_i) + \beta_{03ES}(\text{education}_i) + \beta_{04ES}(\text{gender}_i) + \beta_{10ES}(\text{time}_{it}) + \beta_{11ES}(\text{time}_{it}) \text{ x } (\text{age}_i) + \beta_{12ES}(\text{time}_{it}) \text{ x } (\text{education}_i) + \beta_{13ES}(\text{time}_{it}) \text{ x } (\text{gender}_i) + u_{01iES} + u_{10iES}(\text{time}_{it}) + e_{itES}] + \boldsymbol{\delta}_{\mathbf{M}} [\beta_{01M} + \beta_{02M}(\text{age}_i) + \beta_{03M}(\text{education}_i) + \beta_{04M}(\text{gender}_i) + \beta_{10M}(\text{time}_{it}) + \beta_{11M}(\text{time}_{it}) \text{ x}$$

$$(age_i) + \beta_{12M}(time_{it}) \times (education_i) + \beta_{13M}(time_{it}) \times (gender_i) + u_{01iM} + u_{10iM}(time_{it}) + e_{itM}] + \boldsymbol{\delta_H}$$

$$[\beta_{01H} + \beta_{02H}(age_i) + \beta_{03H}(education_i) + \beta_{04H}(gender_i) + \beta_{10H}(time_{it}) + \beta_{11H}(time_{it}) \times (age_i) + \beta_{12H}$$

$$(time_{it}) \times (education_i) + \beta_{13H}(time_{it}) \times (gender_i) + u_{01iH} + u_{10iH}(time_{it}) + e_{itH}] \quad (13)$$

where age_i is the age of participant *i* at T1; $education_i$ is the years of education for person *i* at T1; and $gender_i$ is the gender for person *i* at T1.

Advantages of using a multivariate latent growth curve model are that developmental relationships can be studied, which include: (1) correlation among the intercepts, (2) correlation among the slopes, (3) correlations between the intercepts and slopes of each respective variable. Additionally, we are able to study a variety of developmental patterns, answer a key question in developmental research regarding how change in one variable is associated with change in another, and easily extend to multivariate situations in which more than two developmental processes are studied (Grimm, 2007).

There are a couple drawbacks to using multivariate latent growth curve models. First, the correlations involving the intercepts depend on its location (Rogosa & Willet, 1985; Rovine & Molenaar, 1998, 2000). Depending on where we place the intercept or center the variables, it can affect the correlations between intercepts and slopes. Hence, the only reliable correlation between growth factors is the slope/slope correlation because it remains consistent for different locations of the intercept. However, this correlation may be difficult to estimate unless there is a large sample or many repeated measurements (Hertzog, Lindenberger, Ghisletta, & von Oertzen, 2007). Second, the correlations between the slopes can change if a researcher chooses a linear growth curve rather than a latent basis growth curve.

All analyses were conducted with MPlus (version 4; Muthén & Muthén, 1998-2007) using full information maximum likelihood estimation to all data points available. That is, all

obtained observations for all participants on all measurement occasions are used to build up maximum-likelihood estimates using a numerical routine that optimizes the model parameters with respect to any available data (cf. McArdle et al., 2004). Maximum likelihood produces estimates for the population parameters that maximize the probability of observing the data that are actually observed, given the model (Hox, 2002). Model fit was assessed using the chi-square goodness of fit statistic, comparative fit index (CFI) and root mean square error of approximation (RMSEA; Browne & Cudeck, 1992). Models with RMSEA values below 0.08 or a CFI above 0.95 are characterized as having good model fit (MacCallum, Browne, & Sugawara, 1996). Due to the large sample size, the RMSEA and CFI are considered more precise fit indices than the chi-square value.

Testing the Hypotheses

As discussed earlier, the use of a multivariate latent growth curve model allows for the modeling of many developmental relationships. This final section is devoted to discussing how each component of the trivariate latent growth curve model used in the present study will function to answer the three research questions being investigated. First, the fixed effects will estimate the amount of change observed over time. The variance parameters in model 1 will establish if there is variability in level and rates of change, and the regression coefficients for age, education, and gender from model 2 will help verify the types of inter-individual differences. The strengths of applying a multivariate latent growth curve model will be utilized to investigate the second research question. By modeling the covariances between random parameters, we are able to estimate the correlations between the latent level and slope factors to test cross-domain associations and observe relationships among aspects of change between each domain. Lastly, nested comparison models will investigate if cross-domain associations differ by

groups of age, education, and gender. Age was divided into a young adulthood to midlife (age < 60, n = 1,924) and old age (age ≥ 60, n = 1,678) group; education was separated by individuals with less than a high school education (n =1,341) and those with a high school education and beyond (n =2,261); and, gender was split by men (n =1,348) and women (n =2,254). A separate model is estimated for each group; subsequent models constrain the variances, covariances, and means to be invariant across groups. Significant changes in the chi-square value from each model are interpreted as the inability to assume similarity across groups in the parameters tested.

Chapter 3. Results

This chapter is devoted to presenting the results of the current study. Based on our research questions the findings are organized into three sections. First, we report results from simultaneously modeling intra-individual change in emotional support, mastery, and health over time and analyzing inter-individual differences in level and rate of change among age, education, and gender. In a second step, we examine intercorrelations between the latent level and slope factors among emotional support, mastery, and health. Finally, age, education, and gender differences in cross-domain associations will be investigated.

Intra-Individual Change over Time

Similar to a univariate latent growth curve, the fixed effects of a trivariate latent growth curve estimate the average level and rates of change, and the random effects estimate the amount of variability in level and rates of change. Table 3 shows the parameter estimates and standard errors of the means and variances for emotional support, mastery, and health for both Model 1 and Model 2. It is important to note that both models have good model fit as indicated by a CFI above 0.95 and RMSEA below 0.05. Shown in figure 3 are the model implied means from model 1; emotional support, mastery, and health displayed systematic change over the course of the study. More specifically, emotional support showed a steady linear increase over time. For every one unit increase in time (2.6 years), emotional support increased by .18 T-score units. Over a ten year period this translates into an almost one T-score unit increase in emotional support. In contrast to emotional support increasing over time, mastery and health displayed differential trajectories. Change in mastery was characterized by stability or a slight decline over time. Every one unit increase in time was associated with a .08 T-score unit decrease in mastery, which translates into a small or minor change. Health demonstrated the greatest rate of change among

the three constructs of interest. As expected, health decreased linearly over time at a rate of -0.39 T-score units per unit of time. Over a ten year period, this translates into almost 2 T-score units. Referring back to hypothesis 1a in Table 1, we correctly predicted change in emotional support and health, but not for mastery.

It is also important to assess the random effects in the models. The bottom of Table 3 shows the random effects associated with the intercept and slope in Model 1 for emotional support, mastery, and health were all significant. This indicates there is variability or inter-individual differences in level and rates of change in each of these domains. Next, we examine if age, education, and gender account for inter-individual differences in level and rates of change.

Heterogeneity in Level and Rate of Change

There was significant variation around the intercept and slope for emotional support, mastery, and health. We investigated if age, education, and gender explain some of the variance in level and rates of change in emotional support, mastery, and health. For each of the three constructs, the column under Model 2 in Table 3 reports the regression coefficients for the effects of age, education, and gender on level and slope. Age and being a woman were predictive of level differences in emotional support. Only gender was associated with variability in rates of change in emotional support over time. Women display a less gradual increase in emotional support, or put differently, men experience a greater increase in emotional support over time.

The left portion of Table 3 displays the effects of age, education, and gender on level and rate of change in mastery. Being a man and greater years of education are associated with level differences in mastery. Although age was not predictive of level differences in mastery, it was a significant predictor of variability in rate of change. Overall, participants in the study exhibited

stability/slight decline in mastery, but older individuals who declined had a sharper decline than younger individuals.

Lastly, we examined inter-individual differences among age, education, and gender in level and rates of change in health. The right foremost column in Table 3 displays the effects of age, education, and gender on level and rates of change in health. Age, education, and gender were predictive of level differences in health. Participants, who were younger, more educated, and men reported superior levels of health. In contrast, only age was a significant predictor of declines in health; older participants displayed a steeper decline in health over time. Our hypothesis that age, education, and gender will account for inter-individual differences in level and rate of change is to some extent confirmed (Table 1, question 1b).

It should be noted the random effects in Model 2 for each of the variables are still significant. This means that additional interpersonal variation in these parameters, beyond that which can be explained by age, education, and gender, remained unaccounted for in these models. Exploration of additional sources of variance in level and rates of change is beyond the scope of this study, but will be discussed further in the discussion section.

Evidence of Cross-Domain Linkages

We utilized the advantages of a multivariate latent growth curve model to investigate cross-domain associations in level and rates of change among emotional support, mastery, and health. By doing so, we examined if there are associations between the latent levels, slopes, and between levels and slopes. Results from modeling the intercorrelations between the latent level and slope factors among emotional support, mastery, and health are shown in Table 4. Note, above the diagonal in Table 4 are the intercorrelations from Model 1, whereas the intercorrelations estimated from Model 2 (controlling for the effects of age, education, and

gender) are below the diagonal. For the purposes of the results section we report on the intercorrelations from Model 2. The Model 2 intercorrelations will be reported, because the covariates (i.e. age, education, and gender) slightly change the coefficients from Model 1 and only alter the significance of one of the correlations. As shown on the left side of Table 4, the mean levels (intercepts) of functioning among emotional support, mastery, and health were all positively correlated with one another. Levels of emotional support and mastery displayed the largest correlation (r = .38). Greater receipt of emotional support is associated with more feelings of mastery, and feelings of mastery are associated with greater receipt of emotional support. Furthermore, levels of mastery and health are positively correlated (r = .16). Individuals with greater levels of mastery are more likely to report better health, and superior health is associated with greater influence on one's life. Put differently, from these correlations we infer poorer levels of mastery are associated with lower receipt of emotional support and poor health. We should acknowledge the correlation between the mean levels of emotional support and health is significant (r = .05), but low and not very meaningful. We confirm our hypotheses that levels among emotional support, mastery, and health are positively correlated (Table 1, question 2a).

Next, we examined interrelationships between the latent level and slope factors. Six level-slope cross-domain correlations were estimated, and only the association between level of emotional support and rate of change in health was statistically significant (r = .09). This correlation indicates greater levels of emotional support are associated with protective effects on health, whereas lower receipt of emotional support is related to a more precipitous decline in health. Figure 4 depicts a graphical representation of the intercorrelation. A separate bivariate latent growth curve model was estimated for emotional support and health to model change in health by function of level of emotional support at T1. Over the course of the study, health

declines, but individuals at baseline who reported a half a standard deviation or higher (i.e. 55 T-score units) level of emotional support experience a less steep decline in health, whereas participants that reported poorer levels of emotional support at baseline (half a standard deviation or below the mean, 45 T-score units) displayed a steeper decline in health. We confirm our hypothesis that level of emotional support is associated with changes in health, but are unable to confirm that levels of mastery are associated with rate of change in health (Table 1, question 2b).

Finally, analogous to examining level-level cross-domain associations, we investigated cross-domain associations between rates of change. Three slope-slope correlations were estimated. The only significant correlation was between emotional support and mastery (r = .32). This indicates the rates of linear change in emotional support and mastery are correlated across individuals. Change in emotional support is associated with change in mastery and vice versa. Figure 5 illustrates a graphical representation of the correlation. A separate bivariate latent growth curve model for emotional support and mastery was estimated on individuals who provided data for the first two time points to model change in mastery from T2 to T4 (13 years of time) by function of change in emotional support from T1 to T2. Over the course of the study, mastery was stable/slightly declined, but a greater increase in emotional support from T1 to T2 was associated with a less gradual decline in mastery. In contrast, declines or a less gradual increase in emotional support from T1 to T2 was associated with a greater decline in mastery. Even though it is not graphically represented, we can make statements regarding how changes in mastery are associated with changes in emotional support. For example, a more precipitous decline in mastery would be associated with a less gradual increase in emotional support, and a mitigated decline in mastery is related to a greater increase in emotional support over time. Hypothesis 2c is confirmed that the slopes between emotional support and mastery are

significantly correlated. Our results from modeling the random covariances or correlations assert evidence for cross-domain linkages among emotional support, mastery, and health. In a final set of analyses we examined if these linkages differ by groups of age, education, and gender.

Inter-Individual Differences in Cross-Domain Linkages

To answer the third and final research question, we tested nested comparison models to examine if the interrelationships between the levels and rates of change among emotional support, mastery, and health differed by groups of age, education, and gender. Since, we are testing group differences between the covariates used in the study, analyses were conducted using Model 1. Analyses were carried out in a stepwise fashion, by first estimating a baseline model, with subsequent models constraining the variance, covariance, and means to be invariant across each respective group. Table 5 displays the results from group difference analyses.

Age group differences in cross-domain linkages were tested by dividing the sample into two groups based on their age at T1: young adulthood to midlife (participants 59 and younger; n = 1,924) and old age (participants 60 and older; n = 1,678). The sample was split at age 60 to allow for relatively even groups and also, this is consistent with previous papers using the ACL that have considered old age participants to be those age 60 and older (Fiori et al., 2006; Shaw & Krause, 2001). The top portion of table 5 displays the results from age-group analyses. The baseline model displays good model fit based on the CFI and RMSEA. Subsequent models that set the variance and means invariant across age groups resulted in a significant increase in the chi-square, suggesting we cannot assume these parameters to be similar across age groups. The older age group displays greater variance in the intercepts and slopes for emotional support, mastery, and health. Additionally, the two age groups significantly differ in their levels and rates of change. Most important to our research question and hypothesis, we find that constraining the

covariances to be invariant does not result in a significant change in the chi-square value. This indicates that cross-domain associations do not differ by age, and are assumed to be an age invariant process.

Next, we explored if there are differences in cross-domain associations for individuals with less than a high school education versus those with a high school education and beyond. For education group analyses, the sample was divided into two groups by years of education at T1: participants who received less than a high school education (n = 1,341) and individuals who attained a high school education or higher (n = 2,261)[2]. The center portion of Table 5 displays the results from the models testing if the variance, covariance, and means differ by groups of education. Analyses reveal significant changes in the chi-square value when the variances and means were constrained to be invariant. These results indicate the variances and means are not assumed to be equvalant across educational levels. Inspection of the baseline model reveals compared to the high education group, the low education group has greater variance in each of the parameters estimated (i.e. intercepts and slopes). Similar to age group analyses, constraining the covariances to be invariant did not result in a significant change in the chi-square value. We assume the covariances or cross-domain associations do not differ by education level. These results ascertain education differences in variance and means, but not in cross-domain associations.

Finally, nested comparison models were tested to examine if cross-domain associations differ by gender. Our sample consists of more women (n = 2,254) than men (n = 1,348). The

[2] We attain similar results if we divide the education groups by; (1) low education group signifying individuals who completed high school and below; and (2) individuals who completed years of schooling beyond high school. The group sizes would be similar: low education group, n = 2,392; high education group, n = 1, 210.

lower third of Table 5 displays the results of gender group difference analyses. Analogous to age and education, we find significant changes in the chi-square value by constraining the variances and means to be invariant across gender. This indicates men and women differ in both variability around their intercepts and slopes and their levels and rates of change in emotional support, mastery, and health. More specifically, examination of the baseline model reveals men have greater variance in the intercept and slope for emotional support, whereas women have greater variability in the intercept and slope for mastery and health. Lastly, we observe a non-significant change in the chi-square value when constraining the covariances to be invariant, indicating cross-domain associations do not significantly differ across men and women. These results indicate the cross-domain associations observed in the study are gender invariant.

In conclusion, we found significant differences in the means and amount of variability in the means for groups of age, education, and gender. Contrary to our hypothesis, the covariances or cross-domain associations do not significantly differ by groups of age, education, and gender.

Chapter 4. Discussion

The goal of this chapter is to review and discuss the results of the present study. The focus will be reviewing and expanding the results attained, embedding them within the literature, and discussing future directions and analyses.

The Present Study

Lifespan psychologists have long been interested in intra-individual changes within and structural relations between domains of functioning (P. B. Baltes & Nesselroade, 1979; Brandtstädter & Lerner, 1999; Cairns et al., 1996). Using lifespan developmental psychology as a guiding theoretical framework, the central objective of this study was to examine cross-domain linkages among facets of social support, control beliefs, and health in a lifespan sample (young adulthood to oldest old). Our study was based on the premise that the influential nature of these constructs is not derived from their operation in isolation, but by their transactional relationship, as depicted in Figure 1. Specifically, we investigated three questions: (1) How do emotional support, mastery, and health simultaneously change over time and are there inter-individual differences in level and rate of change, (2) Are there cross-domain associations between the level and rates of change among emotional support, mastery, and health, and (3) Do interrelationships between emotional support, mastery, and health vary by groups of age, education, and gender? To examine our research questions we applied a multivariate latent growth curve model to 15.5 year incomplete data from the Americans' Changing Lives Study.

At the sample level, emotional support, mastery, and health showed systemic change and inter-individual differences in level and rate of change. Our results indicate multidirectionality in these constructs, with emotional support increasing, mastery showing stability, and health declining over time. Age, education, and gender accounted for some, but not all the inter-

individual differences in level and rates of change. Secondly, we find profound associations among emotional support, mastery, and health not only exist in mean levels of functioning, but also that across-domain changes are moderately interrelated. Specifically, level of emotional support was positively correlated with rate of change in health; this is consistent with the extant literature showing social integration and emotional support are protective of declines in health (for reviews, see Berkman et al., 2000; House et al., 1988a; Uchino et al., 1996). Furthermore, rates of change between emotional support and mastery are moderately correlated across individuals. Correlations between rates of change in emotional support and mastery provide evidence for the support/efficacy framework (Antonucci & Jackson, 1987) and social cognitive theory (Bandura, 1977, 1986). Each of these theories/frameworks details how the relationship between facets of the environment and control beliefs has implications for health and well-being. Finally, nested comparison models investigated if cross-domain associations differ by groups of age, education, and gender. The nested comparison models revealed significant differences in the variances and means between each respective group, but the cross-domain associations are assumed to be age, education, and gender invariant processes. We take our results to highlight the multidimensional, multidirectional, and transactional (i.e. interplay of component parts and processes) nature of behavioral development, and how interrelationships between social (emotional support), psychological (mastery), and biological (health) dimensions contribute to lifespan development and successful aging.

Nature of Change over Time

Our descriptive finding that emotional support, mastery, and health systemically change over time is consistent with the literature revealing the multidirectional nature of these constructs. In line with previous findings (Martire et al., 1999; Shaw et al., 2007) and consistent

with socioemotional selectivity theory (Carstensen, 1992), emotional support increased over the course of the study. Over time individuals on average draw closer to proximal, emotionally connected relationships, such as with children and spouses. Our findings extend previous studies due to the unique nature of our sample. The ACL sample consists of individuals from young adulthood to the oldest old and we find individuals from across adulthood on average report an increase in receipt of emotional support over time. Social relationships constitute an important resource for actively influencing the source and outcomes of development (Lang, 2001), and this study provides evidence for the regulation of social relationships across adulthood and old age.

Our results add to the growing body of literature demonstrating general feelings of control show stability or slight decline over time. Consistent with previous reports on large panel studies (Brandtstädter & Rothermund, 1994; Lachman, 1985, 1986b) and samples of the oldest old (Femia et al., 1997) we observe mastery remains stable in a sample of individuals from young adulthood to the oldest old. These findings are in contrast to reports involving individuals with chronic illnesses, where declines in control were observed over a one year period (Wolinsky et al., 2003). The results of the present study extend the extant literature for two reasons: sample composition and time frame. Previous longitudinal studies were comprised of solely younger or older adults, whereas we find stability in a sample consisting of individuals from young adulthood to the oldest old. Secondly, our study followed individuals on average for a period of 15.5 years allowing for long term observance of change. Observed stability in general feelings of control brings attention to the important matter of modeling change over various time indices. It appears general feelings of control might possess similar properties like that of well-being, where when modeled over age or time it is stable; it is conceivable that analogous to well-being, general control may display differential change when observed over distance-to-death (i.e.

terminal decline; Gerstorf, Ram, Estabrook, Schupp, Wagner, & Lindenberger, 2008a; Gerstorf, Ram, Röcke, Lindenberger, & Smith, 2008b).

Increasing age and time are associated with a greater susceptibility to declines in health. In our study we find individuals on average display declines in health, or, put differently are more susceptible to acquiring health conditions over time. These findings are consistent with general notions of aging that increasing age is associated with a greater probability of being diagnosed with a health condition (Manton & Soldo, 1985). Similarly, increasing age is associated with greater susceptibility to disability (Crimmins et al., 1997). As individuals develop into old age, there is a decrease in biological plasticity, leading to a greater vulnerability towards declining health (P. B. Baltes, 1997; Jette, 1996). Decreases in health with time may be the result of the accumulation of less desirable traits (i.e. social isolation, diminished locus of control; Smith & P. B. Baltes, 1997).

What accounts for level and rates of change in emotional support, mastery, and health?

In addition to examining intra-individual change in emotional support, mastery, and health, we explored if age, education, and gender account for inter-individual differences in level and rate of change. First, we discuss sources of variability in emotional support. Older age is found to be positively associated with greater receipt of support from emotionally connected social relationships. Our results signify older adults, compared to younger adults, are focusing more on short-term goals such as emotion regulation (Carstensen, 1992; Lang, 2001). Emotion regulation is a salient short-term goal for older adults and intimate social relationships are the best opportunity to attain this goal (M. M. Baltes & Carstensen, 1999). Analogous to Shaw et al. (2007), we find men report lower receipt, but a greater increase in emotional support over time. Our findings are parallel despite modeling change over time (compared to age), and our sample

consisting of individuals from young adulthood to the oldest old (compared to only old age). Gender differences in levels and rate of change in emotional support could be for two reasons. First, women are shown to have more integrated and diverse networks (Antonucci, 2001; Smith & M. M. Baltes, 1998) and maintain higher levels of support through adulthood and old age (Antonucci & Akiyama, 1987; Kahn & Antonucci, 1980). Secondly, men typically may not maintain close social relationships until old age, when changes associated with age (i.e. declining health, retirement), lead to drawing closer to network members for help and guidance (Gurung et al., 2003; Kahn & Antonucci, 1980).

Education and gender accounted for level variations in mastery, whereas age was associated with variability in change over time. Consistent with the literature (Feingold, 1994; Schieman & Campbell, 2001; Ross & Mirowsky, 2002; Shaw & Krause, 2001), we find women report lower feelings of mastery. Gender differences in mastery could be role linked (i.e. social role hypothesis; Schieman, 2001). In line with previous findings education is positively related to feelings of control (Mirowsky, 1995; Ross & Mirowsky, 2002). It is argued education differences in control are an artifact of the association between age and sense of control (Mirowsky, 1995; Ross & Mirowsky, 2002). We argue the positive relationship between education and mastery is the result of education generally being associated with superior health, having access to more resources (e.g. community, psychosocial), and possessing a cumulative advantageous profile across the life course. In contrast to gender and education accounting for variation in levels of mastery, only age was predictive of inter-individual differences in rates of change. This finding is consistent with and extends cross-sectional studies reporting age differences in general feelings of control, with sharper declines observed in older ages (Lachman & Firth, 2004; Mirowsky, 1995; Ross & Mirowsky, 2002). Mastery displays stable properties

over time, but increasing age may put strains on our ability to exercise control and directly influence one's life (Mirowsky, 1995). Maintaining a sense of control is important in old age to help prevent or minimize declines associated with the aging process (Lachman & Firth, 2004), in addition to contributing to successful aging (P. B. Baltes & M. M. Baltes, 1990; Rowe & Kahn, 1987, 1997).

Age, education, and gender accounted for some inter-individual differences in levels of health, whereas only age was predictive of variability in rate of change. Consistent with the literature we find participants who were older, received fewer years of education, and gender female reported poorer levels of health. It has repeatedly been shown that old age is associated with a greater likelihood of accruing physical limitations and chronic illnesses (Crimmins et al., 1997; Jette, 1996; Manton & Soldo, 1985; Smith & M. M. Baltes, 1998; Smith et al., 2002). Biological plasticity decreases with age, leading to a greater susceptibility to poor health (P. B. Baltes, 1997; P. B. Baltes & Smith, 2003). We find women are more likely to report poorer levels of health. In general, the literature shows women have a greater likelihood of accumulating chronic conditions and reporting greater difficulty with activities of daily living (Crimmins, Kim, Hagedorn, 2002; Smith & M. M. Baltes, 1998; Verbrugge, 1990a; 1990b). Education differences in levels of health provide support for the socioeconomic status (SES) hierarchical health gradient; every level increase in SES (in this case education) is associated with lower levels of morbidity and mortality (Adler et al. 1994, 1999). Possible reasons for education differences in health include the cumulative disadvantageous effects a lower education has on health and associated behaviors (Ferraro, 2001). Lastly, age was predictive of variability in health declines over time. Compared to individuals of young ages, individuals in older adulthood displayed a sharper decline in health over time. Increasing age is associated with a

greater susceptibility to health declines and acquisition of chronic illnesses (Crimmins et al., 1997; Manton & Soldo, 1985).

How are emotional support, mastery, and health interrelated?

In accordance with lifespan developmental psychology's interest in examining structural relationships between domains of functioning, we observe emotional support, mastery, and health possess transactional properties, not only at mean levels, but in level-slope, and slope-slope sources of functioning. Latent levels between emotional support, mastery, and health were all significantly correlated. In line with previous findings, levels of emotional support and mastery are associated or predictive of one another (Eckenrode, 1983; Hay & Fingerman, 2005; Krause, 1992; Krause & Shaw, 2001). We observe that emotional support can either increase or decrease the autonomy and control of an individual, in addition to the amount of control can increase or decrease receipt of emotional support. Rowe & Kahn (1987) describe the positive effect support can have on successful aging is through the effect it has on psychosocial predictors of success, of which autonomy and control are an important example. Correspondingly, individuals who feel a greater sense of mastery engage or interact with social network members more effectively, resulting in more receipt of support.

Interestingly, our study provides evidence that not only are emotional support and mastery correlated at the mean sources of functioning, but their rates of change display a similar moderate correlation. Our results provide evidence that the relationship between rate of change in facets of social support/environmental contexts and personal factors is reciprocal. Consistent receipt of emotional support over time is associated with changes in mastery, in the form of an alleviated decline or possible increase over time. Correspondingly, exhibiting stability or increases in mastery over time is associated with greater receipt of support or more effective

engagement with social network members. Such moderate transactional relationships between emotional support and mastery have important implications for behavioral development across the lifespan. First, these findings provide support for understanding how sense of control is a mechanism by which social support affects health (Antonucci, 2001; Cacioppo et al., 2000; Haidt & Rodin, 1999). Secondly, the relationship between emotional support and mastery is critical because, both are predictive of health, comprise integral components of successful aging (M. M. Baltes & P. B. Baltes, 1990; Rowe & Kahn, 1987, 1997), and contribute to reaching old age in a good state (Vaillant & Mukamel, 2001). Finally, we only tested correlations between these variables, thus, by no means can we infer directionality. Further work is needed to disentangle this relationship and explore dynamic (i.e. time-ordered) associations, especially between specific types of emotional support, such as with children or a spouse, and corresponding effects on control beliefs.

In the present study we find mean levels of emotional support are significantly correlated with rate of change in health over time. These results are consistent with and in line with the abundance of literature linking emotional support to health (for reviews, see Berkman et al., 2000; House et al., 1988a; Uchino et al., 1996). Being embedded in a positive social network characterized by receipt of emotional support is associated with a less steep decline in health. There are multiple explanations for why emotional support is associated with positive health outcomes. A strong social network is associated with engaging in protective health behaviors (Antonucci & Jackson, 1987; Mendes de Leon et al., 1999), feeling greater feelings of control (Antonucci & Jackson, 1987; Bandura, 1986; Mendes de Leon et al., 1999), and superior physiological functioning (Seeman, 2001; Uchino et al., 1996). Concomitantly, we can argue absence of emotional support or social isolation is associated with a more precipitous decline in

health. Work by Cacioppo and colleagues documents the detrimental effects of loneliness or social isolation on health (for overview, see Cacioppo et al., 2003).

Lastly, we find the mean levels of mastery and health are significantly correlated. These results denote the importance of control on health related outcomes, and that health has an effect on how individuals directly influence and regulate one's life. Our findings are in accordance with empirical evidence suggesting greater perceived mastery is predictive of better health (Lachman & Weaver, 1998a). Additionally, empirical evidence has accumulated illustrating compromised health and physical impairments are associated with decreased feelings of control (Lachman, 1986a; Mirowsky, 1995). Health and feelings of control are uniquely associated with one another, and are considered interactive partners in the aging process (Skaff, 2007). Their relationship is critical to development in adulthood, and is theorized to grow stronger in old age (Rodin, 1986). Associations between health and feelings of control has implications for interventions aimed at improving feelings of control and falls efficacy (Lachman, 2006; Tennstedt et al., 1998). Researchers hypothesize there are several mechanisms by which control impacts health. Individuals with a greater sense of control practice more health relevant behaviors, have superior physiological functioning, and are more capable of reducing stress (Rodin, 1986). Future work should examine lead-lag associations between control beliefs and health, in addition to exploring potential mechanisms mediating this relationship.

What is the role age, education, and gender play in cross-domain linkages?

Contrary to our hypotheses, we find cross-domain associations among emotional support, mastery, and health do not differ by groups of age, education, and gender. Our findings are surprising and make substantive contributions to the literature. First, we take from our results that cross-domain associations among emotional support, mastery, and health are integral,

important, and similar processes for individuals from young adulthood to the oldest old, with low and higher levels of education, and for men and women. These findings illustrate that such cross-domain associations as seen between mean levels of functioning and among the slopes of emotional support and mastery are age, education, and gender invariant processes. Secondly, our findings contradict notions that social relationships, sense of control, and health contribute differently to development in midlife and old age. These parameters comprise integral components of successful aging and it is interesting to see these are invariant across age, education, and gender.

Although we did not specify any hypotheses regarding age, education, and gender group differences in variances and means, it is important to acknowledge our findings. Lifespan developmental psychologists have long been interested in exploring heterogeneity in old age. Individuals approach old age from a range of starting points that contribute to differential trajectories and variability in old age (P. B. Baltes & Smith, 2003; Smith & Gerstorf, 2004). Life experiences are diverse and unique, and typically not the same between individuals, influencing how individuals approach old age (i.e. differential ageing, Smith & Gerstorf, 2004). Empirically, using cross-sectional data from the Health and Retirement Study, Infurna and Smith (2008) show, compared to individuals in midlife, older adults display greater heterogeneity in psychological profiles of functioning. From the education group analyses we find individuals with lower levels of education have greater variability in the intercepts and slopes for each construct. It appears more years of education have a homogenizing effect on levels and rates of change across individuals in various constructs. Education may have a homogenizing effect by fostering psychological resources (i.e. sense of control, social support) and influencing individuals' health promoting behaviors, leading to decreased variability (House, Lepkowski,

Kinney, Mero, Kessler, & Herzog, 1994; Ross & Mirowsky, 1999). Finally, men exhibit greater variability in level and rates of change in emotional support, and women demonstrate greater variability in the level and rates of change among mastery and health. From these results we hypothesize that men are more varied amongst one another in receipt of emotional support, whereas because women typically receive greater receipt of support it has a homogenizing effect. Additionally, we observe women have greater diversity in levels and rates of change in mastery and health. Generally speaking, it appears if lower levels are reported on a construct for groups of individuals, greater variability is exhibited.

Is There an Optimal Level of Control?

An interesting point raised in my master's defense and in previous drafts was, is there an optimal level of control, or put differently, can having too much control be maladaptive? Lachman describes this concept as the adaptive value of control beliefs. There is empirical evidence to suggest control beliefs can be both adaptive and maladaptive. Lachman (2006) depicts a multidirectional conceptual model detailing how adaptive beliefs (e.g. control) influences performance and outcomes through their impact on behavior, motivation, and affect. There is empirical evidence to suggest that sense of control is adaptive because it provides the motivation to cope and take action even in the face of great adversity (Taylor & Brown, 1988), leading, ultimately, to greater well-being. When faced with uncontrollable events or unattainable goals, it is hypothesized that individuals with a strong sense of control would be expected to be better at finding ways to cope by using secondary (change the self) rather than primary (change the situation) control strategies (Wrosch, Heckhausen, & Lachman, 2006). In contrast, too much control has been shown to be maladaptive. For example, M. M. Baltes and colleagues have shown that in institutional settings, control may have an aversive effect on health and well-being

(e.g. dependency-support script, independence-ignore script; M. M. Baltes, 1995, 1996). They demonstrated reliably that many behavioral interactions between old people and their social environments are characterized by a stable pattern that reinforces dependency and ignores independence (M. M. Baltes & Carstensen, 1999). Additionally, in a sample of recent widows, greater levels of perceived control over their social support was associated with poorer overall adjustment across the first 4 months of widowhood (Bisconti, Bergeman, & Boker, 2006). It could be that individuals who highly regard control or have too much control may ruminate about losing control, negatively affecting behaviors, emotions, and physiological functioning, ultimately, leading to poor health and well-being. Similarly, research has accumulated showing there may be an optimal level of social support. Krause (1987) suggests a non-linear association between social support and feelings of control. Increases in social support tend to increase feelings of control, but only up to a certain threshold; beyond this point, additional support tends to decrease feelings of personal control (Krause, 1987).

Theoretical Embedding

At this segment of the discussion, I would like to place the findings, analyses, and conceptual model depicted in figure 1 in the broader context of lifespan developmental theory and conceptualizations of human development. To do this, I will use one of the guiding principles of lifespan developmental psychology to further explicate cross-domain linkages and place them in the broader context of lifespan development. The influential nature of social, psychological, and biological domains of functioning is not derived from their operation in isolation, but by their *transactional* (i.e. interplay of component parts and processes) nature or properties. Individuals are conceptualized as being comprised of multiple levels or domains (i.e. social, psychological, and biological) and it is the interactions or interplays among these levels

that contribute to lifespan development. In this study we made an effort to examine the transactional nature between emotional support, mastery, and health, which respectively comprise the grander arenas of social, psychological, and biological domains, respectively. To study the transactional nature of our data, we applied a multivariate latent growth curve to examine interrelationships between mean levels (parts) and slopes or rate of change (processes) among these constructs. We find the "parts" between emotional support, mastery, and health; the "parts" of emotional support and "processes" of health; and the "processes" between emotional support and mastery to be significantly correlated. Although, we only estimated correlations between the component parts and processes, this was a stride in the right direction towards strengthening conceptual models of how these constructs are interrelated (House et al., 1988a). We provide further evidence to strengthen the conceptual model depicted in figure 1, and provide substantiation for integrative research across various domains of functioning. Associations do not imply causation, but often, the causal direction that is tested depends on one's disciplinary level of analysis (Cacioppo et al., 2000). This is the principle of reciprocal determinism, which specifies that there can be mutual influences between microscopic and macroscopic factors in determining behavior (Cacioppo & Berntson, 1992).

Researchers have coined numerous terms to describe these types of integrative approaches or multi-level analyses. Cacioppo and colleagues describe this approach as multilevel integrative analysis; research needs to span molar and molecular levels of analysis (Cacioppo et al., 2000). Gottlieb (1992) states the cause of development-what makes development happen-is the relationship of two components, not the components themselves. Gottlieb solidifies his viewpoint by outlining a developmental psychobiological systems framework, where traffic between levels of environment, behavior, neural activity, and genetic activity is bidirectional

(Gottlieb, 1996). Life-span psychology describes this integrative approach has taking a systemic-wholistic perspective (P. B. Baltes & Smith, 1997; Smith & P. B. Baltes, 1997; Gerstorf, Smith, & P. B. Baltes, 2006). Aging and development are seen as a process of interrelated constancy and change in which elements are part of a "structural ensemble" that possibly interact with each other and that need to be considered conjointly (P. B. Baltes & Smith, 1997). Concomitantly, it is foreseeable that people change on many dimensions simultaneously, or multiple forms of functional change occur within a person, associated change trajectories may or may not be interrelated and different people may show different patterns of change across domains (e.g. ageing differently; Smith & Gerstorf, 2004). Each of these integrative approaches share a common conceptual core that individuals should be thought of as integrated wholes comprised of multiple domains, moving through time, with multiple domains (and interactions amongst multiple domains) simultaneously influencing development along various time continuums (e.g. distal and proximal time scales; Smith & Infurna, in press).

Future Directions

This work has lead to a myriad of ideas for future analyses; two specific thoughts merit discussion. First, in accordance with Skaff (2007) more investigative work is necessary for examining intra-individual change and inter-individual differences in intra-individual change in mastery *over age.* Specifically, how does mastery change in individuals age 65 and older and what accounts for inter-individual differences in level and rates of change? Preliminary analyses reveal mastery demonstrates a quadratic trend; there is stability among the young-old, with sharper declines in the oldest old. Variability in levels and rates of change would be tested among education, gender, social support, health, well-being, cognition, and personality. Secondly, future work should examine each two-domain relationship separately (i.e. emotional

support-control, emotional support-health, and control-health) to examine dynamic (i.e. time-ordered; Gerstorf, Lövdén, Röcke, Lindenberger, & Smith, 2007) or lead-lag associations with the bivariate dual change score model (BDCSM; McArdle & Hamagami, 2001). Preliminary analyses involving mastery and health are promising. There is evidence of age differential lead-lag associations between mastery and health; for individuals age 64 and younger, levels of mastery are associated with subsequent change in health, but emotional support attenuates this relationship. For individuals in old age (age 65 and older) mastery predicts changes in health over time independent of age, education, gender, and emotional support. Additional work is needed to further expound these results.

Limitations and Outlook

Despite the numerous findings and contributions of our study to the literature, there are several limitations to take note of. First, social support, control, and health are multidimensional and we only examined one facet of each construct. Depending on the type of construct utilized, they may behave differently over time and demonstrate differential cross-domain associations. For example, if instrumental support was utilized in place of emotional support, we hypothesize its level associations between mastery and health would be negative, in addition to higher levels resulting in a sharper decline in health. Additionally, our measure of emotional support consisted of a mean index across three types of social relationships. By creating a mean index, we assumed that social relationships across family and friends, children, and spouses are equal in their effect on the individual. Follow-up analyses will examine how each relationship may contribute differently to associations among control beliefs and health. Second, the cross-domain associations presented in Table 4 are correlations, thus we cannot imply causality or directionality. Only with future analyses applying the dual change score model will we be able to

explore lead-lag associations. Third, we modeled change and cross-domain associations over time and not age. This leaves open the possibility of cohort effects affecting the results. Fourthly, we constrain the slopes to be linear and did not explore if emotional support, mastery, or health exhibited non-linear change over time. Lastly, our study consisted of four waves of data that spanned 15.5 years, which leaves us susceptible to attrition. Selectivity analyses revealed individuals who were younger, completed more years of education, and were in better health at T1 were likely to contribute more data points. There are implications of such selectivity, where with more complete data we could have showed greater change and associations among the constructs of interest. It is likely we underestimated change, but despite selectivity we show systemic change and moderate cross-domain associations.

In the present analysis of cross-domain associations between emotional support, mastery, and health, we found systemic change and variability in level and rates of change, cross-domain associations in mean levels and rates of change in functioning, and cross-domain associations do not differ by groups of age, education, and gender. Our findings indicate the relationship between mean levels of mastery and health is stronger than similar associations between emotional support and health. Additionally, not only are the mean levels between emotional support and mastery moderately correlated, but so are their rates of change. This signifies change in these constructs is correlated across individuals. Furthermore, mean levels of emotional support were associated with changes in health over time. This is consistent with the literature displaying greater levels of emotional support are protective of declines in health. Lastly, these extensive cross-domain associations did not differ by groups of age, education, and gender. We imply these interplays or cross-domain associations are important contributors to and inform conceptual models of lifespan development.

References

Adler, N. E., Boyce, T., Chesney, M. A., Cohen, S., Folkman, S., Kahn, R. L., & Syme, S L. (1994). Socioeconomic status and health: The challenge of the gradient. *American Psychologist*, 49, 15-24.

Adler, N. E., Marmot, M., McEwen, B. S., Stewart, J. (Eds.). (1999). Socioeconomic status and health in industrialized nations: Social, psychological and biological pathways. *Annals of the New York Academy of Sciences,* 896. New York: New York Academy of Sciences.

Antonucci, T. C. (2001). Social relations: An examination of social networks, social support, and sense of control. In J. E. Birren & K. W. Schaie (Eds.), *Handbook of the psychology of aging* (pp. 427-453). San Diego: Academic Press.

Antonucci, T. C., & Jackson, J. S. (1987). Social support, interpersonal efficacy and health. In L. L. Carstensen, & B. A. Edelstein (Eds.), *Handbook of clinical gerontology,* (pp. 291-311). New York: Pergamon.

Baltes, M. M. (1995). Dependency in old age: Gains and losses. *Current Directions in Psychological Science, 4,* 14-19.

Baltes, M. M. (1996). *The many faces of dependency in old age.* New York: Cambridge University Press.

Baltes, M. M., & Carstensen, L. L. (1999). Social-psychological theories and their applications to aging: From individual to collective. In V. L. Bengtson & K. W. Schaie (Eds.), *Handbook of theories on aging* (pp. 209-226). New York: Springer.

Baltes, M. M., Freund, A. M., & Horgas, A. L. (1999). Men and women in the Berlin Aging Study. In P. B. Baltes & K. U. Mayer (Eds.), *The Berlin Aging Study: Aging from 70 to 100* (pp. 282-301). New York: Cambridge University Press.

Baltes, P. B. (1987). Theoretical propositions of life-span developmental psychology: On the dynamics between growth and decline. *Developmental Psychology, 23*, 611-626.

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

Baltes, P. B., & Baltes, M. M. (1990). Psychological perspectives on successful aging: The model of selective optimization with compensation. In P. B. Baltes, & M. M. Baltes (Eds.), *Successful aging: Perspectives from the behavioral sciences* (pp. 1-34). Cambridge, UK: Cambridge University Press.

Baltes, P. B. & Mayer, K. U. (1999). *The Berlin Aging Study: Aging from 70 to 100*. New York: Cambridge University Press.

Baltes, P. B. & Nesselroade, J. R. (1979). History and rationale of longitudinal research. In J. R. Nesselroade & P. B. Baltes (Eds.), *Longitudinal research in the study of behavior and development* (pp. 1-39). New York: Academic Press.

Baltes, P. B., Reese, H. W., & Nesselroade, J. R. (1977). *Life-span developmental psychology: Introduction to research methods.* Monterrey, CA: Brooks/Cole.

Baltes, P. B., & Smith, J. (1997). A systemic-wholistic view of psychological functioning in very old age: Introduction to a collection of articles from the Berlin Aging Study. *Psychology and Aging, 12,* 395-409.

Baltes, P. B. & Smith, J. (1999). Multilevel and systemic analyses of old age: Theoretical and empirical evidence for a fourth age. In V. L. Bengston & K. W. Schaie (Eds.) *Handbook of theories of aging,* (pp. 153-173). New York: Springer.

Baltes, P. B. & Smith, J. (2003). New frontiers in the future of aging: From successful aging of the young old to the dilemmas of the fourth age. *Gerontology, 49*, 123-135.

Baltes, P. B. & Smith, J. (2004). Lifespan psychology: From developmental contextualism to developmental biocultural co-constructivism. *Research in Human Development,* 1, 123-144.

Bandura, A. (1977). Self-efficacy: Toward a unifying theory of behavioral change. *Psychological Review, 84*, 191-215.

Bandura, A. (1986). *Social foundations of thought and action: A social cognitive theory.* Englewood Cliffs, NJ: Prentice Hall.

Berkman, L. F., Glass, T., Brissette, I., & Seeman, T. E. (2000). From social integration to health: Durkheim in the new millennium. *Social Science & Medicine, 51*, 843-857.

Bischop, M. I., Kriegsman, D. M. W., van Tilburg, T. G., Penninx, G. W. J. H., van Eijk, J. Th. M., & Deeg, D. J. H. (2003). The influence of differing social ties on decline in physical functioning among older people with and without chronic disease: The longitudinal aging study Amsterdam. *Aging Clinical and Experimental Research, 15*, 164-173.

Bisconti, T. L., Bergeman, C. S., & Boker, S. M. (2006). Social support as a predictor of variability: An examination of the adjustment trajectories of recent widows. *Psychology and Aging, 21,* 590-599.

Branch, L. G., Katz, S., Kniepmann, K. & Papsiedo, J. A. (1984). A prospective study of functional status among community elders. *American Journal of Public Health, 74*, 266-268.

Brandtstädter, J. & Lerner, R. M. (1999). *Action and self development: Theory and research through the lifespan.* Thousand Oaks, CA: Sage.

Brandtstädter, J., & Rothermund, K. (1994). Self-perception of control in middle and later adulthood: Buffering losses by rescaling goals. *Psychology and Aging,* 9, 265-273.

Browne, M. W., & Cudeck, R. (1992). Alternative ways of assessing model fit. *Sociological Methods Research, 21,* 230-258.

Cacioppo, J. T., & Berntson, G. G. (1992). Social psychological contributions to the decade of the brain: The doctrine of multilevel analysis. *American Psychologist, 47,* 1019-1028.

Cacioppo, J. T., Berntson, G. G., Sheridan, J. F., & McClintock, M. K. (2000). Multilevel integrative analyses of human behavior: Social neuroscience and the complementing nature of social and biological approaches. *Psychological Bulletin, 126*, 829-843.

Cacioppo, J. T., Hawkley, L. C., & Berntson, G. G. (2003). The anatomy of loneliness. *Current Directions in Psychological Science, 12,* 71-74.

Cairns, R. B., Elder, G. H., & Costello, E. J. (1996). *Developmental science.* New York: Cambridge University Press.

Caplan, L. J., & Schooler, C. (2003). The roles of fatalism, self-confidence, and intellectual resources in the disablement process in older adults. *Psychology and Aging, 18*, 551-561.

Carstensen, L. L. (1992). Social and emotional patterns in adulthood: Support for socioemotional selectivity theory. *Psychology and Aging, 7*, 331-338.

Carstensen, L. L., Isaacowitz, D. M., & Charles, S. T. (1999). Taking time seriously: A theory of socioemotional selectivity. *American Psychologist, 54*, 165-181.

Cobb, S. (1976). Social support as a moderator of life stress. *Psychosomatic Medicine, 38*, 300-314.

Cohen, S. & Willis, T. A. (1985). Stress, social support, and the buffering hypothesis. *Psychological Bulletin, 98*, 310-357.

Crimmins, E. M., Kim, J. K., & Hagedorn, A. (2002). Life with and without disease: Women experience more of both. *Journal of Women and Aging, 14,* 47-59.

Crimmins, E. M., Saito, Y., & Reynolds, S. L. (1997). Further evidence on recent trends in the prevalence and incidence of disability among older Americans from two sources: the LSOA and the NHIS. *Journal of Gerontology: Social Sciences, 52B,* S59-S71.

Fauth, E. B., Zarit, S. H., Malmberg, B., & Johansson, B. (2007). Physical, cognitive, and psychosocial variables from the disablement process model predict patterns of independence and the transition into disability for the oldest-old. *The Gerontologist, 47,* 613-624.

Feingold, A. (1994). Gender differences in personality: A meta-analysis. *Psychological Bulletin, 116,* 429-456.

Femia, E. E., Zarit, S. H., & Johansson, B. (1997). Predicting change in activities of daily living: A longitudinal study of the oldest old in Sweden. *Journal of Gerontology: Psychological Sciences, 52B,* P294-P302.

Ferraro, K. F. (2001). Health and Aging. In R. H. Binstock, & L. K. George (Eds.), *Handbook of Aging and the Social Sciences* (pp. 238-256). San Diego: Academic Press.

Field, D. & Minkler, M. (1988). Continuity and change in social support between young-old and old-old or very-old age. *Journal of Gerontology: Psychological Sciences, 43*, P100-P106.

Fiori, K. L., Antonucci, T. C., & Cortina, K. S. (2006). Social network typologies and mental health among older adults. *Journal of Gerontology: Psychological Sciences, 61B,* P25-P32.

Fiori, K. L., Smith, J., & Antonucci, T. C. (2007). Social network types among older adults: A multidimensional approach. *Journals of Gerontology: Psychological Sciences, 62B*, P322-P330.

Fries, J. F. (1980). Aging, natural death and the compression of morbidity. *New England Journal of Medicine, 303*, 130-135.

Fries, J. F. (1990). Medical perspectives upon successful aging. In P. B. Baltes, & M. M. Baltes (Eds.), *Successful aging: Perspectives from the behavioral sciences* (pp. 35-49). Cambridge, UK: Cambridge University Press.

Gatz, M., Siegler, I. C., George, L. K., & Tyler, F. B. (1986). Attributional components of locus of control: Longitudinal, retrospective, and contemporaneous analyses. M. M. Baltes & P. B. Baltes (Eds.), *The psychology of control and aging* (pp. 237-263). Hillsdale, NJ: Erlbaum.

Gerstorf, D., Lövdén, M., Röcke, C., Smith, J., & Lindenberger, U. (2007). Well-being affects changes in perceptual speed in advanced old age: Longitudinal evidence for a dynamic link. *Developmental Psychology, 43,* 705-718.

Gerstorf, D., Ram, N., Estabrook, R., Schupp, J., Wagner, G. G., & Lindenberger, U. (2008a). Life satisfaction shows terminal decline in old age: Longitudinal evidence from the German Socio-Economic Panel Study (SOEP). *Developmental Psychology, 44,* 1148-1159.

Gerstorf, D., Ram, N., Röcke, C., Lindenberger, U., Smith, J. (2008b). Decline in life satisfaction in old age: Longitudinal evidence for links to distance-to-death. *Psychology and Aging, 23*, 154-168.

Gerstorf, D., Röcke, C., & Lachman, M. E. (*submitted*) Antecedent-consequent relations of perceived control to health and social support: Nine-year longitudinal evidence for between-domain associations across adulthood.

Gerstorf, D., Smith, J., & Baltes, P. B. (2006). A systemic-wholistic approach to differential aging: Longitudinal findings from the Berlin Aging Study. *Psychology and Aging, 21,* 645-663.

Gottlieb, G. (1992). *Individual development and evolution: The genesis of novel behavior.* New York: Oxford University Press.

Gottlieb, G. (1996). Developmental psychobiological theory. In R. B. Cairns, G. H. Elder, & E. J. Costello (Eds.), *Developmental science* (pp. 63-77). New York: Cambridge University Press.

Grimm, K. J. (2007). Multivariate longitudinal methods for studying developmental relationships between depression and academic achievement. *International Journal of Behavioral Development, 31,* 328-339.

Haidt, J., & Rodin, J. (1999). Control and efficacy as interdisciplinary bridges. *Review of General Psychology, 3*, 317-337.

Hay, E. L., & Fingerman, K. L. (2005). Age differences in perceptions of control in social relationships. *International Journal of Aging and Human Development, 60,* 53-75.

Herd, P., Goesling, B., & House, J. S. (2007). Socioeconomic position and health: The differential effects of education versus income on the onset versus progression of health problems. *Journal of Health and Social Behavior, 48*, 223-238.

Hertzog, C., Lindenberger, U., Ghisletta, P., & von Oertzen, T. (2006). On the power of multivariate latent growth curve models to detect correlated change. *Psychological Methods, 11,* 244-252.

House, J. S., Landis, K. R., & Umberson, D. (1988a). Social relationships and health. *Science, 241*, 540-545.

House, J. S., Lepkowski, J. M., Kinney, A. M., Mero, R. P., Kessler, R. C., & Herzog, A. R. (1994). The social stratification of aging and health. *Journal of Health and Social Behavior, 35,* 213-234.

House, J. S., Kessler, R. C., Herzog, A. R., Meto, R. P., Kinney, A. M., & Breslow, M. J. (1990). Age, socioeconomic status, and health. *The Milbank Quarterly, 68*, 383-411.

House, J. S., Umberson, D., & Landis, K. R. (1988b). Structures and processes of social support. *Annual Review of Sociology, 14,* 293-318.

Hox, J. (2002). *Multilevel analysis: Techniques and applications.* Mahwah, NJ: Erlbaum.

Infurna, F. J. & Smith, J. (2008, July). *How we age: Examining psychological profiles in midlife and old age.* SRC Summer Internship Program 5th Annual Symposium. Institute for Social Research, University of Michigan, Ann Arbor, MI.

Jang, Y., Borenstein-Graves, A., Haley, W. E., Small, B. J., & Mortimer, J. A. (2003). Determinants of a sense of mastery in African American and White older adults. *Journal of Gerontology: Social Sciences, 58B,* S221-S224.

Jette, A. (1996). Disability trends and transitions. In R. Binstock & L. K. George (Eds.), *Handbook of aging and the social sciences* (4th ed., pp. 94-117). San Diego, CA: Academic Press.

Kahn, R. L. & Antonucci, T. C. (1980). Convoys over the life course: Attachment, roles and social support. In P. B. Baltes & O. G. Brim (Eds.), *Life-span development and behavior* (pp. 253-286). New York: Academic Press.

Kliegl, R., Smith, J., & Baltes, P. B. (1989). Testing-the-limits and the study of adult age differences in cognitive plasticity of a mnemonic skill. *Developmental Psychology, 25*, 247-256.

Krause, N. (1987). Understanding the stress process: Linking social support with locus of control beliefs. *Journal of Gerontology, 42,* 589-593.

Krause, N. (1997). Social support and feelings of personal control in later life. In G. R. Pierce, B. Lakey, I. G. Sarason, & B. R. Sarason (Eds.), *Sourcebook of social support and personality* (pp. 335-355). New York: Plenum Press.

Krause, N., & Shaw, B. A. (2000). Giving social support to others, socioeconomic status, and changes in self-esteem in late life. *Journal of Gerontology: Social Sciences, 55B,* S323-S333.

Lachman, M. E. (1985). Personal efficacy in middle and old age: Differential and normative patterns of change. In G. H. Elder, Jr. (Eds.), *Life-course dynamics: Trajectories and transitions, 1968-1980* (pp. 207-236). Ithaca, NY: Cornell University Press.

Lachman, M. E. (1986a). Locus of control in aging research: A case for multidimensional and domain-specific assessment. *Psychology and Aging, 1*, 34-40.

Lachman, M. E. (1986b). Personal control in later life: Stability, change, and cognitive correlates. In M. M. Baltes & P. B. Baltes (Eds.), *The psychology of control and aging* (pp. 207-236). Hillsdale, NJ: Erlbaum.

Lachman, M. E. (2006). Perceived control over aging-related declines: Adaptive beliefs and behaviors. *Current Directions in Psychological Science, 15*, 282-286.

Lachman, M. E., & Andreoletti, C. (2006). Strategy use mediates the relationship between control beliefs and memory performance for middle-aged and older adults. *Journals of Gerontology: Psychological Sciences, 61B,* P88-P94.

Lachman, M. E., & Prenda-Firth, K. M. (2004). The adaptive value of feeling in control during midlife. In O. G. Brim, Jr., C. D. Ryff, & R. C. Kessler (Eds.), *How health are we?: A national study of well-being at midlife* (pp. 320-349). Chicago: University of Chicago Press.

Lachman, M. E., & Weaver, S. L. (1998a). The sense of control as a moderator of social class differences in health and well-being. *Journal of Personality and Social Psychology, 74*, 763-773.

Lachman, M. E., & Weaver, S. L. (1998b). Sociodemographic variations in the sense of control by domain: Findings from the MacArthur Studies of Midlife. *Psychology and Aging, 13*, 553-562.

Lang, F. R. (2001). Regulation of social relationships in later adulthood. *Journals of Gerontology: Psychological Sciences, 56B*, P321-P326.

Lang, F. R., Featherman, D. L., & Nesselroade, J. R. (1997). Social self-efficacy and short-term variability in social relationships: The MacArthur Successful Aging Studies. *Psychology and Aging, 12*, 657-666.

Lawton, M. P. & Lawrence, R. H. (1994). Assessing health. In M. P. Lawton & J. A. Teresi (Eds.) *Annual review of gerontology and geriatrics,* (pp. 23-56). New York: Springer.

Lemke, S., & Moos, R. H. (1981). The suprapersonal environments of sheltered care settings. *Journal of Gerontology, 36,* 233-243.

Lindenberger, U., Singer, T., & Baltes, P. B. (2002). Longitudinal selectivity in aging populations: Separating mortality-associated versus experimental components in the Berlin Aging Study (BASE). *Journals of Gerontology Series B: Psychological Sciences, 57B,* P474-P482.

Litwin, H. (2001). Social network type and morale in old age. *The Gerontologist, 41,* 516-524.

MacCallum, R. C., Browne, M. W., & Sugawara, H. M. (1996). Power analysis and determination of sample size for covariance structure modeling. *Psychological Methods, 1,* 130-149.

MacCallum, R. C., Kim, C., Malarkey, W. B., & Kiecolt-Glaser, J. K. (1997). Studying multivariate change using multilevel models and latent curve models. *Multivariate Behavioral Research, 32,* 215-253.

Manton, K., & Soldo, B. J. (1985). Dynamics of health changes in the oldest old: New perspectives and evidence. *Milbank Memorial Fund Quarterly-Health and Society, 63*, 206-285.

Martire, L. M., Schulz, R., Mittelmark, M. B., & Newsom, J. T. (1999). Stability and change in older adults' social contact and social support: The Cardiovascular Health Study. *Journal of Gerontology: Social Sciences, 54B*, S302-S311.

McArdle, J. J., (1989). A structural modeling experiment with multiple growth functions. In R. Kanfer, P. L. Ackerman, & R. Cudeck (Eds.), *Abilities, motivation, and methodology: The Minneapolis symposium on learning and individual differences* (pp. 71-117). Hillsdale, NJ: Lawrence Erlbaum.

McArdle, J. J., & Hamagami, F. (2001). Latent difference score structural models for linear dynamic analyses with incomplete longitudinal data. In L. M. Collins & A. G. Sayer (Eds.), *New methods for the analysis of change* (pp. 137-176). Washington, DC: American Psychological Association.

McArdle, J. J., Hamagami, F., Jones, K., Jolesz, F., Kikinis, R., Spiro, A., et al. (2004). Structural modeling of dynamic changes in memory and brain structure using longitudinal data from the Normative Aging Study. *Journals of Gerontology Series B: Psychological Sciences, 59B,* P294-P304.

McAvay, G. J., Seeman, T. E., & Rodin, J. (1996). A longitudinal study of change in domain-specific self-efficacy among older adults. *Journal of Gerontology: Psychological Sciences, 51B,* P243-P253.

Medalie, J. H., & Goldbourt, U. (1976). Angina pectoris among 10,000 men: Psychosocial and other risk factors as evidenced by a multivariate analysis of a five year incidence study. *The American Journal of Medicine, 60,* 910-921.

Melchior, M., Berkman, L. F., Niedhammer, I., Chea, M., & Goldberg, M. (2003). Social relations and self-reported health: A prospective analysis of the French Gazel cohort. *Social Science & Medicine, 56,* 1817-1830.

Mendes de Leon, C. F., Seeman, T. E., Baker, D. I., Richardson, E. D., & Tinetti, M. E. (1996). Self-efficacy, physical decline and change in functioning in community-living elders: A prospective study. *Journal of Gerontology: Social Sciences, 51B*, S183-S190.

Mendes de Leon, C. F., Glass, T. A., Beckett, L. A., Seeman, T. E., Evans, D. A., & Berkman, L. F. (1999). Social networks and disability transitions across eight intervals of yearly data in the new haven EPESE. *Journals of Gerontology: Social Sciences, 54B*, S162-S172.

Mirowsky, J. (1995). Age and the sense of control. *Social Psychology Quarterly, 58,* 31-43.

Moos, R. H. (1981). Environment choice and control in community care settings for older people. *Journal of Applied Psychology, 11,* 23-43.

Moos, R. H., & Ingra, A. (1980). Determinants of the social environments of sheltered care settings. *Journal of Health and Social Behavior, 21,* 88-98.

Muthén, L. K., & Muthén, B. O. (1998-2007). *Mplus user's guide* (4th ed.). Los Angeles, CA: Muthén & Muthén.

Newsom, J. T., Mahan, T. L., Rook, K. S., & Krause, N. (2008). Stable negative social exchanges and health. *Health Psychology, 27*, 78-86.

Newsom, J. T., & Schulz, R. (1996). Social support as a mediator in the relation between functional status and quality of life in older adults. *Psychology and Aging, 11,* 34-44.

Orth-Gomer, K., Rosengren, A., & Wilhelmsen, L. (1993). Lack of social support and incidence of coronary heart disease in middle-aged Swedish men. *Psychosomatic Medicine, 55*, 37-43.

Pearlin, L. I., Menaghan, E. G., Lieberman, M. A., & Mullan, J. T. (1981). The stress process. *Journal of Health and Social Behavior, 22,* 337-356.

Pearlin, L. I., & Pioli, M. F. (2003). Personal control: Some conceptual turf and future directions. In S. H. Zarit, L. I. Pearlin, & Schaie, K. W. (Eds.), *Personal control in social and life course contexts: Societal impact on aging* (pp. 1-21). New York: Springer.

Pearlin, L. I., & Schooler, C. (1978). The structure of coping. *Journal of Health and Social Behavior, 19*, 2-21.

Penninx, B. W. J. H., van Tilburg, T., Kriegsman, D. M. W., Deeg, D. J. H., Boeke, A. J. P., & van Eijk, J. Th. M. (1997). Effects of social support and personal coping resources on

mortality in older age: The Longitudinal Aging Study Amsterdam. *American Journal of Epidemiology, 146,* 510-519.

Preacher, K. J., Wichman, A. L., MacCallum, R. C., & Briggs, N. E. (2008). *Latent growth curve modeling.* Thousand Oaks: Sage Publications.

Rodin, J. (1986). Aging and health: Effects of the sense of control. *Science, 233,* 1271-1276.

Rogosa, D. R., & Willett, J. B. (1985). Understanding correlates of change by modeling individual differences in growth. *Psychometrika, 50,* 203-228.

Rook, K. S. (1984). The negative side of social interaction: Impact on psychological well-being. *Journal of Personality and Social Psychology, 46*, 1097-1108.

Rook, K. S. (1992). Detrimental aspects of social relationships: Taking stock of an emerging literature. In H. O. F. Veiel & U. Baumann (Eds.) *The meaning and measurement of social support* (pp. 157-169). New York: Hemisphere.

Ross, C. E., & Mirowsky, J. (1999). Refining the association between education and health: The effects of quantity, credential, and selectivity. *Demography, 36,* 445-460.

Ross, C. E., & Mirowsky, J. (2002). Age and the gender gap in the sense of personal control. *Social Psychology Quarterly, 65,* 125-145.

Rotter, J. B. (1966). Generalized expectancies for internal versus external control of reinforcement. *Psychological Monographs: General and Applied, 80,* 1-28.

Rovine, M. J., & Molenaar, P. C. M. (1998). The covariance between level and shape in the latent growth curve model with estimated basis vector coefficients. *Methods of Psychological Research, 3,* 95-107.

Rovine, M. J., & Molenaar, P. C. M. (2000). A structural modeling approach to a multilevel random coefficients model. *Multivariate Behavioral Research, 35,* 51-88.

Rowe, J. W., & Kahn, R. L. (1987). Human aging: Usual and successful. *Science, 237*, 143-149.

Rowe, J. W., & Kahn, R. L. (1997). Successful aging. *The Gerontologist, 37,* 433-440.

Ryff, C. D., & Singer, B. (1998). The contours of positive human health. *Psychological Inquiry, 9*, 1-28.

Sandler, I. N., & Lakey, B. (1982). Locus of control as a stress moderator: The role of control perceptions and social support. *American Journal of Community Psychology, 10,* 61-80.

Schaie, K. W. & Willis, S. L. (1986). Can adult intellectual decline be reversed? *Developmental Psychology, 22*, 223-232.

Schieman, S. (2001). Age, education, and the sense of control. *Research on Aging, 23,* 153-178.

Schieman, S., & Campbell, J. E. (2001). Age variations in personal agency and self-esteem: The context of physical disability. *Journal of Aging and Health, 13,* 155-185.

Schulz, R., & Heckhausen, J. (1996). A life span model of successful aging. *American Psychologist, 51,* 702-714.

Seeman, M., & Lewis, S. (1995). Powerlessness, health and mortality: A longitudinal study of older men and mature women. *Social Science & Medicine, 41,* 517-525.

Seeman, T. E. (2001). How do others get under our skin? Social relationships and health. In C. D. Ryff & B. H. Singer (Eds.), *Emotion, social relationships, and health* (pp. 189-210). New York: Oxford University Press.

Seeman, T. E., Bruce, M. L., & McAvay, G. J. (1996). Social network characteristics and onset of ADL disability: MacArthur studies of successful aging. *Journals of Gerontology: Social Sciences, 51B,* S191-S200.

Seeman, T. E., Unger, J. B., McAvay, G., & Mendes de Leon, C. F. (1999). Self-efficacy beliefs and perceived declines in functional ability: MacArthur Studies of Successful Aging. *Journal of Gerontology: Psychological Sciences, 54B*, P214-P222.

Shaw, B. A., & Krause, N. (2001). Exploring race variations in aging and personal control. *Journal of Gerontology: Social Sciences, 56B,* S119-S124.

Shaw, B. A., Krause, N., Liang, J., & Bennett, J. (2007). Tracking changes in social relations throughout late life. *Journal of Gerontology: Social Sciences, 62B*, S90-S99.

Singer, T., Verhaeghen, P., Ghisletta, P., Lindenberger, U., & Baltes, P. B. (2003). The fate of cognition in very old age: Six-year longitudinal findings in the Berlin Aging Study (BASE). *Psychology and Aging, 18,* 318-331.

Skaff, M. M. (2007). Sense of control and health: A dynamic duo in the aging process. In C. M. Aldwin, C. L. Park, & A. Spiro (Eds.), *Handbook of health psychology and aging* (pp. 186-209). New York: Guilford Press.

Smith, J. & Baltes, M. M. (1998). The role of gender in very old age: Profiles of functioning and everyday life patterns. *Psychology and Aging, 13*, 676-695.

Smith, J. & Baltes, P. B. (1997). Profiles and psychological functioning in the old and oldest old. *Psychology and Aging, 12*, 458-472.

Smith, J. & Baltes, P. B. (1999). Trends and profiles of psychological functioning in very old age. In P. B. Baltes & K. U. Mayer (Eds.), *The Berlin Aging Study: Aging from 70 to 100* (pp. 282-301). New York: Cambridge University Press.

Smith, J., Borchelt, M., Maier, H., & Jopp, D. (2002). Health and well-being in the young old and oldest old. *Journal of Social Issues, 58*, 715-732.

Smith, J., & Gerstorf, D. (2004). Aging differently: Potentials and limits. In S. O. Daatland & S. Biggs (Eds.), *Ageing and diversity: Multiple pathways and cultural migrations* (pp. 13-28). Bristol, United Kingdom: Policy Press.

Smith, J., & Infurna, F. J. (*in press*). Early precursors of later health. In. C. A. Berg, K. L. Fingerman, J. Smith, & T. C. Antonucci (Eds.), *Handbook of lifespan development*.

Spiro, A. (2001). Health in midlife: Toward a life-span view. In M. E. Lachman (Ed.), *Handbook of midlife development* (pp. 156-187). New York: Wiley.

Steinhagen-Thiessen, E. & Borchelt, M. (1999). Morbidity, mediation and functional limitation in very old age. In P. B. Baltes & K. U. Mayer (Eds.), *The Berlin Aging Study: Aging from 70 to 100* (pp. 282-301). New York: Cambridge University Press.

Taylor, C. R., Bandura, A., Ewart, C. K., Miller, N. H., & DeBusk, R. F. (1985). Exercise testing to enhance wives' confidence in their husbands' cardiac capability soon after clincially uncomplicated acute myocardial infarction. *American Journal of Cardiology, 55,* 635-638.

Taylor, S. E. (1990). Health psychology: The science and the field. *American Psychologist, 45,* 40-50.

Taylor, S. E., & Brown, J. D. (1988). Illusion and well-being: A social psychological perspective on mental health. *Psychological Bulletin, 103,* 193-210.

Tennstedt, S., Howland, J., Lachman, M., Peterson, E. W., Kasten, L., & Jette, A. (1998). A randomized, controlled trial of a group intervention to reduce fear of falling and associated activity restriction in older adults. *The Journals of Gerontology: Psychological Sciences, 538,* 384-392.

Uchino, B. N., Cacioppo, J. T., & Kiecolt-Glaser, J. K. (1996). The relationship between social support and physiologic processes: A review with emphasis on underlying mechanisms and implications for health. *Psychological Bulletin, 119*, 488-531.

Unger, J. B., McAvay, G., Bruce, M. L., Berkman, L., & Seeman, T. (1999). Variation in the impact of social network characteristics on physical functioning in elderly persons: MacArthur studies of successful aging. *Journals of Gerontology: Social Sciences, 54B*, S245-S251.

Vaillant, G. E., & Mukamal, K. (2001). Successful aging. *American Journal of Psychiatry, 158,* 839-847.

Verbrugge, L. M. (1990a). Pathways of health and death. In R. D. Apple (Ed.), *Women, health, and medicine in America. A historical handbook* (pp. 41-79). New York: Garland.

Verbrugge, L. M. (1990b). The iceberg of disability. In S. M. Stahl (Ed.), *The legacy of longevity. Health and health care in later life* (pp. 55-75). Newbury Park, CA: Sage Publications.

Wagner, M., Schitze, Y., & Lang, F. R. (1999). Social relationships in old age. In P. B. Baltes & K. U. Mayer (Eds.), *The Berlin Aging Study: Aging from 70 to 100* (pp. 282-301). New York: Cambridge University Press.

Wolinsky, F. D., Wyrwich, K. W., Babu, A. N., Kroenke, K., & Tierney, W. M. (2003). Age, aging, and the sense of control among older adults: A longitudinal reconsideration. *Journal of Gerontology: Social Sciences, 58B,* S212-S220.

Wrosch, C., Heckhausen, J., & Lachman, M. E. (2006). Goal management across adulthood and old age: The adaptive value of primary and secondary control. In D. Mroczek & T. Little (Eds.), *Handbook of personality development* (pp. 399-421). Mahwah, NJ: Erlbaum.

Appendix: Tables and Figures

Table 1

Research Questions and Hypotheses of the Present Study

Intra-individual Change and Inter-individual Differences in Intra-individual Change	
Q_{1a}	Is there intra-individual change in emotional support, mastery, and health? Hypothesis: Emotional support is expected to increase, whereas health and mastery are expected to decline over time.
Q_{1b}	Are there inter-individual differences between level and intra-individual change in emotional support, mastery, and health? Hypothesis: Age, education, and gender are expected to account for some, but not all of the variability in level and rate of change in emotional support, mastery, and health.
Cross-domain Linkages between Emotional Support, Mastery, and Health	
Q_{2a}	Are there significant correlations between the latent level factors of emotional support, mastery, and health? Hypothesis: We predict the latent level factors between emotional support, mastery, and health will display small to moderate positive correlations.
Q_{2b}	Are the latent level and slope factors between emotional support, mastery, and health significantly correlated? Hypothesis: Small to moderate correlations are expected between level in emotional support, mastery, and rate of change in health.
Q_{2c}	Is the rate of change in emotional support, mastery, and health correlated? Hypothesis: We predict the rate of change between emotional support and mastery will be moderately correlated.
Differential Interrelationships between Age, Education, and Gender	
Q_{3a}	Are there group differences by age, education, and gender in cross-domain linkages between emotional support, mastery, and health? Hypothesis: We expect cross-domain linkages between emotional support, mastery, and health will vary by age, level of education, and gender.

Table 2

Descriptive Statistics for Measures Used in the Present Study

Measure	N	M	SD
Mastery			
T1	3,602	50.00	10.00
T2	2,845	49.99	10.11
T3	2,389	50.40	9.56
T4	1,684	49.62	10.00
Emotional Support			
T1	3,602	50.00	10.00
T2	2,858	49.84	9.85
T3	2,391	52.01	9.20
T4	1,688	52.67	8.91
Health			
T1	3,602	50.00	10.00
T2	2,858	49.86	10.11
T3	2,555	48.82	10.34
T4	1,687	46.79	11.23
Age			
T1	3,602	54.02	17.62
T2	2,858	56.39	17.09
T3	2,555	59.72	16.61
T4	1,784	62.80	14.94
		Percent	
High Education			
T1	2,261	63%	
Gender (% women)			
T1	3,602	63%	

Note. T1, T2, T3, and T4 = Time points 1 (0 years), 2 (2.6 years), 3 (7.6 years), and 4 (15.5 years), respectively. We standardized scores of mastery, emotional support, and health to the T metric by using the T1 ACL sample (N = 3,602, M = 50, SD = 10). High education signifies that the participants received 12 years of schooling (high school education) or higher. M = Mean. SD = Standard Deviation.

Table 3

Trivariate Latent Growth Curve Model: Parameter Estimates and Standard Errors of Means and Variances for Mastery, Emotional Support, and Health

	Mastery		Emotional Support		Health	
Parameter	Model 1	Model 2	Model 1	Model 2	Model 1	Model 2
Fixed Effects						
Intercept	50.06* (0.15)	50.84* (0.24)	49.82* (0.15)	48.53* (0.25)	50.32* (0.16)	51.21* (0.22)
Slope	-0.08* (0.02)	-0.10* (0.03)	0.18* (0.02)	0.22* (0.02)	-0.39* (0.02)	-0.44* (0.03)
Age		0.02 (0.01)		0.05* (0.01)		-0.25* (0.01)
Education		0.65* (0.05)		0.32 (0.05)		0.55* (0.04)
Gender (1 = Women)		-1.21* (0.30)		2.05* (0.31)		-1.42* (0.28)
Age X Slope		-0.004* (0.001)		-0.001 (0.001)		-0.003* (0.001)
Education X Slope		-0.01 (0.01)		-0.10 (0.01)		-0.01 (0.01)
Gender X Slope		-0.10 (0.03)		-0.07* (0.03)		0.04 (0.03)
Random Effects						
Variance intercept	45.10* (2.07)	40.09* (1.95)	53.93* (2.07)	51.59* (2.02)	74.59* (2.27)	44.66* (1.57)
Variance slope	0.11* (0.02)	0.11* (0.02)	0.07* (0.02)	0.07* (0.02)	0.20* (0.02)	0.20* (0.02)
Residual variance	56.40* (1.16)	56.22* (1.15)	45.41* (0.93)	45.42* (0.93)	29.30* (0.62)	29.42* (0.62)

Note. Unstandardized estimates are presented and standard errors are in parentheses. Age is centered at age 54; Slope or rate of change is scaled in T-units per 2.6 years. *N*=3,602. T-scores standardized to cross-sectional ACL sample at T1 (N = 3,602, M = 50, SD = 10). Model 1 fit statistics: χ^2 (df) = 276.85, df= 57, *CFI*= .98; *RMSEA* = .03. Model 2 fit statistics: χ^2 (df) = 310.76, df = 75, *CFI*= .98; *RMSEA* = .03. R^2 for latent factors: Intercept and slope for mastery = .12 and .04, for emotional support = .04 and .03, and for health = .40 and .01.

* $p < .05$ or below

Table 4
Trivariate Latent Growth Curve Model: Intercorrelation between Intercept and Slope Factors for Mastery, Emotional Support, and Health

Parameter	1	2	3	4	5	6
1. Intercept Mastery	–	.41*	.29*	–.32*	–.06	–.01
2. Intercept ES	.38*	–	.02	–.12	–.45*	.08
3. Intercept Health	.16*	.05*	–	.01	.01	–.05
4. Slope Mastery	–.31*	–.07	–.09	–	.35*	.08
5. Slope ES	–.05	–.42*	–.02	.32*	–	–.07
6. Slope Health	.02	.09*	–.07*	.06	–.07	–

Note. Significance testing refers to the underlying covariances. The numbers in the upper right triangle are the correlations in Model 1, and the numbers below the diagonal are the correlations in Model 2 controlling for the effects of age, education, and gender. Model 1 fit statistics: χ^2 (df) = 276.85, *df* = 57, *CFI* = .98; *RMSEA* = .03. Model 2 fit statistics: χ^2 (df) = 310.76, *df* = 75, *CFI*= .98; *RMSEA* = .03. R^2 for latent factors: Intercept and slope for mastery = .12 and .04, for emotional support = .04 and .03, and for health = .40 and .01. ES = Emotional Support.
* $p < .05$ or below

Table 5

Trivariate Latent Growth Curve Model: Nested Model Comparison Testing Age, Education, and Gender Group Differences in Parameter Estimates and Intercorrelations between Mastery, Emotional Support, and Health

Model	χ^2	*df*	$\Delta \chi^2/df$	CFI	RMSEA
Age					
Baseline	656.14	120	–	0.95	0.05
Variance invariance	844.21	126	188.07/6*	0.92	0.06
Covariance invariance	863.08	138	18.87/12	0.92	0.05
Mean invariance	1,928.56	144	1,065.48/6*	0.79	0.08
Education					
Baseline	737.76	120	–	0.93	0.05
Variance invariance	915.73	126	177.97/6*	0.91	0.06
Covariance invariance	935.33	138	19.60/12	0.91	0.06
Mean invariance	1,526.12	144	590.79/6*	0.84	0.07
Gender					
Baseline	362.24	120	–	0.97	0.03
Variance invariance	390.50	126	28.26/6*	0.97	0.03
Covariance invariance	409.71	138	19.21/12	0.97	0.03
Mean invariance	564.10	144	154.39/6*	0.96	0.04

Note. Age groups: young adulthood to midlife, age < 59, *n* = 1,924; old age, age > 60, *n* = 1,678. Education groups: low, *n* = 1,341; high, *n* = 2,261. Gender groups: men, *n* = 1,348; women, *n* = 2,254. Baseline model allows differences in groups for means (i.e. intercepts and slopes). Variance invariance, covariance invariance, and mean invariance models constrain the variances in the intercepts and slopes, the random covariances, or correlations between latent level and slope factors, and the intercepts and slopes to be equal across groups, respectively. CFI = Comparative Fit Index. RMSEA = Root Mean Square Error of Approximation.

* $p < .05$

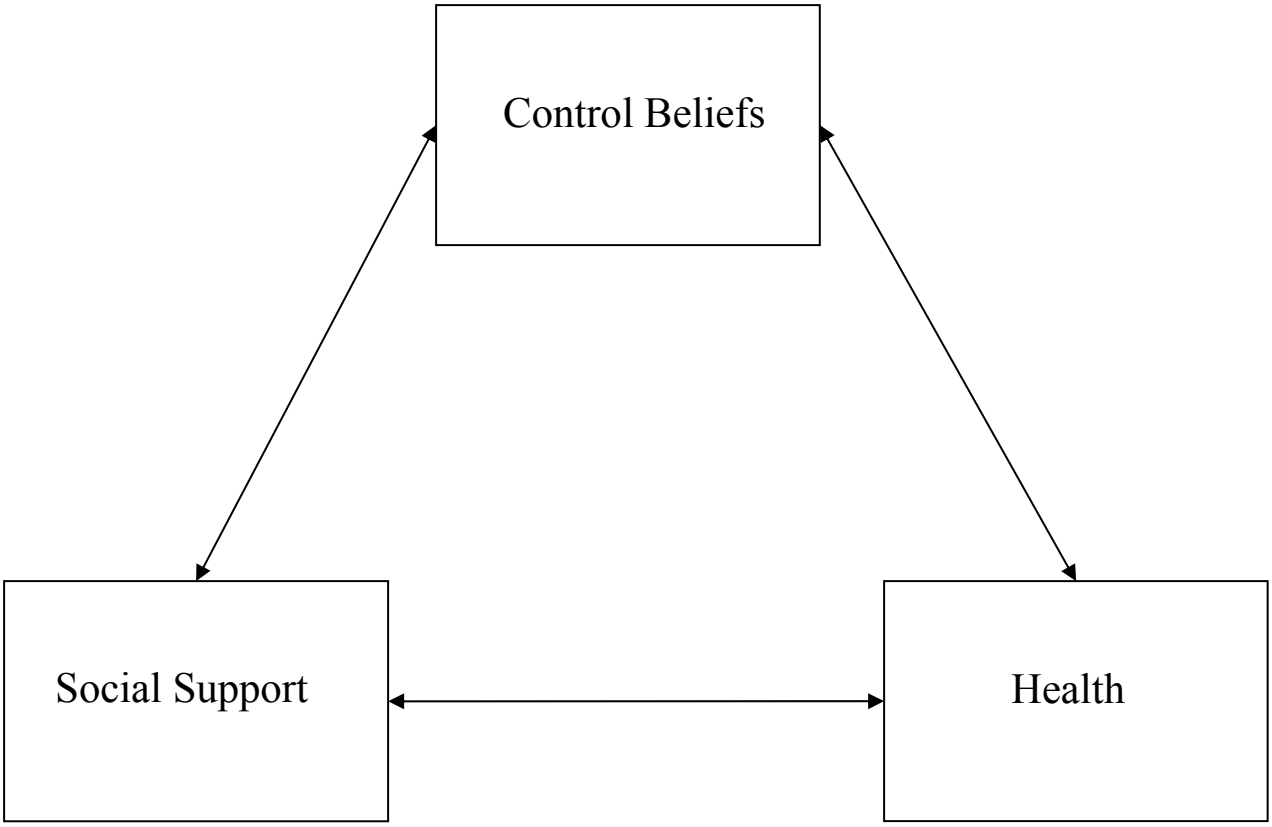

Figure 1. Schematic representation of interrelationships between social support, control beliefs, and health. Social support, control beliefs, and health operate in triadic reciprocality. The term reciprocality signifies mutual action between each factor, and the bi-directional arrows represent reciprocal influences. The influential nature of these constructs is not derived from their operation in isolation, but by their transactional relationship (i.e. interplay between component parts and processes).

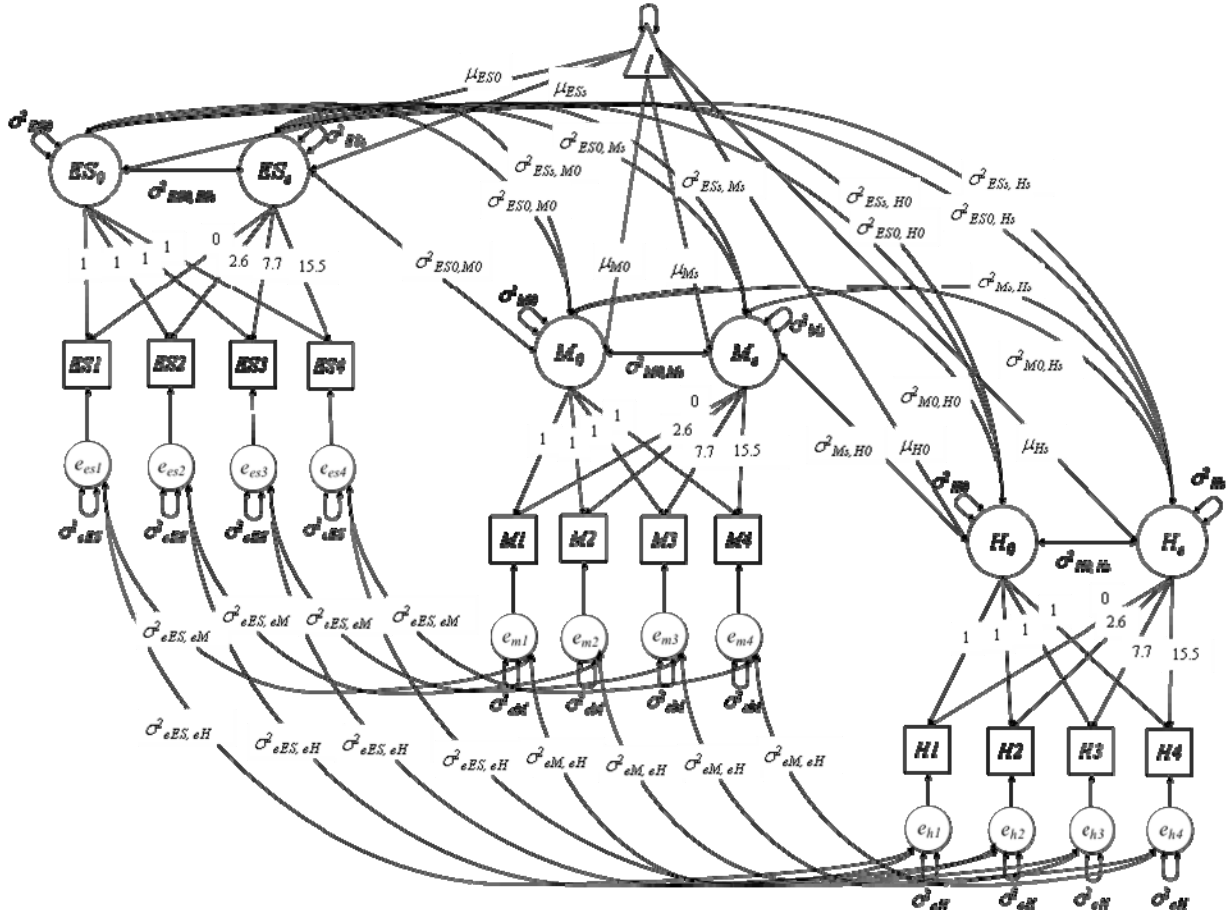

Figure 2. Graphic representation of the trivariate latent growth curve model estimated in the present study. Observed variables are represented by squares, latent variables by circles, regression weights by one-headed arrows, and variances and covariances by two-headed arrows; the triangle represents a constant indicating means and intercepts. There are four repeated measures of emotional support (ES), mastery (M), and health (H). The four repeated measures have three sources: the latent intercept with unit loadings, the latent slope with linear loadings (0, 2.6, 7.7, 15.5): and the time-specific residual. Intercepts and slopes are estimated at the population level and are allowed to vary and covary within and across domains of functioning. Time-specific residuals have a mean of zero, a single variable, and are allowed to covary with each other within occasion.

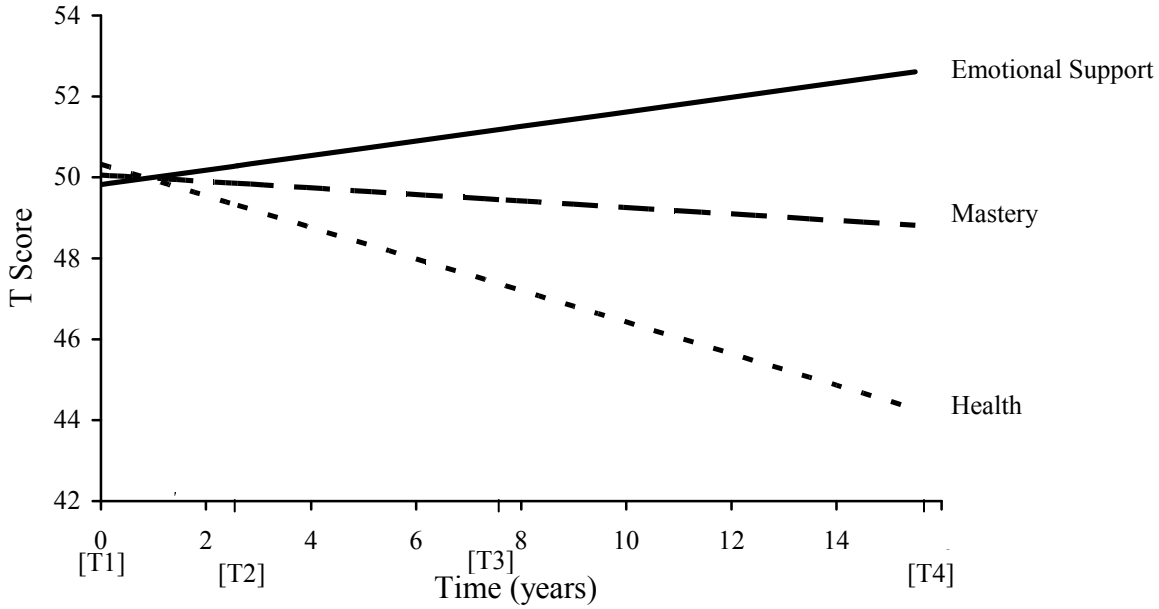

Figure 3. Graphical representation of the model implied means from model 1 displaying change in emotional support, mastery, and health over time. The graph illustrates emotional support has a slight linear increase over time, mastery displays stability/slight decline, and health steadily decreases over time.

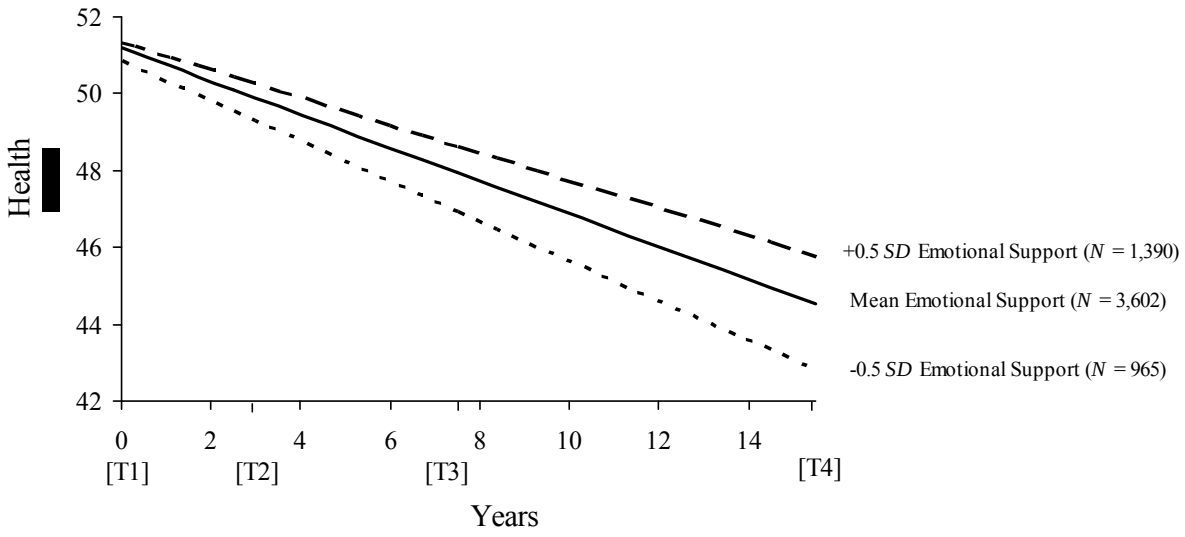

Figure 4. Graphical representation of intercorrelations between level of emotional support and rate of change in health. A separate bivariate latent growth curve model for emotional support and health was run on the entire sample. Overall, health declines over the course of the study, however, a model based on individuals who at T1 have greater levels of emotional support display less of a health decline. In contrast, individuals who are less socially embedded demonstrate a stronger health related decline as shown by a model based on individuals at T1 with levels of emotional support 45 T-score units and below.

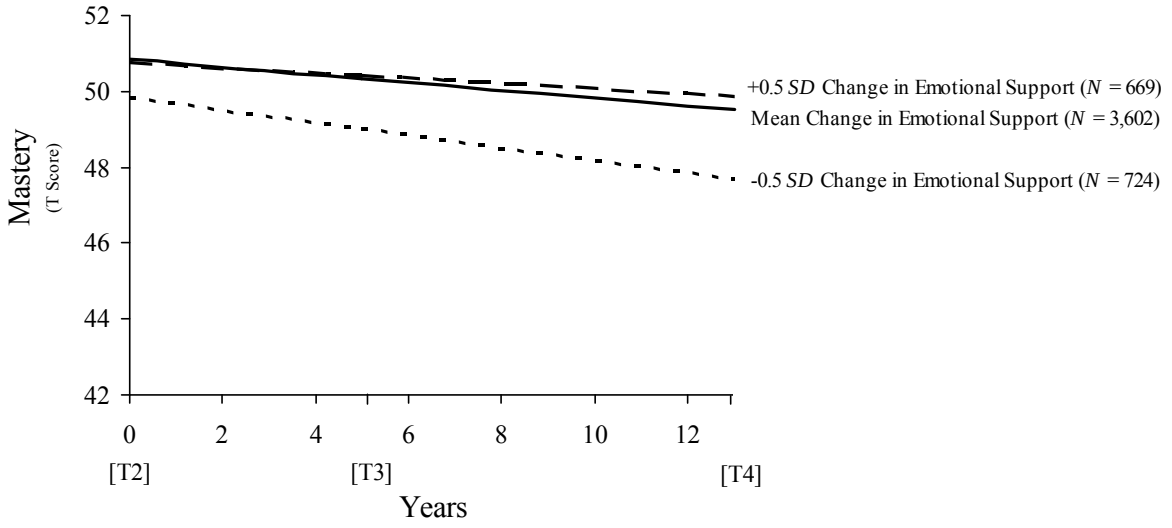

Figure 5. Graphical representation of intercorrelations between the latent slopes of emotional support and mastery. A separate bivariate latent growth curve model for emotional support and mastery was run on individuals who have data for at least the first two time points. Overall, mastery is declining over the course of the study, however, a model based on individuals who display a greater than average increase (i.e. half a standard deviation) in emotional support from T1 to T2 show a less gradual decline in mastery from T2 to T4. In contrast, individuals who demonstrate a half a standard deviation decline in emotional support from T1 to T2 show a stronger decline in mastery from T2 to T4.