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EXAMINING ANTECEDENTS AND OUTCOMES OF PERCEIVED CONTROL

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Abstract

Perceived control refers to beliefs about one's capability to shape and exert influence over life circumstances. Perceived control does not operate in isolation but is embedded within multiple systems of influence operating as both an antecedent of aging-related outcomes, as well as being a consequence of resources in the social, well-being, and health domains. For example, interactions with network members may inspire and enlarge one's feelings of control to perform health-promoting behaviors, leading to more positive health profiles; in turn, individuals reporting stronger perceptions of control are more likely to draw from and utilize social resources in times of strain.

My dissertation consists of three papers that utilize the multi-directional integrative framework detailed above to examine antecedents and outcomes of perceived control. Paper one focuses on mastery within caregiving processes and targets how caregivers' mastery changes in relation to the placement of a care recipient in a nursing home or similar institution. I also explore the role of primary stressors in mediating reaction to placement and whether caregiver and care recipient characteristics moderate reaction to placement. Results indicate that caregivers typically experienced declines in mastery preceding placement, followed by a significant increase within one year of placement and further increases thereafter. Corresponding changes in role overload mediated the significant increase in mastery within one year of placement. Caregivers who reported more depressive symptoms and ADL/IADL dependencies of the care recipient were more likely to experience larger increases in mastery with placement.

In papers two and three, I target how control potentially influences health outcomes. Empirical evidence suggests that control is linked to disability, disease incidence, and mortality in adulthood and old age; the next steps are to determine the psychosocial, health, and biological processes that underlie control-health associations. My goal is to target well-being, physical activity, social support, health, and physiological indicators that may underlie the reported control-health associations. In paper two I examine whether perceived control is associated with physiological indicators of functional health and cardio-metabolic risk and the role of physical activity in mediating such associations. Findings indicated that perceiving more control related to better grip strength and lower cardio-metabolic risk. I also found that the link between control and each physiological indicator was in part due to physical activity levels.

Paper 3 focuses on conjointly examining psychosocial and health factors that may underlie control-health associations and the unique predictive ability of time-related change in perceived control in predicting 19-year mortality. Using data from the adult lifespan sample of the Americans' Changing Lives Study, I first examine whether levels of perceived control predict mortality over a 19-year follow-up period and target the role of well-being, physical activity, social support, and health factors in accounting for this association. Second, I examine whether time-related change in control uniquely predicts mortality, over and above levels of control and known correlates of mortality. Results show that higher levels of control predicted 19-year survival, independent of socio-demographics and this association was primarily driven by well-being and health factors. More positive time-related changes in control uniquely predicted survival over and above levels of control and known correlates of mortality.

In sum, this dissertation aims to extend our knowledge of how perceived control operates both as an antecedent of aging-related outcomes and as a consequence of resources in various domains of functioning. To do so, the collective dissertation papers target perceived control within caregiving processes, as a facilitator of better physiological functioning, and the unique predictive ability of time-related control change for mortality.

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In Jimmy Valvano's memorable 1993 ESPY speech, he said that you should always consider these three things: "Where you started; where you are; and where you're gonna be." Where I am now is completing work on my dissertation, and in the future my goal is to have a tenure-track position where I can conduct research and teach. When reflecting about where I started, I think about my roots, my beginning, who I am, and my family is what comes to mind. My family has had a tremendous effect on the person I am today. To my parents, Anna and Joe, for providing Chuck and I with the opportunities to succeed in life through your support and love, and providing us with the ultimate example of how hard work, dedication, and motivation can put you in a position to succeed in life. To my brother, Chuck, for always being someone I can turn to for advice on matters of life, love, and school; thank you especially for never sugarcoating your advice, but giving me honesty even though I sometimes did not want to hear it. To my grandparents, Nonni Argento and Nonni Infurna, for your generativity, which made studying old age, make sense.

CHAPTER I

OVERVIEW CHAPTER

"Our destiny remains our choice."
President Barack Obama, 2011 State of the Union Address

"… 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."
(Lachman, 2006, p. 282)

Constructs encompassing perceptions of control range from locus of control to constraints, fatalism, mastery, agency, competence, learned helplessness, and self-efficacy. This set of constructs represents an integral general-purpose belief system that has diverse effects across the lifespan. Accumulated empirical evidence has consistently shown that higher levels of perceived control are related to positive cognitive, mental, and physical health across adulthood and old age (Antonucci & Jackson, 1987; Baltes & Baltes, 1986; Bandura, 1997; Eccles et al., 1993; Haidt & Rodin, 1999; Heckhausen & Schulz, 1995; Heckman, Stixrud, & Urzua, 2006; Lachman, 2006; Pearlin, Menaghan, Lieberman, & Mullan, 1981; Peterson & Stunkard, 1989; Rodin, 1986; Rowe & Kahn, 1987; Ryan & Deci, 2000; Ryff & Singer, 1998; Seligman, 1975; Skaff, 2007; Skinner, 1995; Uchino, 2006; Verbrugge & Jette, 1994; Wahl, Schmitt, Danner, & Coppin, 2010; Zimmerman, Phelps, & Lerner, 2008). Conceptual models of control and the supporting empirical evidence, suggest that individuals who feel that they have the capability to exert influence over and shape one's life circumstances are more likely to experience positive developmental and aging-related outcomes. The applicability and pervasiveness of perceived control stretches across various disciplines (e.g., psychology, sociology, health promotion, and economics), and its operation is not in isolation, but is embedded within multiple systems of influence. Perceived control operates as both an antecedent condition, by facilitating developmental and aging-related outcomes, as well as being a consequence of its interaction with resources in the social, well-being, and health domains.

Figure 1.1 conceptualizes the interrelatedness of perceived control across various domains. The figure resembles a Venn diagram that represents how perceived control is inter-related with various components of developmental functioning, including health,

behavior/emotion, and social context. A limitation of such a large, wide-ranging model is that it is very broad and difficult to test. Each of the domains is interrelated with one another, but not in a conjoint, easy to follow manner; the model lacks the ability to test specific mechanisms linking the various domains with perceived control. Conceptual models should and need to be reductive and parsimonious to better allow for hypothesizing specific mechanisms across domains that can be easily implemented and tested using statistical models. Big models convey that developmental processes are inter-related across various domains, but lack the how and why due to the many interrelated components.

To more easily conceptualize the role of perceived control within lifespan development and its implications for developmental and aging-related outcomes, I have developed two mini-models that will be used as a guiding framework for my dissertation. Figure 1.2 illustrates that perceived control is an outcome of and grows out of experiences in the social context, which broadly includes one's social network, social support, school, work, and stressors/burdens. Additionally, the health domain, which broadly encompasses biological, physical, behavioral, cognitive, and emotional health, contributes to and shapes levels and changes in perceived control. Along the y-axis are the many time scales that social context and health can potentially influence perceived control. The influence of social context and health on levels and changes in control transpires across various time metrics, including days, weeks, months, years, as well as aging-, pathology-, and mortality-related processes.

Figure 1.3 illustrates how perceived control facilitates aging-related outcomes. Perceived control is associated with various aging-related outcomes, including cognitive and physical functioning, disability, cardiovascular disease incidence, and mortality. Figure 1.3 graphically demonstrates that these associations are mediated by behavioral, motivational, emotional, social support, and biological pathways. Additionally, the health implications of control may be moderated by person-specific (e.g., age, gender, socio-economic status [SES], and culture) and

situation-specific (e.g., control potential or objective control) characteristics. In the later section on "Associations among Perceived Control and Its Antecedents and Outcomes (see pg. 16)," I will discuss in more detail each of the mini-models within the context of the perceived control literature and each dissertation paper.

The lifespan developmental model of perceived control that I propose and use as a guiding framework for my dissertation is an integration and synthesis across various models and theories including Lachman's (2006) integrative conceptual model, the lifespan theory of control (Heckhausen & Schulz, 1995; Heckhausen, Wrosch, & Schulz, 2010), self-efficacy theory (Bandura, 1977, 1997), learned helplessness (Abramson, Seligman, & Teasdale, 1978; Peterson et al., 1993; Seligman, 1975), Rodin (1986), the stress process model (Pearlin et al., 1981), and the disablement process model (Verbrugge & Jette, 1994). In conceptualizing and formulating this model, I capitalized on strengths from the aforementioned models, including emphasis on the lifespan development of control, increased focus on and consideration of how social context and health changes across the lifespan may differentially shape control, mechanisms that mediate associations between control and aging-related outcomes, and the inherent need for multidisciplinary frameworks to study control and its antecedents and outcomes.

Limitations from previous models that the proposed models overcome include greater parsimony in model depiction, which allows for testing specific mechanisms linking each of the domains, more explicitly incorporating time processes (non-normative influences and aging-related, pathology-related, and mortality-related processes), and the moderating role of person- and situation-specific characteristics for interrelationships amongst control and its antecedents and outcomes. First, more specificity in the model depiction allows for being able to test specific hypotheses within mathematical models regarding antecedents and outcomes of perceived control. Second, time is an omnipresent force that is measured in multiple ways and its quantification can differentially shape development centered on perceived control and its

interrelationships with various domains. Third, an increasing focus on and consideration should be placed on whether person- and situation-specific characteristics moderate interrelationships centered on perceived control.

The lifespan developmental model of perceived control that I propose here contains two mini-models that allow for more easily testing specific propositions. Similar to Lachman's (2006) integrative conceptual model, the mini-models shown in Figures 1.2 and 1.3 outline that perceived control is embedded within multiple systems of influence acting as (a) an antecedent condition that facilitates aging-related outcomes (e.g., health and cognition) and (b) is considerably shaped by previous outcomes, performances, and resources in various domains of functioning (e.g., social context and health). This is shown with perceived control being an outcome of the social context and health (Figure 1.2), as well as facilitating aging-related outcomes through behavioral, emotional, motivational, social support, and biological pathways (Figure 1.3). For example, interactions with network members may inspire and enlarge one's feelings of control to perform health-promoting behaviors, leading to more positive health profiles; in turn, individuals perceiving themselves in control may be more likely to draw from and utilize social resources in times of strain (see also Antonucci, 2001; Skaff, 2007).

A second component of the model is that time processes (non-normative and aging-related, pathology-related, and mortality-related) and person- and situation-specific characteristics moderate antecedent-consequent associations with perceived control. For example, control-health associations may be particularly strong in old age when frequent or severe health decrements can prototypically be expected (Rodin, 1986). Whereas in young adulthood and midlife, perceived control may have distal impacts on health in old age through its relation to health behaviors and physiological functioning, whose effects take longer to accumulate or reveal subclinical manifestations, leading to increased vulnerability for disease incidence and disability.

A third component of the model is the inclusion of mechanisms by which perceived control facilitates developmental and aging-related outcomes. Mechanisms that are conceptually and to a lesser extent empirically shown to mediate control-health associations include behavioral, emotional, motivational, social support, and biological processes (see also, Lachman, Neupert, & Agrigoroaei, 2011; Peterson, Maier, & Seligman, 1993; Rodin, 1986; Skaff, 2007; Skinner, 1995). For example, individuals with higher levels of control are more likely to adopt and maintain health promoting behaviors, resulting in a decreased likelihood of accumulating functional limitations (Grembowski et al., 1993; Seeman et al., 1999; Ziff et al., 1995).

My dissertation consists of three papers that target components of the lifespan developmental model of perceived control. Paper one uses Figure 1.2 as a guiding framework and papers two and three use Figure 1.3 as a guiding framework. Paper one focuses on mastery within caregiving processes and examines how caregivers' mastery changes in relation to the transition of placement of a care recipient with dementia in a nursing home or other institution. I will also explore the role of primary stressors in mediating reaction to placement and whether caregiver and care recipient characteristics moderate reaction to placement. The second paper uses data from the nation-wide Health and Retirement Study to target mechanisms that mediate control-health associations. More specifically, the second paper examines whether perceived control is associated with physiological indicators of functional health (grip strength) and cardio-metabolic risk (hemoglobin A_{1c}, High Density Lipoprotein Cholesterol [HDL–C], Systolic Blood Pressure [SBP], Pulse Rate [PR], and Waist Circumference [WC]) and the role of physical activity in mediating such associations. Lastly, the third paper uses data from the adult lifespan sample of the Americans' Changing Lives Study to examine whether levels of perceived control predict mortality over a 19-year follow-up period, and the role of psychosocial and health factors in accounting for such associations. Additionally, I will examine whether time-related change in

control between the first two assessments (2.5-year period) uniquely predicts mortality over and above levels of control and known correlates of mortality.

The rest of this overview chapter will be divided as follows: (1) I will provide and discuss definitions of control; (2) I will provide a literature overview that focuses on antecedents and outcomes of perceived control within the context of the mini-models and dissertation papers; and (3) I will discuss how the dissertation papers promise to advance the literature.

What is Perceived Control?

In 1996, Ellen Skinner published a review article that outlined a detailed guide to constructs of control, which included a framework to analyze the many terms (more than 100) that reflect aspects of control (Skinner, 1996). Skinner's framework included two basic distinctions for considering constructs of control. The first distinguishes three aspects of control: objective control, subjective control, and experiences of control. The second distinguishes among agents, means, and ends of control. In this dissertation, the measures of control primarily focus on subjective perceptions of control and the target agent is the self.

Objective control, subjective control, and experiences of control. Before moving forward, it is essential to first differentiate between the distinctions of control outlined by Skinner (1996). First, objective control relates to conditions where individuals feel they have direct influence or actual control over outcomes, such as in predicting coin flips, in stressful laboratory situations, or predicting market trends. For example, in experimental conditions Langer and Roth (1975) found undergraduate participants believed that with practice their ability to make correct choices (in predicting coin flips) would increase despite coin toss outcomes being largely determined by chance (researchers also consider this illusions of control; see Langer, 1975; Thompson, 1999). In stressful lab situations researchers have shown that participants reporting more feelings of control and self-efficacy over the stressor (e.g., noise-cognitive paradigm) showed a reduced cortisol response, heart rate reactivity and increased

blood pressure (Baker & Stephenson, 2000; Bollini, Walker, Hamann, & Kestler, 2004; Glass & Singer, 1972; Sanz & Villamrín, 2000). Objective control has been studied in the economic and business literatures by examining one's abilities for forecasting the stock market and economic market trends. Companies and stock brokers who believed that they had actual control over market and economic trends in fact performed more poorly (i.e., increased likelihood of making less of a profit and going out of business) and were at greater risk for major economic downfall (acknowledging the role that luck and chance play in markets typically leads to more positive outcomes; Makridakis, Hogarth, & Gaba, 2009). More recently, Heckhausen and colleagues (2010) have discussed objective control as control potential, or one's ability to exert control given the particular situation. For example, when people are diagnosed with a severe illness such as cancer (as opposed to dealing with more acute health problems) or in childhood are experiencing parental divorce, high control in these low control potential situations can result in negative health and well-being outcomes, whereas low perceived control in a low control potential situation can have positive effects on long-term health and well-being (Hall et al., 2010; Skinner, 1995).

Subjective control refers to one's perceptions or beliefs regarding their ability to attain a desired outcome or ascertain control over life circumstances. Previously it has been discussed that perceived control may be a more powerful predictor of functioning than actual control (Averill, 1973; Burger, 1989). Even in the most extreme circumstances where no objective control exists, assurance or belief that control is available over an important aspect of one's life proves beneficial (e.g., individuals held in concentration camps during World War II; for discussion, see Bettelheim, 1943). For example, despite the harsh living conditions in concentration camps, prisoners who were able to preserve some areas of independent action and keep control of some important aspects of life were less likely to feel helplessness and hopelessness, thereby increasing their chances of survival (Bettelheim, 1943; see also Frankl,

1984). Because subjective or perceived control constructs will be the focus of my dissertation, more specific definitions of constructs will be discussed later on. Experiences of control are products of external conditions such as interacting with one's social network or efficacy expectation towards a behavior. For example, an individual intentionally exerts effort toward a goal to produce an outcome such as going to the gym to fulfill a new year's resolution or training for a half-marathon. More self-control in childhood and adolescence is shown to predict adult outcomes of better health, wealth, and decreased likelihood of criminal convictions (Moffitt et al., 2011). These experiences can also be referred to feelings of efficacy or experiences of mastery (Harter, 1978; Skinner, 1996; White, 1959).

It is crucial not to confuse the distinctions of objective and subjective control and use them interchangeably, which has been done previously by researchers writing for the general public on topics relating to randomness, chance, and illusions of control (see Mlodinow, 2008). Indeed, randomness and chance play a role in determining life events and outcomes (see Bandura, 1982; Finch & Kirkwood, 2000), but not to the degree where perceptions of control have no impact whatsoever. Mlodinow (2008) argues that since certain events are largely random (e.g., predicting coin tosses or hot streaks in sports) we are not in control, leading to a fundamental clash between our need to feel in control and our ability to recognize randomness. This is in the face of empirical evidence suggesting that illusions of control have positive effects on well-being, even when individuals have little to no actual control (Taylor & Brown, 1988; Thompson, 1999). Why then are perceptions of control consistently shown to be associated with developmental and aging-related outcomes? Indeed, I acknowledge that randomness and chance have a role in life events, and as argued by Makridakis et al. (2009) recognizing the role of chance, luck, and even powerful others (Levenson, 1981) may enhance one's control (paradox of control). However, Mlodinow discusses control in the context of skill and chance situations as if they are everyday occurrences (his analysis is best suited for gamblers), whereas cognitive and

physical functioning, disability and disease incidence, and mortality, more times than not, are the result of *accumulated* life choices and experiences. Previous research suggests that (and as I will show in dissertation papers two and three) people who view their life as controllable are more likely to experience positive health outcomes. These constructs have some overlap but not to the degree where they can be used interchangeably. Confusing objective and subjective control as done by Mlodinow (2008) is the equivalent of communicating that subjective stress as measured by the perceived stress scale is the same concept and entity as interpersonal and work stressors that are measured daily. In physics terms, it would be the equivalent of writing that protons, neutrons, and electrons provide similar functions for elements of matter.

Agents, means, and ends of control. The second basic distinction for differentiating between constructs of control is distinguishing between agents, means, and ends of control (see Figure 4.1 in Skinner, 1995). Agents of control refer to the individuals or groups who exert control (e.g., internality, powerful others, or chance; see Levenson, 1981). Agents of control are not always defined as the self but can also be defined at the group level or by powerful others. For example, Kunzmann and colleagues (2002) measured and distinguished between personal control and perceived others' control over desirable and undesirable outcomes and their relation to well-being in older adults. Higher levels of perceived others' control was associated with stronger declines in positive affect over time, whereas more personal control over desirable outcomes was associated with stronger declines in negative affect (Kunzmann et al., 2002). Means of control refer to pathways through which control is exerted, such as health behaviors or motivation and vitality. Lastly, ends of control refer to desired or undesired outcomes over which control is exerted. Associations between agents-means are often times called capacity beliefs, which refer to one's ability to effectively engage in the behavior (competence; also similar to Bandura's concept of efficacy expectations); mean-ends links are called strategy beliefs and refer to the connection between performing a behavior and that it will lead to the desired outcome

(contingency; also similar to Bandura's concept of outcomes expectations); and lastly, control beliefs are discussed as agent-ends relations referring to whether one believes in their ability to attain a desired end or outcomes (for detailed discussion, see Skinner, 1996; Skinner, Chapman, & Baltes, 1988).

These three components (agents, means, and ends) can be linked to the lifespan developmental model of perceived control shown in Figure 1.3. Agents, means, and ends typically focus on the actual construct of control, whereas these concepts can be utilized to describe associations among perceived control, its mechanisms, and aging-related outcomes. For example, a positive health profile (e.g., improved physical functioning) can be considered an end outcome or goal and for attainment an individual (agent) may practice more health promoting behaviors (e.g., exercise regularly, eat a healthy diet; means). In the context of dissertation paper two, the target agent will be the self, means will be functional health, cardio-metabolic risk, and physical activity, and the end outcome that will not be measured is health outcomes. Similar to self-efficacy theory (Bandura, 1977, 1997) and learned helplessness (Peterson et al., 1993; Seligman, 1975), an individual may believe a behavior will lead to a particular outcome (contingency, outcome expectations, universal helplessness), but if they do not believe in their ability to partake in the behavior (competence, efficacy expectation, personal helplessness), then they will not be capable of producing the requisite responses (for detailed discussion, see Skinner, 1996).

What perceived control is not. Although some components of perceived control (e.g., attitudes and beliefs centered on shaping life circumstances) may be similar to constructs related to autonomy and self-determination, they should be considered mutually exclusive. Autonomy or self-determination may be considered similar to perceived control to the point of using them interchangeably, but this should not be done. Perceived control refers to one's beliefs in their means and abilities to attain desired outcomes; it is an interrelated set of beliefs towards one's

life circumstances. In contrast, the need for autonomy or self-determination refers to the innate desire to experience one's true self as the origin of one's own actions (Deci & Ryan, 1985; Skinner, 1996).

Additionally, the terms primary and secondary control and assimilative and accommodative coping are sometimes discussed in the context of perceived control. Similar to autonomy and self-determination, these constructs share some overlap with perceived control, but also should be considered mutually exclusive. These constructs are typically used in the context of the impressive adaptive capacity of individuals to optimize development across major changes in the life course (Brandtstädter & Renner, 1990; Heckhausen et al., 2010; Rothbaum, Weisz, & Snyder, 1982; Wrosch, Schulz, & Heckhausen, 2004). Therefore, they are best used for assessing adaptation to major life events, such as functional disability due to disease incidence (Wrosch, Schulz, & Heckhausen, 2002), protection of mental health with functional disability (Dunne, Wrosch, & Miller, 2011), caregiving (Wrosch, Amir, & Miller, 2011), transitions from adolescence to young adulthood and to the work force (Heckhausen et al., 2010). In the context of the lifespan developmental model of perceived control, I think of primary/secondary control and assimilative/accommodative coping as motivational resources that operate as mechanisms through which control facilitates aging-related outcomes and adjustment to major life events, disease incidence, and stressors/burdens. The former is shown in Figure 1.3 and the latter will be discussed in the concluding chapter (see Figure 5.1).

Perceived control in this dissertation. Perceived control in this dissertation is considered a catch-all term that encompasses many different constructs relating to control, such as locus of control (Rotter, 1966), self-efficacy (Bandura, 1977), learned helplessness (Seligman, 1975), constraints (Lachman & Weaver, 1998b), and mastery (Pearlin & Schooler, 1978). At the very heart of the various definitions and constructs of perceived control are *competence* and *contingency*. Competence is defined as one's ability or capacity to interact effectively with its

environment and effectiveness in carrying out goals (White, 1959). Contingency refers to the belief that performing a particular behavior will then lead to the desired outcome or belief that there are obstacles or factors beyond one's control that interfere with reaching goals (Skinner, 1996). Generally speaking, the collective measures of perceived control can be broadly defined as (a) the belief that one's own actions, efforts, and choices can exert influence over and shape life circumstances and (b) one's ability to attain desired outcomes (Fung, Abeles, & Carstensen, 1999; Krause, 2003; Levenson, 1981; Pearlin & Schooler, 1978; Skinner, 1996). Lastly, I think it is important to point out that the distinctions of competence and contingency for control constructs can be taken to be analogous to cognitive and affective distinctions of subjective well-being (Diener, 1984; Diener et al., 1999). I will next discuss this in more detail.

In reviewing the literature on perceived control, there are similarities in the concepts centered on competence and contingency across the major theories and models, including Bandura (self-efficacy theory), Pearlin (stress process), Lachman, Seligman and colleagues (learned helplessness), Skinner, Rotter (internal/external control), Dweck (motivation and personality) and Thompson (control heuristic: intentionality and connection). Table 1.1 provides an overview of how each of these researchers' control terms falls under the concepts of competence and contingency. In most cases, there is overlap across the general concepts and definitions. However, in some instances there are discrepancies; Bandura (1977, 1997) typically discusses self-efficacy as being more critical for domain-specific outcomes, whereas Pearlin discuss perceived control in more general terms. An interesting note to point out is that Thompson and colleagues' (1998) control heuristic model involves intentionality and connection, which map on very closely to Bandura, Rotter, and Skinner's concepts, but Thompson and colleagues do not cite these authors. They mostly focus their discussion on experimental manipulations that focus on skill, chance, and luck situations (research done on undergraduates, which is not generalizable across the lifespan and to real life situations focused

on aging-related outcomes), rarely on developmental and aging-related outcomes. They do, however, discuss the applications of their control heuristic model for enhancing emotional and physical well-being in adjustment to chronic illness (Thompson et al., 1998). Further discussion of this topic is not within the scope of my dissertation, but a synthesis or integration similar to Skinner (1996) may be in order for future endeavors that focuses on these various terms.

More broadly, perceived control can be viewed as one's *orientation* towards life circumstances. The dictionary defines orientation as the adjustment or alignment of oneself or one's ideas to surroundings or circumstances. Perceived control refers to how individuals orient themselves with their life circumstances; do individuals believe they have the means and abilities for attaining desired outcomes or do they view their life as being determined by external factors (fatalistically ruled), to which their actions have no way of attaining desired outcomes? Also, does one's orientation function to assist in adaptation by protection against the adverse effects of stressors through soliciting support from their social network or engaging in the wrong goals, leading to negative outcomes?

This orientation towards life circumstances is comprised of one's attitudes, beliefs, motivations, and volitions (see Figure 1.4). Attitudes are one's manner and tendencies for behavior; Beliefs are thoughts, feelings, and convictions for behavior; Motivations are actions in a particular process for attaining goals or objectives; Volitions are the act of willing, choosing, or exerting effort on decisions for behaviors (goal implementation). This orientation towards life influences one's actions (motivation), action regulation (coping), cognitions, emotions, and behaviors. Actions are behaviors for attaining desired outcomes, such as viewing one's health as controllable, resulting in the participation of health-promoting activities. Action regulation refers to one's orientation towards adapting to stressful life circumstances, such as caregiving or experiencing unemployment. Additionally, in line with Seligman (1975) and Taylor and Brown (1988), control influences cognitions (i.e., ability to learn), emotions (i.e., stress, anxiety, and

depression), and motivations (i.e., initiate action, behavior). In sum, perceived control is a general-purpose belief system that consists of a toolbox for success, which encompasses one's attitudes, beliefs, motivations, and volitions that influence behavioral, emotional, motivational, social support, and biological processes.

Furthermore, perceived control can be differentiated from general control, as defined earlier, to more domain-specific measures (e.g., health locus of control or control in one's most salient role). Domain-specific measures of control assess and refer to the amount of control individuals perceive they have over specific domains or components of life such as one's health, finances, or marriage (see Krause, 2007; Lachman & Firth, 2004). Papers one, two, and three utilize measures of perceived control (mastery, constraints). Mastery refers to one's agency, drive to succeed, effectiveness in carrying out goals, and feeling that one has control over life circumstances (competence). Conversely, constraints refers to perceptions of external factors or events that are beyond one's own control that may interfere with reaching goals and helplessness in dealing with problems in life (contingency). Also, it is essential to note that perceived control is considered an important self-concept that grows out of experiences and is shaped by or can be challenged with different contexts and experiences (Pearlin, Nguyen, Schieman, & Milkie, 2007). As illustrated in Figure 1.2, perceived control is shaped and influenced by social context and health. Therefore, perceived control does not reflect innate attributes that are fixed in personality, such as conscientiousness or openness to experience. Personality researchers have discussed perceived control being contained within the taxonomy of the big 5 personality traits and self-esteem (for discussion, see Chapman, Roberts, & Duberstein, 2011; Judge, 2002). Instead, perceived control should be thought of and considered as a flexible set of interrelated beliefs that are organized around interpretations of prior interactions in specific domains or learned appraisals of one's capabilities (Pearlin, 2010; Skinner, 1995).

Associations among Perceived Control and its Antecedents and Outcomes

In the previous section, I discussed and delineated amongst various definitions of control. It is evident that there are numerous definitions and constructs of control, and my dissertation will focus on perceived control. Next, I will review literature on associations between perceived control and its antecedents and outcomes within the context of the lifespan developmental model of perceived control.

Antecedents of Perceived Control

The first mini-model illustrated in Figure 1.2 demonstrates that perceived control is shaped by and grows out of experiences in one's social context and health domains. The social context broadly ranges from social integration and social support (i.e., emotional, informational, instrumental, and negative) to work, school and stressors/burdens, which have the capability to shape and influence one's orientation towards life circumstances. Health, which broadly includes the physical ability to complete everyday activities of daily living to emotional well-being, also plays a vital role in shaping perceived control. The social context and health domains influence levels of and changes in control across various time scales (as opposed to being static and only occurring at one point in time), including days, weeks, months, years, as well as aging-, pathology-, and mortality-related processes.

Perceived control and social context. Theoretical and conceptual models of development argue that social relationships and integration are a prime source of control (Antonucci & Jackson, 1987; Bandura, 1977, 1997). Through interactions and modeling of network members, beliefs of control and efficacy may become internalized and eventually increase the frequency with which individuals engage in effective behaviors. Studies report that more emotional support and social integration, as well as less instrumental support are protective against declines in control and self-efficacy (Krause, 1987; McAvay et al., 1996). Additionally, results from the Midlife in the United States (MIDUS) Study show that over a 9-year period

more social support was associated with more positive changes in perceived control (Gerstorf, Röcke, & Lachman, 2011). Lastly, recent findings from the nationally representative German Socio-Economic Panel (SOEP) Study show that not only are higher levels of social participation related to perceived control, but more positive changes in social participation over time are associated with stronger beliefs of exercising control (Infurna et al., 2011a). Increasing community participation or continual interaction with network members over time provides individuals with access to their social network resources (e.g., information, reinforcement of certain behaviors) to utilize to exercise control over attaining desired outcomes, whereas disengagement over time may restrain the amount of encouragement and positive feedback for completing particular tasks.

Although the association is not tested as often, perceived control is also predictive of social support. For example, Gerstorf et al. (2011c) found that stronger feelings of control were associated with more positive 9-year changes in social support. Theoretical and conceptual models highlight that control beliefs allow people to mobilize social support within the context of disease incidence and disability (Verbrugge & Jette, 1994) and particularly in times of strain, thereby serving as a buffer against the effects of stress (Antonucci, 2001; Cohen & Wills, 1985; Heckhausen & Schulz, 1995).

Stressors or burdens that are embedded within the social context shape perceptions of control. For example, in dissertation paper one I focus on how mastery changes in dementia caregivers who experience placement of their care recipient in a nursing home or similar institution. The chronic stress and daily disturbances involved in caregiving may erode one's adaptive capacity and resources. For example, mastery has been observed to decline for long-term caregivers (Skaff et al., 1996). Less is known about whether and how mastery changes during important transitions in caregiving. Some studies report that mastery remains relatively unchanged post placement of one's care recipient (Gaugler et al, 2007; Skaff et al., 1996),

whereas other studies found caregivers' mastery increases post bereavement (Mausbach et al., 2007a; Mullan, 1992; Seltzer & Li, 2000).

There are a variety of structural properties of social systems that may shape perceived control (Haidt & Rodin, 1999). Workplace and school contexts have the potential to affect how people orient themselves towards their life circumstances. Closeness of supervision in the workplace, substantive complexity of work, and routinization of work can exert a potent force on perceived control (Kohn & Schooler, 1983). Work environments that promote self-directed activity and motivations to succeed promote feelings of control, whereas working conditions marked by feelings of powerlessness and external factors directing behavior can obstruct perceived control (Haidt & Rodin, 1999). The school (and classroom) context contributes to children's motivational processes. Schools and classrooms that provide structure (versus chaos) provide for the dissemination of knowledge and competences through interactions that lead to desired outcomes and development of competence and contingency (Connell, 1990; Skinner, 1995). For example, high teacher efficacy and positive teacher-student relations are associated with positive teacher and student motivation (Allen, Pianta, Gregory, Mikami, & Lun, 2011; Eccles et al., 1993; Moos, 1979). Structured contexts provide clear expectations for action and sometimes even instructions for enactment, as well as provide consistent feedback and are contingent and responsive. Chaotic contexts are non-contingent, confusing, unpredictable, and objectively uncontrollable.

Social contexts facilitate or impede control through various mechanisms. First, verbal persuasion and modeling of behaviors operate similarly in their function to influence control. Presence of and contact with network members reinforce and strengthen people's beliefs about exercising control over various domains of life (Bandura, 1977). For example, interactions with a network member directed at a particular goal can serve to enhance or erode one's own sense of efficacy to carry out and persist with behaviors to attain the desired outcome. Second, research

has accumulated showing that contagion of health behaviors (i.e., obesity, smoking, and alcohol use) and perceptions of belonging (i.e., loneliness) spreads through social networks (Cacioppo, Fowler, & Christakis, 2009; for extensive discussion, see Christakis & Fowler, 2009). For example, having many friends who do not exercise, smoke regularly, or are obese may reduce one's vigor for attempts at attaining a desired goal or enacting control over life circumstances. Additionally, a network that is comprised of people who are lonely or disengaged may reduce one's access to social relationships that could provide aid or bolster feelings of control for various situations. Third, the social context influences control through objective control conditions and encouraging or discouraging action (Eccles et al., 1993). For example, the contextual landscape of caregiving often confronts caregivers with conditions, experiences, and persistent role strains that deplete mastery, resulting in less desirable adaptation to their immediate circumstances (e.g., depressive symptoms and poor overall health; Aneshenshel et al., 1995). Lastly, the social context offers translations of individuals' interactions with the environment that favor or discount control (Skinner, 1995).

Perceived control and physical health. Physical health is a multidimensional construct that comprises disease incidence, physical health symptoms, everyday functioning, and assessments of one's own health (Steinhagen-Thiessen & Borchelt, 1999). Various facets of health are shown to undermine perceived control. For example, overall disease burden and specific disease incidences, such as cardiovascular disease, cancer, stroke, and diabetes hinder perceptions of and striving for control (Gerstorf et al., 2011c; Penninx et al., 1996; Wurm et al., 2007). Also, empirical evidence suggests that greater frequency of contact with medical doctors (Cairney et al., 2007), poorer assessments of one's own health (Infurna et al., 2011a), disease related activity limitations (Seeman & Lewis, 1995), and functional disability (Krause, 2007) can undermine perceived control. Incidence and accumulation of disease and functional limitations may undermine perceptions of control through perceiving more external factors or constraints

that interfere with making a change or adapting to a challenging life situation. Furthermore, individuals with more positive perceptions of their health are motivated to maintain their health through adopting and persevering with healthy behaviors. For example, positive assessments of one's health may be related to maintaining beliefs that one's health behaviors are indeed linked with attaining positive health outcomes (Infurna et al., 2011a).

Perceived control and cognition. Cognitive functioning is viewed as a general-purpose mechanism for adaptation and a resource to draw upon in the face of obstacles (Baltes, Lindenberger, & Staudinger, 2006). There is limited evidence for associations linking cognition to control. Empirical evidence from MIDUS shows that better memory is associated with higher levels of and more positive changes in mastery and constraints over time (Lachman et al., 2009). More recently, Infurna and Gerstorf (in preparation) have examined how level and time-related changes in memory relate to level and changes in perceived control, and found that higher levels of memory are related to perceiving more control; when examining four-year changes in perceived control, higher levels of and more positive time-related changes in memory were linked to more positive control changes. One possible mechanism for cognition predicting levels and changes in cognition include memory lapses or declines in processing speed and ability to complete everyday tasks may lead to decreased feelings of control in these domains and general control over life circumstances (Lachman, 2006). Memory may also relate to control through one's capability to complete everyday activities of living, which limit one's ability to successfully carry out desired outcomes (Infurna, Gerstorf, Ryan, & Smith, 2011).

Perceived control and well-being. Perceptions of control and various facets of well-being are interrelated across adulthood and old age. For example, McAvay et al. (1996) observed that participants reporting more depressive symptoms were at an increased risk for subsequent three-year declines in domains of self-efficacy. Furthermore, studies have shown that negative affect discourages efforts for enacting control (Schulz & Heckhausen, 1998). Life satisfaction is

also related to perceived control, such that feeling greater joy over life may be instrumental for exerting effort for the attainment of successful outcomes (Infurna et al., 2011a; Lyubomirsky, King, & Diener, 2005). Associations between well-being and control may be stronger in older ages; Infurna and colleagues (2011a) found that levels and time-related changes in life satisfaction appear to be stronger in older ages, indicating that well-being may be a prime source of control in older ages.

Perceived control is also adaptive for one's mental health and well-being (Peterson & Seligman, 1984; Taylor & Brown, 1988, 1994). Perceiving that one's own actions, efforts, and choices lead to control over life circumstances may result in feeling greater joy in life (Schulz & Heckhausen, 1998). Stronger perceptions of control may provide individuals a means for action-growth potentials and compensating for failures thereby down-regulating negative emotional experiences (Lang & Heckhausen, 2001). Lastly, empirical evidence suggests that associations between perceived control and negative affect may be stronger in young adulthood and midlife compared to old age (Lang & Heckhausen, 2001; Windsor & Anstey, 2010).

Aging-Related Outcomes of Perceived Control

Figure 1.3 illustrates the pathways through which control facilitates aging-related outcomes. Perceived control is an antecedent of various aging-relating processes, including but not limited to facets of health and cognition. The effects of perceived control for various aging-related outcomes may be moderated by person- and situation-specific characteristics (i.e., age, gender, education, culture, control potential). Next, I will discuss in more detail research that has documented associations between control and aging-related outcomes.

Perceived control and health. The health implications of perceived control are far and wide-ranging. Stronger feelings of various facets of control (i.e., higher mastery, fewer constraints, higher domain-specific control, and low globality explanatory style) are associated with a decreased risk of mortality (Infurna et al., 2011a; Krause & Shaw, 2000; Penninx et al.,

1997; Peterson et al., 1998; Seeman & Lewis, 1995; Surtees et al., 2006, 2010), disease incidence (Rosengren et al., 2004; Stürmer, Hasselbach, & Amelang, 2006), progression of disease burden (Gerstorf et al., 2011c; Infurna, Gerstorf, & Zarit, 2011), physical health symptoms (Matthews, Scheier, Brunson, & Carducci, 1980; Schachter & Singer, 1962), declines in physical functioning (Caplan & Schooler, 2003; Femia et al., 1997; Lachman & Agrigoroaei, 2010; Mendes de Leon et al., 1996) and disability (Fauth et al., 2007; Kempen et al., 1999), as well as facilitating adjustment to disease (Taylor, Helgeson, Reed, & Skokan, 1991; Thompson & Kyle, 2000; Wrosch et al., 2004).

Perceived control and cognition. Perceived control is linked to cognitive functioning. For example, Windsor and Anstey (2008) found that higher levels of mastery were associated with better performance on tests of memory, processing speed, and verbal intelligence across adulthood and old age. Interestingly, interaction effects indicated that associations between mastery and indices of speed were stronger in older ages. Results from MIDUS show that people who engage in more modifiable psychosocial factors (control beliefs, quality of social support, and physical exercise) are more likely to perform better on cognitive tests covering memory, executive functioning, and reasoning (Agrigoroaei & Lachman, 2011). Similarly, in older ages, domain-specific measures of cognition were a better predictor of cognitive functioning than general feelings of control (Lachman, 1986). Longitudinal samples involving participants from across adulthood and old age have found that facets of control are protective against declines in cognitive functioning over four and 20 years of time (Caplan & Schooler, 2003; Wahl et al., 2010).

Mechanisms that underlie associations between perceived control and aging-related outcomes. The paragraphs above make clear that perceived control is linked to various areas of functioning within the cognitive and health domains. Despite numerous studies linking control to aging-related outcomes of health and cognitive functioning, there is limited research focusing on

the mechanisms driving such associations. Control is related to various health indices, but for the most part, the how and why is missing. In Miller, Chen, and Cole's (2009) review focusing on developing biologically plausible models that link the social world and physical health, they discuss that once a relationship has been established in the literature between a psychological construct and health outcomes, the next steps are to unpack the biological processes driving these linkages. In the case of perceived control, numerous studies have documented its protective effect on cognitive and health declines in adulthood and old age. However, more work needs to focus on unpacking the biological processes through which control has downstream effects on health outcomes. Research will also benefit from conjointly targeting psychosocial and health factors that underlie control-health associations. In particular, research that targets biological processes needs to target bodily systems that (1) are linked to common health outcomes of control, (2) have plausible pathways linking them to shared health outcomes of control, and most importantly, (3) there are plausible pathways for control to influence their manifestations. Focusing on biological processes that potentially underlie control-health associations will contribute to bridging the gap between control and health. This will be the focus of dissertation papers two and three.

Figure 1.3 illustrates my guiding conceptual model for how perceived control facilitates aging-related outcomes. Perceived control facilitates or impacts aging-related outcomes through behavioral, emotional, motivational, and social support pathways that have subsequent downstream effects on biological and cellular processes. As a first pathway, individuals who view their life and health as controllable are more likely to partake in health-promoting behaviors. For example, individuals perceiving more control are more likely to adopt and maintain health promoting behaviors, such as exercise, preventive care, and proper diet resulting in a decreased likelihood of poor health outcomes (Grembowski et al., 1993; Lachman & Firth, 2004; Peterson et al., 1993; Rodin, 1986; Seeman et al., 1999; Skinner, 1995; White et al., in

press; Ziff et al., 1995). As a consequence, lower perceived control may alter one's behavioral and biological functioning, probably leading to increased vulnerability to diseases and subsequent mortality. Second, perceived control is known to be involved in emotion regulation (Lang & Heckhausen, 2001; Seligman, 1975; Skinner, 1995). Perceived control allows people to better down regulate negative emotional experiences, thereby alleviating the detrimental effects of negative emotions on cardiovascular and immune functioning (Danner, Snowdon, & Friesen, 2001; Pressman & Cohen, 2005). Also, the association between helplessness and depression is strong (Peterson & Seligman, 1984), which may contribute to alterations in biological functioning (see Kiecolt-Glaser et al., 2002). Third, perceiving a greater number of constraints or harboring more feelings of helplessness can immobilize motivation and goal-directed behavior, resulting in less practice of health maintenance behaviors (Abramson et al., 1978; Peterson et al., 1993). Fourth, various theories of control argue that control beliefs allow people to mobilize social support, particularly in times of strain, thereby serving as a buffer against the effects of stress (see Antonucci, 2001; Cohen & Wills, 1985; Heckhausen & Schulz, 1995; Lang et al., 1997).

Biological processes or physiological functioning that underlie control-health associations include but are not limited to cardio-metabolic (cardiovascular, metabolic), functional, immune, and neuroendocrine (for review, see Roepke & Grant, 2011). Several studies have documented that control directly affects physiological systems of functioning, particularly the cardiovascular and immune systems (Bandura, 1991, 1997). The lack of contingency or "uncontrollability" associated with constraints (and also helplessness) may increase plasma corticosteroids which regulate metabolism of cholesterol (Brennan, Job, Watkins, & Maier, 1992; Rodin, 1986) and possibly contribute to poorer immune functioning (Kamen-Siegel, Rodin, Seligman, & Dwyer, 1991). For example, lower feelings of control or fatalism may have

immunosuppressive tendencies and result in elevated blood pressure and catecholamine levels (Rodin et al., 1985).

Underlying associations between biological processes and aging-related outcomes are various cellular processes, which range from arterial stiffness and plaque accumulation (atherosclerosis) to oxidative stress, and telomere length. For example, HDL–C is linked to cardiovascular disease and mortality through atherosclerosis (plaque accumulation, hardening of arterial walls; for discussion, see Libby & Theroux, 2005). Also, elevated levels of Hemoglobin A_{1c} are linked to mortality through protein glycation of vessel walls, inflammatory processes, and oxidative stress (Hotamisligil, 2006).

Motivation may directly impact aging-related outcomes; motivational resources may facilitate engagement in strategies to protect against cognitive and physical declines that do not necessarily involve biological processes (dotted line on the right side of Figure 1.3). For example, perceived control relates to engaging in memory and cognitive strategies to maintain one's everyday cognitive functioning and independent living (de Frias, Dixon, & Bäckman, 2003; Hertzog, Dunlosky, & Robinson, 2003; Horhota, Lineweaver, Ositelu, Summers, & Hertzog, in press; Lachman & Andreoletti, 2006). Similarly, individuals with higher levels of control are more socially integrated and more likely to engage in rehab behaviors to protect against disease incidence leading to disability (Verbrugge & Jette, 1994).

Perceived control is a facilitator. As a side note, it is important to explicate what I mean when I say perceived control is a facilitator. By facilitate, I would like to convey that perceived control provides opportunities for developmental and aging-related outcomes through various outlined mechanisms. Perceived control not only operates by increasing the likelihood that individuals engage in health-promoting behaviors, but also buffers against the negative impact of stressors and helps compensate for failures by down-regulating negative emotions, leading to more positive health profiles. An analogy that comes to mind and should help with this thinking

process is control is analogous to a point guard on a basketball team whose job is to facilitate the basketball and provide teammates with ample opportunities to score. Perceived control has numerous facilitators, including behavioral, emotion, motivation, social support, and biological; similarly, a point guard can distribute the basketball via a bounce pass, direct pass to the chest or alley oop. However, not all point guards are created equal. The aforementioned point guard displays the characteristics of an Oscar Robertson or John Stockton – these types of point guards emphasize team first and typically positively benefit the team; whereas there may be selfish point guards that are not good facilitators, such as Stephon Marbury who negatively impact the performance of the team. In the former case, perceived control results in positive outcomes, whereas in the latter case, poor performance from the point guard can lead to less adaptive functioning through perceived control (e.g., Baltes, 1995; Bisconti et al., 2006). For example, M. M. Baltes and colleagues (1995, 1996) 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). 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 four months of widowhood (Bisconti et al., 2006). It may be that individuals who highly regard control or have too much control may ruminate about losing control, negatively affecting behaviors, emotions, and physiological functioning, leading to poor health and well-being (e.g., Seeman, 1991).

I will detail this further in the next section, but time processes, as well as person- and situation-specific characteristics may moderate interrelationships between perceived control and its antecedents and outcomes. In basketball, assorted passes may have differential effects when executed on various areas of the court. For example, an alley oop pass from half court that results

in a resounding slam dunk may exponentially increase team morale, vigor and vitality, resulting in more opportunities to score points. When thinking about this in terms of perceived control and lifespan development, perceived control in earlier phases of the lifespan can have developmental long-arm effects that reach into young adulthood, midlife, and old age. For example, locus of control in childhood was associated with a reduced risk of obesity and psychological distress in young adulthood (Gale et al., 2008). Also, the person or agent may affect the pass or facilitation sequence. For example, an alley oop to a player who cannot dunk would have a negative effect on the outcome of the game (missed opportunity to score). Within the lifespan developmental model of perceived control, control-health associations may differ by gender and SES.

Person- and Situation-Specific Characteristics and Time Processes

Embedded within Figures 1.2 and 1.3 is that interrelationships between perceived control and its antecedents and outcomes need to be considered within the context of various time-related processes of development (non-normative influences, aging-, pathology-, and mortality-related processes) and person- and situation-specific characteristics. Development is a continuous lifelong process and depending on one's epoch (e.g., young adulthood vs. old age) or developmental rate (e.g., pathology-related processes), the interrelationships and implications of perceived control may differ.

Person- and Situation-Specific Characteristics. First, age may moderate associations between control and aging-related outcomes. Both conceptual and empirical work suggests that perceived control is more strongly related to health in older ages (Caplan & Schooler, 2003; Infurna et al., 2011b; Lachman & Agrigoroaei, 2010; Rodin, 1986). In young adulthood and midlife perceived control may operate via mechanisms such as health behaviors and physiological functioning whose effects take time to evolve and accumulate, whereas lower feelings of control may have more proximal effects in older ages. I also acknowledge that

stronger control-health associations in older ages may be a methodological artifact of there being more variance or between-person differences in health in older ages, compared to younger ages.

Second, gender differences in perceived control may relate to differential associations involving control. For example, associations between control and various aging-related outcomes may be stronger for men due to their greater tendency for agency, whereas women are more communal and may rely on aspects of their social support system more, resulting in weaker associations between control and aging-related outcomes (Helgeson, 1994). Third, the SES-health gradient is well-established (Adler et al., 1994), but low SES individuals who report more control are less likely to report poor health (Clarke & Smith, 2009; Lachman & Weaver, 1998b). Cultural belief systems have the potential to moderate associations between perceived control and its antecedents and outcomes. Perceived control may be more prevalent in Western versus Eastern cultures (Yamaguchi, Gelfand, Ohasi, & Zemba, 2005), as well as more prevalent in individualistic versus collectivistic societies. Clarke and Smith (2009) analyzed data from both a US and England sample and found that both low SES and low control were associated with an increased risk of disability. Interestingly, the control-SES interaction was reliably different from zero in the US sample but not in the England sample, suggesting that differences in social structures and the way individuals are socialized (individual versus collectivistic) may result in moderating the integrative model (for discussion regarding a similar stance on social support, see Kim, Sherman, & Taylor, 2008).

Lastly, situation-specific characteristics, such as control potential (or objective control) have the ability to moderate associations between control and aging-related outcomes. For example, individuals who report more chronic health problems and functional disability, but partake in more goal disengagement control strategies are more likely to be protected against mental health declines and mortality (Dunne et al., 2011; Hall et al., 2010). Additionally, for children and adolescence whose parents are going through a divorce, this is a situation where

they have little to no control over the events and realizing this may result in fewer externalizing problem behaviors, maladjustment, and poorer school-related outcomes (Skinner, 1995).

Time processes. Developmental change is not a static enterprise but occurs across a dynamical, moving force called time. Change in relation to non-normative processes (e.g., caregiving) or developmental processes tied to age (e.g., change in fluid and crystallized intelligence), pathology (e.g., disability and morbidity), and mortality are instrumental in shaping perceived control, its corresponding antecedents and outcomes and their across-domain interplay. Non-normative, as well as aging-, pathology-, and mortality-related processes contribute to and need to be considered for perceived control and its dynamical interplay with its antecedents and outcomes.

Non-normative processes refer to events whose occurrence, patterning, and sequencing are not applicable to many individuals, nor are they clearly tied to a dimension of developmental time (Baltes 1987; Baltes & Nesselroade, 1984; Bandura, 1982). Examples of such events include incidence of cancer in childhood and caregiving for someone with dementia. Caregiving for someone with dementia is a significant stressful experience that challenges and constrains systemic functioning across a myriad of domains (Aneshensel et al., 1995; Pearlin et al., 1981). Perceived control has been analyzed as both a protective resource for various outcomes of caregiving, such as depressive symptoms, as well as itself being targeted as an outcome. For example, caregivers reporting stronger feelings of mastery are more likely to experience fewer depressive symptoms post bereavement (Aneshensel, Botticello, & Yamaoto-Mitani, 2004). Furthermore, compared to non-caregivers, caregivers typically report lower self-efficacy (Pinquart & Sörensen, 2003). What is particularly interesting and has the potential to contribute to a more complete understanding of control and its antecedents and outcomes is tracking change processes in relation to prominent events of caregiving, such as placement or bereavement. Empirical evidence suggests that mastery increases in the caregiver post bereavement of their

care recipient (Skaff et al., 1996). Dissertation paper one will target how caregivers' mastery changes in relation to placement of a care recipient in a nursing home or similar institution and whether caregiver and care recipient characteristics moderate reaction to placement. Empirical reports that offer opportunities for examining "natural experiments" will contribute to earlier discussion and consideration that constructs of control are not innate attributes but are an interrelated set of beliefs that are influenced by one's context and the result of previous experiences and interactions.

Aging-, pathology-, and mortality-related processes (for discussions, see Birren & Cunningham, 1985; Ram, Gerstorf et al., 2010) can operate as contextual systematical influences on developmental change processes involving perceived control. Targeting aging-related processes, initial work examining age-differences in control and constraints showed that older adults compared to individuals in midlife and young adulthood reported lower levels of mastery and higher levels of constraints (Lachman & Firth, 2004; Mirowsky, 1995). Recent longitudinal evidence echoes cross-sectional findings such that changes in perceived control across adulthood and old age is characterized by a curvilinear (quadratic) trend, peaking in late midlife and displaying accelerated declines in older ages (Gerstorf, Ram, Lindenberger, & Smith, 2011; Lachman et al., 2009; Mirowsky & Ross, 2007). Similarly, constraints show stability in midlife with increases in older ages (Lachman et al., 2009). In contrast, the literature examining changes in domain-specific measures of control across adulthood and old age is not as advanced and straightforward. Cross-sectional (Lachman & Firth, 2004; Lachman & Weaver, 1998) and more recently longitudinal work (Krause, 2007; Lachman et al., 2009) found that domain-specific measures of control display differential age-gradients. Cross-sectional findings from MIDUS demonstrate that compared to individuals in young adulthood and midlife, older adults report lower levels of control in the health, sex, and children domains, but higher levels of control in the financial, marriage, work, contributions, and life domains (Lachman & Firth, 2004).

Longitudinal findings from MIDUS have corroborated and extended the earlier cross-sectional work (Lachman et al., 2009).

Development may not be best characterized by chronological age (Baltes & Nesselroade, 1979) but through developmental changes in relation to pathology- and mortality-related processes. Pathology-related processes include assessing within-person changes in functioning in relation to disease or disability and the role of pathology-related burdens such as incidence of chronic illness or disability as between-person difference variables (Infurna, Gerstorf, & Ram, 2011; Ram, Gerstorf et al., 2010; Verbrugge & Jette, 1994). Perceived control shows stability across adulthood but declines in older ages (Lachman et al., 2009; Mirowsky & Ross, 2007); whereas in relation to cancer diagnosis (pathology) control may display a differential pattern. For example, Ranchor et al. (2010) examined change in control in relation to cancer diagnosis and found that individuals, on average, experienced significant declines in control immediately following diagnosis followed by stability, thereafter. Additionally, at the between-person level greater disease burden constrains feelings of mastery (Penninx et al., 1996). Furthermore, perceptions of control play an instrumental role in adjustment to illness (see Taylor, 1983). Health stresses associated with chronic illness may compromise well-being, but the enactment of control processes buffers from mental health declines (Wrosch et al., 2000, 2004).

Mortality-related processes may rise to the forefront and drive developmental changes occurring in old age (Bäckman & MacDonald, 2006; Gerstorf, Ram et al., 2008). Accumulated research shows that stronger perceptions of control are associated with an increased likelihood of longevity or decreased risk of mortality (Infurna et al., 2011a; Krause & Shaw, 2000; Penninx et al., 1997; Surtees et al., 2006, 2010), but much less is known regarding how control changes in relation to mortality. One scenario is that the pervasiveness and cascade of mortality-related processes would result in steeper changes in feelings of control (declines) and constraints (increases) as compared to changes over chronological age. A contrasting scenario is that as

individuals are approaching death and perceive time as being restrictive they will turn to (unconsciously or not) domains of functioning that are controllable, preserving one's feelings of control. Preliminary evidence from the Berlin Aging Study (BASE) provides support for scenario one that is, perceived control shows steeper declines in relation to death, as compared to chronological age (Gerstorf et al., 2011b). Additionally, at the between-person level, perceiving more remaining time in life is associated with stronger perceptions of control (Mirowsky, 1997).

Ultimately, by maximizing the potential of longitudinal studies, future research questions examining control, its antecedents and outcomes, and their across domain interplay in relation to aging-, pathology-, and mortality-related processes, as well as major life events (non-normative processes) will hopefully be developed to help characterize their nature and function across the multiple clocks that track development.

How My Dissertation Aims to Extend Previous Research on Perceived Control

The purpose and goal of the previous sections was to provide background on constructs and definitions of perceived control, elaborate on Figures 1.2 and 1.3 within the perceived control literature, and set the stage for my dissertation papers. This final section pinpoints the goals of my dissertation and how each paper aims to extend previous research, followed by each of the three respective papers.

Dissertation Goals

The overarching goal of my dissertation is to target and examine antecedents and outcomes of perceived control. To do so, I will utilize the multi-directional integrative model outlined in Figures 1.2 and 1.3 to extend the literature in three specific ways. First, perceived control has largely been utilized as a predictor of various aging-related outcomes, whereas much less is known regarding its antecedents. In dissertation paper one I target antecedents of perceived control in a high-risk group (caregivers), with the goal of arriving at a better understanding of the domains that individuals derive control from. Several domains that will be

explored include role overload (caregiving processes and context), facets of social support, well-being, and health, as well as care recipient characteristics. Second, there is limited mechanism-oriented research for perceived control. Research has accumulated showing that control is associated with cardiovascular incidence (Rosengren et al., 2004; Stürmer et al., 2006) and all-cause mortality (Infurna et al., 2011; Krause & Shaw, 2000; Penninx et al., 1997; Surtees et al., 2006, 2010); the next steps are to develop and empirically test biologically and psychologically plausible models linking control to aging-related outcomes. Dissertation papers two and three focus on associations between control and functional health and cardio-metabolic risk, as well as conjointly examining the role of behavioral, emotional, social support, and health factors in underlying control-health associations. By doing so, this can help elucidate the pathways through which control facilitates health related outcomes. Third, given that developmental change occurs across various time processes this dissertation will explore how control changes in relation to non-normative processes and how time-related control change can provide an added and distinctive contribution to predicting health outcomes. Very little research has targeted how change components of perceived control (e.g., change or variability) are linked to long-term health outcomes (for notable exception, see Eizenman et al., 1997).

Extension of Previous Research by Dissertation Paper One

A limitation of previous research is that perceived control has largely been utilized as a predictor of various aging-related outcomes, whereas much less is known regarding its antecedents. More research is needed that targets antecedents of control to arrive at a better understanding of the domains that individuals utilize as sources to derive control from across adulthood and old age. Several domains I will explore include stressors/burdens, such as caregiving, as well as facets of social support (Krause, 2003), well-being (Fung et al., 1999) and health (Schieman & Turner, 1998). The central focus of dissertation paper one is to examine how mastery changes in a sample of caregivers as they experience placement (non-normative

process), whether primary stressors (role overload) mediate reaction to placement and examine moderators of reaction to placement. More specifically, in dissertation paper one I use data from the Caregiving Stress and Coping Study (Aneshenshel et al., 1995; Pearlin et al., 1990), which consists of a sample of caregivers who were caring for a loved one with dementia. Caregivers are a high-risk group where perceptions of control are challenged and constrained due to daily hassles that are closely intertwined with caregiving for a loved one. I focus on dementia caregivers because challenges associated with providing care for a loved one with dementia and observing their physical and mental deterioration are often particularly taxing (Aneshensel et al., 1995; Schulz & Martire, 2004). For example, dementia caregivers are confronted with various daily challenges and hassles, among them to help their care recipient with everyday activities of daily living (e.g., to eat, bath, and get out of bed), to deal with the care recipients' cognitive difficulties (e.g., understanding simple instructions), and the frequent and numerous problem behaviors (e.g., restlessness or agitation). As a result, cumulative demands and experiences of caregiving may be a constant reminder of how little caregivers can do to affect the course of their own life circumstances, which may be especially detrimental to perceptions of mastery and control. To utilize the strengths of the six annual assessments that covered five years of time in the CSCS, I focus on examining how mastery changes in relation to placement of a care recipient in a nursing home or similar institution. Re-aligning the time metric in relation to placement will provide for a "natural experiment" that will permit for examining mastery during caregiving, within a year after placement, and in the years following placement. This will permit for examining how mastery changes across the changing contextual landscapes of caregiving.

Extension of Previous Research by Dissertation Paper Two

The goal of dissertation paper two is to develop further the health relevance of perceived control by targeting biological processes that potentially underlie control-health associations. In particular, perceived control can be construed as representing a key protective factor with major

health implications; dissertation paper two will provide insights on whether functional health and cardio-metabolic risk are mechanisms through which control facilitates health outcomes. As delineated in Figure 1.3, perceived control impacts aging-related outcomes through behavioral, emotion, motivation, social support, and biological or physiological processes. Analyses in dissertation paper two will focus on examining whether perceived control is directly linked to functional health and cardio-metabolic risk and the role of physical activity in mediating such associations.

The targeted indicators in paper two represent functional health (grip strength) and cardio-metabolic risk (Hemoglobin A_{1c}, HDL–C, SBP, PR, and WC). As reviewed above, constructs of control are associated with wide-ranging health outcomes, but much less is known regarding mechanisms that underlie such associations. I target indicators of functional health and cardio-metabolic risk because they (1) share common health outcomes of control, (2) have plausible pathways for impacting health outcomes of control, and (3) empirical evidence suggests that they are modifiable through social cognitive means (perceived control) and physical activity.

Perceived control and functional health. The measure of functional health is grip strength. Grip strength is a reliable biological marker of aging that focuses on underlying physiological changes that are an inevitable aging process that is independent of disease (Anstey, Luszcz, Giles, & Andrews, 2001). Researchers have specified that grip strength is an indicator of physical activity, subclinical disease, vitality or motivation that results in good functional ability, general musclo-skeletal functional capacity, and a measure of overall health (Anstey et al., 2001; Rantanen et al., 1999). Several studies show that better functioning in grip strength protects against disability, functional decline (Giampaou et al., 1999; Rantanen et al., 1999), and mortality (Anstey, et al., 2001; Snih et al., 1999). For example, Snih et al. (2002) found that each 1-kg increase in handgrip strength was associated with a 3% decreased risk of mortality after

adjusting for socio-demographic and health factors. Research suggests that the beneficial effects of control for functional health are found in earlier phases of the lifespan. Children with asthma that report higher levels of health locus of control are more likely to have better pulmonary function (Grffin & Chen, 2006).

Perceiving control may influence functional health through behavioral and motivational pathways. For example, higher levels of control are associated with participating in more leisure and restorative activities that promote physical well-being and influence muscle strength and functional abilities (Pressman et al., 2009). Additionally, control is linked to beliefs and motivations for better performance on tasks of physical abilities and overall physical and emotional health (Rozanski & Kubzansky, 2005). Functional health or grip strength may be a proxy for presence of chronic disease, resistance to external stressors, and cumulative biological burden that are established markers of disability, disease incidence, and mortality (McEwen, 1998; Rantanen et al., 2003).

Perceived control and cardio-metabolic risk. Cardio-metabolic risk is a constellation of interrelated risk factors of metabolic origin that promote the development of cardiovascular disease and increase the risk for developing type 2 diabetes mellitus (Grundy et al., 2005). Perceived control may influence cardio-metabolic risk through behavioral and coping strategy pathways. Attitudes and beliefs of exercising control are associated with increased likelihood of partaking in strenuous exercise and physical activity that suppress glucose production, reduces adiposity, and protect against oxidative stress (Stefanik et al., 1998; Williams et al., 2000). Higher levels of control enable people to mobilize more effective utilization of coping strategies to buffer against stress and promote self-care, thereby protecting against cardio-metabolic risk (Peyrot et al., 1999; Roepke et al., 2011; Tsenkova et al., 2008). Poor management of one's cardio-metabolic health can promote atherosclerosis, protein glycation of vessel walls, and induce release of inflammatory cytokines that are linked to increased risk for cardiovascular

disease incidence and mortality (Barter & Rye, 1996; Khaw & Wareham, 2006; Kiecolt-Glaser et al., 2002).

The cardio-metabolic risk factors that I focus on in dissertation paper two are Hemoglobin A_{1c}, High Density Lipoprotein–Cholesterol, Systolic Blood Pressure, Pulse Rate, and Waist Circumference. Hemoglobin A_{1c} is a marker of blood glucose levels and metabolism over time (120 days) and is often times used as a marker of glucose control in diabetics but has also shown utility in populations of individuals without diabetes. For people without diabetes, the normal range for hemoglobin A_{1c} is between 4% and 6%, whereas the goal for people with diabetes is less than 7% (Khaw & Wareham, 2006). Khaw and Wareham (2006) discuss that hemoglobin A_{1c} is an indicator of cardiovascular risk and individuals with higher levels have an increased risk for cardiovascular disease incidence and all-cause mortality (Carson et al., 2010; Coutinho, Gerstein, Wang, & Yusuf, 1999; Khaw et al., 2004; Matsushita et al., 2010; Selvin et al., 2010; Wareham & Pfister, 2010). For example, a .1 percentage point reduction in hemoglobin A_{1c} has the potential to reduce total mortality by up to 6% (Khaw et al., 2004). Similar to functional health, in earlier areas of the lifespan research suggests that children reporting higher levels of control are more likely to have lower or better levels of hemoglobin A_{1c} (Nabors, McGrady, & Kichler, 2010).

High Density Lipoprotein–Cholesterol is a lipid or fat that binds to proteins to form particles known as lipoproteins that circulate the blood (Barter & Rye, 1996). High Density Lipoprotein–Cholesterol transports excess cholesterol from peripheral tissues and artery walls to the liver to be broken down (also known as reverse cholesterol transport); higher levels are better or protective against cardiovascular incidence (Ashen et al., 2005). For men, low High Density Lipoprotein–Cholesterol levels are less than 40 mg/dL, whereas for women low High Density Lipoprotein–Cholesterol levels are less than 50 mg/dL (Ashen et al., 2005). Large epidemiological studies found that lower levels of High Density Lipoprotein–Cholesterol are

associated with an increased risk of cardiovascular disease incidence (Ashen et al., 2005; Barter & Rye, 1996; Barter et al., 2007) and higher levels are protective against cardiovascular incidence and mortality (Gordon et al., 1989). A 1 mg/dL increase in High Density Lipoprotein–Cholesterol is associated with a 6% reduction in the risk of death from coronary disease or of myocardial infarction (Ashen et al., 2005; Gordon et al., 1986).

Systolic Blood Pressure is a measure of the amount of force that blood exerts on the walls of the blood vessels while the heart is beating (Chobanian, 2007). Clinical recommendations suggest that people with systolic blood pressure levels above 140 mmHg are considered to have hypertension (Chobanian, 2007). Research shows that elevated levels of SBP are a risk factor for cognitive decline, as well as cardiovascular disease and mortality (Anstey & Christensen, 2000; Chobanian, 2007; Hertzog, Schaie, & Gribbin, 1978; Tzourio, 2007; Verhaegen, Borchlet, & Smith, 2003). Pulse Rate indicates the heart rate or number of beats per minute, with lower resting levels typically signifying a better state of general health. More broadly, Pulse Rate represents one's overall level of health and physical functioning because it is often times lower in people who are more physically activity and is sensitive to smoking habits and intrinsic aging of the heart's conducting system. For example, epidemiological reports show that Pulse Rate is a risk factor that predicts cardiovascular disease and mortality (Gillum et al., 1991; Young et al., 1993). Systolic Blood Pressure and Pulse Rate operate to impact aging-related outcomes by accelerating atherosclerosis (hardening of arterial walls) through hemodynamic (e.g., cerebrovascular symptoms due to calcification, rupture, ulceration, hemorrhage) or metabolic mechanisms (Eversen, Helkala, Kaplan, & Salonen, 2001).

Waist Circumference is an index of more chronic levels of metabolism and adipose tissue deposition, which is in contrast to body mass index, which provides an index of obesity (Dagenais et al., 2005; Seeman et al., 1997). Researchers discuss that it may be the distribution of the adipose tissue, not obesity per se that is related to increased risk for key health outcomes

(Ducimetiere et al., 1985; National Heart, Lung, and Blood Institute, 1998). For example, empirical evidence suggests that higher Waist Circumference is related to an increased likelihood of disability, disease incidence, and mortality (Dagenais et al., 2005; Ducimetiere et al., 1985). Waist Circumference operates to impact aging-related outcomes by activating coagulation, inflammation, and the sympathetic and rennin-angiotensin-aldosterone systems (Dagenais et al., 2005; MacDonald, 1995; Yudkin et al., 1999).

Pathways linking perceived control to functional health and cardio-metabolic risk. Physical activity can be assumed to play a key role in linking perceptions of control to functional health and cardio-metabolic risk. Physical activity refers to one's involvement or engagement in vigorous (e.g., running or gym workout), moderate (e.g., gardening or walking) and mild (e.g., vacuuming) activities (Levine et al., 1999; McAuley, 1993). Empirical evidence suggests that more active individuals have an increased likelihood of reporting better physiological functioning (i.e., better functional health and lower cardio-metabolic risk), as well as being protected against the development of disability, functional limitations, and coronary heart disease (Arsenault et al., 2010; Balzi et al., 2010; Boyle, Buchman, Wilson, Bienias, & Bennett, 2007; Couillard et al., 2001; Fletcher et al., 1996; King, Haskell, Young, Oka, & Stefanick, 1995; Kuh et al., 2005; Jette et al., 1999; Penedo & Dahn, 2005; Sargeant et al., 2001). Higher levels of control are linked to the increased likelihood of adopting and maintaining health promoting behaviors, such as exercise, preventive care, and proper diet resulting in a decreased likelihood of poor health outcomes (Grembowski et al., 1993; Lachman & Firth, 2004; Peterson et al., 1993; Rodin, 1986; Seeman et al., 1999; Skinner, 1995; White et al., in press; Ziff et al., 1995). As a consequence, lower perceived control may alter one's behavioral and physiological functioning, probably leading to increased vulnerability to diseases and subsequent mortality. Therefore, perceived control is hypothesized to be a facilitator of healthier physiological or

biological functioning and positive aging-related outcomes both directly and indirectly via physical activity.

Additional pathways that may link control to health outcomes via biological processes, but will not be targeted in paper two, include emotion, motivation, and social support. Behavioral is the only targeted mechanism for dissertation paper two because functional health and cardio-metabolic risk are modifiable largely through physical activity and little evidence has accumulated linking these systems with the other mechanisms. Therefore, it is implied and noted that there may be specificity with associations among control, its mechanisms, and physiological functioning. Physiological pathways that are typically involved in associations between emotions, stressors, and health outcomes include immune and endocrine systems (Kiecolt-Glaser et al., 2002; Segerstrom & Miller, 2004). Research shows that perceived control buffers the negative impact of stressors on emotional and physiological reactivity (Kunz-Ebrecht et al., 2004). For example, reports from the National Study of Daily Experiences (NSDE) show that lower personal control was related to increases in emotional distress and physical health symptoms to stressors (Neupert et al., 2007). In turn, a lack of effective coping resources to stressors can alter physiological functioning (e.g., dysregulation of the HPA axis), resulting in increasing the risk for accumulating diseases (Cohen, 2000).The dataset for dissertation paper two did not measure these physiological systems, however, these systems are considered targeted areas for future research that will be elaborated on in the concluding chapter.

Extension of Previous Research by Dissertation Paper Three

The goal of dissertation paper three is to first examine whether levels of perceived control predict mortality over a 19-year period and conjointly target the role of psychosocial and health factors in underlying this association. Conceptual models of control delineate that control-health associations operate through emotional, behavioral, social, and health pathways (Bandura, 1997; Lachman, 2006; Rodin, 1986), but research testing such inquiries in a conjoint manner is largely

lacking. I will examine whether well-being, physical activity, social support, and health factors account for the association between levels of perceived control and mortality. Second, I will examine whether time-related change in control uniquely predicts mortality, over and above levels of control and known correlates of mortality. Most previous research examining associations between perceived control and mortality has used level assessments taken at one point in time. For example, research from panel surveys consisting of adult lifespan samples and samples of older adults suggests that reporting higher levels of control are linked to survival over follow-up periods ranging from 2.5 to 14 years (Infurna et al., 2011; Penninx et al., 1997; Surtees et al., 2006, 2010), and in patient populations involving people who have coronary artery disease, cancer, amyotrophic lateral sclerosis, and on dialysis (Brown, Levy, Rosberger, & Edgar, 2003; Helgeson, 2003; Kutner et al., 1997; McDonald, Wiedenfeld, Hillel, Carpenter, & Walter, 1994). Lastly, seminal research from Rodin and Langer (1977) in nursing home residents showed that increasing perceptions of control through environmental manipulation provides people feelings of competence and contingency, leading to a decreased likelihood of mortality (see also Langer & Rodin, 1976; Schulz, 1976).

Previous research linking control to mortality across various populations has almost exclusively involved level assessments taken at one point in time. A notable exception is research from the Cornwall Manor Study, where researchers used data taken from 26 weekly assessments of perceived control to compute an overall within-person mean and variability (within-person standard deviation) score to predict 5-year mortality. Eizenman and colleagues (1997) found that greater variability in control over the 26 weekly assessments was associated with an increased risk for 5-year mortality over and above levels of control. Findings from the Cornwall Manor Study illustrate the importance of including behavioral components of development beyond level, such as change or variability, into models to predict developmental and aging-related outcomes.

Level assessments of control that are taken at one point in time can be taken to indicate snapshot assessments in peoples photo album of life that can be considered the culmination of one's prior and current experiences, interactions, context, health, and life events. In contrast to level assessments, time-related change in control is indicative of changes in one's resources over a period of time that can provide an added and distinctive contribution to shaping health outcomes. Time-related change in control may reflect changes in one's capabilities to exert influence over and shape life circumstances, which can have implications for behavioral functioning, emotion regulation, and coping. First, increases in control over a one or two year period may modify one's attitudes and beliefs regarding the controllability of their health, leading to increasing participation in health-promoting behaviors. Second, declines in control may impact one's ability to effectively mobilize coping strategies and engage with social network members to buffer the negative effects of stress and promote emotion regulation. Moving beyond only using level assessments of control to predict outcomes and towards incorporating aspects of change promises to provide a more comprehensive understanding of how perceived control impacts key health outcomes in adulthood and old age.

Table 1.1

Constructs That Encompass Competence and Contingency

Author	Competence	Contains Aspects of Both Distinctions	Contingency
Bandura	Efficacy expectations		Outcome expectations
Skinner	Capacity beliefs		Strategy beliefs
Rotter	Internal control		External control
Thompson	Intentionality		Connection
Seligman	Personal helplessness		Universal helplessness
Pearlin		Mastery	
Lachman	Personal mastery		Perceived constraints
Dweck	Mastery-oriented pattern	Motivation	Helpless pattern
Heckhausen		Control Striving Goal (dis) engagement	
Brandtstädter		Assimilative Coping Accommodative Coping	
Judge		Core self-evaluations	

Note. See the reference section for citations.

Figure Caption

Figure 1.1. Graphical illustration of interrelatedness of perceived control with social context, health, and behavior/emotion.

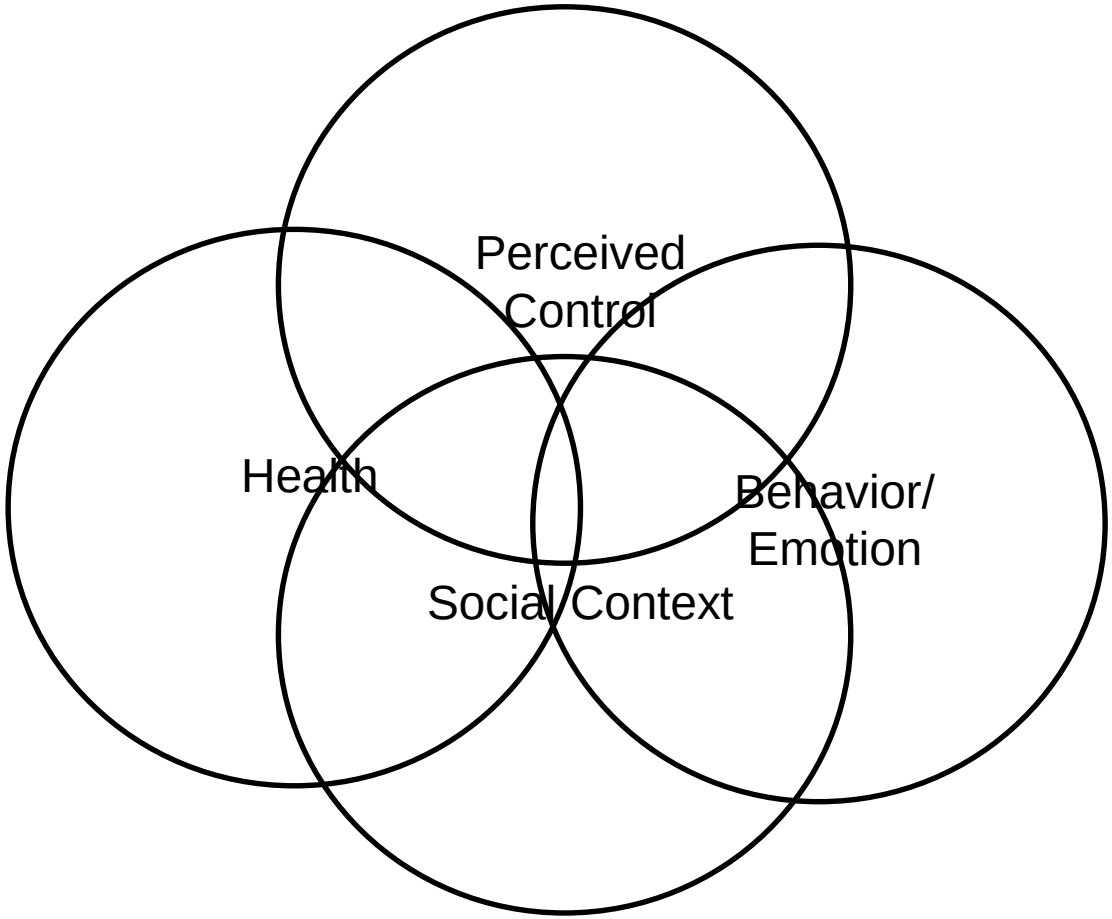
Figure 1.2. Depiction of how social context and health influence level and changes in perceived control across various time metrics. Perceived control is shaped by and grows out of experiences in one's social context and health domains. The social context broadly ranges from social integration and social support (i.e., emotional, informational, instrumental, and negative) to work, school and stressors/burdens, which have the capability to shape and influence one's orientation towards life circumstances. Health, which broadly includes the physical ability to complete everyday activities of daily living to emotional well-being, also plays a vital role in shaping perceived control. The social context and health domains influence levels of and changes in control across various time scales (as opposed to being static and only occurring at one point in time), including days, weeks, months, years, as well as aging-, pathology-, and mortality-related processes.

Figure 1.3. Depiction of how perceived control facilitates aging-related outcomes. Perceived control is an antecedent of various aging-relating outcomes, including but not limited to cognitive and physical functioning, disease incidence, and mortality. Perceived control facilitates aging-related outcomes through behavioral, emotional, motivational, and social support pathways that have subsequent downstream effects on biological and cellular processes. Additionally, the effects of perceived control for various aging-related outcomes may be moderated by person- and situation-specific characteristics.

Figure 1.4. Depiction of the various facets or belief systems that comprise perceived control. Perceived control is considered an orientation towards life circumstances that is comprised of one's attitudes, beliefs, motivations, and volitions. Attitudes are one's manner and tendencies for behavior; Beliefs are thoughts, feelings, and convictions for behavior; Motivations are actions in

a particular process for attaining goals or objectives; Volitions are the act of willing, choosing, or exerting effort on decisions for behaviors (goal implementation).

Figure 1.1.


Perceived
Control
Health
Behavior/
Emotion
Social Context

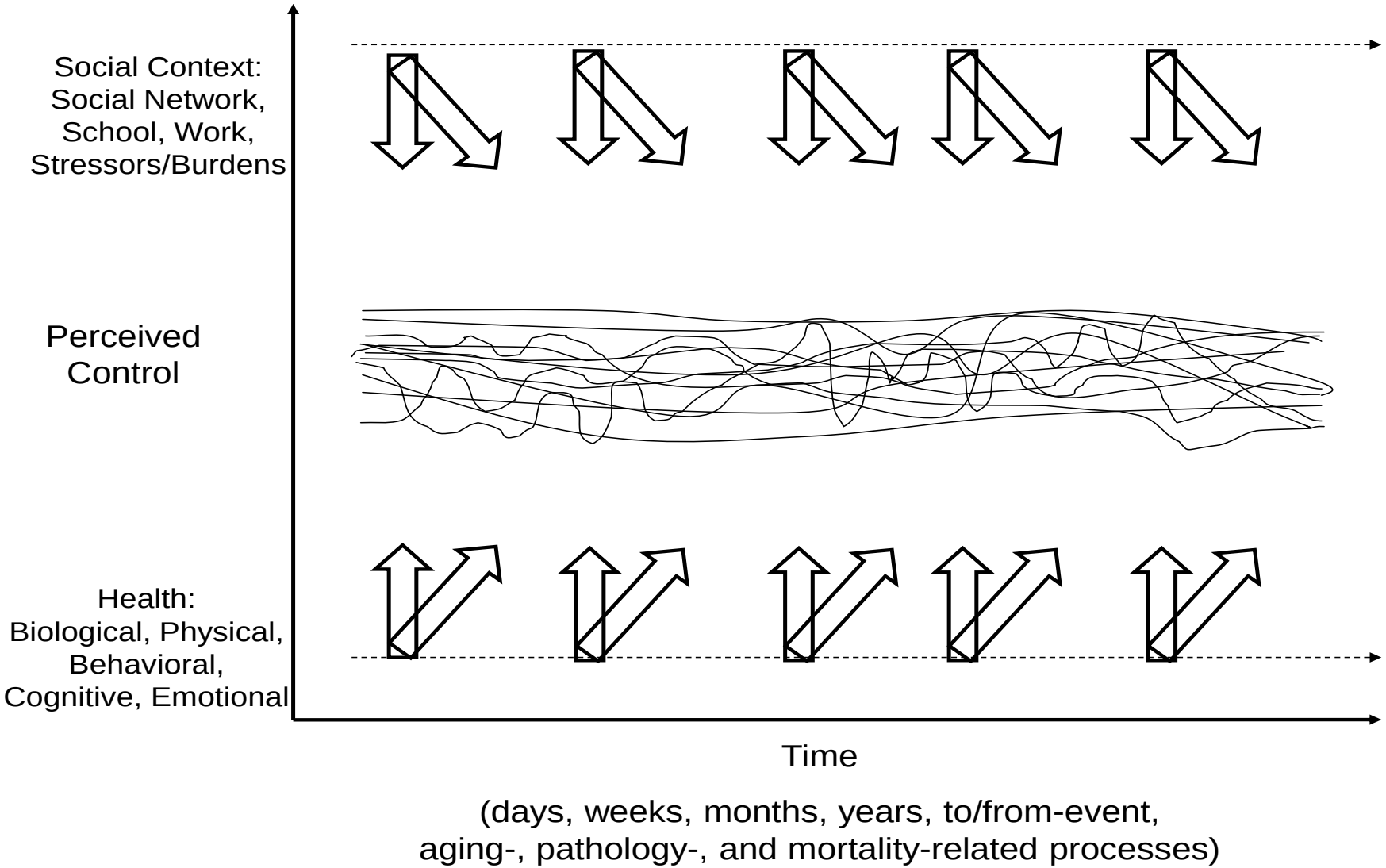

Social Context:
Social Network,
School, Work,
Stressors/Burdens
Perceived
Control
Health:
Biological, Physical,
Behavioral,
Cognitive, Emotional
Time
(days, weeks, months, years, to/from-event,
aging-, pathology-, and mortality-related processes)

Figure 1.3.

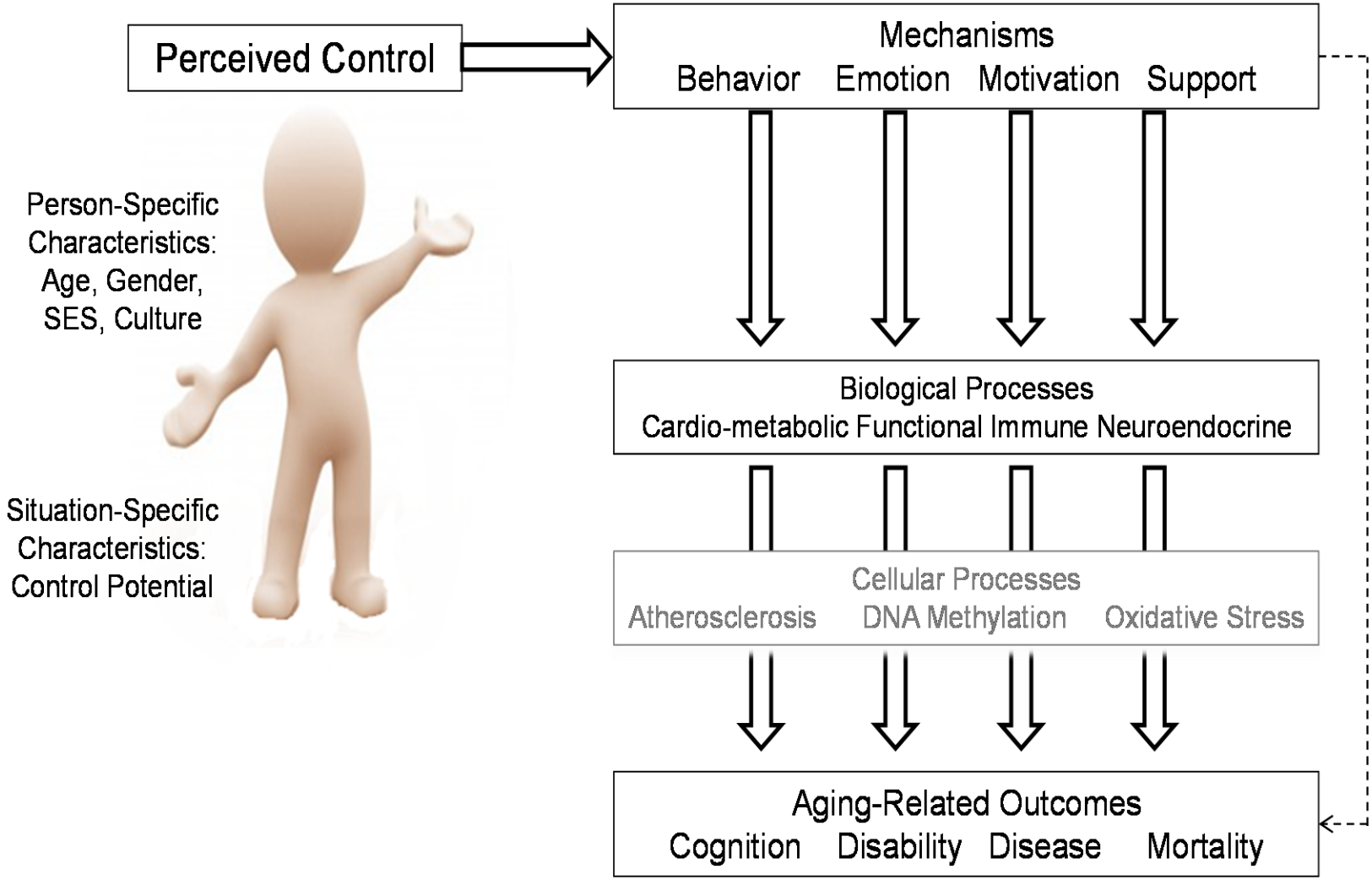
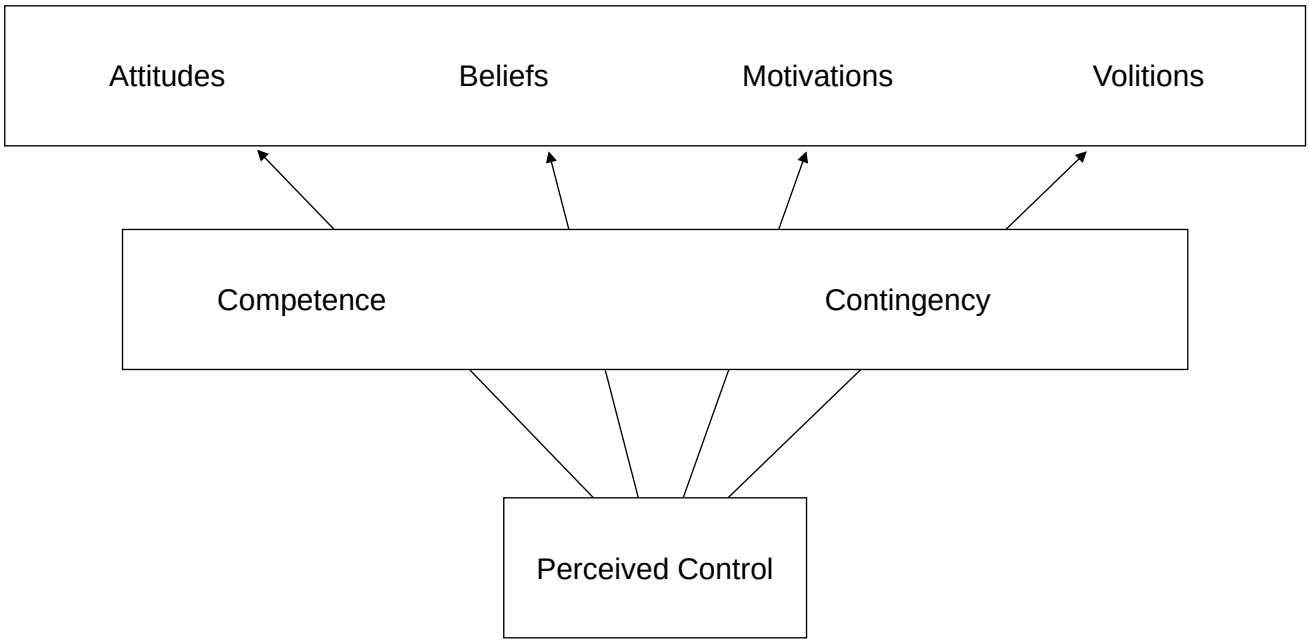

Perceived Control
Mechanisms
Behavior Emotion Motivation Support
Person-Specific Characteristics: Age, Gender, SES, Culture
Situation-Specific Characteristics: Control Potential
Biological Processes
Cardio-metabolic Functional Immune Neuroendocrine
Cellular Processes
Atherosclerosis DNA Methylation Oxidative Stress
Aging-Related Outcomes
Cognition Disability Disease Mortality

Figure 1.4.


Attitudes
Beliefs
Motivations
Volitions
Competence
Contingency
Perceived Control

CHAPTER II

DISSERTATION PAPER 1

Substantial Changes in Mastery Perceptions of Caregivers with

the Placement of a Care Recipient

Abstract

Objective: The current study examined how global mastery perceptions as a key component of the caregiving stress process change with placing the care recipient in a nursing home or institution. We also explored the role of primary stressors in accounting for mastery changes with placement and whether characteristics of the caregiver and care recipient moderate reactions to placement. ***Methods:*** We applied multi-phase growth curve models to prospective longitudinal data from 271 caregivers in the Caregiver Stress and Coping Study who experienced placement of their care recipient. ***Results:*** Using a time-to/from-placement metric, we found that caregivers typically experienced declines in mastery preceding placement, followed by a significant increase within one year after placement and further increases thereafter. Corresponding changes in primary stressors (role overload) mediated the placement-related increase in mastery. Caregivers who reported more depressive symptoms and ADL/IADL dependencies of the care recipient were more likely to experience larger placement-related increases in mastery perceptions. ***Discussion:*** Our findings suggest that placement alters psychological resources of caregivers and this effect is driven by corresponding changes in primary stressors. Findings also underscore the importance of examining change processes across salient life events and transitions.

Key words: Caregiving; Placement; Stress Process; Caring for Dementia-related conditions; Caregiver Stress and Coping Study

Substantial Changes in Mastery Perceptions of Caregivers with the Placement of a Care Recipient

Major life events and transitions often trigger developmental change across various domains of functioning (Baltes & Nesselroade, 1979; Diener et al., 2006; Gerstorf et al., 2010; Ram et al., 2010). In line with central models of stress and of control, transitions in caregiving such as caregiving onset, placement of the care recipient, or bereavement can be expected to initiate profound changes in psychological resources (Heckhausen & Schulz, 1995; Lachman, 2006; Pearlin et al., 1981; Skinner, 1995). In this study, we focus on examining global perceptions of mastery as a key psychological resource in the stress process and examine how mastery changes with placing a care recipient into a nursing home or similar institution. Placement has been identified as an important event that can have tremendous effects on the caregiver (Aneshensel et al., 1995). In our report, we use longitudinal data from the Caregiver Stress and Coping Study (CSCS) to track how changes in mastery of caregivers unfold prior to, within one year of, and in the years following placement of a care recipient suffering from dementia into a nursing home or similar institution. We will also explore whether and how primary stressors (role overload) mediate reaction to placement and examine the moderating role of caregiver and care recipient characteristics in reaction to placement.

Global Sense of Mastery and Caregiving

Psychological resources such as global sense of mastery enable individuals to have control over life circumstances and strive for goal attainment (Pearlin & Schooler, 1978). For caregivers, global beliefs of mastery protect against the adverse effects of caregiving strains on well-being and physical health (Aneshensel et al., 2004; Harmell et al., 2011; Roepke et al., 2008). It is likely that those mastery perceptions themselves are profoundly shaped by experiences that accompany the caregiving process. The chronic stress and daily disturbances involved in caregiving may deplete one’s adaptive capacity and resources. More specifically,

caregiving often confronts caregivers with conditions, experiences, and persistent role strains that erodes global sense of mastery and in turn result in poor adaptation such as depressive symptoms and compromised health (Monin & Schulz, 2009). For example, caregivers are often confronted with frequent and numerous problem behaviors, such as restlessness or agitation that constrain and undermine caregivers' ability to pursue behaviors directed at the attainment of desired outcomes (Aneshensel et al., 1995). In line with those arguments, mastery has been observed to decline for long-term caregivers (Skaff et al., 1996).

Little is known, however, about whether and how mastery changes during important transitions in caregiving. Placement can be expected to alter the challenges associated with caregiving because caregivers are no longer the primary person taking care of their loved one, which can lead to significant changes in both psychological resources such as mastery and consequent effects on well-being and physical health. A first possible scenario is that placement will operate as a relief to caregivers, resulting in improved mastery. Placement may then be perceived as a relief from everyday challenges associated with caregiving and thus result in a restoration of a caregiver's sense of control over the events in his/her own life. A contrasting scenario is that placement will not alter change trajectories in mastery. New stressors may emerge such as scheduling visits, feelings of guilt, or financial strains that further deplete one's resources and caregivers may feel less control over what happens to their relative compared to when they provided all of the care (Whitlatch et al., 2001; Zarit & Whitlatch, 1992). Empirical evidence so far is relatively scarce. Initial evidence exists to suggest that mastery remains relatively unchanged after placement of one's care recipient (Gaugler et al., 2007; Skaff et al., 1996).

Role Overload as a Proxy for Challenges Associated with Caregiving

Several lines of inquiry highlight how mastery may change with the experience of caregiving and transitions in caregiving. To begin with, the accumulation of primary care-related

stressors such as role overload often constrains and seriously undermines perceptions of control. In particular, role overload refers to role demands, fatigue, and experiences of being overwhelmed by caregiving-related tasks and responsibilities (Pearlin et al., 1990). Chronic stressors and daily disturbances that arise directly from patient care (e.g., help with dressing) often lead to increases in role overload over time (Gaugler et al., 2000; Sugihara et al., 2004). During caregiving, increasing role overload can be especially taxing on mastery because taking on the role of a primary caregiver for a loved one typically relinquishes caregivers' ability to be the primary driver of their own life circumstances. For example, dementia caregivers are often faced with stressors and events that interfere with and constrain one's own lifestyle (Bookwala & Schulz, 1998; Gignac & Gottlieb, 1996). Such impediments challenge the fulfillment of motivational strivings and goal implementation strategies that are essential for attainment of desired outcomes (see Heckhausen, Wrosch, & Schulz, 2010). The transition to placement often results in declines in role overload (Gaugler et al., 2007, 2009; Mausbach et al., 2007a), illustrating that placement acts as a partial relief to caregivers. Changes (declines) in role overload with placement may result in parallel changes (increases) in mastery, thereby providing relief to caregivers' psychological resources.

The Moderating Role of Caregiver and Care Recipient Characteristics

Embedded within the seminal stress process model (Pearlin et al., 1981, 1990) is that caregiver and care recipient characteristics moderate caregiving-related resources and outcomes. Caregivers bring to their caregiving career their own abilities and resources that they can draw upon when dealing with caregiving challenges. For example, caregivers who are older and/or women are more likely to report lower self-efficacy (Pinquart & Sörensen, 2003). In a similar vein, depressive symptoms and mastery are often closely intertwined. For example, caregivers who report high levels of depressive symptoms may be constrained in their perceptions of and ability to ascertain control over life circumstances (Schulz, O'Brien, Bookwala, & Feissner,

1995). In turn, a strong sense of mastery is protective against increases in depressive symptoms (Kaplan & Boss, 2004). Finally, the social embedding of the caregiver can also be expected to be relevant (for discussion, see Knight & Sayegh, 2010). For example, more emotional support and lower family tensions have been linked to experiencing increases in mastery post placement (Skaff et al., 1996).

It is also conceivable that factors associated with the caregiving process such as care recipient characteristics shape whether and how mastery changes with the placement of the care recipient. For example, aiding a care recipient with everyday activities of daily living may undermine the mastery perceptions of the care provider (Skaff et al., 1996). Caregivers may perceive their care recipients' frailty and inability to eat or dress without help as a window into his or her own (distant) future and so demoralize the general sense of mastery (Monin & Schulz, 2009). Similarly, being confronted with more problem behaviors such as irritability and being kept up at night may also constrain and limit caregivers' beliefs regarding exercising control over the situation (Li et al., 1999).

The Present Study

Our objectives are to examine (a) how caregivers' perceptions of mastery change with the placement of their care recipient in a nursing home or similar institution, (b) to explore whether role overload mediates those placement effects, and (c) how caregiver and care recipient characteristics moderate reactions to placement. We focus on dementia caregivers because challenges associated with providing care for a loved one with dementia and observing their physical and mental deterioration are often particularly taxing (Aneshensel et al., 1995; Schulz & Martire, 2004). Dementia caregivers are confronted with daily challenges and hassles such as helping their care recipient with everyday activities of daily living (e.g., to eat, bath, and get out of bed) and dealing with the care recipients' cognitive difficulties (e.g., understanding simple instructions). As a result, cumulative demands and experiences of caregiving may be a constant

reminder of how little caregivers can do to affect the course of their own life circumstances, which may be especially detrimental to perceptions of mastery and control.

To address these research questions, we used longitudinal data from the Caregiver Stress and Coping Study (CSCS) that assessed caregivers yearly for five years. The longitudinal and prospective nature of the CSCS allows examining how mastery changes in relation to placement. Previous work using the CSCS (Aneshensel et al., 1995; Pearlin et al., 1990) has either focused solely on post placement change or (group) mean-level differences in mastery (Gaugler et al., 2007; Skaff et al., 1996). We extend previous research by applying a comprehensive approach to examining change processes in mastery as they unfold prior to, within one year of, and in the years following placement. Based on extant research, we expect that mastery declines leading up to placement, increases with placement, and is relatively stable in the years following placement. For the mediation, we hypothesize that the reduction in accumulated caregiving stressors with placement (operationally defined by role overload) account for placement-related increase in mastery. In a final exploratory step, we targeted whether caregiving-related resources (caregiver characteristics) and factors associated with the caregiving process such as care recipient characteristics moderate placement-related changes in mastery.

Method

Participants and Procedure

The CSCS is a 6-wave longitudinal study of caregivers of individuals with progressive dementia (for details, see Aneshensel et al., 1995; Pearlin et al., 1990). Potential respondents were identified through local Alzheimer's Association chapters in the San Francisco and greater Los Angeles areas and through the Family Caregiver Alliance in the San Francisco Area. Caregivers were recruited over the telephone to determine interest in participation. Respondents met the following eligibility criteria: (1) the care recipient had a confirmed physician diagnosis of Alzheimer's disease or another progressive dementia; (2) the caregiver was the spouse or adult

child (including daughters- and sons-in-law) of an elderly relative suffering from dementia; and (3) the participant was the primary caregiver (or, the family member who provided the most help) of a relative living in the community at the time of initial screening.

The sample consisted of 555 caregivers at Time 1 who were assessed yearly over the course of 5 years (6 measurement occasions) across a wide range of topics concerning their caregiving career. With our interest in examining placement-related changes in mastery, we focused on the 271 participants (70% women, 88% attained at least high school education, and 84% were white) who placed their care recipient in a nursing home or other institution during the course of the study. To quantify selectivity effects, we compared those 271 participants with the Time 1 sample of 284 participants who did not experience placement. Analyses revealed that participants who experienced placement did not differ in age at Time 1, gender, education, role overload at Time 1, and mastery at Time 1 (all p's > .10), suggesting that our participants are comparable to the study population from which they were drawn.

Measures

Outcome. *Global sense of mastery* was assessed at each wave using seven items from Pearlin and Schooler's (1978) Mastery scale that measures global feelings of control (e.g., "*I can do just about anything I really set my mind to do.*"). Participants rated the extent to which they felt their life was under their control using a 4-point Likert scale (1=*strongly disagree* to 4=*strongly agree*). A mean index was created with higher scores indicating more mastery (baseline α=.75). To facilitate interpretation of relative changes, we standardized mastery to the T metric (M=50, SD=10) with the Time 1 sample (N=555) serving as the reference.

Mediator. *Role overload* represents caregivers' subjective evaluation of care-related stressors, tasks, and responsibilities and was measured at each wave using three items assessing feelings of emotional exhaustion and fatigue due to informal care provision (e.g., "*You have more things to do than you can handle.*"; Pearlin et al., 1990). Participants rated each item using

a 4-point Likert scale (1=*not at all* to 4=*completely*). A mean index was created with higher scores indicating more role overload (baseline α=.78) and was included in our analyses as a time-varying predictor to examine whether corresponding changes in role overload mediated changes in mastery.

Moderators. Table 1 shows descriptive statistics for caregiver and care recipient characteristics assumed to moderate placement-related mastery changes. With an interest in the resources caregivers could draw from and the constraints they were confronted with, we used data for each candidate moderator from the wave immediately preceding the placement. Socio-demographic factors included were age, gender, education, and years of caregiving. *Emotional support* was measured with a 7-item scale assessing the amount of connection caregivers felt toward their family and friends using a 4-point Likert scale (e.g., "*You have someone that you feel you can trust*."; 1=*strongly disagree* to 4=*strongly agree*; baseline α=.81). *Family tension* was measured using three items assessing the degree to which family members get along with one another using a 4-point Likert scale (e.g., "*There is tension in our family*."; 1=*not at all like your family* to 4=*very much like your family*; baseline α=.72). *Depressive symptoms* were assessed using a 7-item scale from the Hopkins Symptoms Checklist (e.g., "*In the past week, on how many days did you feel caught or trapped*."; see Derogatis et al., 1974), which asked how often symptoms occurred in the past week using a 4-point Likert scale (0=*no days* to 3=*5 or more days*; baseline α=.86). Mean indices were created for each caregiver characteristic with higher scores indexing more emotional support, family tension, and depressive symptoms.

Care recipient characteristics were also considered as potential moderators of placement-related mastery changes and included caregiver reports about the cognitive difficulties, ADL/IADL dependencies and problem behaviors of the care recipient at the wave prior to placement. *Cognitive difficulty* was measured by asking the caregiver how difficult is it for the care recipient to perform seven tasks, including understanding simple instructions and speaking

sentences using a 5-point Likert scale (0=*not at all difficult* to 4=*can't do at all*; see Pearlin et al., 1990; baseline α=.86). *ADL/IADL dependencies* were measured by asking the caregiver how much does the care recipient depend on the caregiver for 15 everyday tasks ranging from bathing/showering to getting in/out of bed using a 4-point Likert scale (1=*not at all* to 4=*completely*; see Gaugler et al., 2004; baseline α=.91). *Problem behaviors* were measured by asking the caregiver on how many days in the past week he or she personally had to deal with 14 problem behaviors, including becoming restless or agitated and keeping you up at night using a 4-point Likert scale (1=*no days* to 4=*5 or more days*; see Pearlin et al., 1990; baseline α=.78). Mean indices were created for each care recipient characteristic with higher scores indexing more dependent or reliant behavior.

Time metric of time-to/from-placement. During each wave, caregivers were asked to update their caregiving status (i.e., continuing care, placement, or bereavement). Caregivers who reported caring for their relative at home in the previous wave, but their relative was now institutionalized (placement) were selected. We then re-aligned these selected caregivers' mastery assessments in relation to the wave placement occurred. Re-aligning caregivers' mastery in relation to placement allowed for tracking changes prior to, within one year of, and in the years following placement. We also did this same procedure for role overload to allow examining whether corresponding changes in role overload accounted for changes in mastery. Table 2 shows the descriptive statistics for mastery and role overload prior to (years –5 to –1), immediately following (year 0), and in the years following placement (years 1 to 4). The descriptive statistics indicate that mastery declines prior to placement, followed by an increase within one year of placement, and gradual increases thereafter. Conversely, the descriptive statistics indicate that role overload increases prior to placement, followed by a substantial decline within one year of placement, and stability thereafter.

We note that caregivers may have experienced placement at any time during the

approximately 12-month interval between assessments. On average, caregivers experienced placement five months prior to the interview wave they reported placement (SD = 3.74, range 0–15 months). Thus, the time-to/from-placement metric contains some error of measurement by not assessing caregivers at the exact moment of placement. In follow-up analyses, we included months since placement as an additional correlate into our models. We obtained substantively the same pattern of findings as reported (see Tables 3 and 4) and did not find any evidence to suggest that months since placement were moderating placement-related mastery change. In further follow-up analyses, we also explored the role of bereavement. Again, results obtained did not differ between caregivers who additionally experienced bereavement and those who did not.

Statistical Procedures

Our first task was to establish a model of placement-related within-person changes in mastery that captures between-person differences in the multiple phases of change (see Fauth et al., in press; Ram & Grimm, 2007). To do so, we operationally defined two constructs: time-to/from-placement and reaction. Time-to/from-placement refers to the implied linear rate of change in mastery leading up to placement. Reaction was measured via a time-varying dummy-coded variable. *Reaction* indexes the effect of placement on caregivers' mastery and was coded as 0 for all years prior to placement (years –5 to –1) and 1 for the year immediately following placement and all years thereafter (years 0 to 4). The multi-phase growth curve model was specified as

$$y_{ti} = \beta_{0i} + \beta_{1i}\,(\textit{time-to/from-placement}_{ti}) + \beta_{2i}\,(\textit{reaction}_{ti}) + \beta_{3i}\,(\textit{time-to/from-placement}_{ti}\ x\ \textit{reaction}_{ti}) + e_{ti} \quad (1)$$

where person *i*'s level of mastery at time *t*, y_{ti}, is a function of an individual-specific intercept parameter that represents levels prior to placement, β_{0i}, an individual-specific slope parameter, β_{1i}, that captures rates of linear change prior to placement, an individual-specific reaction

parameter, β_{2i}, that represents the effect of placement on caregivers' mastery, and an individual-specific interaction between linear rate of change and reaction, β_{3i}, that indexes whether rates of change in mastery differed prior to and post placement, and residual error, e_{ti}.

Following standard multilevel or latent growth modeling procedures (e.g., McArdle & Nesselroade, 2003; Ram & Grimm, 2007; Singer & Willett, 2003), individual-specific intercepts and slopes (βs from the Level 1 model given in Equation 1) were modeled as the Level 2 model where between-person differences were estimated (i.e., variance parameters) for level (β_{0i}), linear change (β_{1i}), and reaction (β_{2i}) and are assumed to be normally distributed, correlated with each other, and uncorrelated with the residual errors, e_{ti}. We note that the relatively small number of measurement occasions for this kind of multi-phase model restricted our ability to thoroughly examine between-person difference questions. Because of our focus on predictors of level differences in mastery prior to placement and moderators of reaction to placement, we did not estimate the variance component for post-placement change (β_{3i}).

In subsequent steps, role overload and moderators were added into the model at the within-person (Level 1) and between-person level (Level 2), respectively. Specifically, role overload was added at Level 1 to assess whether corresponding changes in role overload mediated changes in mastery (for discussion, see Preacher, Zyphur, & Zhang, 2010; Sliwinski & Mogle, 2008). Additionally, we included a between-person, mean-level component of role overload at Level 2 to assess whether between-person differences in role overload moderated reaction to placement. Caregiver and care recipient characteristics were added at Level 2 as moderators of reaction to placement (β_{2i}). All moderators were grand-mean centered and role overload was centered using each caregivers overall role overload score (within-person level).

All models were estimated using SAS (PROC MIXED; see Littell, Milliken, Stroup, Wolfinger, & Schabenberger, 2006), with incomplete data accommodated under missing at random assumptions at the within- and between-person level (Little & Rubin, 1987).

Results

Global Sense of Mastery and Caregiving

The intraclass correlation for mastery was .62, suggesting that between-person differences accounted for the majority of the total variance (62%), but there was also substantial variability within-persons over time (38%). Figure 1 graphically illustrates the model-implied rate of average placement-related change in mastery (black line). Results in Table 3 show that the prototypical change in mastery was characterized by significant declines leading up to placement (γ_{10} = –0.66 T-units per year), followed by sizeable increases within one year of placement (γ_{20} = 1.92 T-units). Compared with prior to placement, changes in mastery differed post placement and caregivers, on average, experienced increases ($\gamma_{10} + \gamma_{30}$ = –0.66 + 1.11 = 0.45 T-units per year). Based on the model-implied parameters, we also calculated the cumulative distribution function of the model-implied normally distributed inter-individual differences for time-to-placement change and reaction to placement. Results revealed that 75% of caregivers were likely to experience some form or another of decline or erosion in mastery in the years preceding placement and 64% of caregivers were likely to experience some increase or boost in mastery with placement. The time-to-placement (linear rate of change), reaction, and post-placement change parameters conjointly accounted for 18% of the within-person variance in mastery.[1] Moreover, the reaction variance parameter was reliably different from zero (σ^2_{u2} = 28.09), indicating that there was heterogeneity in caregivers' reaction to placement.

Role Overload as a Proxy for Challenges Associated with Caregiving

In the next step, we included role overload into our model and examined whether corresponding changes in role overload mediated mastery changes. Results from Table 4 (Model 1) indicate that the inclusion of role overload altered the structure of our findings. Two findings are particularly noteworthy. First, the reaction parameter is no longer reliably different from zero (γ_{20} = 0.86, p > .05), suggesting that parallel changes (declines) in role overload with

placement mediated the significant boost in mastery. We corroborated this finding by using Preacher and colleagues (2010) multilevel mediation approach (e.g., 1-1-1 design). The parameter estimate for the indirect effect of placement (reaction) onto mastery changes through role overload was reliably different from zero (indirect effect = 0.72, SE = 0.25, $p < .05$). Second, the within-person role overload parameter was reliably different from zero and negative ($\gamma_{40} = -1.09$, $p < .05$), suggesting that on assessments when participants reported more role overload, they correspondingly reported lower mastery and vice versa. Figure 2 shows the time series of three individual caregivers to illustrate how changes in role overload (dotted line) and mastery (solid line) correspond with one another. Prior to placement, higher role overload was coupled with lower mastery for each caregiver; after placement, the picture was reversed with individuals experiencing lower levels of role overload and higher levels of mastery. Additionally, the main effect ($\gamma_{01} = -4.24$, $p < .05$) and moderation with reaction ($\gamma_{21} = 1.23$, $p < .05$) parameters for the between-person component of role overload were reliably different from zero. This between-person level finding suggests that people who report more role overload than their caregiver peers also reported lower mastery prior to placement and experienced larger placement-related increases in mastery than other caregivers. The inclusion of role overload accounted for an additional 7% of within-person variation in mastery above and beyond the time-to-placement (linear rate of change), reaction, and post-placement parameters.

The Moderating Role of Caregiver and Care Recipient Characteristics

In a final set of analyses, we included caregiver and care recipient characteristics into the model and examined whether these factors moderated reaction to placement. Results of this model are presented in Table 4 (Model 2). We first note that the within-person effect of role overload remains significant with the inclusion of the moderators, but the between-person component no longer moderates reaction to placement. Findings also revealed that caregivers who were younger and reported higher levels of emotional support, less family tension, less role

overload, and fewer depressive symptoms were each more likely to report higher mastery prior to placement. Most pertinent to our research question, our results show that caregivers reporting more depressive symptoms and ADL/IADL dependencies of the care recipient experienced larger increases in mastery within one year of placement. Socio-demographic factors, emotional support, family tension, and caregiver characteristics, including cognitive difficulties and problem behaviors did not moderate reaction to placement. The moderators accounted for a total of 38% and 26% of the variance in level and reaction parameters, respectively.

Discussion

Our objective in this study was to examine how global mastery perceptions as a key component of the caregiving stress process are shaped and influenced by placement of a care recipient in a nursing home or similar institution. Applying multi-phase growth curve models to longitudinal data of a sample of caregivers who experienced placement, we observed that changes in mastery with placement were characterized by a multi-phase pattern, that role overload mediated this change, and that caregiver and care recipient characteristics moderated reaction to placement. Prior to placement, caregivers typically experienced an erosion of mastery. On average, the transition of placement resulted in a significant boost (almost .20 *SD*) in mastery, followed by gradual increases thereafter. This finding is consistent with previous work demonstrating that placement of the care recipient provides caregivers release from cumulative chronic stress associated with caregiving (Gaugler et al., 2007; Mausbach et al., 2007a), thus allowing caregivers to feel more in control of their everyday life. This hypothesis was supported by the finding that reductions in role overload (i.e., the subjective evaluation of one's caregiving-related tasks and responsibilities) mediated the significant boost in mastery within one year of placement. Our findings extend previous research by providing support for conceptual models of stress and control, suggesting that mastery is a malleable construct that is shaped by the contexts people are confronted with and the experiences people make (Infurna et

al., 2011a; Pearlin, 2010; Skinner, 1995). Our approach provides impetus for future work examining how various domains of functioning change in relation to transitions in caregiving.

Global Sense of Mastery and Caregiving

We found that caregivers' global sense of mastery followed a multi-phase pattern when examined prospectively in relation to placement. First, caregivers typically experienced declines or an erosion of mastery prior to placement. Caregivers are frequently confronted with challenges such as preparing meals or constantly monitoring their loved one, which can constrain their ability to strive to attain goals, feel competent, and ascertain control over life circumstances (Mullan, 1992). Second, within one year of placement, caregivers typically reported significant increases in mastery. The experience of placing a care recipient in an institution or nursing home appears to operate as a relief, probably allowing individuals to once again concentrate on their own tasks and desired outcomes. Caregivers are no longer constrained by the daily challenges of caregiving for a loved one at home and are likely to have fewer external factors constraining their ability to exercise control. Lastly, post placement, caregivers experienced a shift in mastery that was characterized by gradual increases. Increases in mastery post placement may be due to caregivers no longer being the primary person providing direct care, resulting in continued feelings of competence and expected contingencies for one's own pursuits.

We note that our methodological approach applied to prospective longitudinal data was critical in identifying these patterns of change. Previous research focusing on mean-level differences comparing mastery pre- and immediately post-placement or using data from the post-placement period only found that mastery remained relatively stable (Gaugler et al., 2007; Skaff et al., 1996). By centering longitudinal trajectories of mastery along placement, we were able to observe significant patterns of decline and growth around a critical transition in caregiving. Empirical research suggests that mastery typically remains relatively stable across adulthood and shows minor declines in old age (Lachman et al., 2009; Mirowsky & Ross, 2007). Our results

(see also Footnote 1) qualify those reports by demonstrating that alignment along placement revealed a more efficient description of the data than chronological age or time in study, allowing insights into how mastery may systematically change along different stages in the caregiving process.

Role Overload as a Proxy for Challenges Associated with Caregiving

To examine whether the conditions and challenges associated with caregiving shaped and influenced change processes in mastery, we included role overload into our analyses as a time-varying predictor. The inclusion of role overload altered the structure of our findings; the reaction parameter was no longer significant, suggesting that corresponding changes in role overload accounted for changes in mastery within one year of placement. During caregiving, primary stressors that arise from taking care of someone with dementia (e.g., help with everyday activities or problematic behaviors) contribute to corresponding erosion of one's psychological resources. Placement changes the caregiving context from the overwhelming nature of daily demands and challenges associated with caregiving to a sense of relief characterized by fewer perceived external constraints. Caregivers are likely to experience an increasing awareness that future desired goals and outcomes will (once again) be dependent on one's own actions and choices, not so much on the care recipient as it has been in the past. Lastly, our results illustrate that mastery is malleable in that mastery develops out of certain kinds of experiences (e.g., life events and transitions) and is affected by contextual factors (e.g., primary stressors of caregiving; Pearlin, Nguyen, Schieman, & Milkie, 2007). The context (here, primary care-related stressors) shapes one's belief system, which in turn has consequences for well-being and health (Infurna et al., 2011b; Mausbach et al., 2007b; Wrosch et al., 2011). We observed in our natural experiment of tracking change before and after a major transition that the trajectory of mastery shifted to be more positive within one year of and in the years following placement (for discussion on various other contexts shaping control, see Heckhausen & Schulz, 1995; Skinner, 1995).

The Moderating Role of Caregiver and Care Recipient Characteristics

We also examined whether characteristics of the caregiver and care recipient moderated placement-related mastery changes. Caregivers who reported more emotional support and less family tension reported higher mastery prior to placement, which is in line with previous studies suggesting that one's social network and integration contributes to and enlarges one's ability to exercise control (Gerstorf et al., 2011; Infurna et al., 2011a; Krause, 1987). Caregivers reporting more depressive symptoms were more likely to report lower mastery, but experienced a larger increase in mastery with placement. Well-being constitutes an important source of mastery (Infurna et al., 2011a; McAvay et al., 1996) and depressive symptoms that may arise through daily challenges associated with caregiving may affect one's feelings of mastery and ability to attain desired outcomes. Finally, ADL/IADL dependencies were observed to be the only care recipient characteristics that revealed reliable associations with mastery. Caregivers who help with more everyday activities such as dressing have further restrictions on their feelings of mastery; placement is experienced as a larger relief compared to caregivers who do not have to deal with as many everyday hassles.

We also note that socio-demographic factors, cognitive difficulties, and problem behaviors of the care recipient did not moderate reaction to placement. Our findings are in contrast to previous research that has shown these resources to be critical in shaping caregivers' functioning across a variety of domains (Pearlin et al., 1990). It may be that when examined in the context of other resources such as social support and mental health, these factors do not play as large of a role as previously thought.

Caregiving Implications

Our findings bear implications for designing effective caregiving interventions, for example, by informing about the focus and timing of those interventions. First, we showed that caregivers' global sense of mastery may systematically change, depending on the level of

subjective stress they experience, the number of ADL/IADL dependencies, and the social resources available to them. This malleability suggests it may be useful to address mastery in services or interventions for caregivers. Would services such as Adult Day Care, which provide partial relief of role overload by giving caregivers predictable time away from care (Zarit et al., 1998) also reduce the erosion of mastery? Likewise, would family interventions that increase social support and reduce conflict (e.g., Mittelman, Roth, Haley, & Zarit, 2004) provide a buffer against decline in mastery? By focusing on the potential for intervention to have an effect on maintenance or enhancement of global sense of mastery, it may be possible to sustain the psychological resources and means for protection against mental and physical health declines due to caregiving strains. As a final note, we do not advocate that nursing home placement is the only strategy for addressing low levels of mastery in caregivers. Our findings can be a basis for future research centered on caregivers' adult day service utilization. More specifically, future studies can assess whether mastery fluctuates across days where adult day service is or is not utilized. Previous research has already shown that caregivers typically experience fewer exposures to stressors and stressor appraisals on days where adult day services were used (Zarit et al., 2011), and based on our findings we would expect that mastery would be higher on adult day service days.

Limitations and Outlook

We note several limitations of our study. First, care recipient characteristics were self-reports of the caregiver. Depending on the length of caregiving, caregivers may be sensitized to problem behaviors of their care recipient, leading to under-reporting the help they provide. Second, our sample is not nationally representative of caregivers, therefore limiting our ability to generalize our findings to the larger population of caregivers. However, our approach hopefully encourages researchers to re-align change in various constructs around transitions in caregiving in larger, more representative caregiving samples so as to further our understanding of these

processes. Lastly, our study only targeted caregiver reports as the outcome. It would be additionally insightful to assess how care recipients experienced the transition of placement and how much those experiences affect the persons who provided care earlier on.

In closing, our study highlights the importance of examining how caregivers' psychological resources change in relation to care recipient placement and how primary stressors associated with caregiving shape these processes. Our study adds to extant reports examining the important role that mastery plays in caregiving (Aneshensel et al., 1995; Gaugler et al., 2007; Harmell et al., 2011; Schulz et al., 2004) and provides insight into how this pivotal component of caregiving changes in relation to placement. We take our results to provide impetus for prospectively examining how key components of caregiving change in relation to transitions, as well as examining whether similar processes of changes in mastery and other key components, such as role overload may occur when care recipients receive interventions or use services such as adult day care (Zarit et al., 1998, 2011). Whether these transitions affect the subjective experience of stress and resources such as mastery may be more effectively examined within the larger trajectory of the caregiver's experiences.

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Footnotes

[1]We note that those 18% variance explained in within-person variation of mastery are larger than the <1% and 13% explained that follow-up analyses revealed for chronological age and time in study.

Table 2.1

Means, Standard Deviations, and Intercorrelations Among Caregiver and Care Recipient Characteristics

Moderators	*M*	*SD*	1	2	3	4	5	6	7	8	9	10
Caregiver characteristics												
1. Age (30–88)	63.29	13.12	--									
2. Gender (0=men)	0.70	0.46	–.31*	--								
3. Education (0–3)	1.80	1.02	–.08	–.09	--							
4. Years of caregiving (1.25–12.5)	4.66	2.34	.01	–.10	.13*	--						
5. Emotional support (2–4)	3.30	0.47	–.12*	.06	.04	–.11	--					
6. Family tension (1–4)	1.86	0.71	–.33*	.15*	.03	–.03	–.09	--				
7. Depressive symptoms (1–4)	1.89	0.71	–.06	.24*	–.18*	–.14*	–.18*	.30*	--			
Care recipient characteristics												
8. Cognitive difficulties (0–4)	2.47	0.78	.07	–.08	.06	.20*	.04	–.10	–.09	--		
9. ADL/IADL dependencies (1–4)	2.67	0.74	.22*	–.11	–.18*	–.07	–.08	–.02	.08	.33*	--	
10. Problem behaviors (1 – 3.64)	2.01	0.61	–.03	.17*	–.10	–.14*	–.07	.12	.28*	–.13*	.29*	--

Note. N = 271. Education was divided into four categories: 0 = less than high school (n = 33), 1 = high school graduate/vocational training (n = 74), 2 = some college (n = 78), 3 = college degree and more (n = 86). Years of caregiving refers to caregiving years at the assessment period immediately prior to placement. ADL/IADL = activities of daily living/instrumental activities of daily living.

* $p < .05$.

Table 2

Descriptive Statistics for Global Sense of Mastery and Role Overload Over time-to/from-Placement of Care Recipient

	Global Sense of Mastery			Role Overload		
Time to/from Placement (years)	*n*	*M*	*SD*	*n*	*M*	*SD*
–5	9	52.15	7.45	9	2.33	0.80
–4	35	50.55	9.20	35	2.44	1.01
–3	80	49.52	8.27	80	2.41	0.94
–2	142	49.06	9.88	143	2.62	0.92
–1	271	49.46	9.99	272	2.69	0.93
0	269	50.36	9.55	272	2.06	0.86
1	245	50.29	9.68	247	2.01	0.84
2	209	51.27	9.40	210	1.99	0.81
3	159	52.56	9.62	160	2.02	0.85
4	104	53.15	9.63	105	2.07	0.78

Note. N = 271. Scores for Global Sense of Mastery were standardized to a T metric (M = 50, SD = 10) using the baseline (N = 555) sample. Number of Observations: Global Sense of Mastery = 1,523, Role Overload: = 1,533.

Table 3

Fixed and Random Effects for Global Sense of Mastery to/from Placement of Care Recipient

	Mastery	
	Estimate	SE
Fixed effects		
Intercept, γ_{00}	48.42*	0.79
Time-to-placement, γ_{10}	–0.66*	0.29
Reaction, γ_{20}	1.92*	0.72
After placement change, γ_{30}	1.11*	0.31
Random effects		
Variance intercept, σ^2_{u0}	70.55*	9.25
Variance time-to-placement, σ^2_{u1}	0.93*	0.47
Variance reaction, σ^2_{u2}	28.09*	8.57
Covariance, σ_{u0u1}	1.98	1.98
Covariance, σ_{u0u2}	–18.01*	7.40
Covariance, σ_{u1u2}	–2.90	1.73
Residual, σ^2_{e1}	28.85*	1.50
Pseudo R^2 for inclusion of time-to-placement, reaction, and after placement change parameters	.182	
–2 LL	10,319	

Note. N = 271. Number of Observations = 1,523. Pseudo R^2 refers to reduction in residual variance from random intercept only model (35.28 – 28.85/35.28).

* $p < .05$

Table 4

Fixed and Random Effects for Global Sense of Mastery to/from Placement of Care Recipient: The Effect of Role Overload and Moderators.

	Model 1		Model 2	
	Estimate	SE	Estimate	SE
Fixed effects				
Intercept, γ_{00}	49.20*	0.77	49.72*	1.02
Caregiver Characteristics				
Role overload of caregiver, γ_{01}	–4.24*	0.76	–1.88*	0.73
Age of caregiver, γ_{02}			–0.17*	0.04
Gender of caregiver, γ_{03}			–0.84	1.05
Education of caregiver, γ_{04}			0.70	0.45
Years of caregiving, γ_{05}			–0.19	0.20
Emotional support, γ_{06}			3.50*	0.98
Family tension, γ_{07}			–1.27	0.73
Depressive symptoms, γ_{08}			–4.65*	0.72
Care Recipient Characteristics				
Cognitive difficulties of care recipient, γ_{09}			0.85	0.62
ADL/IADL dependencies of care recipient, γ_{110}			–0.92	0.69
Problem behaviors of care recipient, γ_{111}			0.34	0.81
Time-to-placement, γ_{10}	–0.56*	0.28	–0.54	0.29
Reaction, γ_{20}	0.86	0.74	0.09	0.95
Caregiver Characteristics				
Role overload of caregiver, γ_{21}	1.23*	0.63	-0.08	0.67
Age of Caregiver, γ_{22}			-0.01	0.03
Gender of caregiver, γ_{23}			1.41	0.91
Education of caregiver, γ_{24}			0.12	0.39
Years of caregiving, γ_{25}			0.13	0.17
Emotional support, γ_{26}			-1.27	0.85
Family tension, γ_{27}			-0.39	0.63
Depressive symptoms, γ_{28}			1.60*	0.62
Care Recipient Characteristics				

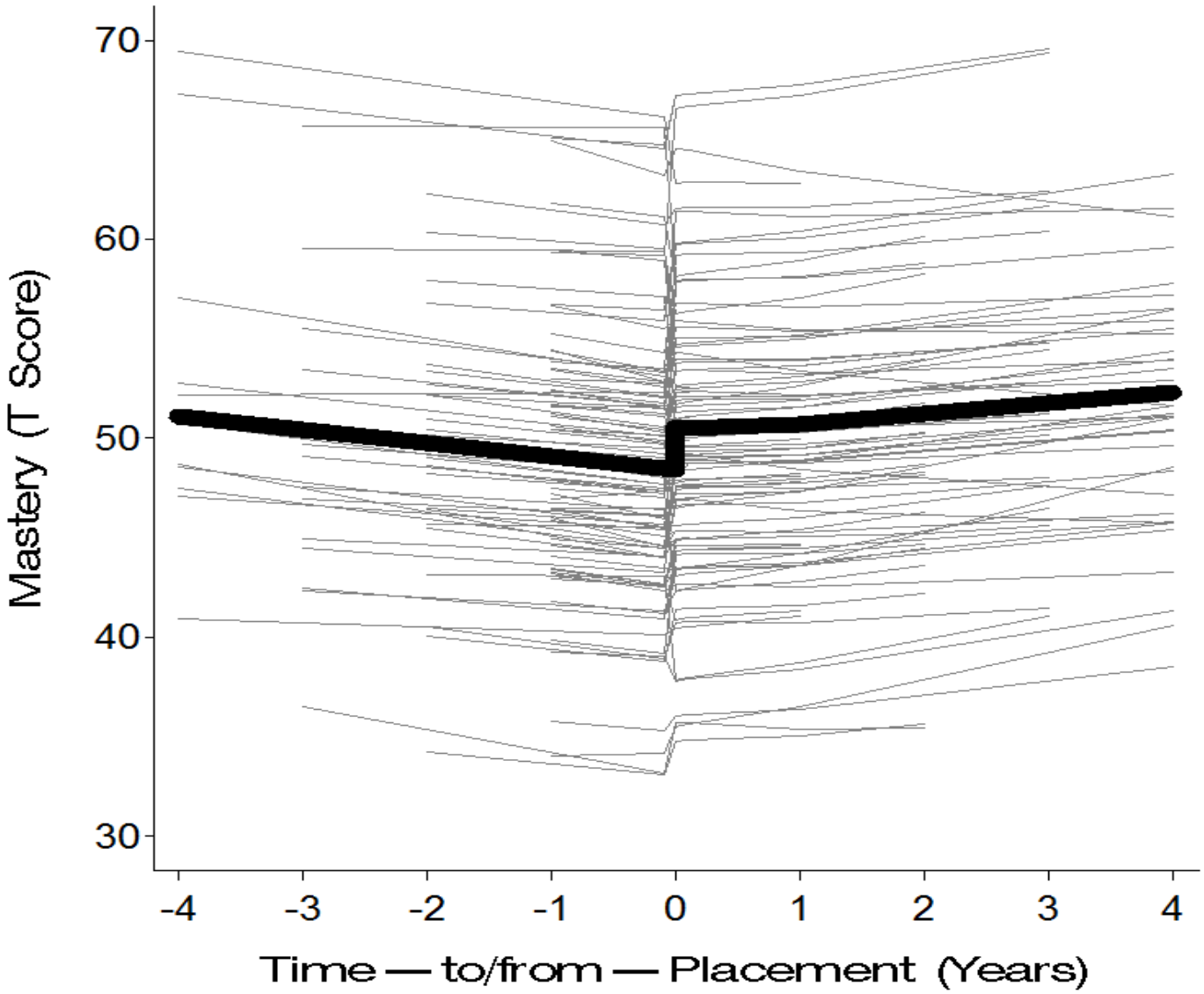
Cognitive difficulties of care recipient, γ_{29}			-0.32	0.54
ADL/IADL dependencies of care recipient, γ_{210}			1.51*	0.60
Problem behaviors of care recipient, γ_{211}			1.12	0.71
After placement change, γ_{30}	1.02*	0.31	1.11*	0.35
Within-person change in role overload, γ_{40}	-1.09*	0.32	-0.81*	0.32
Within-person role overload x between-person role overload, γ_{41}	-0.23	0.55	-0.38	0.54
Random effects				
Variance intercept, σ^2_{u0}	60.32*	8.60	37.28*	6.59
Proportion of variance intercept attributable to caregiver and care recipient characteristics			37.90%	
Variance time-to-placement, σ^2_{u1}	0.97*	0.47	1.06*	0.47
Variance reaction, σ^2_{u2}	26.71*	9.30	19.46*	8.66
Proportion of variance reaction attributable to caregiver and care recipient characteristics			26.00%	
Variance within-person role overload, σ^2_{u3}	5.75*	1.80	5.41*	1.73
Covariance, σ_{u0u1}	2.18	1.64	1.97	1.45
Covariance, σ_{u0u2}	–13.50	7.46	–5.48	6.37
Covariance, σ_{u0u3}	–2.07	2.87	–2.87	2.51
Covariance, σ_{u1u2}	–3.33	1.79	–3.07	1.73
Covariance, σ_{u1u3}	–0.75	0.66	–0.75	0.65
Covariance, σ_{u2u3}	4.72	2.91	4.13	2.80
Residual, σ^2_{e1}	26.72*	1.46	26.71*	1.45
Pseudo R^2 due to inclusion of role overload	.074			
Goodness-of-fit				
–2 LL	10,249		10,130	

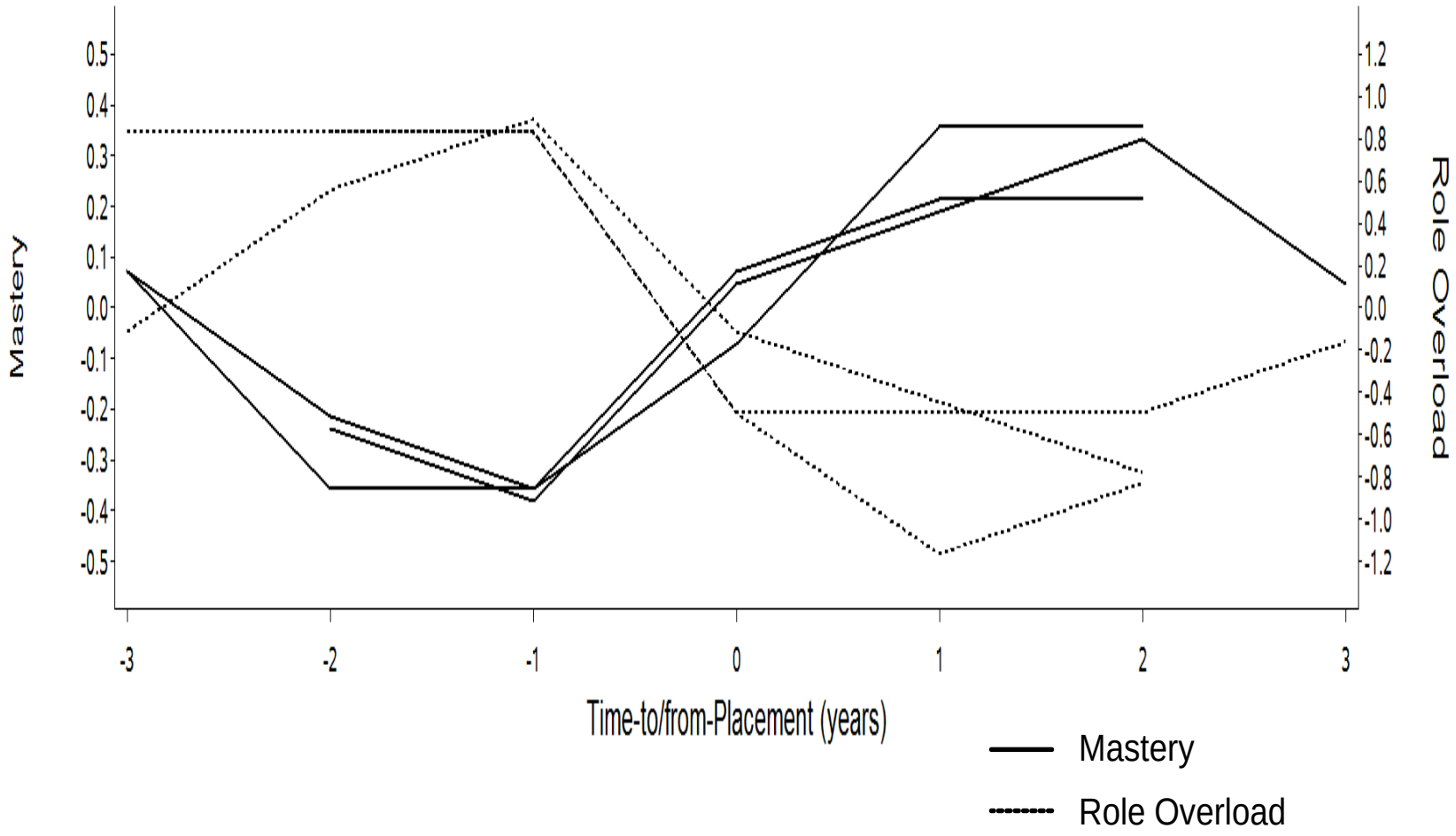
Note. N = 271. Number of Observations = 1,523. Pseudo R^2 indicates the amount of within-person variation in global sense of mastery that role overload accounted for (28.85 – 26.72/ 28.85). Model 1 = Adding role overload to the within-person model at Level 1. Model 2 = Adding a total of 10 individual difference characteristics to the between-person model at Level 2. ADL/IADL = activities of daily living/instrumental activities of daily living.
*p < .05.

Figure Caption

Figure 1. Model-implied mean longitudinal change trajectories for mastery in relation to placement of care recipient. Mastery eroded prior to placement, but the transition of placement significantly altered the caregiver's trajectory of change with a significant increase in mastery within one year of placement, followed by a gradual increase. For clarity, predicted scores are shown for a subsample of 150 participants.

Figure 2. Graphical illustration of how changes in role overload and global sense of mastery correspond with one another in relation to placement. The time series of three participants are shown to exemplify how changes in role overload and mastery corresponded with one another. For all three participants, declines in role overload (dotted black line) with placement were accompanied by increases in mastery (solid black line). Prior to placement, higher role overload was coupled with lower mastery and post placement the picture was reversed with individuals experiencing lower levels of role overload and higher levels of mastery.


70
60
50
40
30
Mastery (T Score)
-4
-3
-2
-1
0
1
2
3
4
Time — to/from — Placement (Years)


Mastery
0.5
0.4
0.3
0.2
0.1
0.0
-0.1
-0.2
-0.3
-0.4
-0.5
Role Overload
1.2
1.0
0.8
0.6
0.4
0.2
0.0
-0.2
-0.4
-0.6
-0.8
-1.0
-1.2
-3
-2
-1
0
1
2
3
Time-to/from-Placement (years)
Mastery
Role Overload

CHAPTER III

DISSERTATION PAPER 2

Perceived Control Relates to Better Functional Health and Lower Cardio-Metabolic Risk:

The Mediating Role of Physical Activity

Abstract

Objective: The objective of the current study was to examine empirically associations between perceived control and indicators of functional health (grip strength) and cardio-metabolic risk (hemoglobin A_{1C}, High Density Lipoprotein Cholesterol [HDL–C], Systolic Blood Pressure [SBP], Pulse Rate [PR], and Waist Circumference [WC]) and to explore the mediating role of physical activity. **Methods:** Using cross-sectional data from the nation-wide Health and Retirement Study (*N* = 4,292; Mean age = 67, range 50 – 97; 59% women), we examined whether perceived control was predictive of the various health indicators over and above socio-demographic characteristics. We also tested whether those direct associations were mediated by physical activity. **Results:** Findings indicated that perceiving more control related to better grip strength and lower cardio-metabolic risk (lower hemoglobin A_{1C}, higher HDL–C, lower PR, and lower WC). We also found that physical activity mediated five of the six control–health associations. **Discussion:** Our results suggest that control may serve as a facilitator of positive health outcomes, including functional health, cardio-metabolic risk, and physical activity. Findings provide impetus for future research to elucidate mechanisms underlying the health implications of perceived control.

Key words: Perceived Control; Physical Activity; Biomarkers; Health and Retirement Study; Adulthood and Old Age

Perceived Control Relates to Better Functional Health and Lower Cardio-Metabolic Risk: The Mediating Role of Physical Activity

Perceived control plays an important role in shaping physical health across adulthood and old age (Baltes & Baltes, 1986; Bandura, 1997; Lachman, 2006; Rodin, 1986). Empirical research suggests that perceiving more control is protective against declines in physical functioning (Caplan & Schooler, 2003; Lachman & Agrigoroaei, 2010; Seeman et al., 1999), cardiovascular disease incidence (Rosengren et al., 2004; Stürmer et al., 2006), and mortality (Infurna et al., 2011a; Penninx et al., 1997; Surtees et al., 2006, 2010). However, much less is known regarding the functional and physiological health indicators that underlie such associations and the behavioral factors that may play a mediating role in this context (Lachman, 2006; Rodin, 1986; Uchino, 2006). In the present report, we use cross-sectional data from the Health and Retirement Study (HRS) to examine how control links to several markers of functional and physiological health, including grip strength and measures of cardio-metabolic risk (hemoglobin A_{1C}; High Density Lipoprotein–Cholesterol, HDL–C; systolic blood pressure, SBP; pulse rate, PR; and waist circumference, WC). Additionally, we explore the role of physical activity in mediating these associations.

Health Implications of Perceived Control

Because of the health demographics in the United States, the identification of risk and protective factors that contribute to key health outcomes of disability and disease in adulthood and old age has become a major theme of scientific inquiry (Miller et al., 2009; Rozanski et al., 2005). For example, Seeman and colleagues (2010) reported that over 15% of older adults aged 60 and older are typically suffering from at least one limitation in performing everyday activities of daily living. Similarly, cardiovascular disease is the leading cause of death in the United States, accounting for over 600,000 deaths in 2007 (Xu et al., 2010), and although its incidence rate has remained relatively stable, disease incidences of metabolic syndrome (e.g., diabetes) have increased in recent years (Crimmins & Beltrán-Sánchez, 2010; Grundy et al., 2005). Those

statistics highlight the importance of identifying risk and protective factors for health outcomes so as to eventually help promote better health in adulthood and old age and mitigate accrued societal burdens arising from impaired health of large population segments (Olshansky et al., 2009; Rae et al., 2010).

Perceived control can be construed as representing one key protective factor with major health implications. Perceptions of control refer to beliefs about one's capability to exert influence over and shape one's life circumstances (Pearlin & Schooler, 1978; Skinner, 1996). Both conceptual work and empirical reports suggest that individuals who report higher levels of control tend to view their health as controllable, making it more likely for them to engage in healthy behaviors and adequately manage their health (Bandura, 2004; Lachman et al., 1997). As a consequence, perceiving greater control has been linked to lower risk of declines in physical functioning, cardiovascular disease incidence, and mortality (Caplan & Schooler, 2003; Gerstorf et al., 2011; Infurna et al., 2011a, 2011b; Rosengren et al., 2004; Surtees et al., 2006, 2010). Underlying the health salutary effects of perceived control are presumably functional and physiological factors (Lachman, 2006; Rodin, 1986; Uchino, 2006). In particular, several studies reported that control relates to better functional health, neuroendocrine functioning, and cardio-metabolic health (Bollini et al., 2004; Brach et al., 2003; Roepke & Grant, 2011; Surgenor et al., 2000). Such associations between control and various indicators of functional and physiological health may be carried by behavioral factors. For example, individuals who perceive more control can be expected to adopt and maintain health-promoting behaviors including exercise, preventive care, and proper diet, which in the long run help sustaining good health (McAuley, 1993; White et al., in press).

Perceived Control and Indicators of Functional Health and Cardio-Metabolic Risk

Our goal in this study is to target functional and physiological indicators that may underlie the reported control-health associations. We are particularly interested in whether perceived control is associated with indicators of functional health and cardio-metabolic risk because each

of these factors is linked to health outcomes of disability, disease incidence, and mortality. Additionally, conceptual models of control delineate that control is linked to behavioral resources that subsequently influence these processes (Lachman, 2006; Uchino, 2006). To begin with, functional health represents one's state of general muscle strength, subclinical disease, and general vitality that results in good functional ability (Anstey et al., 2001; Rantanen et al., 1999). Limitations in functional health or grip strength represent often-used proxies for the presence of chronic disease, lack of resistance to external stressors, and cumulative biological burdens that are established markers of disability, disease incidence, and mortality (McEwen, 1998; Rantanen et al., 2003). Studies across the lifespan have linked perceptions of control to functional health indices. For example, participants in childhood and young adulthood who reported higher levels of control were more likely to exhibit better functional health, as indexed by forced expiratory volume and functional status (Gale et al., 2008; Griffin & Chen, 2006). In adulthood and old age, perceiving control may facilitate and motivate participating in leisure and restorative activities, which in turn promote muscle strength and functional abilities (Pressman et al., 2009; Rozanski et al., 2005).

Cardio-metabolic risk is a constellation of interrelated risk factors of metabolic origin that promote the development of cardiovascular disease and type 2 diabetes mellitus (Grundy et al., 2005). Poor management of one's cardio-metabolic health can contribute to atherogenesis, protein glycation of vessel walls, and induce release of inflammatory cytokines that are linked to increased risk for cardiovascular disease incidence, metabolic syndrome, and mortality (Barter & Rye, 1996; Després et al., 2008; Khaw & Wareham, 2006). Links between perceived control and cardio-metabolic risk have been reported from population studies using different age groups as well as high-risk groups such as caregivers and people with chronic illnesses. For example, in children with diabetes and in adult samples, perceived control was linked to lower hemoglobin A_{1C}, higher HDL–C, and lower waist circumference (Nabors et al., 2010; Paquet et al., 2010; Tsenkova et al., 2008). For caregivers and people with metabolic diseases and diabetes,

perceiving more control serves as a psychological resource that protects against increasing cardio-metabolic risk (Roepke & Grant, 2011; Surgenor et al., 2000). In sum, there is reason to believe that functional health and cardio-metabolic risk underlie the well-documented associations between perceived control and disease incidence/mortality and that behavioral (physical activity) pathways may provide the means for control to facilitate better functional health and lower cardio-metabolic risk. We aim to extend previous research by pinpointing the functional and physiological processes that may underlie control-health associations. To do so, we conjointly examine associations between control and multiple indicators of functional health and cardio-metabolic risk.

The Mediating Role of Physical Activity

In a first step, we substantiate control–health associations by targeting functional health and cardio-metabolic risk. However, the factors underlying such associations are not well understood. Physical activity can be assumed to play a key role in linking perceptions of control to indicators of functional health and cardio-metabolic risk. Physical activity refers to one's involvement with and engagement in vigorous (e.g., running or gym workout), moderate (e.g., gardening or walking) and mild (e.g., vacuuming) activities (Levine et al., 1999; McAuley, 1993). Perceived control is often instrumental in facilitating and regulating physical activity and strenuous exercise, which are in turn linked to better functional health and lower cardio-metabolic risk (Arsenault et al., 2010; Lakka et al., 2003). As a functional health implication, physical activity is known to increase muscle strength (Brach et al., 2003). Also, partaking in strenuous exercise and physical activity promotes vitality and vigor that helps maintain functional abilities (Pressman et al., 2009; Rozanski et al., 2005). As cardio-metabolic implications, engaging in physical activities often suppresses endogenous glucose production and promotes antioxidant functions (Selvin et al., 2010). In a similar vein, exercise helps lowering cardio-metabolic risk by reducing adipose tissue and body mass or fat, as well as increasing HDL–C production and reverse cholesterol transport (Penedo & Dahn, 2005;

Stefanick et al., 1998). Taken together, empirical evidence suggests that perceived control facilitates positive health through fostering and motivating physical activity.

The Present Study

In sum, recent empirical research shows that the health implications of perceived control range from being protective against disability and declines in physical functioning to having a decreased risk of cardiovascular disease incidence and mortality. Our goal in this study is to elucidate how control relates to several indicators that in the long-run may contribute to the predictive effects of control for major health outcomes such as mortality. Previous research testing the functional and physiological indicators that underlie these associations has largely been done focusing on single, primarily stress-related indicators in experimental settings and convenience samples. In the present report, we aim to extend previous research by targeting many indicators conjointly in one study. We utilize data from the nation-wide HRS that consists of individuals in late adulthood and old age (ages 50+) and first examine whether perceived control is associated with functional health (grip strength) and cardio-metabolic risk (hemoglobin A_{1C}, HDL–C, SBP, PR, and WC), net of the effects of socio-demographic characteristics. We note that utilizing data from the nation-wide HRS allows for our findings to be generalized to the larger adult population in the US. Based on previous findings, we expect that higher levels of perceived control are linked to better functional health and lower cardio-metabolic risk. Second, our mediation analyses evaluate the role of physical activity in explaining why more perceived control may be related to better functional health and lower cardio-metabolic risk (MacKinnon & Luecken, 2008). We expect that much of the health salutary effects of perceived control for the targeted functional and physiological indicators is mediated by physical activity.

Method

Participants and Procedure

The HRS is a nationally representative probability sample of households in the contiguous United States of non-institutionalized adults aged 50 years and older that now has in

total surveyed more than 30,000 individuals (McArdle et al., 2007; Soldo et al., 1997). The measures assessed cover a wide range of economic, sociological, psychological, mental, and physical health information. In 2006, approximately 50% of the longitudinal HRS sample completed an enhanced face-to-face interview. Selected respondents received a self-report questionnaire and were asked to complete and mail (for details, see Clarke et al., 2008), and were also given the opportunity to contribute biomarker and physical health marker measurements (for details, see Crimmins et al., 2008, 2009). The HRS was conducted under Institutional Review Board approval by the relevant committees at the University of Michigan and the National Institute on Aging, the primary sponsor of HRS.

In the present study, we utilize data from 4,292 participants who (a) participated in the 2006 enhanced face-to-face interview, (b) were aged 50 years and older at the time of assessment (so as to reduce menopausal effects on blood measurements among women: 144 participants below age 50 were excluded, 118 or 82% were women), and (c) provided data on all of our measures of interest. Table 1 shows descriptive statistics for our sample and the measures of interest in the present study. Participants were, on average, 68 years of age (*SD* = 9.74), attained 13 years of education (*SD* = 3.03), 59% were women, 86% were white, and 70% were married or partnered. Relative to those participants who participated in the enhanced face-to-face interview, but were not included in our analyses because of missing data (*n* = 4,303), our subsample did not differ in age (*M* = 67.56, *SD* = 9.74 vs. *M* = 67.36, *SD* = 11.82; *F* [1, 8,595] = 0.71, $p > .05$), gender (59% vs. 58%; χ^2 [1, 8,595] = 2.36, $p > .05$), grip strength (*M* = 30.92, *SD* = 10.86 vs. *M* = 30.93, *SD* = 11.43; *F* [1, 7,403] = 0.00, $p > .05$), HDL–C (*M* = 57.23, *SD* = 14.32 vs. *M* = 57.27, *SD* = 16.62; *F* [1, 5,039] = 0.00, $p > .05$), and pulse (*M* = 70.40, *SD* = 11.20 vs. *M* = 70.93, *SD* = 11.79; *F* [1, 7,358] = 3.79, $p > .05$), but attained slightly more years of education (*M* = 12.73, *SD* = 3.03 vs. *M* = 12.28, *SD* = 3.32; *F* [1, 8,582] = 42.05, $p < .05$), were more likely to be white (86% vs. 79%; χ^2 [1, 8,591] = 73.68, $p < .05$), married or partnered (70% vs. 66%; χ^2 [1, 8,595] = 16.49, $p < .05$), reported more perceived control (*M* = 4.79, *SD* = 0.95 vs. *M* = 4.70, *SD* = 1.00; *F* [1,

7,622] = 15.50, $p < .05$), were more physically active (M = 2.95, SD = 0.89 vs. M = 2.73, SD = 0.98; F [1, 8,594] = 113.04, $p < .05$), had lower hemoglobin A_{1c} (M = 5.82, SD = 0.82 vs. M = 5.88, SD = 0.94; F [1, 6,505] = 8.68, $p < .05$), higher SBP (M = 131.91, SD = 20.39 vs. M = 130.83, SD = 21.20; F [1, 7,359] = 4.94, $p < .05$), and higher WC (M = 39.79, SD = 6.03 vs. M = 39.41, SD = 6.07; F [1, 7,355] = 6.94, $p < .05$). Although there are differences in education, race, marital status, perceived control, physical activity, hemoglobin A_{1c}, SBP, and WC, the relatively small differences in substantive terms ($\eta^2 < .01$ for all comparisons) suggest that the study sample is comparable to the study population from which they were drawn.

Measures

Outcomes. The target outcome variables were six indicators that represent functional health and cardio-metabolic risk (see Table 1). *Grip strength* was measured using a Smedley spring-type hand dynamometer (Anstey et al., 2001; Crimmins et al., 2008). The dynamometer was fit to the participant's hand, and the person was instructed to stand and squeeze the meter as hard as they were able to for a couple of seconds and then let go. Participants completed two measurements with each hand, alternating hands, while standing or if a participant was unable to stand, the measurement was completed with the participant seated. The participants' maximum score out of their total measurement trials was selected (M = 30.92 kilograms [kg], SD = 10.86).

Blood acquisition and determination was performed using instructions and kits from Biosafe Laboratories, Chicago, IL (for details, see Crimmins et al., 2009). Blood was taken by pricking the participant's finger with a sterile lancet after cleansing the finger with an alcohol swab and analyzed for concentrations of *hemoglobin* A_{1c} and *HDL–C*. Droplets of blood were directly placed on specially treated filter paper, within circles printed on the paper. The blood spots on filter paper were then placed in special foil envelopes with a desiccant packet and then within mailing containers, and shipped to Biosafe Labs. Repeated measures within a specific laboratory run showed a coefficient of variation of less than 3.5% for HDL–C and less than 7% between runs (Crimmins et al., 2009). During quality control studies, the correlation between finger prick

and serum levels was 0.949 for HDL–C. Hemoglobin A_{1c} is a summary measure of blood glucose metabolism that covers the last 120 days.

Participants' *systolic blood pressure* and *pulse rate* were measured using an Omron HEM-780 Intellisense Automated blood pressure monitor with ComFit cuff (see Crimmins et al., 2008). Respondents were instructed to sit down with both feet on the floor and their left arm comfortably support with the palm facing up. The cuff was adjusted to the respondent's arm ensuring that it made direct contact with the skin; the bottom of the cuff was approximately half an inch above the elbow and the air tube ran down the middle of the respondent's arm. Three measurements were taken, 45 seconds apart, on the respondent's left arm. We used the average of three measurements for SBP (M = 131.91 mmHg, SD = 20.39) and PR (M = 70.40 beats per minute, SD = 11.20).

Waist circumference was measured at the level of the respondents naval with a tape measure. Respondents were asked to stand up and remove any bulky clothing and then the interviewer placed the tape measure around the waist at the level of their navel. The respondent was instructed to inhale and slowly exhale, and waist circumference was measured while holding the exhale (M = 39.79 inches, SD = 6.03; see Crimmins et al., 2008).

Perceived control. We used a unit-weighted composite of 10 items that assessed one's feelings of control over life circumstances to index perceived control (see Clarke et al., 2008; Pearlin & Schooler, 1978). Participants were asked to indicate the extent to which they agree with each of the items, using a 6-point scale (1 = *strongly disagree* to 6 = *strongly agree*; e.g., "*I can do just about anything I really set my mind to*"). Negatively valenced items were reverse coded, so that higher scores reflected perceiving more control (M = 4.79, SD = 0.95; α = .87).

Physical activity. *Physical activity* was measured using a unit-weight composite of 3 items assessing how often participants partake in vigorous activity (e.g., jogging, swimming, or gym workout), moderate activity (e.g., gardening or walking at a moderate pace), and mild activity (e.g., vacuuming or laundry). Participants rated each item using a 5-point scale (1 =

every day to 5 = *hardly ever or never*). The items were reverse coded and averaged, with higher scores indicating more physical activity (M = 2.95, SD = 0.89; α = .54). Substantively similar findings were observed when we first weighted the three items (vigorous activity .9, moderate activity .5 and light activity .3) and then averaged them (see Levine et al., 1999; McAuley, 1993).

Statistical Analyses

To test our research questions, two regression models were estimated. In a first step, each physiological indicator was regressed onto perceived control and socio-demographics (age, gender, and education). In a second step, we tested a mediation model where physical activity was regressed onto perceived control and each indicator was regressed onto physical activity. A non-parametric re-sampling or bootstrapping procedure was applied using *Mplus* (Muthén & Muthén, 1998-2007) to test whether the indirect effect of perceived control through the hypothesized mediator (physical activity) and whether the targeted indicator were reliably different from zero. To acknowledge the possible skew of the distribution of the indirect effect, our models did not impose normality assumptions (see Preacher & Hayes, 2008).

Results

Perceived Control and Indicators of Functional Health and Cardio-Metabolic Risk

Table 2 shows results from our regression models examining whether perceived control is associated with each physiological indicator. Results from Model 1 suggest that, independent of socio-demographics, perceived control was predictive of each indicator. More perceived control was associated with stronger grip strength, lower hemoglobin A_{1C}, higher HDL–C, higher SBP, lower PR, and lower WC. Each one unit increase in perceived control is associated with a 0.95 kg increase in grip strength, 0.04% reduction in hemoglobin A_{1C} levels, 0.92 mg/dL increase in HDL–C levels, 1.05 mmHg increase in SBP, 0.62 decrease in PR, and 0.24 reduction in WC. Figure 1 illustrates that participants who reported higher levels of perceived control were, on average, more likely to exhibit stronger grip strength and higher HDL–C.

The Mediating Role of Physical Activity

In our second model, we included physical activity as a mediator to examine whether physical activity mediates associations between perceived control and each indicator. To begin with, we observed that perceiving more control was linked to participating in more frequent physical activity. Also, reporting more physical activity was associated with better grip strength, lower hemoglobin A_{1C}, higher HDL–C, lower PR, and lower WC. Most importantly for our research question, we found that for grip strength, HDL–C, SBP, and PR the direct effect of perceived control was reduced, but remained reliably different from zero, whereas for hemoglobin A_{1C} and WC the inclusion of physical activity attenuated the direct effect of control to the null. The non-parametric bootstrapping technique allowed us to quantify whether the indirect effect of control through physical activity was reliably different from zero for each outcome. Analyses revealed that physical activity reliably mediated the relationship between perceived control and grip strength, hemoglobin A_{1C}, HDL–C, PR, and WC, but not SBP (indirect effect). Our results suggest that the direct effect of perceived control onto functional health and cardio-metabolic risk is (partly) attributable to physical activity. Following procedures outlined by Preacher and Kelley (in press), we quantified the observed effect size for the indirect effect of perceived control through physical activity, which was .01, .03, .01, .01, and .03 for grip strength, hemoglobin A_{1C}, HDL–C, PR, and WC, respectively. The effect size metric discussed by Preacher and Kelley (in press) follows the same distribution as Cohen's *d* (.01 = small, .05 = medium, .21 = large). The observed effects are in the small range of effect sizes.

Discussion

Our objective was to examine whether and how perceived control relates to a variety of different physiological indicators and to explore the mediating role of physical activity for such links. In a first step, we found that, independent of socio-demographics, perceived control was linked to prime indicators of functional health (better grip strength) and cardio-metabolic risk (lower hemoglobin A_{1C}, higher HDL–C, higher SBP, lower PR, and lower WC). In a second

step, we further elucidated this association by conducting mediation analyses targeting the role of physical activity. These analyses revealed that physical activity mediated associations of perceived control with grip strength, hemoglobin A_{1C}, HDL–C, PR, and WC, but not SBP. Our results suggest that the effect of perceived control onto functional health and cardio-metabolic risk was (partly) attributable to physical activity. Our discussion focuses on the health implications of perceived control and how control facilitates positive health outcomes through behavioral (physical activity) and physiological functioning. We also highlight the need for future research to pinpoint the specific mechanisms that underlie control-health associations.

Perceived Control and Indicators of Functional Health and Cardio-Metabolic Risk

Our study is among the first to demonstrate empirically in a conjoint manner that perceived control is indeed associated with key markers of functional health and cardio-metabolic risk. In line with Roepke and Grant's (2011) review, our findings strengthen notions that perceived control facilitates positive health through systems or processes that represent functional health and cardio-metabolic health. Our findings obtained from a nation-wide sample of older adults are similar to and extend previous research on earlier phases of the lifespan, on caregivers, patient populations, and convenience samples that found control was associated with better functional health and protective against cardio-metabolic risk (Gale et al., 2008; Nabors et al., 2010; Roepke et al., 2011; Surgenor et al., 2000). In our view, the effect size of such associations is not negligible, but striking. For example, results from Model 1 in Table 2 indicate that a 1 *SD* increase in control is associated with 2.5 *fewer* years of aging on grip strength, 10 *fewer* years of aging for hemoglobin A_{1C}, 14.5 *fewer* years of aging for HDL–C, 3.7 *fewer* years of aging for pulse rate, and 5.75 *fewer* years of aging for waist circumference. In a similar vein, Snih et al. (2002) reported that a 1 kg increase in grip strength reduces the risk of mortality by 3%. In our study, a one-unit increase in perceived control on a scale from 1 to 6 was associated with a 0.95 kg increase in grip strength. Following those numbers, this increase in perceived control translates via grip strength into a reduction of mortality risk by almost 3%. We also note

that our findings extend the previous literature through utilization of the nation-wide HRS that permits for our results to be generalized to the larger adult population in the US. Additionally, we did not solely focus on one indicator, but in the case of cardio-metabolic risk included a total of five key factors to index this multidimensional physiological component.

Our findings complement studies done in experimental settings and panel surveys focusing on immune and endocrine systems. Specifically, we corroborate laboratory- or experimentally-based findings linking facets of control to markers of stress (Bollini et al., 2004) using a nation-wide sample. In a similar vein, earlier studies have primarily linked aspects of well-being or certain coping strategies to various interrelated physiological systems or processes (Friedman et al., 2007; Steptoe et al., 2005). With perceived control, we have linked yet another psychosocial indicator to pivotal markers of functional health and cardio-metabolic risk. Of note is that those psychosocial indicators are often modifiable. For example, community health and intervention programs with a joint focus on modifying perceptions of control, acquiring new skills and behaviors, and setting realistic expectations are shown to be effective for improving health profiles (Lachman et al., 1997).

The Mediating Role of Physical Activity

Our second set of analyses revealed that the above associations between perceived control and functional and physiological indicators were largely mediated through physical activity. Perceived control appears to operate by mobilizing individuals to be more physically active, perform strenuous exercise, and be involved with leisure activities, subsequently resulting in better or maintained functional health and lower cardio-metabolic risk (Lachman, 2006; Rodin, 1986). Perceptions of control provide individuals with motivations and means to engage in more health salutary behaviors, as well as with attitudes and beliefs of contingency that behaviors will lead to desired outcomes (Bandura, 2004; Lachman et al., 1997). Similar to above, from our mediation analyses (Model 2 in Table 2), we can quantify the indirect effect of physical activity. For example, every 1 *SD* increase in control is accounted for indirectly through physical

activity for .59 *fewer* years of aging on grip strength, 9.5 *fewer* years of aging for hemoglobin A_{1C}, 8.8 *fewer* years of aging for HDL–C, .81 *fewer* years of aging for pulse rate, and 5.6 *fewer* years of aging for waist circumference. As delineated in the seminal work by Bandura (1997), health and other central outcomes are predicated by social-cognitive and behavior processes. For example, if one acknowledges that physical activity will most likely lead to a positive health profile (outcome expectations), but one does not believe to be personally capable of engaging in such behaviors (efficacy expectations), his or her efforts for a healthy profile would not be fruitful. Additionally, if people believe that their health is largely fixed rather than dynamic and modifiable, they are unlikely to have the motivational resources to engage in health-promoting behaviors, such as physical activity or eating a balanced diet, resulting in a poorer health profile.

Several pathways may underlie the supposed salutary effects of physical activity on functional health and cardio-metabolic risk. First, regularly exercising or partaking in moderate activities increases muscle strength and provides for intrinsic vitality and better functional health (Brach et al., 2003; Rantanen et al., 1999). Second, physical activity and exercise are known to suppress glucose production and promote antioxidant functioning (Selvin et al., 2010). Lastly, a byproduct of physical activity is a reduction in adipose tissue and body mass or fat, which promotes pre HDL production and reverse cholesterol transport (resulting in higher HDL–C levels) and protects against atherogenesis (Penedo & Dahn, 2005; Stefanick et al., 1998). In sum, our findings are consistent with notions suggesting that perceived control facilitates positive health through physical activity and physiological indicators that more broadly represent functional health and cardio-metabolic risk. As a consequence, lower perceived control alters one's behavioral and physiological functioning, probably leading to increased vulnerability to disability, diseases, and subsequent mortality. We also observed that control was linked to higher SBP and this effect was not mediated through physical activity. One possible reason may be that resting state (as opposed to more dynamic assessments) may be a sub-optimal operational definition to examine control-SBP associations. For example, control is shown to buffer

increases in SBP during times of acute stress, such as in experimental settings or in people who experience chronic stress, such as caregivers (Roepke & Grant, 2011).

Health Implications of Perceived Control

The health demographics of the United States bespeaks to further understanding the risk and protective factors, along with the underlying mechanisms implicated in disability, disease, and mortality processes. Our objective was to examine how control is directly and indirectly associated with some of the functional and physiological health indicators that may accumulate and in the long-run contribute to key health outcomes. Perceived control represents a protective factor for health outcomes because it represents a health-promoting, modifiable factor that can be subjected to targeted intervention and infrastructure programs (Bandura, 2004; Lachman & Agrigoroaei, 2010). Programs that focus on one's attitudes, beliefs, and motivations regarding life circumstances can help individuals to feel competent and motivated to engage in physical activity aimed at improving physiological and overall health profiles (Bandura, 2004; Estabrooks et al., 2011; Lachman et al., 1997). At a more general level, programs that are aimed at strengthening control (or mental capital) have the possibility to reduce accrued societal, family, and individual burdens (Beddington et al., 2008; Rae et al., 2010). To inform the design and implementation of effective intervention programs, future research is needed to more thoroughly examine possible moderators of control-health associations (e.g., potential for control; Heckhausen, Wrosch, & Schulz, 2010). For example, perceiving high control in situations where control potential is low often results in negative outcomes (e.g., poorer subjective well-being, increased likelihood of mortality), whereas low perceived control in a low control potential situation can have positive effects (Hall et al., 2010).

Limitations and Conclusion

In closing, we highlight several limitations of our study. First, our study is cross-sectional making it impossible to draw inferences regarding directionality. As opposed to the direction examined here, more physical activity and better physiological functioning may in turn improve

one's ability to complete everyday activities thereby enhancing and enlarging people's perceived control. If longitudinal data were available, future studies may be able to employ latent change score models (Ferrer & McArdle, 2010; Gerstorf et al., 2007) and examine multi-directional dynamics between control, physical activity, and physiological functioning. Second, our measure of physical activity was broad, and we were unable to directly test the frequency of specific activities individuals participated in (Levine et al., 1999; McAuley, 1993). It will be instructive to incorporate more specific indices of physical activity that assess both duration and calories burned to enable more direct specification of the types of physical activities that are most beneficial. Third, effect sizes observed in our study were small, probably reflecting the fact that our measures of physiological indicators were objective and performance-based, resulting in smaller shared variance than what is typically observed between two self-rated indices (Spiro & Brady, 2008). We note, however, that calculating an effect size metric in mediation analyses has been a recent endeavor, and more work is clearly needed to better understand the properties of the approach applied here (Preacher & Kelley, in press). Finally, conceptual frameworks of control and empirical research indicate that perceived control facilitates positive health through various pathways. Indicators that should be targeted in future studies as mechanisms that underlie associations between control and health include emotion regulation (Kiecolt-Glaser et al., 2002), stress-buffering properties (Hay & Diehl, 2010; Neupert et al., 2007), and direct modulation of immune and neuroendocrine functioning (Bosch, Fischer, & Fischer, 2009; Roepke et al., 2011). As of now, it is an open question whether high perceived control serves as a protective factor against poor physiological functioning, whether reduced perceived control may act as a risk factor for impaired physiological functioning, or whether both mechanisms are operating at the same time.

Taken together, our study examined how perceived control relates to markers of functional and physiological health that may underlie control-health associations. Our results underscore the importance and facilitative nature of perceived control for better health in adulthood and old age.

We found that perceiving more control is associated with better functional health and lower cardio-metabolic risk, and one way control relates to these systems is via physical activity. Our findings provide empirical evidence for conceptual frameworks of control that detail how behavioral and physiological functioning underlie control-health associations (Bandura, 1997; Lachman, 2006; Rodin, 1986; Uchino, 2006). We take our results to provide impetus for future studies to examine biomarkers as pathways linking psychosocial indicators to health outcomes (Steptoe, 2011), which will allow for thoroughly examining processes involved in linking psychosocial indicators to key health outcomes in adulthood and old age.

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Table 3.1

Means, Standard Deviations, and Intercorrelations Among Measures in the Health and Retirement Study

Construct	*M*	*SD*	1	2	3	4	5
Predictors							
1. Perceived control (1 – 6)	4.79	0.95	–				
2. Physical activity (1 – 5)	2.95	0.89	.23*	–			
3. Age (50 – 97)	67.56	9.74	–.12*	–.18*	–		
4. Gender (0=men)	0.59	0.49	–.04*	–.07*	–.02	–	
5. Education (0 – 17)	12.73	3.03	.21*	.21*	–.16*	–.06*	–
Physiological indicators							
Grip Strength (3.75 – 76.0)	30.92	10.86	.16*	.20*	–.32*	–.72*	.15*
Hemoglobin A_{1c} (4.3 – 13.2)	5.82	0.82	–.08*	–.14*	.06*	.01	–.12*
HDL–C (21 – 133)	57.24	14.32	.07*	.11*	–.07*	.35*	.10*
Systolic blood pressure (68.5 – 219.67)	131.91	20.39	–.002	–.07*	.20*	–.10*	–.12*
Pulse rate (34.33 – 129.33)	70.40	11.20	–.05*	–.05*	–.12*	.07*	–.05*
Waist Circumference (20.5 – 73)	39.79	6.03	–.04	–.18*	–.03*	–.25*	–.09*

Note. N = 4,292. Gender: men: n = 1,752; women: n = 2,542. Grip strength was measured in kilograms (kg). Hemoglobin A_{1c} was measured in %. HDL–C was measured in mg/dL. Systolic blood pressure was measured in mmHg. Pulse rate was measured in beats per minute. Waist circumference was measured in inches. HDL–C = High Density Lipoprotein Cholesterol.

* $p < .05$

Table 3.2

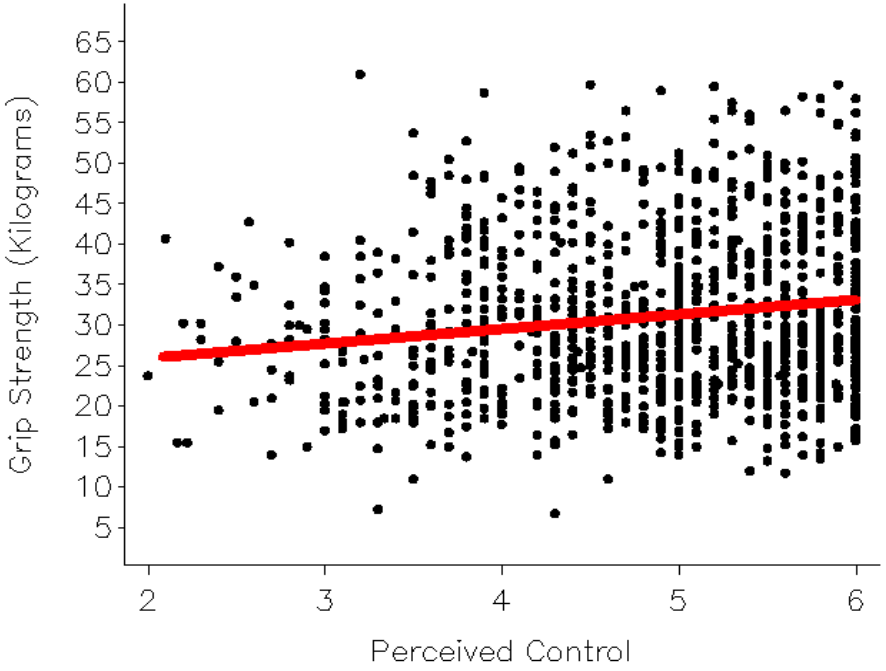
Unstandardized and Standardized Estimates from Regression Models Predicting Indicators of Functional Health and Cardio-metabolic Risk

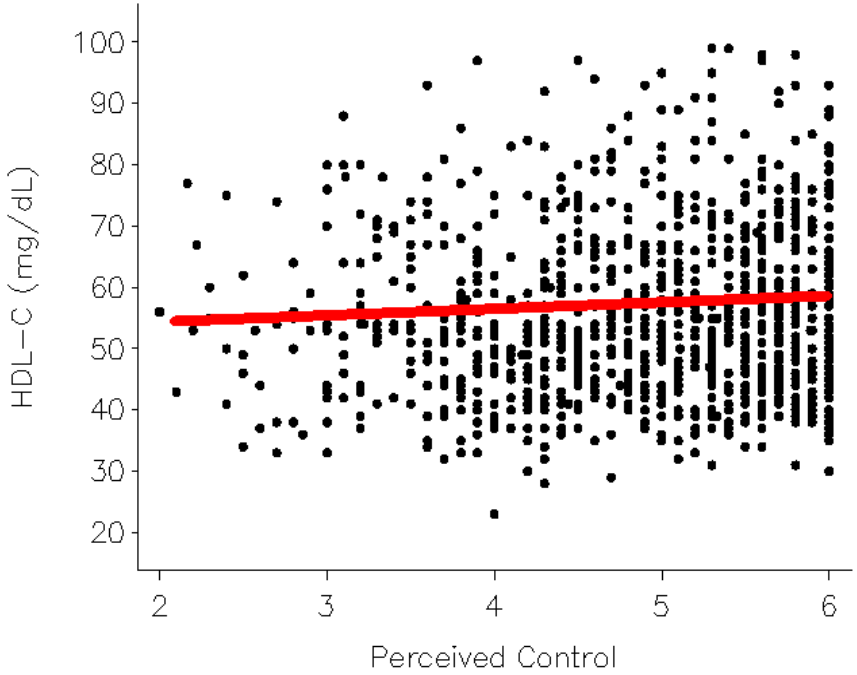
Outcome	Grip Strength		Hemoglobin A_{1c}		HDL–C		SBP		PR		WC	
	Estimate (SE)	β	Estimate (SE)	β	Estimate (SE)	β	Estimate (SE)	β	Estimate (SE)	β	Estimate (SE)	β
Model 1												
Intercept	29.97		5.85		56.73		133.38		70.19		39.85	
	(0.10)		(0.01)		(0.21)		(0.34)		(0.18)		(0.09)	
Perceived	0.95*	.08	–0.04*	–.05	0.92*	.06	0.84*	.04	–0.62*	–.05	–0.24*	–.04
Control	(0.12)		(0.01)		(0.22)		(0.37)		(0.20)		(0.10)	
Age	–0.36*	–.32	0.004*	.04	–0.06*	–.04	0.39*	.19	–0.16*	–.14	–0.04*	–.06
	(0.01)		(0.001)		(0.02)		(0.03)		(0.02)		(0.01)	
Gender	–15.91*	–.72	0.002	.001	10.48*	.36	–4.12*	–.10	1.44*	.06	–3.22*	–.26
	(0.21)		(0.03)		(0.41)		(0.61)		(0.36)		(0.18)	
Education	0.16*	.04	–0.03*	–.11	0.47*	.10	–0.74*	–.11	–0.22*	–.06	–0.22*	–.11
	(0.04)		(0.01)		(0.07)		(0.11)		(0.06)		(0.03)	
R^2	.640		.020		.143		.061		.027		.080	
Model 2												
Intercept	30.03		5.84		56.84		133.34		70.16		39.78	
	(0.10)		(0.01)		(0.21)		(0.34)		(0.18)		(0.09)	
Perceived	0.79*	.07	–0.03	–.03	0.62*	.04	0.95*	.04	–0.50*	–.04	–0.02	–.003
Control	(0.11)		(0.01)		(0.22)		(0.36)		(0.20)		(0.10)	
Age	–0.34*	–.31	0.002	.03	–0.04	–.02	0.38*	.18	–0.16*	–.14	–0.05*	–.09
	(0.01)		(0.001)		(0.02)		(0.03)		(0.02)		(0.01)	
Gender	–15.82*	–.72	–0.01	–.004	10.64*	.37	–4.17*	–.10	1.39*	.06	–3.34*	–.27
	(0.21)		(0.03)		(0.41)		(0.61)		(0.36)		(0.18)	
Education	0.12*	.03	–0.03*	–.09	0.40*	.08	–0.71*	–.11	–0.19*	–.05	–0.16*	–.08
	(0.04)		(0.01)		(0.07)		(0.11)		(0.06)		(0.03)	
Physical	0.95*	.08	–0.10*	–.11	1.70*	.11	–0.62	–.03	–0.65*	–.05	–1.31*	–.19
Activity	(0.12)		(0.02)		(0.24)		(0.37)		(0.20)		(0.11)	
R^2	.640		.026		.154		.059		.030		.119	
Indirect	0.21*	.02	–0.02*	–.03	0.37*	.03	–0.14	–.01	–0.14*	–.01	–0.29*	–.05
Effect	(0.03)		(0.004)		(0.06)		(0.08)		(0.05)		(0.03)	

Note. N = 4,294. Model 2 parameters for physical activity regressed on perceived control: 0.22* (0.01), Std. β = .23, R^2 = .055. Std. β = Standardized Beta. HDL–C = High Density Lipoprotein–Cholesterol. SBP = Systolic Blood Pressure. PR = Pulse Rate. WC = Waist Circumference.

Figure Caption

Figure 3.1. Graphical illustration of associations between perceived control with grip strength and High Density Lipoprotein Cholesterol (HDL–C) for a subsample of 1,000 participants. Individuals who perceived more control, on average, reported better grip strength and higher levels of HDL–C. The figure also highlights the tremendous amount of between-person heterogeneity in those associations. The red line is the model implied values from Model 1 for each indicator.


Grip Strength (Kilograms)
65
60
55
50
45
40
35
30
25
20
15
10
5
2
3
4
5
6
Perceived Control


HDL−C (mg/dL)
100
90
80
70
60
50
40
30
20
2
3
4
5
6
Perceived Control

CHAPTER IV

DISSERTATION PAPER 3

2.5-year Change in Perceived Control Predicts 19-Year Mortality:

Trajectories from the Americans' Changing Lives Study

Abstract

Perceived control plays an important role for health across adulthood and old age. However, little is known about the factors that account for such associations and whether changes in control (or control trajectory) uniquely predict major health outcomes over and above levels of control. Using data from the nation-wide Americans' Changing Lives Study (*N* = 2,840, *M* age at T2: 56.32 years, range: 28 – 99, 64% women), we examined whether levels of and 2.5-year changes in perceived control predict all-cause mortality over a 19-year follow-up period. Cox hazard regression models revealed that (a) higher levels of perceived control were associated with longer survival times, independent of socio-demographic correlates, (b) associations between level of control and mortality risk were accounted for by well-being and health factors, (c) more positive 2.5-year changes in perceived control were uniquely associated with lower mortality hazards, and (d) associations between change in control and mortality risk were not accounted for by well-being, physical activity, social support, and health factors. Our results illustrate that associations between levels of perceived control and mortality are carried by well-being and health factors and suggest that year-to-year changes in control provide unique predictive and potentially intervention utility for health outcomes in adulthood and old age.

Key words: Sense of Control; Longevity: Adulthood and Old Age; Americans' Changing Lives Study; Psychosocial

2.5-year Change in Perceived Control Predicts 19-Year Mortality: Trajectories from the Americans' Changing Lives Study

Perceived control facilitates positive health outcomes across adulthood and old age (Baltes & Baltes, 1986; Bandura, 1997; Lachman, 2006; Rowe & Kahn, 1987; Skaff, 2007; Uchino, 2006). Empirical evidence suggests that perceiving more control over one's life circumstances is protective against declines in physical functioning (Caplan & Schooler, 2003; Gerstorf et al., 2011; Lachman & Agrigoroaei, 2010; Seeman et al., 1999), progression of disease burden (Infurna et al., 2011b; Thompson & Spacapan, 1991), cardiovascular disease incidence (Rosengren et al., 2004; Stürmer et al., 2006) and mortality (Infurna et al., 2011a; Krause & Shaw, 2000; Penninx et al., 1997; Seeman & Lewis, 1995; Surtees et al., 2006, 2010). Conceptual models of control suggest that emotional, behavioral, social, and health pathways account for control-health associations (Bandura, 1997; Lachman, 2006; Rodin, 1986), but research testing the pathways in a conjoint manner is largely lacking. As well, empirical research linking control to mortality in adulthood and old age has not made use of longitudinal assessments of control (for a notable exception, see Eizenman et al., 1997). Using data from the adult sample of the nation-wide Americans' Changing Lives (ACL) Study, we examine whether levels of perceived control predict all-cause mortality over a 19-year follow-up period and test whether psychosocial and health factors account for this association. We also consider whether 2.5-year changes in perceived control uniquely predict mortality, beyond initial levels of control and known correlates of mortality.

Associations between Perceived Control and Mortality

Perceptions of control are individuals' beliefs about their capability to exert influence over and shape one's life circumstances (Pearlin & Schooler, 1978; Skinner, 1996). For example, seminal research from Rodin and Langer (1977) involving nursing home residents demonstrated that interventions aimed at increasing individuals' perceptions of control indeed provide people with feelings of competence and contingency, which in turn results in decreased mortality risks

(see also Langer & Rodin, 1976; Schulz, 1976). Empirical evidence from large panel surveys of middle-aged and older adults suggests that more perceived control is linked to greater probability of survival over follow-up periods ranging from 2.5 years (Penninx et al., 1997) and 4.8 years (Surtees et al., 2006) to 11.3 years (Surtees et al., 2010) and 14 years (Infurna et al., 2011a). Similarly, in various patient populations, such as those diagnosed with coronary artery disease, cancer, amyotrophic lateral sclerosis, and on dialysis, higher levels of control are associated with an increased likelihood of survival (Brown et al., 2003; Helgeson, 2003; Kutner et al., 1997; McDonald et al., 1994).

Factors Underlying Associations between Perceived Control and Mortality

Conceptual frameworks suggest that control facilitates positive health through a variety of mechanisms, including emotion regulation, engagement in health-promoting behaviors, social support, and subjective and cardio-metabolic health (Bandura, 1997; Lachman, 2006; Uchino, 2006). First, perceived control may support positive health through emotion regulation. In particular, feeling in control often helps people adapt to critical life events and setbacks and down-regulate negative emotions (Lang & Heckhausen, 2001; Windsor & Anstey, 2010), processes which are known to impact biological processes and distal health outcomes such as mortality (Danner et al., 2001; Kiecolt-Glaser et al., 2002; Pressman & Cohen, 2005). Second, perceived control likely supports individuals' capability to view their health as controllable and thus facilitates adoption and maintenance of health-promoting behaviors such as exercising regularly, involvement in preventive care, and eating of a proper diet (Lachman & Firth, 2004; Infurna et al., 2011b; White et al., in press). Third, control beliefs may allow people to mobilize social support, particularly in times of strain, thereby serving as a buffer against the effects of stress (see Antonucci, 2001; Cohen & Wills, 1985; Heckhausen & Schulz, 1995; Lang et al., 1997). Finally, perceived control may distally impact mortality through self-perceptions of health, physical functioning and direct modulation of biological function, such as cardio-metabolic risk (Roepke & Grant, 2011). In sum, higher levels of control have been linked to

better functional health and lower cardio-metabolic risk in children, caregivers, middle-aged and older adults (Gale et al., 2008; Infurna & Gerstorf, 2011; Nabors et al., 2010; Roepke et al., 2011).

Change in Perceived Control and Mortality

Previous research using facets of control to predict mortality has primarily focused on individuals' level of control at one point in time. A notable exception is research from the Cornwall Manor Study, where researchers used 26 weekly assessments of perceived control to compute overall within-person mean and variability (within-person standard deviation) scores to predict 5-year mortality. In particular, Eizenman and colleagues (1997) found that greater week-to-week variability in control was uniquely associated with higher mortality risk, beyond the risks associated with individuals' mean levels of control. The prevailing interpretation is that greater week-to-week variability in control reflects inconsistencies in an individual's ability (or the perceptions thereof) to shape life circumstances. Even though the mechanisms underlying week-to-week fluctuations in control may differ from those underlying fluctuations or changes in control across other time scales, these findings illustrate the importance of examining how changes in control are related to health outcomes.

In the present report, we examine whether the extent to which perceptions of control change over 2.5 years, labeled *control trajectory*, is uniquely associated with mortality risk. Perceptions of control assessed at one point in time can be taken to represent the culmination of one's prior and current (and anticipated future) experiences, interactions, contexts, health, and life events (Pearlin et al., 2007). Over and above level assessments and within-person variability in control, positive or negative control trajectories that manifests across several years may reflect meaningful shifts in individuals' perceived ability to attain desired outcomes in the context of changing living conditions. We argue that control trajectory captures additional information relevant to the prediction of mortality. First, increases in individuals' ability to view their health as controllable may lead to engagement in health-promoting behaviors and better management of

health. Second, declines in control may signify reduced social network integration (Gerstorf et al., 2011; Infurna et al., 2011a). As a consequence, individuals may not be able to mobilize social support that would buffer against stress and protect against vulnerabilities arising from health decrements. Third, declines in control may be indicative of increased depressive or negative thoughts (e.g., hopelessness, helplessness), which would also undermine health (Peterson & Seligman, 1984). In sum, changes in perceived control may have substantial health implications that are distinct from individuals' level of control. Where people are headed or have come from makes a difference. To test this notion, we examine whether control trajectory is uniquely predictive of mortality risk, beyond individuals' levels of control and a variety of other factors.

The Present Study

Our objective is to examine whether levels of and 2.5-year changes in perceived control predict all-cause mortality, uniquely from other psychosocial and health factors. To do so, we use data from the nation-wide adult lifespan sample of the ACL study. First, we test whether levels of perceived control predict mortality over a 19-year follow-up period and examine whether indicators of well-being (life satisfaction, depressive symptoms), physical activity, social support, and health (self-rated health, functional limitations, diagnoses of heart attack/trouble and cancer) account for such associations. Consistent with previous research, we hypothesize that higher levels of perceived control are associated with lower mortality hazards, independent of socio-demographics. We expect that well-being, physical activity, social support, and health factors will largely account for links between levels of control and mortality. Second, we test whether 2.5-year changes in perceived control (control trajectory) provide additional predictive utility, over and above levels of control and known correlates of mortality. We hypothesize that more positive control trajectories (e.g., increases or stability as opposed to declines) will be associated with reduced mortality risk.

Method

Participants and Procedure

We analyzed data from the ACL study, which assessed a wide range of sociological, psychological, and physical health information from a nationally representative stratified probability sample of US residents aged 25 years and older (House et al., 1990) with oversampling of African Americans and individuals age 60 years and older. The study spans 16 years with four repeated measures collected in 1986 (n=3,617), 1989 (n=2,867), 1994 (n=2,653), and 2002 (n=1,787).

For the purposes of the present study, we analyzed data from the 2,840 participants who provided valid responses on (a) the measure of perceived control at Waves 1 and 2 and (b) the covariates at Wave 2. Table 1 shows descriptive statistics for all measures under study. Participants in the analysis sample were, on average, 56 years of age (SD=17.08, range 28–99), 64% were women, and had attained 12 years of education (SD=3.36). Relative to participants who did not provide data at Wave 2 and those not included because of incomplete data on some of the target variables, our subsample was younger at Wave 1 (M=52.31, SD=17.07 vs. M=56.31, SD=19.27; F [1, 3,615] = 22.86, $p < .05$), included more women (64% vs. 57%; χ^2 [1, 3,615] = 10.81, $p < .05$), had attained more years of education (M=11.72, SD=3.36 vs. M=10.54, SD=3.71; F [1, 3,615] = 71.67, $p < .05$), and were more likely to be white (67% vs. 55%; χ^2 [1, 3,615] = 35.30, $p < .05$). The relatively small differences in substantive terms ($\eta^2 < .02$ for all comparisons) suggest that the study sample is reasonably comparable to the population from which they were drawn.[1] The ACL study has continually tracked mortality status, with the latest update obtained in 2008. Over the 19-year follow-up period, 993 participants (or 35%) in our subsample had died.

Measures

Perceived control. *Perceived control* was assessed at Waves 1 and 2 using six items from the Pearlin Mastery Scale (Pearlin & Schooler, 1978). Items asked participants to rate the extent to which they believe their life is under their own control (e.g., "*I can do just about anything I really set my mind to do*") using a 4-point Likert scale (1=*strongly agree* to 4=*strongly disagree*).

Negatively valenced items were reverse coded so that higher scores indicated more feelings of control. We constructed two variables. First, *level of perceived control* is indicated by individuals' Wave 2 score (M = 3.31, SD = 0.54). Second, *control trajectory* was quantified by taking the difference between individuals' Wave 1 and Wave 2 scores, indexed in rate of change in control per year by dividing the difference by the amount of time (in years) between each participant's two assessments (M = 2.62 years, SD = 0.11, range 2.25 – 2.93 years). Although, on average, the control trajectory was stable (M= –0.002, SD = 0.20, range –0.90 – 0.86) there were substantial between-person differences in change. Overall, 651 participants or 23% of the sample experienced at least 1 *SD* changes (positive or negative changes of at least 0.20) in control. Of note, we only used the Wave 1 and Wave 2 assessments of control to calculate our time-related change score, rather than estimating rates of change across the entire span of the study Wave 1 through Wave 4 (15.5 years) as has been done elsewhere (e.g., personality: Mroczek & Spiro, 2007) . Our interest was whether the minimum of change information (2.5-year change) already held predictive value.

Mortality. Timing of death for deceased participants was obtained through the National Death Index by ACL staff (House, 2010). The 993 deceased participants were, on average, 70.12 years of age in Wave 2 (SD=12.33, range 29–99) and died 8.26 years later (SD=4.64, range 0–17). At the time of death, 7 participants (0.70%) were in young adulthood (aged 30–39), 172 participants (17.30%) were in midlife (aged 40–69), and 814 participants (82.00%) were in old age (aged 70 and older). This mortality by age distribution is in line with population-wide mortality hazards, which are generally low for population segments aged 70 years and younger (Arias, 2010). Information on specific causes of death was not available.

Covariates. Socio-demographic, psychosocial, and health variables, as assessed at Wave 2, were included in our models to examine whether those factors accounted for any noted associations between levels of and changes in perceived control and mortality risk. *Life satisfaction* was measured with a single item, "How satisfied are you with life as a whole?" that

was answered on a 5-point Likert scale (1=*completely satisfied* to 5=*not at all satisfied*) and reverse coded so that higher scores reflect more positive assessments of one's life (*M*=3.68, *SD*=0.80). *Depressive symptoms* were measured as the average of responses to 11 items from the Center for Epidemiologic Studies-Depression Scale (CES-D; Radloff, 1977). Participants rated how often they had experienced each feeling during the previous week using a 3-point Likert scale (1=*hardly ever* to 3=*most of the time; M*=1.40 *SD*=0.35; α = 0.83). *Physical activity* was measured with three items asking participants how often they work in the garden, engage in active sports, and take walks (see Parslow et al., 2006). Responses were given on a 4-point Likert scale (1=*often* to 4=*never*; *M*=2.58, *SD*=0.79; α = 0.46) and reverse coded so that higher scores indicate more physical activity. *Social support* was measured using six items that assessed the degree of emotional support participants received from children, their spouse, and friends or relatives (see Fiori et al., 2006). Responses were provided using a 5-point Likert scale (1=*not at all* to 5=*a great deal*), with higher scores indexing more positive support (*M*=4.04, *SD*=0.74; α = 0.64). *Self-rated health* was assessed using a single item, "How would you rate your health at the present time?" that was answered using a 5-point Likert scale (1=*excellent* to 5=*poor*) and reverse coded so that higher scores reflect more positive assessments of one's health (*M*=3.36, *SD*=1.09). *Functional limitations* was measured as the average of responses to four items assessing the degree of difficulty individuals have completing everyday activities of daily living, including bathing, climbing stairs, walking several blocks and heavy housework. Participants rated how much difficulty they have completing each task using a 5-point Likert scale (0=*no difficulty* to 5=*cannot do*), with higher scores indicating more difficulty with everyday activities (*M*=1.52, *SD*=0.87; α = .77). Two binary variables indicated whether or not participants reported having had a *heart attack/trouble* or being diagnosed with *cancer* over the course of the entire study (the two most common causes of death; Xu et al., 2010). At each measurement occasion, participants provided self-reports of whether they were during the past year or were currently

experiencing heart trouble (no=2,202; yes=549) and/or had a cancer/malignant tumor (no=2,507; yes=333).

Statistical Analyses

To examine whether levels of perceived control and control trajectory were predictive of 19-year between-person differences in hazards for all-cause mortality, we applied hierarchical Cox proportional hazard regression model (Cox, 1972). Using SAS (PROC PHREG, see Allison, 1995) in a step-wise fashion, we modeled the hazard of death for the time interval between 1989 and 2008 as a function of level of perceived control, control trajectory, and the covariates of well-being (life satisfaction, depressive symptoms), physical activity, social support, and health indicators (self-rated health, functional limitations, diagnoses of heart attack/trouble and cancer). Specifically, we estimated a series of seven models to examine (a) if level of perceived control was a significant predictor of mortality hazard (Model 1), (b) if these predictive effects were independent of socio-demographics (Model 2), (c) if these effects were accounted for by psychosocial and health factors (Models 3-6), and (d) if control trajectory uniquely predicted mortality over and above the other predictors (Model 7). For clarity, Model 2 was specified as

$$\log h(t_{ij}) = \log h_0(t_j) + \beta_1(\text{level perceived control}_i) + [\beta_2(\text{age}_i) + \beta_3(\text{gender}_i) + \beta_4(\text{education}_i)] \quad (1)$$

where $\log h(t_{ij})$ is the log of individual i's risk of dying (or log hazard: $\log h$) over time period j. The risk of dying at each time at the average level of all other predictors (from z standardization) is captured by $\log h_0(t_j)$, the general baseline log hazard function. β_1 indicates the effects of level of control (included in Model 1) on the hazard of dying, and β_2 through β_4 indicate the independent effects of age, gender, and education on the hazard. In subsequent steps, additional sets of variables were included in analogue. To facilitate interpretation of hazard ratios (HRs), all predictors (except age, gender, education, heart diagnosis and cancer diagnosis) were z standardized ($M = 0$, $SD = 1$).

Results

Associations between Perceived Control and Mortality

Results from the Cox proportional hazard regression models of 19-year mortality incidences are shown in Table 2. At the zero-order level (Model 1), we found that higher levels of perceived control were associated with lower hazard for mortality (*HR* = 0.82, $p < .05$). Each one standard deviation increase in levels of perceived control was associated with an approximately 18% decreased likelihood of death. Figure 1 illustrates that ACL participants who perceived more control tended to have lower risks for dying.

Factors Underlying Associations between Perceived Control and Mortality

In Model 2, we included additional socio-demographic predictors of the mortality hazard. Results revealed that level of perceived control remained a significant predictor of mortality (*HR* = 0.87, $p < .05$)., independent of age, gender, and education. Net of those socio-demographic factors, each one standard deviation increase in level of perceived control was associated with a 13% decreased likelihood of death. Subsequently, in Models 3, 4, 5, and 6, we included well-being, physical activity, social support, or health variables to assess whether and which of these factors accounted for associations between levels of control and mortality. We observed that the inclusion of life satisfaction and depressive symptoms (Model 3) and self-rated health, functional limitation, and indicators of heart disease and cancer (Model 6) attenuated the association between levels of control and mortality to non-significance, suggesting that well-being and health factors may account for control-mortality associations. In contrast, the inclusion of physical activity (Model 4) and emotional support (Model 5) only slightly attenuated associations between levels of perceived control and mortality.

Time-Related Change in Perceived Control and Mortality

In the final analysis (Model 7), we included control trajectory as an additional predictor to test whether 2.5-year change in perceived control uniquely predicted mortality risks over and above the other predictors. Results revealed that, indeed, control trajectory was independently related to mortality hazard. Control trajectories one standard deviation (.20 raw units per year) above the average trajectory ($M = -.002$ raw units per year) were associated with an 8%

decreased likelihood of death. Figure 2 illustrates that, independent of socio-demographic, psychosocial, and health factors, ACL participants who reported more positive time-related changes in perceived control were at lower risks for dying. Implied in Figure 2 is also that a person who was on a positive control trajectory lived one full year longer than someone who was on a negative control trajectory, all else equal. Other significant predictors of higher hazard of mortality included: Older age, being a man, lower education, lower physical activity, lower self-rated health, and reporting more functional limitations.

Discussion

The objective of the present study was to test whether levels of perceived control predicted 19-year mortality in adulthood and old age and to examine whether any association was accounted for by differences in well-being, physical activity, social support, and health. We also investigated whether and how 2.5-year changes in perceived control uniquely predicted mortality, over and above levels of control and known correlates of mortality. Our survival analyses revealed that levels of perceived control were indeed predictive of long-term mortality risks, independent of socio-demographics. The association could be accounted for by differences in well-being and health factors. We also found that changes in perceived control uniquely predicted mortality hazards over and above levels of control and the other correlates. Our findings suggest that well-being and health factors play an important role in control-mortality associations and that change in perceived control offer added utility in predicting final outcomes. We discuss possible pathways through which perceived control operates to facilitate survival and consider implications of the demonstrated utility to use control trajectories to predict key outcomes in adulthood and old age.

Associations between Perceived Control and Mortality

Our first task was to examine whether levels of perceived control predict 19-year hazards for mortality in an adult lifespan sample. Corroborating previous research involving panel surveys (Infurna et al., 2011a; Surtees et al., 2006, 2010), patient populations (Brown et al., 2003;

Helgeson, 2003; Kutner et al., 1997; McDonald et al., 1994), and intervention samples (Rodin & Langer, 1977; Schulz, 1976), we found that, independent of socio-demographics, higher levels of perceived control were associated with a decreased likelihood of mortality. These findings are also consistent with studies showing that perceived control is protective against other adverse health outcomes, including disability, poor physical functioning, and disease incidence (Caplan & Schooler, 2003; Gerstorf et al., 2011; Infurna et al., 2011b; Rosengren et al., 2004; Seeman et al., 1999). Our results demonstrate the importance of attitudes, beliefs, and motivations for survival in adulthood and old age and contribute to the growing interest in and discussion of risk and protective factors for health (for discussions, see Blumenthal et al., 2007; Miller, Chen, & Cole, 2009; Rozanski et al., 2005). To further those discussions, we interpret the findings with respect to the possible pathways through which perceived control may facilitate survival.

Factors Underlying Associations between Perceived Control and Mortality

Conceptual frameworks of control and empirical evidence indicate that perceived control promotes longevity through emotional, behavioral, social, and health mechanisms (Lachman, 2006; Rodin, 1986; Skaff, 2007; Uchino, 2006). In the present report, we found that the health salutary effects of levels of perceived control could be accounted for by differences in well-being and health. Our findings are consistent with the theory that control facilitates a longer life by enhancing mental health and emotion regulation (Lang & Heckhausen, 2001; Windsor & Anstey, 2010). Individuals who perceive more control may be better able to compensate for failures and down-regulate negative emotions that contribute to inflammatory and endocrine processes, which are in turn linked to mortality (Danner et al., 2001; Kiecolt-Glaser et al., 2002; Steptoe et al., 2005). Additionally, viewing one's life circumstances as controllable and predictable has been shown to protect against accumulating anxiety, stress, and depressive symptoms, which would have downstream consequences for survival (Peterson & Seligman, 1984; Seligman, 1975). Second, we found that self-rated health and reports of functional limitations accounted for associations between levels of control and mortality. Individuals with higher levels of control

were more likely to perceive fewer constraints on their ability to perform health behaviors and report better self-rated health (see correlations in Table 1). Also, stronger perceptions of control provide individuals with the motivational resources needed to engage in health and rehabilitation behaviors that prevent from experiencing functional limitations (Verbrugge & Jette, 1994).

In contrast to our expectations based on conceptual models of control and previous empirical research, we only found a little evidence that physical activity and social support accounted for associations between control and mortality. Other studies have found that people who report more control have an increased likelihood of partaking in health-promoting behaviors (Lachman & Firth, 2004; White et al., in press), and we expected that this would account for associations between levels of control and mortality. It is possible that the contributing role of physical activity for control-health associations is specific to indicators of functional and physical health (e.g., activities of daily living, disability incidence, and disease incidence) or to circumscribed causes of death, but not necessarily all-cause mortality. In the present study, we also observed that social support did not account for control-mortality associations. It may be that the buffering effects of social support are better captured in an event-contingent design that allows targeting when and how people need to adjust to particular stressors and major life events (Cohen & Wills, 1985). For example, when confronted with the onset of major diseases, people who perceive more control would be more likely to activate their social network for various kinds of support (e.g., emotional, informational, instrumental) that help mitigate accrued burdens on functioning.

Change in Perceived Control and Mortality

Addressing our second research question, we found that 2.5-year changes in control uniquely predicted 19-year mortality hazards, such that more positive control trajectories were protective against mortality risk. Our findings corroborate reports that incorporating variability and change components of development are important to consider when predicting successful aging outcomes such as longevity (Eizenman et al., 1997; Mroczek & Spiro, 2007). Importantly, our results suggest that control trajectory has implications for long-term mortality, which may

arise from changes in one's sense of effectiveness in carrying out goal-related activities and an altered view on external factors that interfere with reaching those goals. These initial findings provide impetus for community health and intervention programs that target control beliefs to help promote healthy profiles of living across the lifespan (Bandura, 2004; Estabrooks et al., 2011). Interventions that have targeted control beliefs have proven successful (e.g., Lachman et al., 1997; Searle et al., 1998; Tennstedt et al., 1998). Our findings further suggest that health and intervention programs should focus on maintaining and increasing perceived control to promote survival in adulthood and old age. Programs that focus on changing attitudes, beliefs, and motivations regarding life circumstances can help individuals to feel competent and motivated to engage in physical activity or can provide strategies to down-regulate negative emotional states, aimed at improving overall health profiles (Bandura, 2004; Lachman et al., 1997).

Control trajectory may impact survival through several pathways. First, declines in control may undermine one's views regarding the predictability of life circumstances, thereby increasing levels of stress, anxiety, and depressive symptoms (Peterson & Seligman, 1984; Skinner, 1995). Second, increases in control over a one- or two-year period may modify one's attitudes and beliefs regarding the controllability of one's health, leading to an altered participation in health-promoting behaviors (Jette et al., 1999; Lachman et al., 1997). In a similar vein, increases in control may help people manage to actively seek out social support (Lang et al., 1997). Finally, reporting declines in perceived control may reflect increases in perceived constraints that limit one's ability to persist in the face of challenging tasks. For example, onset of a chronic illness may impede an individual's ability to complete activities of daily living and result in behavioral constraints to attain desired outcomes. To fully understand the pathways through which changes in control exert influence on health and mortality, more mechanism-oriented study designs are needed. One avenue would be to examine how control (may or may not) change in relation to major life events (e.g., unemployment, welfare, and transitions in caregiving) or health-related events (disability, disease onset, and partner illness). For example, research suggests that control

declines with cancer incidence and that greater stability in control with the experience of cancer relates to lower levels of psychological distress six and twelve months post diagnosis (Ranchor et al., 2010).

Limitations and Outlook

We note several limitations. First, causes of death likely differed with age. The most common causes of death among young adults include accidents and suicide, whereas older adults tend to die as a result of cardiovascular diseases and cancer (Centers For Disease Control and Prevention, 2005). The implications of control may or may not vary by cause of death. For example, Surtees and colleagues (2006, 2010) found that facets of control are more likely associated with cardiovascular, but not with cancer-specific mortality. Unfortunately, we did not have access to decedents' specific causes of death. Future studies with such information can identify the specific types of deaths that (change in) control is associated with. Second, our analysis made use of indicators of only a few of the pathways through which control may affect health, but a more detailed analysis with biological processes (i.e., cardiovascular, immune, metabolic) will be instructive to disentangle particular pathways that underlie control-health associations. Third, the small number of occasions and the long and unevenly spaced assessment intervals did not permit use of within-person approaches for examining associations between control and mortality. More closely spaced observations, such as those obtained in measurement-burst designs (for discussions, see Nesselroade, 1991; Ram & Gerstorf, 2009) would allow for more intricate examination of how changes in control are linked to health outcomes in adulthood and old age. Lastly, measures of control potential and goal (dis)engagement would help qualify and extend our analyses. For example, perceived control may be adaptive in situations with high control opportunities, but less adaptive in situations that afford few opportunities to exert a positive influence on health outcomes (see Hall et al., 2010).

Our study demonstrates the health implications of levels of perceived control and control trajectory across adulthood and old age. Consistent with conceptual frameworks of control

(Bandura, 1997; Heckhausen & Schulz, 1995; Lachman, 2006; Skaff, 2007), our study sheds light on several emotional and health factors that account for associations between control and mortality. As an extension of previous reports linking levels of perceived control to mortality (Infurna et al., 2011a; Surtees et al., 2006, 2010), our results revealed that control trajectory provides an added and distinct contribution to mortality in adulthood and old age. These findings provide impetus for future research to more thoroughly examine what contributes to short-term and long-term changes in perceived control, how experiential and behavioral components of change contribute to aging-related outcomes, and the mechanisms through which changes in control operate to facilitate health outcomes.

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Footnotes

[1]In follow-up analyses, we examined differences in mortality risk between white and non-white ACL participants. Although the overall risk of mortality was higher for the non-white participants, we found a substantively identical pattern of results to those reported in the text.

Table 4.1

Means, Standard Deviations, and Intercorrelations Among the Constructs Included in the Survival Analyses

Construct	*M*	*SD*	1	2	3	4	5	6	7	8	9	10	11	12
1. Level perceived control	3.31	0.54	–											
2. Control trajectory	–0.002	0.20	.52*	–										
3. Age	56.32	17.08	–.07*	–.09*	–									
4. Gender (0=men)	0.64	0.48	–.08*	–.01	.11*	–								
5. Education	11.72	3.36	.22*	.03	–.37*	–.06	–							
6. Life satisfaction	3.68	0.80	.19*	.02	.14*	.003	–.07*	–						
7. Depressive symptoms	1.40	0.35	–.54*	–.18*	–.01	.09*	–.21*	–.22*	–					
8. Physical activity	2.58	0.79	.19*	.07*	.23*	–.17*	.26*	.06*	–.25*	–				
9. Emotional support	4.04	0.74	.26*	.08*	.04*	.10*	.05*	.18*	–.28*	.12*	–			
10. Self-rated health	3.36	1.09	.35*	.11*	–.26*	–.10*	.29*	.13*	–.40*	.31*	.13*	–		
11. Functional limitations	1.52	0.87	–.26*	–.10*	.40*	.14*	–.31*	–.05*	.32*	–.39*	–.05*	–.52*	–	
12. Heart	0.19	0.39	–.09*	–.01	.24*	.01	–.16*	.01	.10*	–.10*	–.02	.31*	.30*	–
13. Cancer	0.12	0.32	–.01	–.01	.12*	–.01	.03	.03	–.01	.04*	.01	–.06*	.03	.09*

Note. N = 2,840. For variables, 3, 6–11, measurements were taken from wave 2. Heart and cancer measurements were taken from all four waves of the study. Gender: Men = 1,027; Women = 1,813; Heart: no (0) = 2,202; yes (1) = 549. Cancer: no (0) = 2,507; yes (1) = 333.

*p < .05

Table 4.2

19-Year Mortality Risk as a Function of Level and Change in Perceived Control

	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6	Model 7
	HR [95% CI]	HR [95% CI]	HR [95% CI]	HR [95% CI]	HR [95% CI]	HR [95% CI]	HR [95% CI]
Level perceived control	0.82* [0.77, 0.87]	0.87* [0.82, 0.93]	0.97 [0.90, 1.04]	0.90* [0.84, 0.95]	0.89* [0.84, 0.95]	0.97 [0.91, 1.04]	1.07 [0.98, 1.17]
Control trajectory							0.92* [0.86, 0.99]
Age		1.08* [1.07, 1.09]	1.08* [1.08, 1.09]	1.08* [1.07, 1.08]	1.08* [1.07, 1.09]	1.08* [1.07, 1.08]	1.08* [1.07, 1.08]
Gender		0.66* [0.58, 0.76]	0.64* [0.56, 0.73]	0.58* [0.51, 0.67]	0.68* [0.59, 0.77]	0.60* [0.52, 0.69]	0.57* [0.50, 0.66]
Education		0.95* [0.94, 0.97]	0.96* [0.94, 0.98]	0.96* [0.95, 0.98]	0.95* [0.94, 0.97]	0.97* [0.96, 0.99]	0.97* [0.95, 0.99]
Life satisfaction			0.95 [0.89, 1.01]				0.97 [0.91, 1.03]
Depressive symptoms			1.21* [1.12, 1.30]				1.07 [0.99, 1.16]
Physical activity				0.77* [0.72, 0.82]			0.85* [0.79, 0.91]
Emotional support					0.93* [0.87, 0.99]		0.95 [0.89, 1.02]
Self-rated health						0.80* [0.75, 0.87]	0.83* [0.77, 0.90]
Functional limitations						1.18* [1.11, 1.26]	1.12* [1.05, 1.20]
Heart						1.01 [0.88, 1.17]	1.05 [0.91, 1.22]
Cancer						0.88 [0.74, 1.06]	0.91 [0.75, 1.09]
Model Fit Statistics							

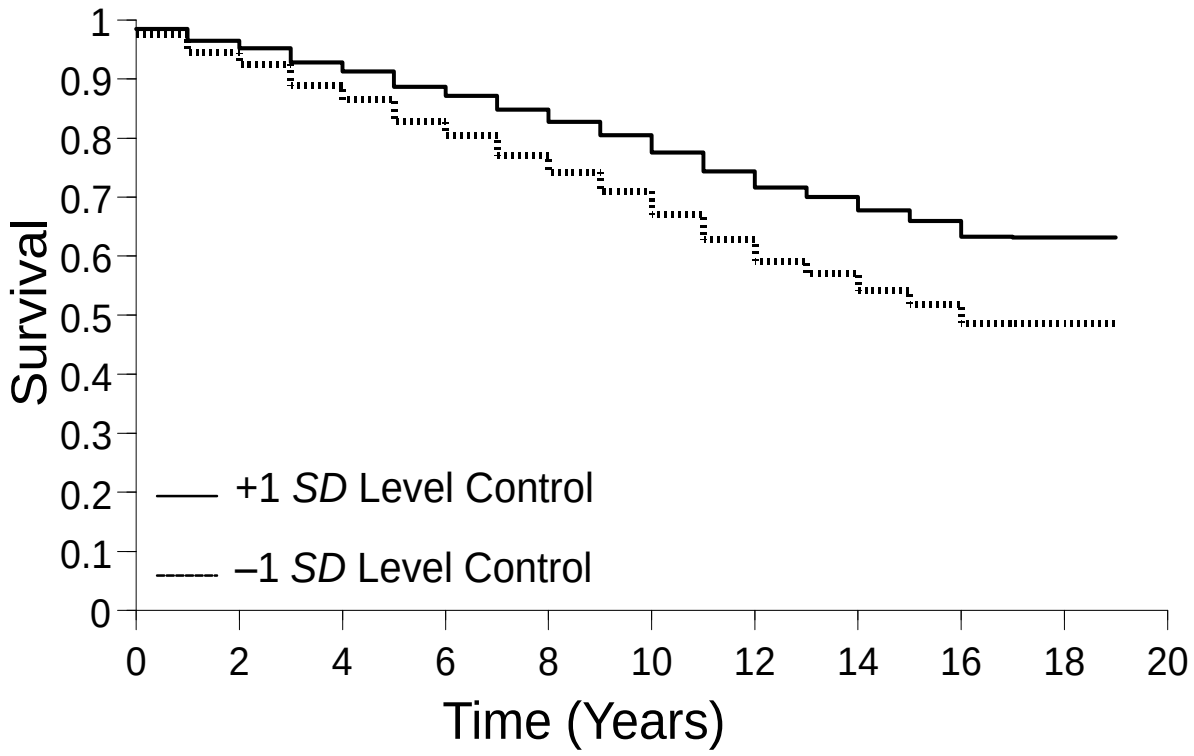
df	1	4	6	5	5	8	14
χ^2	42.66	979.60	1,003.71	1,057.31	983.94	1,071.83	1,120.17

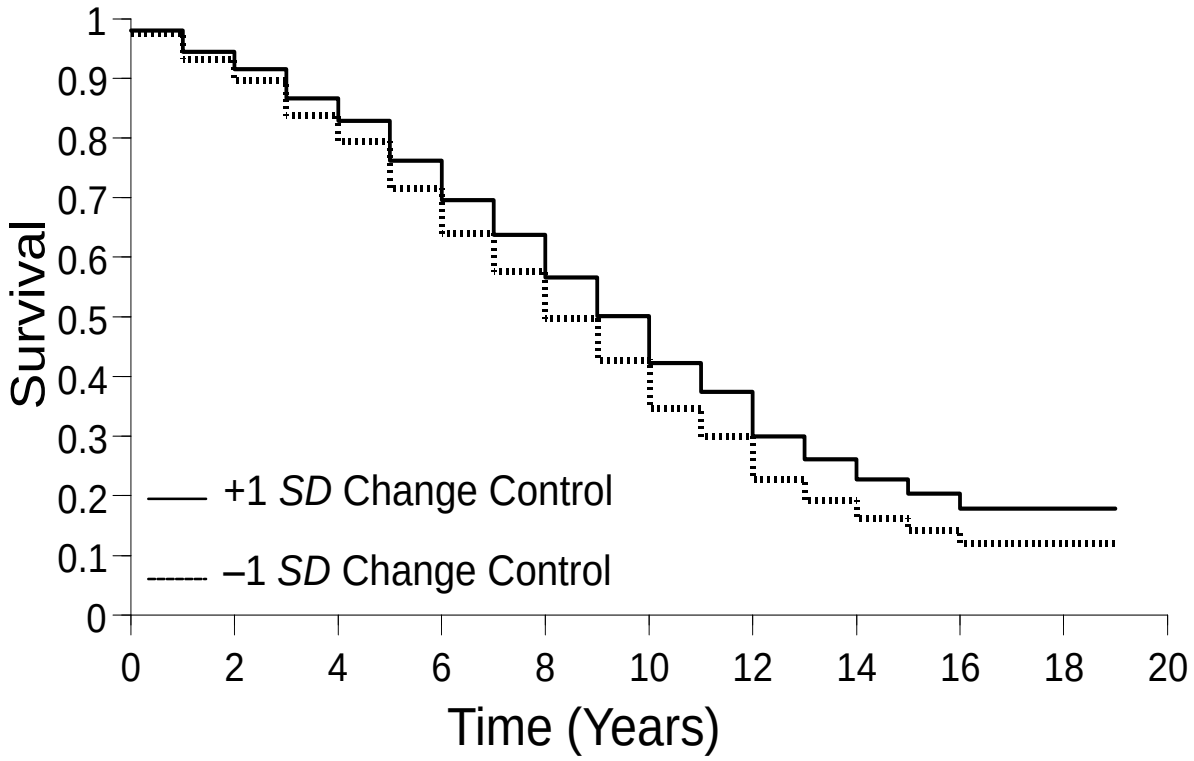
Note. *N* = 2,840 in total. Of those, 993 participants had died over the 19-year follow-up period. HR = Hazard Ratio. CI = Confidence Interval.
* $p < .05$.

Figure Caption

Figure 4.1. Illustrating the predictive effects of levels of perceived control for survival over 19 years in participants who provided data from the first two waves of the Americans' Changing Lives (ACL) Study. ACL participants with more perceived control were at lower risk for mortality. The predictive effect of perceived control was independent of socio-demographic factors. Time was calculated as years after the Wave 2 assessment.

Figure 4.2. Illustrating the predictive effects of control trajectory in perceived control for survival over 19 years in participants who provided data from the first two waves of the Americans' Changing Lives (ACL) Study. ACL participants who reported more positive changes in perceived control over a 2.5 year period were at lower risks for mortality. The figure illustrates the predictive effect of control trajectory was independent of socio-demographic, psychosocial, and health factors. Time was calculated as years after the Wave 2 assessment.


Survival
1
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
+1 *SD* Level Control
–1 *SD* Level Control
0
2
4
6
8
10
12
14
16
18
20
Time (Years)


Survival
1
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
+1 *SD* Change Control
–1 *SD* Change Control
0
2
4
6
8
10
12
14
16
18
20
Time (Years)

CHAPTER V

CONCLUSION

The overarching goal of my dissertation was to use the lifespan developmental model of perceived control that I introduced in the overview chapter to target antecedents and outcomes of perceived control. More specifically, I had three goals. First, research using constructs centered on control have largely focused on predicting outcomes, such as health and how control facilitates adjustment to stressors and chronic illness. To examine how one's context and various factors shape perceived control, paper one used a sample of caregivers to examine how caregiving experiences as quantified through primary stressors or role overload, can shape and influence one's ability to exert control over life circumstances. I found that mastery erodes with continued caregiving, but placement resulted in caregivers experiencing a significant boost in mastery, followed by sustained increases in the years thereafter. Corresponding changes (declines) in role overload accounted for increases in mastery with placement and caregivers reporting more depressive symptoms and ADL/IADL dependencies of the care recipient experienced a larger boost in mastery with placement.

Second, my focus was to target and examine mechanisms that may underlie control-health associations. Control is linked to physical functioning, cardiovascular disease incidence, and all-cause mortality, but research targeting underlying mechanisms is largely lacking. In paper two, I targeted this by examining whether control is directly linked to functional health and cardio-metabolic risk, and the role of physical activity in mediating these associations. Control was directly linked to better functional health and lower cardio-metabolic risk and physical activity mediated each association. In paper three, I examined whether the association between levels of control and mortality was accounted for by psychosocial and health factors and found that the association between levels of control and mortality was primarily driven by well-being and health factors.

My third goal was to examine how control changes in relation to non-normative processes and target the predictive utility of time-related control change for health outcomes. As

discussed above, I found in paper one that mastery follows a multi-phase pattern in relation to placement of a loved one with dementia in a nursing home or similar institution. In paper three, I used data from the Americans' Changing Lives Study to examine whether time-related control change predicted mortality over and above levels of control and known correlates of mortality. More positive time-related changes in control were protective of 19-year mortality over and above levels of control and known correlates of mortality.

My next task is to place the results from each of the papers within the context of the lifespan developmental model of perceived control. To do so, the following sections of the concluding chapter will be divided as follows. First, I will discuss how each of the papers contribute to Figures 1.2 and 1.3, as well as target future directions for empirical inquiry within the context of each dissertation paper. Second, I will target areas for future research centered on perceived control that were beyond the scope of my dissertation. Topics to be discussed include how perceived control facilitates adjustment to life events, transitions and stressors/burdens; and measurement indices of control. Lastly, I will end with final concluding thoughts.

Antecedents of Perceived Control

Figure 1.2 illustrates that perceived control is an outcome of one's social context and health. The focus of paper one was to evaluate further how one's social context, as quantified by primary stressors and caregiving experiences (care recipient characteristics), can shape levels and changes of mastery in caregivers. I also examined whether caregiver characteristics moderate levels and changes in mastery with placement. Findings showed that with placement of a loved one in a nursing home or similar institution, caregivers' typically experienced a significant boost in mastery, followed by sustained elevated levels thereafter. When role overload was included into the model as a time-varying predictor, the effect of placement on mastery was attenuated to the null, suggesting that concurrent changes (declines) in role overload influence changes (boosts) in mastery with placement. Caregivers who had to help their care recipient with more

everyday activities of daily living were more likely to report lower levels of mastery prior to placement, but stronger increases in mastery with placement. Additionally, mental health or depressive symptoms of the caregiver moderated reaction to placement, such that caregivers who reported more depressive symptoms prior to placement were more likely to report lower levels of mastery prior to placement, but stronger increases with placement. Our findings provide empirical support for Figure 1.2, which showcases how one's context and mental health can shape perceptions of control.

Paper one was especially able to capitalize on the proposition of Figure 1.2 because caregivers were followed both prior to AND after placement. This set-up enabled me to provide evidence of how the changing caregiving context exerts its influence on perceived control. Tasks and responsibilities that characterize caregiving prior to placement can be a taxing time for caregivers due to having to deal with chronic disturbances, daily challenges and hassles (Gaugler et al., 2000; Savla, in press; Sugihara et al., 2004) that can severely dampen their ability to exert control over life circumstances. This was signified by the observed erosion of mastery prior to placement and simultaneous increases in role overload. However, a new picture emerged with placement. The contextual landscape of the caregiver was altered through placement of their care recipient in a nursing home or similar institution. Placement resulted in a significant boost in mastery, followed by sustained gradual increases in the years thereafter. Simultaneous changes in role overload with placement mediated changes in mastery, further signifying how one's social context can shape and influence perceptions of control. It is largely an open question regarding the long-term significance of boosts in mastery with placement. Using the results from Table 2.3, I calculated the cumulative distribution function of the model-implied normally distributed inter-individual differences and found that 65% of caregivers experienced an increase in mastery with placement (76% experienced declines in mastery prior to placement), suggesting that placement provides a relief for most caregivers. Caregivers who experience larger mastery increases with

placement may be better able to preserve their emotional well-being in the years following placement (see also Aneshenshel et al., 2004). This question can be targeted by outputting the reaction parameter from the model and using it to predict levels and changes in well-being and long-term health outcomes (disability, mortality) in the years following caregiving.

A second contribution of paper one is that it importantly demonstrates that constructs of control are malleable or plastic, meaning they have the *capacity to change*. Mastery was shaped and influenced by caregiving processes linked to placement. As discussed by Pearlin and Skinner, control constructs should be considered an interrelated set of beliefs that grow out of prior interactions and experiences, as well as being influenced by one's health constraints (Pearlin et al., 2007; Skinner, 1995; see also, Heckhausen et al., 2010). Seligman (1975), writing in the context of learned helplessness, argues that helplessness is not innate or trait-like but learned through experience, meaning it has the capacity to change – individuals learn through experience that outcomes are controllable or not controllable.

Findings from paper one are in slight contrast to research on age-related trends that shows control is relatively stable across adulthood and old age. Conflicting evidence across time metrics signifies that age may not be the best metric for studying change in perceived control (for similar discussions and demonstrations with well-being, see Gerstorf et al., 2008a, 2008b, 2010, 2011), but instead the focus should shift to the importance of examining control fluctuations and short-term changes in relation to life events and transitions (e.g., Eizenman et al., 1997). This calls for research studies and panel surveys to assess control at least yearly or more often (e.g., HRS assesses control every four years). I believe that a very important area for future research is to examine control across various time metrics, which will enable researchers to evaluate further how control develops, is challenged, and is shaped by life experiences. Although the mean level changes in control in relation to caregiving or other life events may not be large (as compared to well-being), short-term control changes may have implications for long-term outcomes (e.g.,

health outcomes, see dissertation paper three). I will discuss short-term control changes in relation to life events and transitions and possible long-term implications more thoroughly in the discussion of paper three that focuses on time-related control changes (see page 161).

Lifespan approach to how social context shapes perceived control. Findings from paper one bespeak to taking into consideration how the social context contributes to shaping and influencing perceptions of control. Conceptual models and theories of control argue for the importance of a lifespan approach to studying facets of control (Heckhausen & Schulz, 1995; Skinner, 1995). Contexts and experiences in childhood are the foundation for shaping perceptions of control and areas that are especially important for shaping control early in development include school and family. School environments that provide structure, predictability, and focus on developing children's actions, efforts, and competence systems contribute most to developing perceived control (Eccles et al., 1991, 1993; Skinner, 1995). Greater participation in family decision making and positive relationships with parents and family members is linked to indicators of school motivation and perceptions of control in adolescence and into adulthood (Eccles et al., 1993; Shaw et al., 2004; Uchino, 2009). By targeting earlier phases of the lifespan as a means for developing and fostering perceptions of control (and more broadly non-cognitive skills and mental capital), this can have a tremendous effect on future developmental and aging-related outcomes for individuals, families, and society as a whole (see Beddington et al., 2008; Heckman, 2006; Heckman et al., 2006).

Moving from childhood to later stages of the lifespan, such as adulthood and old age, influences on control may shift from school to work and adult roles, such as a work environment that is not overly rigid or caregiving for a loved one with dementia. In older ages, residing in assisted living or a nursing home can provide a context that especially influences perceived control. As shown in seminal research by Langer and Rodin (1976), nursing home residents who were given the opportunity to exert more control over everyday activities and given

responsibilities within their environment had a greater likelihood of survival and reported more positive mental health. Workers in these types of places must not do everything for their residents, because this hinders their experiences of control and in the long run residents may rely on staff more (for discussion, see Baltes, 1995, 1996). Assisted living and nursing homes need to emphasize independence, motivation, competence, and contingency for everyday activities. For example, if someone has trouble opening a jar of honey or cutting their food, it may be best to let them struggle a little and in the end succeed in the action, whereas helping them may make them feel helpless for eating, which may carry over into other areas of life. More personally, my grandma walks with a cane and typically has trouble sitting up from the couch. Even though she struggles when sitting up from the couch, I try not to help her so that she uses those muscles each time and keeps them in a functional state.

Future directions for examining antecedents of perceived control. I believe there are several avenues for future research to more thoroughly examine antecedents of perceived control. First, within the caregiving arena, it would be interesting to explore whether at the daily level mastery fluctuates in caregivers, especially comparing mastery on days when caregivers utilize adult day services. Do caregivers experience increases in mastery on days when they utilize adult day services? If so, what would the implications of increases in mastery on adult day service days signify? Based on findings from paper one, I would expect that on days that caregivers bring their loved one to adult day care, they would also be more likely to report higher levels of mastery. Mastery increases on days that the care recipient attends adult day care may relate to better well-being and participation in health-promoting behaviors. Furthermore, future analyses can apply growth mixture models (Grimm & Ram, 2009; Ram & Grimm, 2009) to the data set used in paper one to examine subgroups of mastery change in relation to placement. Large between-person differences were found in caregivers mastery in reaction to placement and growth mixture modeling would be a way to examine whether particular subgroups of people

experienced larger increases or decreases in mastery with placement, as well as being able to compare whether mastery changes differed prior to versus after placement.

A second avenue for targeting antecedents of control is to use longitudinal data from panel surveys to examine how both level and time-related changes in social, cognition, well-being, and health domains are related to levels and changes in control. This would follow-up research from the SOEP where with my colleagues, we examined how level and time-related changes in social participation and life satisfaction were associated with perceived control (Infurna et al., 2011a). We found that more positive changes in social participation, as well as higher levels of social participation and life satisfaction were linked to higher levels of control. Future analyses need to target the health and cognitive domains. For example, is it the incidence of a chronic illness at one point in time that has lasting effects on control or is it the accumulation of multiple illnesses that exert a potent force on one's perceptions of control over life circumstances? Similarly, for functional limitations, is it the incidence or the accumulation of limitations in everyday functioning that undermines control? Does age, gender, or education moderate such associations between level and time-related changes in antecedents with control? These are some of the questions Denis Gerstorf and I are beginning to explore with data from the Health and Retirement Study (HRS; Infurna & Gerstorf, in preparation). In our set-up, we are using HRS data on cognition (memory), mental health (depressive symptoms), and health (functional limitations, self-rated health) from 1992 to 2006 to examine how level (2006) and time-related changes (from 1992 to 2006) in these domains predict level (measured in 2006) and four-year changes (measured in 2006 and 2010) in perceived and domain-specific control. Preliminary findings show that higher levels of memory, reporting fewer depressive symptoms and more positive self-rated health relates to higher levels of control. Stronger time-related increases in both depressive symptoms and functional limitations are linked to lower levels of control. Targeting antecedents of four-year changes in control, higher levels of and exhibiting

more positive changes in memory, reporting fewer depressive symptoms and more positive self-rated health were all related to experiencing positive four-year changes in control. Analyses focusing on moderators are still in the initial stages.

Aging-Related Outcomes of Perceived Control

Figure 1.3 illustrates how perceived control facilitates aging-related outcomes. Perceived control is protective against declines in cognitive and physical functioning (Caplan & Schooler, 2003; Gerstorf et al., 2011; Lachman & Agrigoroaei, 2010; Seeman et al., 1999; Wahl et al., 2010), cardiovascular disease incidence (Rosengren et al., 2004; Stürmer et al., 2006), and all-cause mortality (Infurna et al., 2011a; Krause & Shaw, 2000; Penninx et al., 1997; Peterson et al., 1998; Seeman & Lewis, 1995; Surtees et al., 2006, 2010). The pathways through which control operates to influence these outcomes include behavior, emotion, motivation, social support, and biological processes. Perceived control directly influences behavioral functioning (i.e., physical activity), emotion regulation (i.e., affect and depression), motivational resources (i.e., action initiation, goal [dis]engagement), and social support (i.e., use of support in times of need) that have downstream effects on aging-related outcomes through modulation of biological processes. In papers two and three, my aim was to elucidate the mechanisms that underlie control-health associations.

Discussion and implications of paper two. In paper two, I focused on whether control directly relates to indicators of functional health and cardio-metabolic risk and the role of physical activity in mediating such associations. Following the guidelines of Miller and colleagues (2009), I targeted functional health and cardio-metabolic risk because (1) each are linked to common health outcomes of control, (2) they have plausible pathways for influencing common health outcomes of control, and (3) there is empirical evidence to suggest for plausible pathways that link control and behavioral functioning to these biological processes. I found that perceived control was linked to each of the six indicators (better grip strength, lower

Hemoglobin A_{1c}, higher HDL–C, lower WC, higher SBP, and lower PR) and physical activity mediated the association between control and five of the six indicators (grip strength, Hemoglobin A_{1c}, HDL–C, WC, and PR). Findings provide evidence that functional health and cardio-metabolic risk underlie control-health associations. What was especially striking is the magnitude of the effects that we found when compared to age effects. For example, results from Model 1 in Table 2 indicate that a 1 *SD* increase in control is associated with 2.5 *fewer* years of aging on grip strength, 10 *fewer* years of aging for hemoglobin A_{1C}, 14.5 *fewer* years of aging for HDL–C, 3.7 *fewer* years of aging for pulse rate, and 5.75 *fewer* years of aging for waist circumference. In a similar vein, Snih et al. (2002) reported that a 1 kg increase in grip strength reduces the risk of mortality by 3%. In our study, a one-unit increase in perceived control on a scale from 1 to 6 was associated with a 0.95 kg increase in grip strength. Following those numbers, this increase in perceived control translates via grip strength into a reduction of mortality risk by almost 3%.

Results from paper two need to be interpreted with caution because they are cross-sectional. In order to more thoroughly examine associations between perceived control with functional health and cardio-metabolic risk, longitudinal research needs to be conducted. This can be done in one of two ways. First, I can use latent change score models to examine whether control is linked to longitudinal changes in these biological processes. Latent change score models allow for examining longitudinal change and testing bi-directional associations between the constructs of interest (Ferrer & McArdle, 2010; McArdle, 2009). Therefore, it would be possible to examine whether (1) control protects against declines in grip strength over time, (2) better grip strength results in more positive control changes, and (3) time-related changes in grip strength and control are correlated. Second, the HRS has assessed both cognitive (memory) and physical (functional limitations) functioning longitudinally on a biannual basis from 1992 to 2010. A proposed study will examine whether control as assessed in 2006 is protective of four-

year changes in cognitive and physical functioning (from 2006 to 2010) and whether physical activity (level and 2-year changes) and biological processes (indicators used in paper two) mediate the protective effect of control on these important domains of functioning. This paper will allow for examining whether (1) control is protective of changes in cognitive and physical functioning, (2) the protective effect of control is mediated by level and 2-year changes in physical activity and levels of biological processes, and (3) time-related changes between control with cognitive and physical functioning are correlated. The opposite directional effect can also be accounted for and modeled by including whether levels of cognitive and physical functioning are linked to changes in control and whether changes in these domains are correlated over time (see Gerstorf et al., 2011c for this type of set-up).

It is critical for researchers to be mindful of how the biological system being studied behaves temporally. Does the system fluctuate within and between days or over longer periods of time, such as weeks, months, or years? Inclusion and testing a particular biological system depends on your research question and hypothesis, whether it is centered on the daily or long-term time metric, such as months or years. Indicators used in paper two, such as grip strength, Hemoglobin A_{1c}, HDL–C, and WC are less likely to fluctuate drastically from day-to-day (Crimmins et al., 2008). For example, Hemoglobin A_{1c} is a cumulative measure of blood glucose metabolism that covers 120 days; I would not expect this to fluctuate from day-to-day as opposed to other quantifications of blood glucose that assess daily levels. The same can be said regarding HDL–C since physical activity intervention studies that target cholesterol typically assess cholesterol at baseline and in three to six month intervals (Stefanick et al., 1998). The aforementioned factors represent systems whose effects take time to evolve and accumulate. Whereas, if stress systems such as HPA or SAM axis were assessed (Piazza et al., 2010), then one measurement would not be best, but multiple assessments over the course of the day or throughout the week would be ideal. For example, I found that control was linked to higher

resting SBP. This finding could be due to using the wrong time metric; control may be protective of SBP over short-term time scales, such as in laboratory tasks and in times of stress (e.g, Bollini et al., 2004).

In addition to examining longitudinal associations between control with functional health and cardio-metabolic risk, in future studies, I would like to test whether immune system functioning underlies control-health associations. Immune system functioning includes markers of inflammation (C-reactive protein, Interleukin-6). Following the guidelines of Miller and colleagues (2009), empirical evidence suggests that inflammatory markers (1) are linked to disability, disease incidence, and mortality (Cohen, 2000; Currie, Poole, & Conway, 2008; Danesh et al., 2000; Morley & Baumgartner, 2004), (2) have plausible pathways for contributing to aging-related health outcomes, (3) and there are plausible pathways through which control indirectly effects their levels in the body. In a similar set-up to dissertation paper two, I could test whether perceived control is directly linked to immune system functioning and examine the role of physical activity and emotional health (depressive symptoms, positive and negative affect, or life satisfaction) in mediating such associations. The work of Kiecolt-Glaser and colleagues (2002) demonstrates that emotional health is linked to inflammation and emotional functioning may be an avenue through which control impacts these biological processes. Empirical evidence from cross-sectional and longitudinal research indicates that control is linked to various indicators of emotional health (i.e., depressive symptoms, life satisfaction, positive and negative affect; Lang & Heckhausen, 2001; Peterson & Seligman, 1984; Windsor & Anstey, 2010).

Biologically plausible models linking control to cognitive and physical functioning, disease incidence, and mortality. Using results from paper two and in accordance with Miller and colleagues (2009), I would like to delineate biologically plausible models for linking control to aging-related outcomes. In particular, I propose that there is specificity in the biological and cellular processes through which control influences various aging-related outcomes. For

example, in paper two I found that control is directly linked to grip strength and this association was mediated by physical activity. The pathway of how control impacts disability through physical activity and grip strength would be as follows: People with higher levels of control are more likely to partake in physical activity and strenuous exercise (behavior), which promotes vigor, vitality, and one's functional health or grip strength (biological process), leading to increased musclo-skeletal capacity (cellular process), and a decreased likelihood of having difficulty performing everyday activities of daily living (health outcome of disability). Similarly, I can construct a specific model linking control to cardiovascular disease incidence and mortality through HDL–C and Hemoglobin A_{1c}: Higher levels of control are linked to partaking in more physical activity and strenuous exercise (behavior), which suppresses glucose production, reduces adipose tissue, and increases HDL–C production (biological process), leading to decreased likelihood of atherosclerosis (plaque accumulation in artery walls), arterial wall stiffening, release of inflammatory cytokines, and cerebrovascular symptoms (cellular process); ultimately, resulting in a decreased likelihood of cardiovascular disease incidence and mortality (health outcome). Targeting cognition, control may protect against declines in cognitive functioning (outcome) through physical activity (behavioral) and forced expiratory volume (biological process), leading to better overall blood flow and pulmonary functioning (cellular process). To thoroughly assess the nature of how control and biological processes are interrelated across the lifespan, it is upon future research to extend these pathways to cognitive functioning, test such pathways longitudinally, and conduct in depth studies to examine associations between control and cellular processes (e.g., atherosclerosis, inflammatory cytokines, gene expression, methylation, and receptor binding).

Discussion and implications of paper three. In paper three, the focus was to first examine whether well-being, physical activity, social support, and health factors accounted for associations between levels of control and mortality. Levels of control were protective against

19-year mortality, independent of socio-demographics and well-being and health factors primarily accounted for the association. Findings are in accordance with previous research that indicates control is linked to health outcomes through emotion and health factors. First, perceiving control over life circumstances enables individuals to down-regulate negative emotions that have downstream effects on aging-related outcomes (Lang & Heckhausen, 2001; Windsor & Anstey, 2010). Viewing outcomes and contingencies as controllable protects people against developing stress, anxiety, and depressive symptoms (Seligman, 1975). Second, higher levels of control may lead to perceiving fewer external factors that constrain one's ability to perform health behaviors and report better self-rated health. Stronger perceptions of control may provide individuals with motivational resources to engage in health and rehab behaviors to prevent from experiencing functional limitations (Verbrugge & Jette, 1994).

A second focus in paper three was to target whether time-related change in control uniquely predicted 19-year mortality, over and above levels of control and known correlates of mortality. Time-related control change provided an added and distinctive contribution to predicting mortality. A one *SD* increase in control over one year was associated with an 8% decreased hazard for mortality, suggesting that time-related changes in control are an important component of development to consider for evaluating aging-related outcomes and should be used more frequently in research studies to examine how control permeates across the lifespan to influence various outcomes. Also, results showing that control changes have long-term health implications provide impetus for community health and intervention programs that target control beliefs to help promote healthy profiles of living across the lifespan (Bandura, 2004; Estabrooks et al., 2011). Interventions that have targeted control beliefs have proven successful (e.g., Lachman et al., 1997; Searle et al., 1998; Tennstedt et al., 1998) and coupled with our findings can be a basis for future health and intervention programs to focus on maintenance and increasing perceived control for better long-term health outcomes in adulthood and old age.

To evaluate further how and why time-related control change is an effective measure to include in empirical studies, more research is needed to examine the causes of or why people experience short-term control changes. This will help identify antecedents of control and target how short-term control changes facilitate adjustment to and influence aging-related outcomes. In paper one, I found that caregiving processes shape and influence mastery in a multi-phase pattern with erosion during caregiving, a significant boost with placement, and sustained elevated levels thereafter. Control in the context of caregiving has been studied extensively, but additional research is needed that targets how control is challenged and experienced across health transitions and major life events. Targeting research on health transitions, Ranchor and colleagues (2010) recently found that control declined with incidence of cancer diagnosis and that less steep declines were protective against psychological stress in the years following diagnosis. These findings provide evidence that control is sensitive to one's changing health circumstances and changes in control help facilitate adjustment to such transitions. More research is needed to examine whether similar findings occur with the incidence of various other illnesses in adulthood and old age, such as diabetes, cardiovascular disease, lung disease, and arthritis. Each of these illnesses constrains perceptions of control when examined cross-sectionally (Penninx et al., 1996), but the verdict is still out regarding how control changes in relation to incidence.

In order to examine whether specific life events and transitions shape (or "cause") short-term changes in control, data needs to be collected that assesses control in consecutive years (or waves), either yearly or every other year, but preferably more often. A current project that is underway with Denis Gerstorf, Nilam Ram, Jutta Heckhausen and our colleagues at the DIW (German Institute for Economic Research) Berlin, Jürgen Schupp and Gert Wagner, is using data from the SOEP to examine how perceived control changes in relation to major life events. Major life events that we are targeting include disability, welfare, unemployment, unemployment of

partner, marriage, divorce, and childbirth. The SOEP assessed perceived control in three consecutive waves from 1994 – 1996, permitting for examining short-term, one-year control changes in relation to these events (from one-year before the event to the year of the event). Preliminary findings are promising. For example, people who experience positive events, such as marriage and childbirth, typically report increase in control, whereas control declines with welfare. Our focus paper from this overall project is on unemployment. Experiencing unemployment is a devastating event that wreaks havoc on one's well-being, physical functioning, family, and future prospects of work and health (Bartley, 1994; Gerstorf et al., 2011; Lucas et al., 2004; McKee-Ryan, Song, Wanberg, & Kinicki, 2005). Additionally, recent economic events in the United States and Europe (e.g., recession, economic debt, rising unemployment rates and poverty) demands for a more in depth analysis of how these events and circumstances impact one's psychological resources. Consequences of such events need to be discussed in how they *impact the individual and family and not just solely focus on what they entail for balancing national budgets and debts*.

This project has three aims. First, we examine how perceived control changes with unemployment. Second, we target factors that moderate control changes with unemployment. Third, we focus on how control levels prior to and changes with unemployment are linked to re-employment and welfare incidence in the years after unemployment (i.e., how does control facilitate adjustment to major life events). We observed that control remains relatively stable with unemployment, but there are sizeable between-person differences in change. For people who experience control declines, unemployment may result in viewing the world as being fatalistically ruled and less determined by one's own actions, efforts, and behaviors. As Frankl (1984) eloquently wrote, unemployment may leave people with a feeling of "provisional existence," unable to live for the future and aim for a goal. For people who experience increases in control with unemployment, this may reflect decreased thoughts that life is determined by

powerful others or by chance or luck. Second, women and people who attained fewer years of education experienced stronger declines in control with unemployment. Lastly, stronger increases in control with unemployment were linked to an increased likelihood of finding full-time re-employment in the years following unemployment. For example, a one *SD* increase in control with unemployment was linked to a 17% increased likelihood of re-employment. Compared to those who reported stronger control increases, people who reported stronger declines in control were delayed, on average, 3 years in finding full-time re-employment. Higher levels of control prior to unemployment were protective against welfare incidence in the years following unemployment.

Projects like this contribute to the perceived control literature on several fronts. First, examining control change in relation to major life events contributes to notions that control constructs are indeed not fixed, like personality traits, but are an interrelated set of beliefs that grow out of experiences, interactions, context, and health. This will allow researchers to better evaluate the events and factors at the societal level that influence one's perceptions regarding their ability to shape and exert influence over their life circumstances. Second, this approach targets the utility of control constructs for facilitating adjustment to various life events and transitions. In our study, we observed that reporting higher levels of control prior to unemployment provides people the means and resources to prevent welfare incidence and changes with unemployment can impact one's ability to become re-employed.

Health and Lifespan implications of papers two and three. The focus of papers two and three were on how perceived control facilitates health outcomes, or put differently, I targeted the health implications of perceived control. Results from papers two and three have potential health implications at the societal and policy level. As I discussed in paper two, the health demographics of the United States is unfortunately changing. Cardiovascular disease incidences have remained relatively stable over recent decades, but the same cannot be said for diseases

centered on metabolic syndrome (e.g., diabetes). Empirical evidence is also beginning to show that the number of older adults reporting limitations with everyday activities have been increasing in recent decades (Seeman et al., 2010). These trends have the potential to increase health care costs directly related to patient care and on society through Medicaid and Medicare programs (Manton, 2008; Olshansky et al., 2009). To help protect against these trends, community programs and health policies that focus on aspects of perceived control have the potential to help buffer against the increasing cases of metabolic syndrome related illnesses, limitations with everyday activities of daily living, and mortality processes. By instilling in people the motivational resources to partake in health-promoting behaviors, this can operate as one set of means to protect against health declines. Perceived control is an interrelated set of beliefs that have the capacity to change and targeting one's context, whether it is social network or at the community level has the potential to influence perceived control for bettering one's health profile.

Bandura (1997, 2004) has written extensively on the topic of health promotion through social cognitive means (see also Lachman et al., 1997; Jette et al., 1999; Peterson & Strunkard, 1989). In order to improve societal health, individuals need to first understand that they have control over their health and life circumstances. By viewing one's health as controllable, people will engage in behaviors and have the coping strategies for a healthy profile of living. Behaviors include partaking in health-promoting behaviors of physical activity, exercise, as well as preventive care, such as health-screenings. Changing one's social cognitive means for health promotion can be disseminated through multiple avenues. Bandura (2004) discusses that knowledge, mass media, media influence, and connection and social systems should be the target of community health campaigns. Social systems include the work place, where employers can provide incentive programs for people to join gyms or give gym membership discounts (health insurance companies could also give discounted rates for people who exercise regularly). Work

places that have gyms on the company location or provide gym discounts give individuals direct access to the means for a healthy profile. To take advantage of these perks, workers can use part of their lunch break to get a workout in at the gym or do so before or after work. The school is another social system that exerts influence over one's perceptions of control. Schools whose discussion focuses on health promotion and gym classes can provide children and adolescents at an early age the social cognitive means or tools for later health. Tools include instilling the importance of setting realistic goals, expectations, and also receiving feedback on their progress for health behaviors and later good health (importance of eating a healthy diet, exercising or partaking in physical activities). Targeting and focusing on social cognitive means this early in the lifespan (and in adulthood and old age) can set the stage for people to engage in exercise and other health-promoting behaviors for the rest of their lives (Lachman et al, 1997; Jette et al., 1999). Health campaigns need to focus on increasing knowledge and the search for health information translating perceived risk into more positive avenues for health (Rimal, 2000, 2001). Technology can play a role through the internet and widespread use of smartphones. Advertisements along the internet explorer screen, which target website patterns online, can be used as a health promotion campaign.

Future Directions

Within the context of discussing each of the dissertation papers in lieu of Figures 1.2 and 1.3, I touched upon paper topics for future endeavors. Topics included examining long-term antecedents of control, how physical activity and biological processes underlie links between control and changes in cognitive and physical functioning, biological systems to target (immune system), and more deeply examining how control changes in relation to life events and transitions. This next section will briefly touch upon future research topics not previously discussed and were not the target of my dissertation. Topics include control as a facilitator of adjustment to life events, transitions, and stressors/burdens and measurement inquiries of control.

Perceived control facilitates adjustment to life events and transitions. Dissertation papers two and three targeted how control facilitates aging-related outcomes (see Figure 1.3). In this section, I would like to focus on how control is also an important psychological resource that people can draw upon to facilitate adjustment to chronic illness, stressors/burdens, and life events/transitions. Figure 5.1illustrates how control facilitates adjustment to a wide range of life circumstances through its protection against declines in emotion, cognitive, and physical health, and biological processes. It is important to point out that both levels of control prior to the event and changes with the event can play a major part in facilitating adjustment. For example, with the onset and living with a chronic illness control facilitates adjustment by decreasing psychological stress and helping to maintain physical functioning (Taylor, 1983; Taylor et al., 1991; Thompson et al., 1991, 1993). For caregivers, mastery is a psychological resource that protects against declines in mental health (Aneshenshel et al., 1995, 2004; Lazarus & Folkman, 1984). Control also protects against how stressors can lead to declines in positive affect, life satisfaction, and increases in negative affect. For example, at the between- and within-person level, perceived control is protective against reporting lower levels of well-being and physical health on days in which people report stressors (Hay & Diehl, 2010; Neupert et al., 2007). As discussed above, using data from the SOEP, we found that higher levels of control prior to unemployment protects against welfare incidence and increases in control with unemployment increases the likelihood of re-employment in the years following unemployment.

An important focus for future research is to focus on the specific mechanisms through which control facilitates adjustment. Specific mechanisms shown in Figure 5.1 include social support, motivation (goal [dis]engagement), secondary control (cognitions), coping strategies, and appraisal/prevention. First, control can help protect against declines in emotional and physical health with life events/stressors/burdens through social support. Higher levels of control are associated with greater integration within one's social network system (Gerstorf et al., 2011;

Infurna et al., 2011a), which can be utilized in times of need to protect against health declines. For example, when diagnosed with a chronic illness that limits one's everyday mobility, people can use their social network for instrumental support (help with transportation needs) to buffer declines in mental health through new stressors. In the case of unemployment, people with more control will seek out their social network and community for information regarding re-employment. Second, perceived control can provide people with the motivational resources needed to persist in the face of challenging tasks or life events in order to succeed (Seligman, 1975; Skinner, 1995). For example, people with more chronic health problems who participated in more goal disengagement goals had an increased likelihood of survival and reported better subjective well-being, whereas goal engagement was linked to survival for people with acute health problems (Hall et al., 2010). Third, control can help facilitate adjustment to life events through secondary control strategies or cognitions (i.e., change the self, flexible goal adjustment). Adjustment to disease incidence or unemployment can be better managed through secondary control strategies such as cognitively viewing oneself to be in a better situation than others or learning new strategies to protect against health declines. Fourth, higher levels of control are linked to the increased likelihood of mobilizing effective coping strategies in times of need. Control is linked to better knowing whether to enact problem-focused or emotion-focused coping strategies (Skinner, 1995). Fifth, appraisal/prevention is another means through which control can facilitate adjustment to major life events/stressors through developing strategies that would be beneficial in future circumstances (Skinner, 1995).

It is important to consider how this model is similar to or different from other models that examine how control related constructs facilitate adjustment to life events and illnesses. The model shown in Figure 5.1 is comparable to the model proposed by Wrosch and colleagues (2004). Wrosch et al. (2004) focus on how control processes moderate the association between physical functioning and depressive symptoms in the context of disease. The incidence of disease

has already occurred and control processes are utilized to protect against how declines in physical functioning lead to increases in depressive symptoms. For example, research by Wrosch and colleagues has focused on how health engagement control strategies reduce depressive symptoms and protects against declines in physical functioning, especially for people who report poor physical health (Dunne et al., 2011; Wrosch & Schulz, 2008; Wrosch, Schulz, & Heckhausen, 2002; Wrosch et al., 2007). In contrast, my model targets how levels of control prior to and changes in relation to the event moderate the association between the actual occurrence of the event and emotion regulation, physical health, and biological processes. For example, caregivers who report higher levels of control are protected against caregiving strains on mental and physical health declines (Aneshensel et al., 1995, 2004; Mausbach et al., 2007).

Measurement topics of perceived control. In my dissertation, the measures of control primarily assessed general perceived control and were largely taken or adapted from the Pearlin Mastery Scale (Pearlin & Schooler, 1978). An avenue of future research that I feel would be important to follow is developing a measure that more specifically targets one's beliefs regarding control over health and various other outcomes. A template questionnaire would be the Control, Agency, Means Interview (CAMI) developed by Skinner and colleagues (1988, 1990; see also Little et al., 1997). The CAMI is designed to measure children's levels of control beliefs, strategy beliefs and capacity beliefs for academic achievement. Something similar has been done with examining goals and outcome expectations for physical activity within the context of Bandura's model (see White et al., in press; Wójcicki et al., 2009). Development of such a questionnaire promises to examine in detail the specific beliefs that contribute most to physical activity and health outcomes (e.g., competence versus contingency or the combination of both). For example, is it one's thoughts regarding whether they have the resources or means to engage in physical activity (capacity beliefs, competence) or one's beliefs regarding the contingency between behavior and the health outcome (strategy beliefs, contingency) that drives health

outcomes? Or, is it a combination of all of the above that contribute to health outcomes the most? White et al. (in press) examined whether physical (e.g., physical activity will aid with weight control), social (e.g., physical activity will increase socialization and provide companionship), and self-evaluative outcome expectations (e.g., exercise will provide me with a sense of accomplishment – increase self-worth and well-being) mediated associations between self-efficacy and physical functioning and found that physical outcome expectations, not social and self-evaluative, mediated the relationship between self-efficacy and physical activity. The CAMI uses Skinner's model (1995, 1996) as a backdrop to target control beliefs (link between control and outcome), capacity beliefs (link between self and means or resources), and strategy beliefs (link between means or resources and outcome). Within the capacity and strategy beliefs, participants are assessed on their beliefs regarding their own effort, ability, powerful others, and luck. This would be good to develop for health, cognitive, family, living arrangements, and retirement areas of life. To what beliefs do people attribute their engagement (or lack thereof) in physical activity and subsequent outcome contingency – is it through effort, ability, powerful others, or luck? This would provide a better means to assess people's beliefs regarding health outcomes and could be insightful for interventions – what areas of the control system are most critical for health outcomes? Is it one's beliefs regarding having the means or resources to engage in certain behaviors or is it their beliefs regarding the contingency between their means or resources and the desired outcome or goal?

Final Thoughts

Control is a general-purpose belief system that pertains to a wide range of topics in lifespan development ranging from developmental outcomes in childhood and adolescence to economic and aging-related outcomes across adulthood and old age. The influence of perceived control permeates across disciplines, situations, and time metrics. This is something that I tried to convey (and I hope I did) through my dissertation. This was the intention of the lifespan

developmental model of perceived control that I presented here with Figures 1.2, 1.3, and 5.1 and their accompanying discussion. There are many avenues to explore that focus on perceived control and I look forward to diving in and seeing what happens!

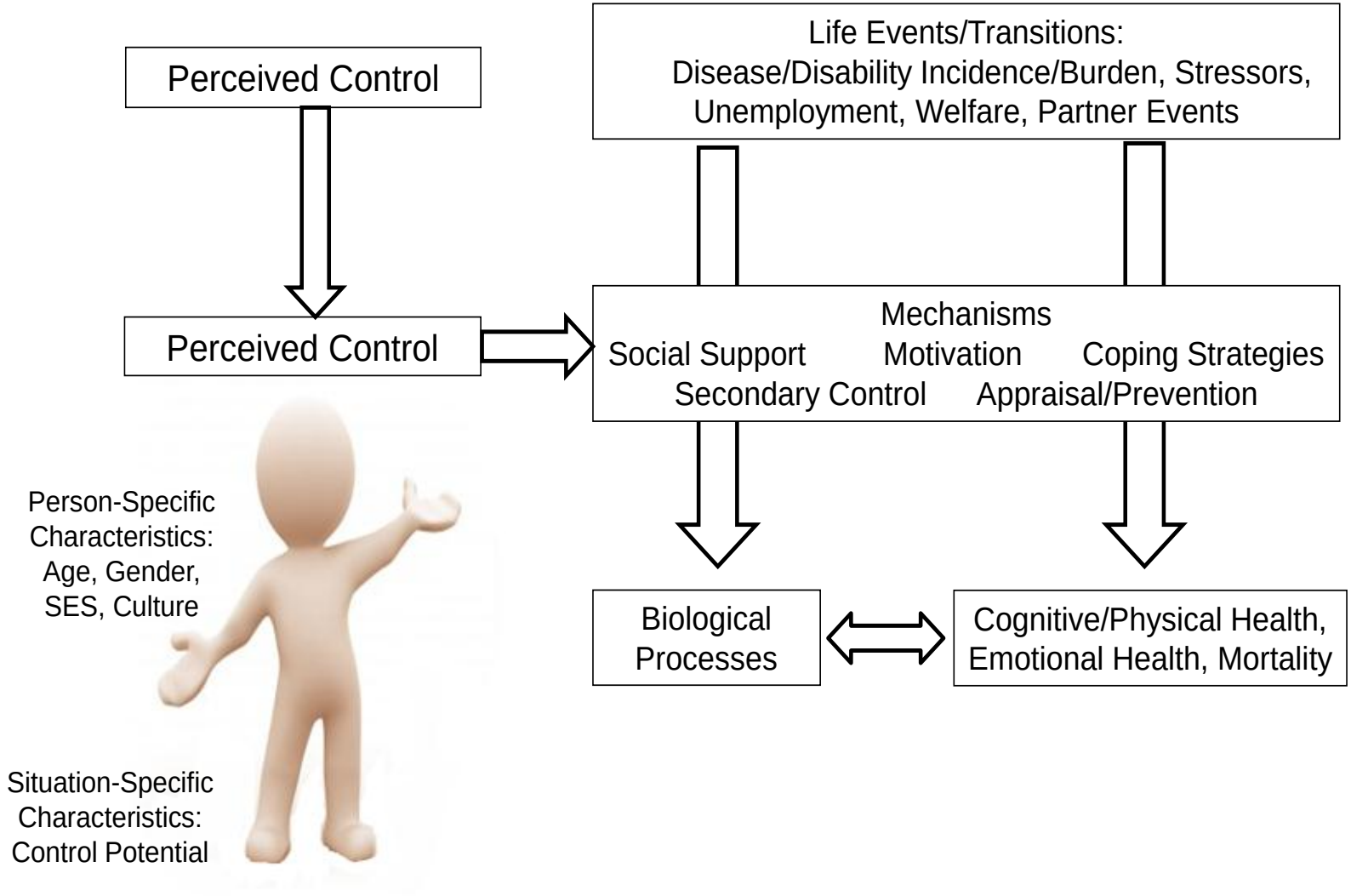
I have one final note (I promise this is the end). I began my dissertation with two quotes. The first quote was taken from President Obama's 2011 State of the Union address. To me, President Obama embodies someone with high levels of control. He has a prevailing *attitude* that is contagious, a *belief* system that is knowledgeable and full of purpose, *motivations* that aim for the betterment of society, and *volitions/efforts* that are purposeful and directed towards a goal. The quote taken from Margie Lachman addresses the adaptive value of control for adult development and aging. I now leave you with one final (lengthy) quote from the godfather of efficacy, Albert Bandura,

> "Among the personal resources that serve us well none is more central or pervasive than beliefs in personal efficacy. Belief in one's causative influence is the foundation of human motivation and accomplishment. Unless people believe they can produce desired effects by their actions, they have little incentive to act or to persevere in the face of difficulties. Whatever other factors serve as guides and motivators, they are rooted in the core belief that one has the power to effect changes by one's actions.
>
> Efficacy beliefs have diverse effects. They influence whether we think optimistically, or pessimistically. They determine the aspirations, and visions we set for ourselves and the strength of our commitment to them. The beliefs we hold about our capabilities determine whether setbacks and failures motivate us or demoralize us. They affect the quality of our emotional life and vulnerability to stress and depression. Efficacy beliefs also play a key role in one's life choices. You have a hand in what you become by the activities and the environments you choose."

Albert Bandura, Stanford Commencement Address

Figure 5.1. Graphical illustration of how control facilitates adjustment to life events and transitions. Perceived control facilitates adjustment to life events and transitions through social support, motivation (goal [dis]engagement), secondary control (cognitions), coping strategies, and appraisal/prevention.

Figure 5.1.


Perceived Control
Life Events/Transitions:
Disease/Disability Incidence/Burden, Stressors,
Unemployment, Welfare, Partner Events
Perceived Control
Mechanisms
Social Support
Motivation
Coping Strategies
Secondary Control
Appraisal/Prevention
Person-Specific
Characteristics:
Age, Gender,
SES, Culture
Biological
Processes
Cognitive/Physical Health,
Emotional Health, Mortality
Situation-Specific
Characteristics:
Control Potential

References for Overview Chapter and Conclusion

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PUBLICATIONS

Infurna, F. J., Gerstorf, D., Ram, N., Schupp, J., & Wagner, G. G. (2011). Long-term antecedents and outcomes of perceived control. *Psychology and Aging, 26,* 559-575. (online available as SOEPpaper 355: http://papers.ssrn.com/sol3/papers.cfm?abstract_id=170253).

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