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Toward a More Complete Understanding of the Effects of Personal Mastery on Cardiometabolic Health

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Abstract

Objective—A great deal of research has been devoted to identifying the psychological factors that might be associated with reduced risk for cardiovascular diseases. In particular, coping resources such as personal mastery might attenuate stress-related pathophysiology. The purpose of the present review was to examine the existing literature reporting associations between personal mastery and cardiometabolic health outcomes in order to determine which outcomes have been studied to date, investigate the extent of inconsistency in the literature, and propose new directions for research.

Design—Systematic review of articles examining the associations between personal mastery and cardiometabolic health.

Main Outcome Measures—Studies were included if they examined objective measures of cardiometabolic function, cardiovascular events, and/or mortality.

Results—Thirty-two studies were identified examining the effect of mastery on the following outcomes: mortality and/or cardiovascular events, psychoneuroendocrine stress systems, cardiovascular reactivity to acute stress, metabolic dysregulation, inflammation/coagulation, and evidence of large vessel disease from imaging methods.

Conclusions—Overall, mastery was associated with better cardiometabolic health and reduced risk for disease and/or death, typically with a small-medium effect size. A relatively small proportion of studies reported contradictory findings that higher mastery was associated with poorer cardiometabolic outcomes. The state of the current research suggests that future investigations should focus on 1) clarifying the mediators and moderators most relevant in the association between mastery and downstream disease, 2) testing the association between mastery and biological outcomes longitudinally, 3) examining the physiological impact of mastery-increasing interventions, and 4) studying the relationship between mastery and disease risk in diverse ethnic or sociocultural groups.

A great deal of research has been devoted to investigating the psychological factors that might predict cardiometabolic risk. In particular, the literature on stress and coping has made

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substantial contributions to the understanding of how psychological factors might translate to poorer cardiometabolic function. It is well-established that chronic stress can have a deleterious impact on cardiovascular disease (Black & Garbutt, 2002; Cacioppo, et al., 1998; Grant, 1999; Vitaliano, et al., 2002). Physiological processes that might explain the link between psychological stress and disease include frequent and prolonged activation of the sympatho-adrenal-medullary (SAM) and hypothalamic-pituitary-adrenal-cortical (HPA) axes (Grant, 1999). These systems that are triggered by stress are associated with pathophysiological changes related to cardiovascular disease risk. SAM activation is characterized by increased sympathetic tone and release of catecholamines whereas HPA activation is characterized by cortisol secretion and immune and inflammatory dysregulation. In fact, Black and Garbutt (2002) postulated that stress-related physiological consequences might account for up to 40% of patients with atherosclerosis who have no other known risk factors.

Although the psychological factors that increase risk for developing cardiovascular disease have received a great deal of attention, interest in the psychological factors that might attenuate this risk has increased in recent years. In particular, coping resources are social or personality resources that people use to help manage stressors and might also attenuate the physiological impact of such stressors (L. I. Pearlin & Schooler, 1978). Personal mastery is one such coping resource. Personal mastery is defined as a global sense of control or the belief that one has control over future important life circumstances (L. I. Pearlin, Mullan, Semple, & Skaff, 1990; Taylor & Seeman, 1999). There is a large body of research reporting that personal mastery and related constructs of personal control are associated with improved psychological (Mausbach, et al., 2006) and physical health outcomes (Matthews, Owens, Edmundowicz, Lee, & Kuller, 2006; Mausbach, Patterson, et al., 2007). Mastery has also been associated with reduced risk for mortality (Penninx, et al., 1997). A greater sense of mastery might also buffer the impact that chronic stress can have on disease (Ma, Faber, & Dubé, 2007; Mausbach, Mills, et al., 2007; Mausbach, von Känel, et al., 2008).

Personal Mastery and Cardiometabolic Health

Lazarus and Folkman's Transactional Model of stress (Lazarus & Folkman, 1984) posits that those who make more positive appraisals regarding their ability to manage or cope with a stressor are likely to experience reduced physiological (SAM and HPA) response to stress. In other words, those with a high sense of personal mastery may appraise themselves as capable of coping with or controlling problems in life, and therefore might be less physiologically-impacted by psychological stressors.

Another explanation supporting a protective effect of mastery on health is that those with higher levels of mastery are more likely to view their health as controllable. As a result, those with higher mastery might exercise healthier behaviors and better management of their health. For example, individuals with higher mastery might take action by adhering to diabetes care regimens and practicing healthier diet habits (Daniel, Rowley, Herbert, O'Dea, & Green, 2001; Paquet, Dubé, Gauvin, Kestens, & Daniel, 2010; Rodin, 1986). A large body of research also suggests that increased perceived control over one's health is associated with health behaviors such as improved medication management (Kirscht & Rosenstock, 1977) and scheduling of medical screenings (Bundek, Marks, & Richardson, 1993).

On the other hand, there is a contradictory set of research suggesting that mastery or sense of control might not be universally beneficial to health (Seeman, 1991). Some have postulated that those who believe that they have a high level of control over life's circumstances may experience a physiological "cost of coping." That is, the mere act of coping with a problem

expends mental and physical resources regardless of the success of a resolution (Cohen, Evans, Stokols, & Krantz, 1986). Consistent with this idea, a study by Manuck and colleagues (1978) found that blood pressure response to difficult cognitive tasks was elevated in participants who were told that they had control over the presentation of aversive stimuli associated with the task compared to participants who were told that they had no control.

Alternatively, Taylor and Seeman (1999) hypothesized that those with a high expectancy for control may be at risk for poorer health outcomes if the opportunities to exercise control are constrained. Consistent with this idea, some studies have found that sympathetic arousal in response to an uncontrollable task is elevated in those who have a higher sense of control (DeGood, 1975; Houston, 1972). Similarly, Type A, or "coronary-prone," behavior pattern, is characterized by a strong need for control (Miller, Lack, & Asroff, 1985). Given this contradictory literature regarding sense of control and cardiovascular outcomes, more work needs to be done to identify the potential factors that might explain why mastery might be beneficial in some contexts and harmful in others.

Personal Mastery and Related Constructs of Personal Control

Several constructs related to control have been identified and studied in the context of physical health outcomes. However, within the control literature, labels and definitions of control-related constructs are not always consistent. Sometimes, two or more control-related terms might share the same definition or a single term might be used to refer to different constructs (Skinner, 1996). For example, some concepts related to personal mastery are "locus of control," "empowerment," "self-efficacy," "(lack of) fatalism," "personal control," and "sense of control" (L. Pearlin & Pioli, 2003). Some of these terms are used interchangeably; however, they can be measured with a variety of different measures, potentially adding noise to the research on mastery and physical health outcomes.

Given the heterogeneity within constructs of control, Skinner (1996) proposed basic distinctions regarding control constructs as an organizational framework. Important distinctions regarding definition and classification of control constructs include: 1) aspects of control (e.g., objective control, subjective control, and experiences of control), 2) agents, means, and ends of control, 3) retrospective versus prospective control, and 4) specific versus general control. Within this framework, Pearlin and Schooler's (1978) construct of personal mastery would be defined as a control belief that is subjective, prospective, general (or global), and involving the self as the agent of control. Mastery also reflects beliefs about the general controllability of the environment (i.e., contingency beliefs) as opposed to beliefs exclusively involving one's competence in controlling one's environment (Paquet, et al., 2010; Thompson & Spacapan, 1991).

Internal locus of control, or the degree to which one attributes reinforcement as being contingent upon one's own behaviors versus a result of environmental forces out of one's control (i.e., external locus of control) has definitional similarities to mastery (Rotter, 1966). Although these terms are sometimes used interchangeably within the literature, there are subtle differences in definition and more substantial differences in how they are measured. One concern is that measures of control should fall somewhere on the continuum of situation-specific control to general control, whereas locus of control measures tend to combine items assessing general sense of control as well as sense of control in multiple specific contexts (Surgenor, Horn, Hudson, Lunt, & Tennent, 2000). Further, labeling someone as making internal versus external attributions regarding control has been criticized as being too simplistic and has yielded contradictory results in the context of health outcomes (Surgenor, Horn, & Hudson, 2002), which may potentially be associated with the

mastery literature by proxy. For these reasons, it is important to carefully consider the definition and measurement of the control construct of interest in order to avoid generalizing research findings across constructs that may actually be incongruent.

Purpose of the Present Review

The purpose of the present review was to collectively examine the existing literature to date reporting associations between personal mastery and cardiometabolic health outcomes. This review aims to 1) determine which cardiometabolic outcomes have been studied to date and to organize these findings, 2) investigate the extent of contradiction in the literature and to offer potential explanations for inconsistencies, and 3) propose new directions for research on mastery and cardiometabolic outcomes. Given the heterogeneity in constructs and measures of personal control, the scope of this review will be limited to studies examining mastery 1) as measured by the Pearlin and Schooler Personal Mastery Scale (1978) or a similar adaptation, and/or 2) defined as a global sense of control over one's future life's circumstances.

Study Selection

The online scientific literature database *PubMed* was used to search for peer-reviewed research articles studying the effects of personal mastery on cardiometabolic health outcomes including 1) biomarkers associated with cardiovascular disease/metabolic dysregulation, 2) future occurrence of cardiovascular events, and 3) mortality (all cause or cardiovascular event related). Combinations of personal mastery search terms and cardiometabolic outcomes of interest were entered simultaneously to obtain articles that included both elements. Keywords entered as search terms included "personal mastery" (and other variations intended to capture relevant studies including "mastery," "sense of mastery," "personal control," "sense of control," "perceived control," "mastery scale," "Pearlin and Schooler," and "Mastery Scale") and "cardiovascular" (and related terms like "cardiometabolic," "coronary," "coronary artery disease," "heart disease," "atherosclerosis," "cardiac," "metabolic," "disease," "blood pressure," "inflammation," "coagulation." Additional studies were obtained by searching for relevant research articles in the reference lists of articles included in this review.

For this review, personal mastery was defined as the extent to which an individual believes that he or she has control over important life circumstances (L. I. Pearlin, Lieberman, Menaghan, & Mullan, 1981; L. I. Pearlin & Schooler, 1978). Importantly, mastery was defined as a global construct, and therefore studies examining control constructs specific to a particular context (e.g., control over health status or control over a specific task) were excluded. Determination of whether or not a study examined a construct of mastery consistent with Pearlin and Schooler's definition of mastery was made by the first author of this review. Studies included in this review 1) examined associations between personal mastery and at least one cardiometabolic or mortality outcome, 2) measured mastery with the Pearlin and Schooler (1978) Mastery Scale or a similar variant designed to measure mastery/control consistent with our operational definition of mastery, 3) used objective measures of cardiometabolic outcomes, 4) conducted quantitative analyses, and 5) were published in English. Studies were excluded if 1) the measure of mastery was inconsistent with our operational definition or was context specific, 2) outcomes were limited to subjective measures such as self-rated health or symptoms, and 3) analyses were limited to qualitative techniques. There were no constraints regarding start date of publication. That is, articles were not excluded if they were published before a given date.

The Personal Mastery Scale (L. I. Pearlin & Schooler, 1978) consists of seven items assessing the extent to which one believes that one can control life events and circumstances

(e.g., “I can do just about anything I really set my mind to do,” “what happens to me in the future mostly depends on me”). Responders rate their agreement to each statement on a 4-point scale from “strongly agree” to “strongly disagree.” Two items are reverse scored and items are summed to create an overall score with higher scores indicating greater sense of mastery. The Personal Mastery Scale has strong structural validity, with principal component factor loadings ranging from −0.47 to 0.76 (L. I. Pearlin & Schooler, 1978).

A flow diagram depicting the study screening, eligibility, and reasons for article exclusion is presented in Figure 1. Search criteria resulted in a final total of 32 peer-reviewed studies. Publication dates for these identified articles spanned from 1985 until January, 2011. Studies were categorized and reviewed based on the type of outcome examined: mortality and/or cardiovascular events, psychoneuroendocrine stress systems, cardiovascular reactivity to acute stress, metabolic dysregulation, inflammation/coagulation, and evidence of large vessel disease from imaging methods. Some studies measured multiple outcomes that fit into more than one category and therefore have multiple listings.

Mastery and Mortality and/or Cardiovascular Events

Table 1 summarizes the studies reporting associations between mastery and risk for future cardiovascular events or death. Seven studies reported associations between mastery and future occurrence of cardiovascular disease events or death. The populations examined in these studies included community-dwelling older adults, disabled older adults, patients diagnosed with coronary artery disease or renal failure, and older adults without history of heart disease.

Three of the seven studies measured mastery using the seven-item Pearlin and Schooler Mastery Scale (1978). Penninx and colleagues (1997) used an abbreviated five-item version of this scale. Two studies used the Cognitive Adaptation Theory Inventory which included the seven-item Mastery Scale as well as other measures of self-esteem, optimism, and heart-disease-specific control (Helgeson, 2003; Helgeson & Fritz, 1999). Scores on these scales were aggregated into a single index score and used to predict future cardiac events or death, however, in both of these studies the unique effect of mastery on these outcomes was not reported. Therefore, it is uncertain if mastery had an effect on these outcomes independently. Similarly, Penninx and colleagues (2000) used an index of “emotional vitality” meant to capture the construct of personal mastery, as well as “happiness” and having low depressive and anxious symptoms. This index included two items from the Pearlin and Schooler Mastery Scale (“I can do just about anything I really set my mind to” and “I often feel helpless in dealing with the problems of life”), but did not report the unique association between mastery and mortality.

Each of these studies conducted prospective investigations and they all reported an inverse relationship between personal mastery (or a similar construct) and risk for cardiac events or death, generally with a small-medium effect size. That is, those with a high sense of personal mastery at a baseline assessment were at reduced risk for mortality or experiencing a future cardiac event. In particular, lower mastery was highly associated with cardiovascular disease-related deaths (Surtees, et al., 2010; Surtees, Wainwright, Luben, Khaw, & Day, 2006).

Mastery and Psychoneuroendocrine Stress Systems

Table 2 summarizes studies reporting associations between mastery and biomarkers of psychoneuroendocrine stress systems, including the SAM and HPA axes. Nine studies were identified that found associations between mastery and indicators of psychoneuroendocrine arousal including blood pressure, $ß_2$-adrenergic receptor sensitivity, cortisol pattern,

catecholamines, and an index of allostatic load (including measures of blood pressure and catecholamines). The allostatic load indicator also included some metabolic indicators; however, given that the relationship between mastery and allostatic load in this particular study was likely heavily influenced by blood pressure, this study was categorized under psychoneuroendocrine studies.

Seven studies were cross-sectional in design and two were prospective. Populations studied included elderly Alzheimer's disease caregivers, recent mothers, rheumatoid arthritis patients, and population-based samples of adults and older adults. Most of these studies utilized the Pearlin and Schooler Mastery Scale, with the exception of Cottington and colleagues (1985) who developed a measure of "confidence/control" reflecting the level of self-confidence one has in general and in terms of one's ability to manage problems, control life circumstances, and be stimulated by and enjoy competition. Given the similarity between this construct definition and the items of the Pearlin and Schooler Mastery Scale, this study was included in the review.

Six of the studies reported that mastery was associated with healthier levels of psychoneuroendocrine indicators. In Alzheimer caregivers, higher levels of mastery were associated with better ß$_2$-adrenergic receptor sensitivity in both cross-sectional (Mausbach, Mills, et al., 2007) and longitudinal analyses (Mausbach, Aschbacher, et al., 2008). Mastery also mediated the relationship between caregiver burden and ß$_2$-adrenergic receptor sensitivity (Mausbach, Mills, et al., 2007). Mastery was also negatively correlated with diurnal cortisol slope and partially mediated the relationship between socioeconomic status and cortisol such that low socioeconomic status was associated with lower mastery which gives rise to higher cortisol levels (Cohen, et al., 2006). In Cottington and colleagues' study (1985) examining the impact of their confidence/control variable, mastery was negatively associated with systolic and diastolic blood pressure in normotensive men, but not women. Higher mastery was associated with lower resting blood pressure in patients with rheumatoid arthritis (Younger, Finan, Zautra, Davis, & Reich, 2008). Finally, a study by Light and colleagues (2004) found that higher levels of oxytocin, a neuropeptide associated with reduced blood pressure and cardiovascular reactivity (Ishak, Kahloon, & Fakhry, 2010), were associated with higher mastery. They also assessed blood pressure, catecholamines, and cortisol, but found no association with these variables and mastery. Two studies found marginal or negligible associations with small effect sizes for the associations between mastery and cortisol patterns (Gerritsen, et al., 2009; van Santen, et al., 2011).

A study of Alzheimer's disease caregivers found that mastery might be associated with poorer heath outcomes with a small-medium effect size (Roepke, et al., In Press). In this study, mastery moderated the relationship between caregiving status (caregiver versus non-caregiving control) and allostatic load, such that caregivers had significantly higher allostatic load compared to controls when mastery was high, but not when mastery was low. This finding was not replicated when using a median-split mastery variable indicating high and low levels of mastery.

Mastery and Cardiovascular Reactivity to Acute Stress

Table 3 summarizes the studies reporting associations between mastery and measures of cardiovascular reactivity to acute stress. Six studies examined the relationship between mastery and sympathetic and endocrine responses to various acute stress tasks. Studies identified examined these relationships in Alzheimer's disease caregivers, rheumatoid arthritis patients, undergraduate men and women, and in samples of women. The

populations examined varied in age, ranging from younger college undergraduates to older adults. All studies used the Pearlin and Schooler Mastery Scale to assess mastery.

Two studies found that higher mastery was associated with improved reactivity outcomes. Among Alzheimer caregivers, those with higher mastery had reduced norepinephrine reactivity to an acute speech stressor task compared to those with lower mastery (Roepke, et al., 2008). Furthermore, mastery moderated the relationship between stress task condition (stress task versus control task) and skin conductance as well as cortisol (Ma, et al., 2007). For each outcome, women with low mastery exhibited elevated stress response to the stress task compared to the control task. Women with high mastery did not experience significant elevations in stress response compared to the control response, suggesting that mastery buffers the autonomic and endocrine response to stress. They did not find such an effect with heart rate variability.

Three studies reported negligible associations between mastery and cardiovascular reactivity to acute stress. These studies did not provide adequate information to calculate effect sizes; therefore it was not possible to compare effect sizes to other studies that report statistically significant associations. Cattanach and colleagues (1988) examined blood pressure and pulse rate reactivity to four different acute stressor tasks (speech delivery, interpersonal conflict, audiovisual conflict, and interpersonal conflict) in a group of women scoring high on an eating disorder inventory and a control group of women scoring low on this scale. Results suggested that mastery was unassociated with cardiovascular reactivity to stress in both groups. Pham and colleagues (2001) also reported that mastery was unassociated with blood pressure reactivity to acute stress. Similarly, Light and colleagues (2004) did not report significant associations between mastery and blood pressure, catecholamines, or cortisol levels post-stressor, but did report that higher mastery was associated with higher levels of oxytocin after a stressor (reactivity was not assessed).

Younger and colleagues (2008) found that mastery was positively associated with cardiovascular reactivity to stress. Mastery was divided into 2 components based on factor analysis: “fatalism” and “control.” In their sample of patients with rheumatoid arthritis, a high sense of control was associated with a lower resting mean arterial pressure, but an elevated blood pressure reactivity to laboratory stress compared to those with lower control.

Mastery and Metabolic Dysregulation

Table 4 summarizes the studies reporting associations between mastery and measures of metabolic function. Five studies were identified that reported associations between mastery and objective indicators of metabolic function including cholesterol, glucose, insulin, and HbA1c. Each study was cross-sectional in design. Three studies used the Pearlin and Schooler Mastery Scale and two studies used the Shapiro Control Inventory (Shapiro, 1994) which includes a general “overall” score for “sense of control.” This component was consistent with the specified definition of mastery and studies using this scale were therefore included in this review. Populations studied within this category varied. Two studies examined women diagnosed with diabetes mellitus, two studied on-reserve registered Indian samples from British Columbia with and at risk for diabetes mellitus, and one study examined men and women free of diabetes mellitus.

Four of these studies concluded that mastery was generally beneficial to metabolic function, with effect sizes ranging from small to large. Paquet and colleagues (2010) found that high mastery was associated with lower metabolic risk score for those who lived in an area dense with fast-food restaurants. This relationship was not apparent for those living in an area less dense with fast-food. Further, higher mastery was generally associated with lower glucose

(Daniel, Gamble, Henderson, & Burgess, 1995) and HbA1c levels (Surgenor, et al., 2002; Surgenor, et al., 2000).

Daniel and colleagues (2001) found mixed results regarding mastery and high-density lipoprotein cholesterol (HDL-C). Specifically, mastery and HDL-C were positively associated for participants diagnosed with diabetes mellitus and impaired glucose tolerance, but negatively associated for normoglyclermics, both with large effect sizes.

Mastery and Inflammation/Coagulation

Table 5 summarizes the findings from the studies reporting associations between mastery and indicators of inflammation and coagulation. Three studies were identified assessing a variety of inflammatory markers including matrix metalloproteinase-9 (MMP-9), C-reactive protein, and interleukin-6 (IL-6). All three studies were cross-sectional, examined a population-based sample of adults, and measured mastery with the Pearlin and Schooler Mastery Scale. All three studies found that mastery was inversely associated with biomarkers of inflammation. In the study by Garvin and colleagues (2009), the association between mastery and MMP-9 became marginally significant when controlling for coronary artery disease and other diagnoses.

Two studies examined the relationship between mastery and coagulation in elderly spousal Alzheimer's disease caregivers. Both used the Pearlin and Schooler scale to assess personal mastery. In Mausbach and colleagues' 2008 cross-sectional analysis, mastery moderated the association between stress in caregivers and plasminogen activator inhibitor-1 (PAI-1) antigen (2008). Specifically, mastery acted as a buffer in that negative stressful life events were positively associated with PAI-1 antigen in caregivers with low mastery, but not in caregivers with high mastery. In a longitudinal analysis by the same team, results suggested that burden and mastery improved after caregivers placed their spouse into institutionalized care or after they were bereaved of their demented spouse. Plasma D-dimer levels rose over time, but declined six months after such an event, suggesting that the improvement in psychological health post-placement may bring forth subsequent improvements in cardiovascular health (Mausbach, Aschbacher, et al., 2007). This study did not directly test the longitudinal association between mastery and coagulation and therefore, more work needs to be done to substantiate this finding.

Mastery and Evidence of Large Vessel Disease from Imaging Methods

Table 6 summarizes the findings from studies examining the relationship between mastery and evidence of large vessel disease using imaging techniques. Both studies were cross-sectional and both used the Pearlin and Schooler scale to assess mastery. In a study utilizing electron beam tomography to detect coronary and aortic calcification in a sample of 155 healthy adult women, lower mastery was associated with high aortic calcification with a medium effect size (Matthews, et al., 2006).

Conversely, high mastery was associated with more severe coronary atherosclerosis in a sample of adult men and women referred for angiography due to suspected coronary artery disease. This effect was independent of the extent of Type A behavior pattern and mastery scores were unassociated with Type A behavior pattern (Seeman, 1991). The authors conducted two statistical analyses: one in which mastery was dichotomized and another using the full range of scores. In the analysis using a dichotomized mastery variable, the association between mastery and coronary atherosclerosis was significant with a medium to large effect size. When using the full range of scores, mastery was not significantly associated with atherosclerosis, with a small effect size.

Directionality of the relationship between mastery and cardiovascular or mortality outcomes

Of the 32 studies reviewed, 24 of these studies concluded that higher mastery was associated with better cardiovascular outcomes or that mastery played a protective role on health. These studies reported at least one association indicating that mastery was protective and zero associations indicating that mastery was harmful. Some of these studies measured multiple cardiometabolic outcomes and found negligable associations between mastery and other outcomes, but overall, the authors of these studies concluded that mastery was beneficial to cardiometabolic health. Conversely, two studies reported results suggesting that higher mastery was associated with poorer cardiovascular outcomes. Two studies reported conflicting results within each study. Specifically, Daniel and colleagues (2001) reported that the association between mastery and HDL-C was positive among those with diabetes and impaired glucose tolerance and negative among normotensives. Younger and colleagues (2008) found that higher mastery was associated with lower resting blood pressure, but elevated blood pressure reactivity to stress. Four studies did not find any associations between mastery and measured cardiovascular outcomes. Each of these studies found small effect sizes for the association between mastery and their outcome(s) or did not provide enough information to calculate effect size.

Conclusions

Studies included in this review indicated that the role of mastery and cardiometabolic health has been studied in a wide variety of outcomes. Furthermore, the studies reviewed largely indicate that a sense of personal mastery is beneficial to cardiometabolic health. A relatively large proportion of the studies reviewed investigated the effect of mastery on mortality or cardiovascular event risk prospectively, and unanimously reported that a higher sense of mastery was associated with reduced risk for these outcomes. Effect sizes were generally small to medium. Studies examining inflammatory and coagulation markers were also in agreement that higher mastery was associated with reductions in these markers, and the effect sizes were generally small to medium.

A relatively small proportion of studies were identified that indicated that mastery did not affect biological outcomes. In particular, studies investigating cardiovascular reactivity to acute stress yielded more null results regarding the role of mastery. One potential reason might be that each of these studies reporting negligible associations between mastery and cardiovascular reactivity examined samples of relatively young women. Past research suggests a positive association between age and cardiovascular reactivity to stress (Uchino, Uno, Holt-Lunstad, & Flinders, 1999). Therefore, studies examining mastery and cardiovascular reactivity in younger samples might lack power to detect an effect. Alternatively, there is a possibility that mastery may have differential effects on acute reactivity to stress compared to more enduring markers of cardiometabolic function. Perhaps having a global sense of control is more beneficial to maintaining cardiometabolic health over time and that one's sense of control might not necessarily make a substantial impact on one's physiology when encountering an acute challenge.

The scope of this review was limited to a very specific definition of mastery in order to reduce variability that can emerge from treating diverse constructs of control as homogeneous. Generalizing findings from one construct of control to another can produce misleading conclusions. For example, research suggests that perceived control of a specific task is associated with increased sympathetic reactivity to that task (Manuck, et al., 1978). When considering such findings together with other control research (such as mastery), it might seem that these findings are in conflict, however the constructs of mastery and

perceived control to a specific task likely reflect very different dimensions of control and therefore should not be used interchangeably. Although we only included studies in this review that measured personal mastery with the Pearlin and Schooler (1978) scale or a scale that was judged to be closely related, it is important to note that a small proportion of studies examined the impact that mastery in combination with other psychosocial variables had on cardiometabolic health. In these studies, it was difficult to determine the unique predictive contribution of mastery.

Yet, in an attempt to include the greatest amount of research possible in this review, there was still some variability in the measurement of mastery. This could be problematic if two constructs using the same label are tapping into diverse dimensions of control (Shapiro, Lindberg, Daniels, Breuer, & Astin, 1994). It is possible that the relatively small amount of studies finding null or deleterious effects of mastery on cardiovascular risk outcomes might be explained by heterogeneity of control constructs. However, there did not seem to be any major differences in findings between studies using the full seven-item Pearlin and Schooler Mastery Scale and studies using a variant measure. Out of the seven studies using variant measures of mastery, each study concluded that mastery was associated with better cardiometabolic health outcomes or reduced mortality risk.

With regards to studies finding that higher mastery might be associated with poorer cardiovascular outcomes, there were some methodological issues to consider. In two such studies, statistical analyses testing the association between mastery and the cardiometabolic outcome were run in two different ways using different forms of the mastery variable, dichotomized mastery (high versus low mastery) or the full range of raw scores (Roepke, et al., In Press; Seeman, 1991). In both studies, analyses were only significant using one version of the mastery variable, either dichotomized (Seeman, 1991) or full range of scores (Roepke, et al., In Press). The alternate analyses did not reach significance. Therefore, these findings warrant replication.

Another possibility is that there might be an unidentified characteristic of the sample that might act as a moderator in the relationship between mastery and cardiometabolic function. For example, individuals with a high sense of mastery might experience frustration and physiological arousal under circumstances in which control is constrained (Taylor & Seeman, 1999). This may or may not be the case for coronary artery disease patients (Seeman, 1991) who actually do not have control over their diagnosis or for Alzheimer caregivers (Roepke, et al., In Press) who cannot control the prognosis of their spouse's dementia. However, other studies identified in this review have examined similar populations with opposing findings, therefore, replication of studies and examination of other potential moderators (e.g., existing diagnosis of coronary artery disease, psychiatric diagnosis, treatment of cardiovascular disease, etc.) is recommended.

Another issue apparent in the literature on mastery and cardiometabolic outcomes is that there is not a consensus on whether mastery is conceptualized as a mediator or moderator in the relationship between chronic stress and indicators of cardiovascular function. Three studies conceptualized mastery as a buffer against chronic stress's impact on health and investigated the moderating role of mastery on the relationship between chronic stress and biological outcomes (Ma, et al., 2007; Mausbach, von Känel, et al., 2008; Roepke, et al., In Press). However, two studies examined mastery as a mediator between chronic stress and cardiometabolic outcomes (Cohen, et al., 2006; Mausbach, Mills, et al., 2007). It may likely be the case that mastery can act in both ways in the relationship between stress and disease, and therefore, investigators should provide a clear theoretical argument supporting the decision to examine mastery as a mediator or moderator in this context.

There are limitations to take into consideration regarding the conclusions drawn from this review. First, it is possible that there was some heterogeneity between studies in the mastery constructs examined. Some studies included used the full version of the Pearlin and Schooler Personal Mastery Scale, whereas others used abbreviated versions. A small proportion of the studies examined a construct of mastery was consistent by definition to ours, but used a different scale of mastery. In order to conduct a more inclusive review of the current literature on mastery and cardiometabolic outcomes, we chose to include studies that used diverse scales, as long as the construct being measured was consistent with Pearlin and Schooler's definition. Also, the determination of study eligibility was made solely by the first author of this review. Therefore, it is possible that there might have been subtle differences in the articles included had there been multiple raters making such determinations. Finally, it is possible that methodological "quality" of the studies included in this review might contribute to some of the variability in the associations found between mastery and cardiometabolic outcomes.

Future Research Directions

The studies reviewed for this paper indicate that there is a great deal of support for the link between low mastery and increased cardiovascular event and mortality risk, typically with a small to medium effect size. However, the literature examining mastery and more upstream biological indicators of cardiovascular disease risk is more equivocal. That is, the research consistently supports a link between mastery and downstream disease outcomes and death, but the physiological mechanisms linking these factors are not yet clearly understood. There are several potential explanations for why associations between mastery and cardiometabolic biomarkers are somewhat inconsistent. For example, existing cardiovascular disease or use of cardiovascular medications might moderate the association between mastery and such outcomes. Longitudinal work aimed at assessing physiological mediators of mastery and downstream disease would help clarify this issue. Another issue might be that the actual effect sizes for mastery on physiological mediators of downstream disease might be relatively small, and therefore, some studies might be underpowered to detect this association. Indeed, the studies examining mortality and/or cardiovascular events used relatively large samples compared to studies in all other categories. Moreover, there may be differential associations between mastery and cardiometabolic outcomes. Identifying the physiological mediators of mastery and downstream cardiovascular disease or death could be improved by examining larger samples and reducing the influence of potential confounders in analyses such as medication use and existing diagnoses. Studies might also consider controlling for behavioral variables associated with cardiovascular risk including exercise, diet, sleep quality, etc.

Another area of research that could increase the understanding of the relationship between mastery and cardiometabolic outcomes is identifying the potential moderators of this relationship. This review of the literature points to some potentially important moderators that might explain for whom and under what circumstances mastery impacts cardiovascular health. One pattern observed in this analysis was that many of the studies that found negligible associations between mastery and cardiometabolic biomarkers were conducted with younger adult samples (i.e., undergraduates, new mothers, etc.). Future studies might examine if age moderates the relationship between mastery and cardiometabolic biomarkers, such that mastery may be more relevant to levels of these biomarkers in older populations. Furthermore, gender may or may not play a role in the relationship between mastery and cardiometabolic outcomes. One study found that mastery was associated with blood pressure in men, but not women (Cottington, et al., 1985). A couple other studies in this review found null results with women samples (Cattanach, et al., 1988; Light, et al., 2004); however more work need to be done given that few studies compared men and women with respect to

mastery and cardiovascular outcomes. Finally, it may be possible that cardiovascular disease and/or risk status may play a role in the relationship between mastery and cardiometabolic outcomes. Surtees and colleagues (2010) found that the association between mastery and mortality was stronger for those with cardiovascular disease risk at baseline. Similarly, Daniel and colleagues (2001) found that a high sense of mastery was associated with better HDL cholesterol in diabetics, but not in normoglycemics. Future work to examine these potential moderators directly would help to further clarify for whom and under what conditions does mastery relate to cardiometabolic outcomes.

Additionally, the vast majority of studies examining mastery and cardiometabolic outcomes measured mastery at a single time point. The understanding of the effect of mastery on health would be improved by designing more studies aimed at examining the relationship between mastery and such outcomes over time to determine if changes in mastery over time are accompanied with changes in indicators of cardiometabolic function. Only two studies identified for this review examined longitudinal changes in mastery. One study reported that decreases in mastery were associated with decreased $ß_2$-adrenergic receptor sensitivity over time in Alzheimer's disease caregivers (Mausbach, Aschbacher, et al., 2008). The other study was also in Alzheimer caregivers and found that mastery increased and d-dimer decreased over time after the death of a demented spouse or placement of a spouse into institutionalized care. Similar studies finding that longitudinal changes in mastery are accompanied by similar changes in various cardiometabolic outcomes (e.g., blood pressure, inflammatory markers, etc.) would provide additional support for the link between mastery and biological outcomes.

Studies implementing interventions aimed at increasing personal mastery could investigate if changes in mastery also translate to changes in cardiometabolic outcomes. Several studies have demonstrated that mastery can be increased by participation in psychoeducational interventions aimed at increasing perceived control over stressful situations (Reich & Zautra, 1989; Strang, 2002). Future research implementing such interventions should examine the resulting impact on psychological and physiological outcomes. This type of research would be particularly relevant clinically such that providing individuals with skills to increase personal mastery might reduce one's cardiovascular disease risk in addition to increasing psychological health.

Finally, there is a gap in this literature involving the effect of mastery on cardiometabolic risk cross-culturally. Only two studies identified focused on this relationship in a minority population. Such research would be particularly valuable given that fatalism, a construct often defined as the lack of mastery or the belief that one's future is predetermined by fate as opposed to the self, has been shown to be higher in Mexican Americans (Chandler, 1979; Neff & Hoppe, 1993) and African Americans compared (McCarthy & Yancey, 1971; Neff & Hoppe, 1993) to Anglo Americans. Although some research suggests that fatalistic attitudes are associated with greater psychological distress (Mirowsky & Ross, 1984), other work suggests that fatalism might act as an adaptive resource in the face of uncontrollable circumstances experienced by minorities (Parker & Kleiner, 1966). Examination of the association between mastery and cardiometabolic outcomes in diverse ethnic or sociocultural groups can help build this understanding.

Summary

Taken together, the studies identified for this review examined the association between mastery and cardiometabolic health in a wide variety of populations (however, not so much cross-culturally) using a variety of biological indicators. Overall, this research suggests that mastery is largely associated with better cardiometabolic health and reduced risk for disease

and/or death. Despite attempts to include only studies using a very specific definition of personal mastery, a few studies reported contradictory findings. This might reflect unidentified moderators of the relationship between mastery and health or differential associations for specific outcomes. Future investigations that could strengthen the state of research in mastery and cardiovascular disease risk include 1) studies clarifying the mediators and moderators most relevant in the association between mastery and downstream outcomes such as cardiovascular events and/or death, 2) longitudinal studies testing the association between mastery and biological outcomes over time, 3) intervention studies aimed at increasing mastery, and 4) studies examining the relationship between mastery and cardiovascular risk across ethnic or sociocultural groups.

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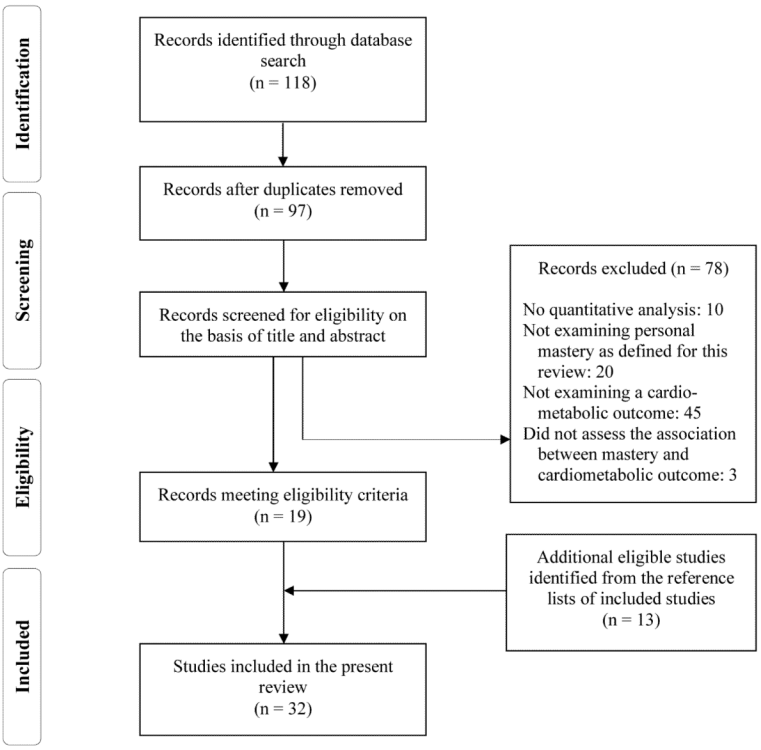

Figure 1.
Flow diagram demonstrating article screening and eligibility.

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Table 1

Studies reporting associations between mastery and future occurrence of cardiovascular events or mortality.

Study	Participants	Design	Mastery Construct	Mastery Measure	CVD Outcome	Results/Findings	Effect Size (Cohen's d /Hazard Ratio)
Helgeson, 2003	199 men and 99 women treated for CAD with percutaneous transluminal coronary angioplasty, ages 31-80 years	Prospective, 4-year follow-up	Personal Mastery	Cognitive Adaptation Index (which included the Pearlin and Schooler Mastery Scale); global and heart disease-specific measures of self-esteem, optimism, and control were aggregated into a single index score.	Occurrence of a subsequent cardiac event 4 years after initial assessment	Higher scores on the Cognitive Adaptation Index (i.e., positive outlook of the future, higher sense of mastery, and general positive regard for self) were predictive of reduced likelihood of having a cardiac event 4 years after baseline assessment. The independent association between the mastery scale and occurrence of cardiac events was not reported.	d = −.38 (for ever having been hospitalized for a cardiac reason during the 4-year follow up period)
Helgeson & Fritz, 1999	303 men and women treated for CAD with percutaneous transluminal coronary angioplasty, ages 31-80 years	Prospective, 6-month follow-up	Personal Mastery	Cognitive Adaptation Index (which included the Pearlin and Schooler Mastery Scale); global and heart disease-specific measures of self-esteem, optimism, and control were aggregated into a single index score.	Future occurrence of a cardiac event 6 months after percutaneous transluminal coronary angioplasty	Higher scores on the cognitive adaptation index (i.e., positive outlook of the future, higher sense of mastery, and general positive regard for self) were predictive of reduced likelihood of having a cardiac event 6 months after baseline assessment. The independent association between the mastery scale and occurrence of cardiac events was not reported.	d = −.42
Kutner et al., 1997	349 dialysis patients, ages 60-87 years	Prospective, 7-year follow-up	Personal Mastery	Pearlin and Schooler Mastery Scale	Long-time survival	Higher mastery was associated with long-term survival.	d = −.07
Penninx et al, 1997	2,829 noninstitutionalized older adults, ages 55-85 years	Prospective, 29-month follow-up on average	Personal Mastery	5 of the 7 items of the Pearlin and Schooler Mastery Scale	Mortality	Greater mastery was associated with reduced mortality risk controlling for age, sex, chronic diseases, and other CVD risk factors.	d = −.06
Penninx et al., 2000	1002 moderately-severely disabled community-dwelling women, ages ≥ 65 year old	Prospective, 3-year follow-up	Emotional Vitality (high sense of personal mastery, being happy, and low depression and anxiety symptoms	"Emotional Vitality Scale" included 2 Pearlin and Schooler scale items: "I can do just about anything I really set my mind to" and "I often feel helpless in dealing with the problems of life"	Mortality and progression of disability	Emotionally vital women were less likely to die after 3-year follow-up. They were also less likely to develop a new disability. The independent associations between the mastery measure and these outcomes were not reported.	d = −.71

Study	Participants	Design	Mastery Construct	Mastery Measure	CVD Outcome	Results/Findings	Effect Size (Cohen's d /Hazard Ratio)
Surtees et al., 2006	20,323 men and women recruited through general practice age-sex registers, ages 40-74 years	Prospective, up to 6-year follow-up	Personal Mastery	Pearlin and Schooler Mastery Scale	Mortality from all causes, CVD, and cancer	Higher mastery was associated with lower rates of all 3 types of mortality controlling for age, sex, and prevalent chronic physical disease. Lower mastery was more associated with CVD deaths than cancer deaths.	d = −.06
Surtees et al., 2010	19,067 men and women with no history of heart disease or stroke at baseline in a population-based sample, ages 41-80 years	Prospective, median 11.3 person-years of follow-up	Personal Mastery	Pearlin and Schooler Mastery Scale	CVD mortality	Lower mastery was associated with an increased risk of CVD mortality. This association was stronger for those who had low CVD risk at baseline.	Hazard Ratio = 1.11 95% CI=1.00-1.23

Note. CAD = coronary artery disease; CVD = cardiovascular disease

Table 2

Studies reporting associations between mastery and measures of psychoneuroendocrine stress systems.

Study	Participants	Design	Mastery Construct	Mastery Measure	CVD Outcome	Results/Findings	Effect Size (Cohen's d)
Cohen et al., 2006	781 men and women from a multi-site sample, ages 33-45 years	Cross-sectional	Personal Mastery	Pearlin and Schooler Mastery Scale	Diurnal cortisol patterns	Mastery was negatively correlated with diurnal cortisol slope. Mastery partially mediated the relationship between SES and cortisol in combination with other psychosocial variables and health practices (Low SES was associated with higher cortisol via low mastery).	d = −.24
Cottington et al., 1985	444 men and women from a probability sample of the adult population of the state of Michigan, ages 18-96	Cross-sectional	Confidence /control	Scale developed for this study reflecting the level of self-confidence one has in general and in terms of one's ability to manage problems, control life circumstances, and be stimulated by and enjoy competition	Blood pressure	For normotensive men, but not women, mastery was negatively associated with systolic and diastolic blood pressure.	For Men: d = −.17 (systolic) d = −.21 (diastolic) For Women: d = −.10 (systolic) d = .06 (diastolic)
Gerritsen et al., 2009	1,150 older adults from the Longitudinal Aging Study Amsterdam (LASA), mean age 75 ± 7	Cross-sectional	Personal Mastery	5 of the 7 items of the Pearlin and Schooler Mastery Scale	Awakening and evening cortisol patterns and diurnal cortisol variability	Mastery was unassociated with all cortisol measures.	Awakening: d = .10 Evening: d = −.04 Diurnal Variability: d = .07
Light et al., 2004	25 recent mothers without history of drug-exposure during pregnancy or postpartum (age 29±1 years) and 10 recent mothers reporting cocaine use during pregnancy (age 30±2 years); participants were free of CVD	Cross-sectional	Personal Mastery	Pearlin and Schooler Mastery Scale	Resting and post-acute stressor measurements of blood pressure, plasma norepinephrine, plasma epinephrine, and plasma oxytocin; serum cortisol as well as urinary cortisol and catecholamines were also collected.	Oxytocin at baseline and during the stressor task were positively associated with mastery in both groups. Mastery was unassociated with other biomarkers.	Oxytocin: d = .85 (baseline) d = .70 (post-speech) Insufficient information to calculate effect size for other biomarkers
Mausbach, Mills et al, 2007	106 elderly spousal Alzheimer's disease caregivers, age ≥ 55 years	Cross-sectional	Personal Mastery	Pearlin and Schooler Mastery Scale	β2-adrenergic receptor sensitivity on peripheral mononuclear cells	Mastery was positively associated with receptor sensitivity. Mastery significantly mediated some of the relationship between caregiver burden and receptor sensitivity	d = .58

Study	Participants	Design	Mastery Construct	Mastery Measure	CVD Outcome	Results/Findings	Effect Size (Cohen's d)
Mausbach, Aschbacher et al., 2008	115 elderly spousal Alzheimer's disease caregivers, age ≥ 55 years	Prospective, annual assessments for 5 years	Personal Mastery	Pearlin and Schooler Mastery Scale	β2-adrenergic receptor sensitivity on peripheral mononuclear cells	Caregivers had age-independent decreases in β2-adrenergic receptor sensitivity. Decreases in mastery over time were associated with decreased sensitivity.	d = .34
Roepke et al., In Press	87 elderly spousal Alzheimer's disease caregivers and 43 non-caregiving controls, age ≥ 55 years	Cross-sectional	Personal Mastery	Pearlin and Schooler Mastery Scale	Allostatic load index including the following indicators: systolic blood pressure, diastolic blood pressure, BMI, total/HDL cholesterol ratio, HDL cholesterol, plasma norepinephrine, and plasma epinephrine	Caregivers had higher allostatic load compared to non-caregiving controls. Mastery moderated the relationship between caregiving status and allostatic load, such that caregivers had significantly higher allostatic load compared to controls when mastery was high, but not when mastery was low.	d = .38
van Santen et al., 2011	381 men and women with and without psychiatric diagnoses from the Netherlands Study of Depression and Anxiety (NESDA), ages 18-65	Cross-sectional	Personal Mastery	5 of the 7 items of the Pearlin and Schooler Mastery Scale	Cortisol awakening curve	Mastery was marginally associated with the dynamic of the cortisol awakening response (CAR). Specifically, higher mastery was associated with flatter CAR. Mastery was unassociated with the total cortisol secretion in the first hour after awakening.	d = −.20 (dynamic of the CARE) d = .12 (total cortisol secretion in the first hour)
Younger et al., 2008	73 men and women with rheumatoid arthritis, ages of 23-81	Prospective laboratory study	Personal Mastery	Pearlin and Schooler Mastery Scale; items were divided into 2 components: fatalism and control	Resting blood pressure and blood pressure reactivity to laboratory stressor tasks	Those scoring high on the control component had lower mean arterial pressure (MAP) at rest compared to those with low control. However, those with high control also exhibited higher blood pressure reactivity to stress compared to those with low control.	d = −.65 (resting MAP) d = .94 (MAP reactivity to stress)

Note. BMI = body mass index; CVD = cardiovascular disease; HDL = high density lipoprotein; MAP = mean arterial pressure; SES = socioeconomic status

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Table 3

Studies reporting associations between mastery and cardiovascular reactivity to acute stress.

Study	Participants	Design	Mastery Construct	Mastery Measure	CVD Outcome	Results/Findings	Effect Size (Cohen's d)
Cattanach et al., 1988	30 undergraduate women (15 women meeting eating disorder criteria based on an eating disorder inventory and 15 controls not meeting criteria), ages 17-21 years	Cross-sectional	Personal Mastery	Pearlin and Schooler Mastery Scale	Blood pressure and pulse rate responses to a stressor task	Mastery was not associated with responses to laboratory stressors in either group.	Insufficient information to calculate effect size
Light et al., 2004	25 recent mothers without history of drug-exposure during pregnancy or postpartum (age 29±1 years) and 10 recent mothers reporting cocaine use during pregnancy (age 30±2 years); participants were free of CVD	Cross-sectional	Personal Mastery	Pearlin and Schooler Mastery Scale	Resting and post-acute stressor measurements of blood pressure, plasma norepinephrine, plasma epinephrine, and plasma oxytocin; serum cortisol as well as urinary cortisol and catecholamines were also collected.	Oxytocin at baseline and during the stressor task were positively associated with mastery in both groups. Mastery was unassociated with other biomarkers.	Oxytocin: d = .85 (baseline) d = .70 (post-speech) Insufficient information to calculate effect size for other biomarkers
Ma et al., 2007	38 healthy women (mean age 58±8 years)	Cross-sectional	Personal Mastery	Pearlin and Schooler Mastery Scale	Autonomic (skin conductance and heart rate variability) and endocrine (salivary cortisol) responses to acute stress versus a control task	Skin conductance and cortisol responses to stress were buffered by mastery, such that women with high mastery showed no differences in their responses to the stress task compared to a control task. Women with low mastery exhibited higher reactivity to the stress task compared to the control task. There was no moderating effect of mastery on heart rate variability (HRV).	Cortisol: d = .97 (Low Mastery) d = .28 (High Mastery) Skin Conductance: d = .42 (Low Mastery) d = .41 (High Mastery) HRV: (insufficient information to calculate)
Pham et al., 2001	96 undergraduates, mean age 20 years	Cross-sectional	Personal Mastery	Pearlin and Schooler Mastery Scale	Blood pressure reactivity to tasks designed to evoke the aspects of college that are predictable, unpredictable, or neutral	Mastery was unassociated with blood pressure reactivity in all tasks.	Insufficient information to calculate effect size
Roepke et al., 2008	69 elderly spousal Alzheimer	Cross-sectional	Personal Mastery	Pearlin and Schooler Mastery Scale	Norepinephrine reactivity to stress	Mastery was significantly and negatively associated with	d = −.52

Study	Participants	Design	Mastery Construct	Mastery Measure	CVD Outcome	Results/Findings	Effect Size (Cohen's d)
	caregivers, age ≥ 55 years					norepinephrine reactivity to acute stress.	
Younger et al., 2008	73 men and women with rheumatoid arthritis, ages of 23-81	Prospective laboratory study	Personal Mastery	Pearlin and Schooler Mastery Scale; items were divided into 2 components: fatalism and control	Resting blood pressure and blood pressure reactivity to laboratory stressor tasks	Those scoring high on the control component had lower mean arterial pressure at rest compared to those with low control. However, those with high control also exhibited higher blood pressure reactivity to stress compared to those with low control.	d = −.65 (resting MAP) d = .94 (MAP reactivity to stress)

Note. CVD = cardiovascular disease

Table 4

Studies reporting associations between mastery and measures of metabolic dysregulation.

Study	Participants	Design	Mastery Construct	Mastery Measure	CVD Outcome	Results/Findings	Effect Size (Cohen's d)
Daniel et al., 1995	189 on-reserve registered Indians in British Columbia (age ≥18 years) with diabetes and family history of non-insulin-depended diabetes mellitus	Cross-sectional	Personal Mastery	Pearlin and Schooler Mastery Scale	Fasting glucose, insulin concentration, anthropometric measures, blood pressure, triglycerides, and cholesterol	Mastery was inversely associated with fasting glucose levels, but not insulin	Glucose: d = −.15 (insufficient information for insulin)
Daniel et al., 2001	198 on-reserve registered Indians in a rural aboriginal population in British Columbia with and at risk for type 2 diabetes, age ≥18 years	Cross-sectional	Personal Mastery	Pearlin and Schooler Mastery Scale	HDL cholesterol and triglycerides	For those with diabetes and impaired glucose tolerance, HDL cholesterol was positively associated with mastery. However, for normoglycemics, HDL cholesterol was negatively associated with mastery. Mastery was unassociated with triglycerides.	HDL: d = 1.71 (diabetics) d = −1.28 (normoglycemics) Triglycerides: d = .31 (all participants)
Paquet et al., 2010	344 men and women free of diagnosed metabolic disease, ages 18-57 years	Cross-sectional	Personal Mastery	Pearlin and Schooler Mastery Scale	Cumulative metabolic risk including measures of HDL and total cholesterol, waist circumference, BMI, triglycerides, and glycated hemoglobin	Mastery was negatively associated with metabolic risk. There was also mastery-by-fast-food exposure (in one's immediate environment) on metabolic risk. Higher mastery was associated with lower metabolic risk for those living near a high concentration of fast-food restaurants. Mastery was unassociated with metabolic risk for those in an area with a low-concentration of fast-food restaurants.	Mastery Main Effect: d = −.28 Mastery X Fast-food Interaction: d = −.16
Surgenor et al., 2000	96 women with diabetes, ages 17-50 years	Cross-sectional	"Sense of Control"	Shapiro Control Inventory; includes a general "overall" score for "sense of control."	Metabolic control status of glucose as assessed by HbA1c	Those with optimal HbA1c status had higher levels of overall sense of control than those with suboptimal or poor HbA1c status.	d = .94
Surgenor et al., 2002	96 women with diabetes mellitus (DM) ages 17-50	Cross-sectional	"Sense of Control"	Shapiro Control Inventory; includes a general "overall" score for "sense of control."	Metabolic control of glucose as assessed by HbA1c	Overall sense of control was negatively associated with HbA1c.	d = −.58

Note. BMI = body mass index; HDL = high density lipoprotein

Table 5

Studies reporting associations between mastery and measures of inflammation and coagulation.

Study	Participants	Design	Mastery Construct	Mastery Measure	CVD Outcome	Results/Findings	Effect Size (Cohen's d)
Garvin et al., 2009	402 men and women, ages 45-69	Cross-sectional	Personal Mastery	Pearlin and Schooler Mastery Scale	Circulating levels of matrix metalloproteinase-9 (MMP-9)	Mastery was negatively associated with MMP-9 when adjusting for age, sex, and known diagnoses. Mastery was marginally associated when controlling for CAD and other risk factors.	d = −1.0
Mausbach, Aschbacher et al., 2007	126 spousal Alzheimer's disease caregivers, age ≥ 55 years	Prospective, annual assessments for 5 years	Personal Mastery	Pearlin and Schooler Mastery Scale	Plasma D-dimer	Caregiver burden decreased and mastery increased after a caregiving transition (placement of spouse into institutionalized care or death of the spouse). D-dimer levels rose over time, but declined 6 months after a transition, suggesting that the improvement in psychological health post-placement may bring forth subsequent improvements in cardiovascular health.	The direct association between mastery and d-dimer was not assessed
Mausbach, von Känel et al., 2008	71 elderly spousal Alzheimer's disease caregivers, age ≥ 55 years	Cross-sectional	Personal Mastery	Pearlin and Schooler Mastery Scale	Plasminogen activator inhibitor-1 (PAI-1) antigen	Negative stressful life events were positively associated with PAI-1 antigen in caregivers with low mastery, but not in caregivers with high mastery. Mastery might buffer the relationship between stress and markers of CVD.	Mastery Main Effect: d = −.36 Stress X mastery interaction: d = .52 (low mastery) d = −.35 (high mastery
Sjögren et al., 2006	34 women and 25 men, ages 30-65 with a broad range of psychosocial status	Cross-sectional	Personal Mastery	Pearlin and Schooler Mastery Scale	Interleukin-6 (IL-6) collected from serum and saliva from 3 time points throughout the day, and in the supernatant of cell cultures stimulated in vitro with lipopolysaccharide	Serum IL-6 was negatively associated with mastery	d = −.72
Taylor et al., 2006	3248 adults ages 32-47 years	Cross-sectional	Personal Mastery	Pearlin and Schooler Mastery Scale	C-reactive Protein	Structural equation modeling indicated that "childhood SES" and "risky families" were associated with C-reactive protein via "psychological functioning," a latent variable characterized by low depression, high mastery, and high positive and low negative	d = −.06

Study	Participants	Design	Mastery Construct	Mastery Measure	CVD Outcome	Results/Findings	Effect Size (Cohen's d)
						social contacts)	

Note. CAD = coronary artery disease; CVD = cardiovascular disease; IL-6 = interleukin-6; MMP-9 = matrix metalloproteinase-9; SES = socioeconomic status

Table 6

Studies reporting associations between mastery and evidence of large vessel disease from imaging methods.

Study	Participants	Design	Mastery Construct	Mastery Measure	CVD Outcome	Results/Findings	Effect Size (Cohen's d)
Matthews et al., 2006	155 healthy women, mean age 65±2 years	Cross-sectional	Personal Mastery	Pearlin and Schooler Mastery Scale	Electron beam tomography scan of coronary and aortic calcification	High aortic calcification was associated with low mastery	d = −.55
Seeman, 1991	119 men and 40 women, ages 30-70 who were referred for angiography because of suspected CAD. They were diagnosed with angina pectoris, CAD, recent MI, asymptomatic CAD	Cross-sectional	Personal Mastery	Pearlin and Schooler Mastery Scale	Extent of coronary atherosclerosis determined from angiography films	Higher mastery was an independent predictor of severe coronary atherosclerosis. Mastery was unassociated with Type A behavior pattern.	d = .69 (with mastery as a dichotomized variable) d = .14 (with mastery as a continuous variable)

Note. CAD = coronary artery disease; MI = myocardial infarction