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Sense of control and sociodemographic differences in self-reported health in older adults

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Abstract

Purpose—Stronger sense of control has been associated with improved health outcomes. This study tested whether the association between sense of control and self-reported health varied among demographic groups and whether sense of control attenuated sociodemographic differences in self-reported health.

Methods—Data from 6,815 participants in the Health and Retirement Study were used to examine moderation between demographic characteristics and sense of control (measured by the personal mastery and perceived constraints scales of the Midlife Developmental Inventory) in their associations with three self-reported health measures (global rating of fair/poor health, functional limitations, and number of comorbid conditions).

Results—Higher personal mastery and lower perceived constraints were associated with better self-reported health. There were no significant interactions between the sense of control measures and age, gender, education level, income, or marital status in their associations with either global self-rated health or functional limitations. Higher levels of mastery were associated with lower likelihood of functional limitations among blacks and whites, but not among those of other races. Perceived constraints were slightly more strongly associated with number of comorbid conditions among older than younger individuals.

Conclusions—Sense of control measures were generally similarly associated with self-reported health across demographic groups and did not attenuate demographic differences in health.

Keywords

Sense of control; Self-rated health; Functional limitations; Disease burden

Introduction

Persons with a strong sense of control believe that their own actions are responsible for their experiences and are less apt to believe that events in life are determined by chance, fate, or other people. It is a learned expectancy regarding one's competence to achieve personal goals and influence outcomes in their life. Sense of control has been established as a foundational element in adaptation, coping, and well-being [1]. Although sense of control is conceived as operating in many domains of life, most research on sense of control has been in the health domain. A stronger sense of personal control has been associated with better self-reported physical and mental health [2–8]. Sense of control has also been associated

with lower incidences of coronary heart disease and diabetes, better chronic disease outcomes, and lower mortality [9–14].

Older individuals, unmarried persons, and those who are less well educated or of lower socioeconomic position tend to report lower sense of control than those who are younger, married, more highly educated, or of higher socioeconomic position [2, 10, 12, 15–21]. These differences raise the question of whether the strength of association between sense of control and health is similar in older and younger individuals, in married and unmarried persons, and those who differ in education level or socioeconomic position.

Moderation of the association between sense of control and health by demographic factors would indicate that sense of control is more salient for some subgroups, which could provide insight into the ways in which sense of control is related to health. For example, if sense of control was more strongly associated with health in unmarried persons than married persons, this may indicate that sense of control affects health primarily in the absence of close social support. Alternatively, moderation of the association between demographic characteristics and health by sense of control may indicate whether enhanced sense of control is likely to attenuate sociodemographic differences in health. For example, evidence of moderation by socioeconomic position would suggest that strategies to enhance sense of control may be an effective means to reduce socioeconomic disparities in health.

Previous studies of moderation by sense of control have had conflicting results. Lachman and Weaver [22] and Pudrovskaya et al. [23] reported that high personal mastery attenuated the association between income or economic hardship and several measures of health, including self-reported health, physical symptoms, depressive symptoms, and anxiety; low perceived constraints also attenuated the association between income and functional limitations. Testing demographic features as moderators, Gale et al. reported that the association between internal locus of control and overweight was stronger in women than men [4]. In contrast, several other studies of large samples found no interactions between demographic characteristics, sense of control, and health outcomes. Bosma et al. [10] found that age, gender, and socioeconomic status did not moderate the association of personal mastery and incident heart disease. Seeman and Lewis found that associations between powerlessness and physical symptoms and activity limitations were similar between women and men, and Cardarelli et al. found no moderation by gender or race of the association between sense of control and incident diabetes mellitus [7, 11]. Gadalla [24] reported that mastery did not moderate socioeconomic differences in psychological distress.

Previous studies have not examined sense of control as both moderator and as the measure to be moderated, even though both perspectives provide important information on the relationship between sense of control and health. Additionally, most studies focused on moderation of one or a few selected demographic characteristics. However, knowing the relative strength of interactions among several demographic features is needed to learn which factors have the greatest impact on this association. This study addresses both issues. The purpose of this study was: (1) to examine whether the strength of association between sense of control and self-reported health varied among demographic subgroups, defined by age, gender, educational level, income, race/ethnicity, and marital status, in a nationally representative sample of older Americans and (2) to determine whether sense of control attenuated or exaggerated demographic differences in self-reported health.

Methods

Data source

Data were from the 2006 wave of the Health and Retirement Study (HRS), an ongoing panel study of the economic and health characteristics of older Americans [25]. Begun in 1992, the original HRS cohort included persons born in 1931–1941 who resided in households in the contiguous United States, and their spouses or partners. Additional cohorts were later added to include individuals in their eighth, ninth, and tenth decades of life. In 2004, the sample was supplemented with a more recent birth cohort. The HRS uses a multistage clustered stratified sampling design to provide a nationally representative sample of non-institutionalized adults older than age 50. The HRS is sponsored by the National Institute of Aging (grant number NIA U01AG009740) and conducted by the University of Michigan. For this analysis, the RAND HRS data file was used, which includes imputations of selected economic variables, to obtain demographic, health, and sampling variables [26]. This study was exempted from human subjects review by the National Institutes of Health Office of Human Subjects Research.

Sample

In 2006, the survey included 18,469 respondents (mean $\pm$ SD age 68.0 ± 11.1 ; 58.9% women; 80.8% white, 14.1% black, 5.1% other race; 9.2% Hispanic ethnicity; mean years of education 12.4 ± 3.2). Questions on sense of control were included in the self-administered 2006 Participant Lifestyle Questionnaire, which was administered to a subsample of participants selected for an extended in-person interview. The response rate for the Participant Lifestyle Questionnaire was 82%. Of 6,928 non-proxy respondents, 113 who did not complete measures of sense of control were excluded, for a sample of 6,815 participants.

Measures of health

Three self-reported measures of health were used as dependent variables: global health, functional limitations, and disease burden. Participants were asked to provide a global rating of their current health as excellent, very good, good, fair, or poor. For analysis, responses were categorized as fair/poor versus excellent/very good/good. This categorization was used because in preliminary analyses, associations were non-linear across response categories, and because subjective ratings of health as either fair or poor are more closely related to illness, while ratings of excellent, very good, or good are more related to perceptions of a healthy lifestyle [27]. Participants were also asked to report the presence of any difficulties in dressing, eating, bathing, using the toilet, walking, or getting in and out of bed, or if they were unable to do or did not do these tasks. Functional limitations were considered present if the participant reported any difficulty or inability to do any of the six tasks. Disease burden was based on the count of the number of chronic medical conditions the participant reported ever having, from among hypertension, arthritis, cardiovascular disease, stroke, diabetes, chronic obstructive pulmonary disease, and cancer. Counts were analyzed as an ordinal variable with categories of none, 1, 2, 3, or 4 or more conditions. Each is a well-established and valid measure of health [28–30].

Sense of control measures

The measures of sense of control included in the Participant Lifestyle Questionnaire were personal mastery and perceived constraints, based on the Midlife Developmental Inventory [22]. Personal mastery represents one's perception of his or her ability to achieve goals. The measure included statements such as "I can do just about anything I really set my mind to" and "What happens to me in the future mostly depends on me." Scores were the mean of responses to five Likert-scaled statements (1 = strongly disagree; 6 = strongly agree), where

higher scores indicated higher personal mastery. Perceived constraints represent one's perception of barriers that limit or interfere with achievement of goals and include the operation of luck or fate. Statements in this measure included "What happens in my life is often beyond my control" and "Other people determine most of what I can and cannot do." Scores were the mean of responses to five Likert-scaled statements (possible range 1–6), with higher scores indicating more perceived constraints. Cronbach's alpha was 0.89 for personal mastery and 0.86 for perceived constraints.

Demographic and other measures

Demographic measures included age, gender, years of formal education, household income, race (white, black, other), Hispanic ethnicity, and marital status. Because affect can confound the association between sense of control and self-reported health (unpublished observations), measures of positive affect and negative affect were also included. The measure of negative affect was based on ratings of how often over the preceding 30 days participants felt each of six emotions: hopeless, restless or fidgety, worthless, nervous, that everything was an effort, and so depressed that nothing could cheer them up [31]. Similarly, the measure of positive affect consisted of six questions about feeling cheerful, in good spirits, extremely happy, calm and peaceful, satisfied, and full of life.

Statistical analysis

All analyses were done using procedures that accounted for the complex sampling of the HRS. Sample weights were included that adjusted for selection into the subsample that received the extended interview and for non-response to the Participant Lifestyle Questionnaire.

Logistic regression models were used to test associations between demographic factors, sense of control measures, and the likelihood of fair/poor health, functional limitations, and higher disease burden. Associations with disease burden were tested using ordinal logistic models. Independent variables in the adjusted models were personal mastery, perceived constraints, age, years of formal education, logarithm of household income, negative affect, positive affect, and indicator variables for gender, race, Hispanic ethnicity, and being married. Based on preliminary analyses that showed improved fit of the models, household income was also included as a squared term. In all models, the coefficient of the linear term for income was positive and the coefficient for the squared term was negative, indicating a stronger association between income and the health measures at lower incomes than at higher incomes.

To examine moderation, first-order interactions between each demographic characteristic and each sense of control measure were tested in separate models. The sense of control measures, age, and household income were tested as continuous variables. Odds ratios for the association of personal mastery and perceived constraints with the health measures were presented for all participants and for demographic subgroups (with age and household income stratified at the group median), to show the degree to which demographic factors moderated the strength of association between the sense of control measures and health. Additionally, odds ratios for the association of each demographic factor with the health measures were presented by levels of personal mastery and perceived constraints, to show the degree to which sense of control measures moderated the strength of association between demographic characteristics and health. For presentation, the sense of control measures were dichotomized; those with scores in the lowest tertile (≤ 4.52) of personal mastery were contrasted with those in the highest two tertiles (>4.52), and those with scores in the highest tertile (≥ 2.53) of perceived constraints were contrasted with those in the lowest two tertiles (<2.53). The tertile was used as the cutpoint, rather than the median, because with the

skewed distributions of these measures, the tertile better separated groups with differences in sense of control.

Data for positive affect and negative affect were missing for 29 (0.4%) and 34 (0.4%) participants, respectively. Data were considered as missing not completely at random, and participants with missing data were included in the analyses as a subpopulation. Models were estimated using survey logistic procedures in SAS version 9.2 (SAS Institute, Cary, NC, USA).

Results

Characteristics of the sample

The median (25th percentile; 75th percentile) age of the sample was 62.6 years (56.4 years; 72.2 years). Women comprised 54% of the sample; 87.2% were white, 8.7% were black, 4.1% reported “other” race, and 6.5% were of Hispanic ethnicity. The mean education level was 13.0 years; 7.5% had 0–8 years of education, 43.1% had 9–12 years of education, and 49.4% had 13 or more years of education. The median household income was \$44,797 (\$22,860; \$84,611). Sixty-eight percent were married. Median score for negative affect was 1.4 (possible range 1–5), indicating most participants reported rarely having negative emotions, and median score for positive affect was 3.6 (possible range 1–5).

Participants generally had high levels of personal mastery (mean $\pm$ SE 4.7 ± 0.02) and low levels of perceived constraints (mean $\pm$ SE 2.2 ± 0.02). Personal mastery and perceived constraints were inversely correlated ($r = -0.42$; $P < 0.0001$). Health was reported as fair/poor by 25.0%, and functional limitations were reported by 15.2%. The proportions of participants with 0, 1, 2, 3, or 4 or more chronic medical conditions were 17.3, 28.7, 25.6, 17.2, and 11.2%, respectively. Table 1 shows that levels of personal mastery and perceived constraints were associated with each health measure (all $P < 0.0001$). The significant main effects provide the basis for investigating interactions with demographic characteristics.

Moderation of sense of control: health associations by demographic characteristics

Table 2 shows the associations between sense of control measures and the likelihood of fair/poor health overall and in demographic subgroups. Among all participants, the likelihood of reporting fair/poor health was lower among those with higher levels of personal mastery [adjusted odds ratio (aOR) 0.86 per 1-point increase in mastery; 95% confidence interval (CI) 0.79, 0.92; $P < 0.0001$] and was higher among those with more perceived constraints (aOR 1.12 per 1-point increase in perceived constraints; 95% CI 1.03, 1.22; $P = 0.008$) in multivariate-adjusted models. There were no significant interactions between either personal mastery or perceived constraints and any demographic measure. Although there were qualitative differences in the strength of association of personal mastery and fair/poor health between Hispanics and non-Hispanics, and between those of “other” race and both whites and blacks, these differences were not statistically significant. Similarly, the strength of association of perceived constraints with fair/poor health varied somewhat among racial groups, but the interaction between race and perceived constraints was not significant.

Findings were similar for associations with functional limitations (Table 3). Among all subjects, higher levels of personal mastery were associated with decreased likelihood of functional limitations (aOR 0.83; 95% CI 0.77, 0.91; $P < 0.0001$), while higher perceived constraints were associated with an increased likelihood of functional limitations (aOR 1.16; 95% CI 1.05, 1.30; $P = 0.004$), in the multivariate-adjusted models. There was a significant interaction between personal mastery and race, with no association between mastery and the presence of functional limitations among those of “other” race, and inverse associations

among both whites and blacks. Personal mastery and perceived constraints were otherwise similarly associated with functional limitations among demographic subgroups.

Among all participants, there was no association between personal mastery and disease burden in the adjusted analysis (aOR 0.98; 95% CI 0.93, 1.04; $P = 0.55$) (Table 4). However, those with more perceived constraints were more likely to have a higher disease burden than those with lower levels of perceived constraints (aOR 1.08; 95% CI 1.01, 1.15; $P = 0.02$). There was a marginally stronger association between perceived constraints and disease burden among older participants than younger participants, but no interactions with other demographic characteristics.

Moderation of demographic: health associations by sense of control

Tables 5, 6, and 7 present the above results with sense of control as the moderating variable. The likelihood of reporting fair/poor health increased with age and was higher among those with less education and lower incomes (Table 5). Women, whites, and non-Hispanics were also more likely to report fair/poor health than men, blacks, and Hispanics in the adjusted analysis. The strength of associations between age, gender, other race, Hispanic ethnicity, and marital status and self-reported health did not vary by level of personal mastery. The associations of education level and income with health tended to be weaker among those with low personal mastery than among those with higher personal mastery, with less steep gradients for each measure. This is contrary to predictions that higher personal mastery would attenuate associations with socioeconomic measures. The lower likelihood of blacks to report fair/poor health tended to be stronger among those with lower levels of mastery. Findings were similar for associations by level of perceived constraints (Table 5). In particular, the association of education level and fair/poor health was similar at lower and higher levels of perceived constraints.

Among all participants, the likelihood of functional limitations increased with age and with lower household income and was higher among men and whites than among women and blacks (Table 6). Personal mastery and perceived constraints did not moderate the association between demographic features and the likelihood of functional limitations, except for that of “other” race. The association of income with functional limitations tended to be less strong among those with lower levels of perceived constraints than among those with higher levels of perceived constraints.

Disease burden increased with age, decreased with more education and higher income, was lower among blacks than whites, was lower among married than non-married participants, and was higher among Hispanics than non-Hispanics (Table 7). The graded association between education level and disease burden was not present among those with higher personal mastery, as it was among those with lower personal mastery. However, this difference was not significant, possibly because of the smaller number of participants with less than a high school education. There was little difference in gradients by household income between those with higher or lower levels of mastery or perceived constraints. Associations among those of “other” race suggest that higher levels of personal mastery and lower levels of perceived constraints may attenuate

Discussion

This study confirmed that older adults with greater personal mastery and fewer perceived constraints reported better health and were less likely to have functional limitations than persons whose sense of control was not as strong. Those with fewer perceived constraints also reported lower disease burdens. The strength of these associations was largely similar across demographic subgroups, indicating that demographic features did not moderate the

association between sense of control and health. There were two exceptions to this general result. The inverse association between higher personal mastery and functional limitations was not present among those whose race was other than white or black, suggesting that persons in this subgroup are more likely to perceive functional limitations as consequences of their environment rather than of their abilities. The association between perceived constraints and disease burden was slightly stronger among older individuals, possibly because the diseases were more severe in this subgroup.

Sense of control measures in this study did not moderate socioeconomic disparities in health. These findings support those of Gadalla [24], but differ, in part, from the results of Pudrovska et al. and Lachman and Weaver, which reported that mastery moderated the association between socioeconomic measures and health [22, 23]. Several differences among these studies should be noted. Pudrovska et al. [23] examined depression, anxiety, and physical symptoms as measures of health, but did not examine self-reported global health rating, functional limitations, or disease burden. These investigators tested whether mastery moderated the association of economic hardship (defined as perceived difficulty meeting needs for food, clothing, housing, costs of transportation, and medical costs) and health, rather than moderation of income or education level. Perception of economic hardship was distinguished from measures of socioeconomic position and may have a different susceptibility to moderation by mastery than measures of socioeconomic position. Lachman and Weaver [22] reported that high levels of mastery attenuated the association of income with self-reported health in two samples that measured self-reported health using a 10-point scale, but not in a third sample that used a categorical scale of excellent to poor. These investigators also reported that mastery attenuated the association of income with depression and physical symptoms. Low constraints attenuated the association of income and functional limitations, but the effect was small, and no moderation was detected for associations with the number of chronic medical conditions.

Integrating these results with those of Bosma et al. [10], which showed no moderation by sense of control of the association of income with incident heart disease, the evidence suggests that moderation of socioeconomic associations by sense of control varies with the nature of the health outcome. Moderation is most often (but not universally) apparent for psychological outcomes and the number of physical symptoms a person reports (which may also reflect mental health [32]). Evidence for moderation is weaker for physical health, including functional limitations and global health on a defined scale (used in the current study), and is not present for physician-diagnosed chronic conditions.

The nature of the association between sense of control and health must also be considered [17, 33]. Depressive symptoms and anxiety might influence measures of sense of control to a greater degree than the presence of chronic physical health conditions and may also affect the likelihood of interactions [2, 3, 16, 21, 23, 34, 35]. In this study, positive affect and negative affect were included as control variables, rather than as measures of health, to adjust for group differences in affect that may have affected the relationship between measures of sense of control and health. In separate analyses not detailed here, results were similar in models that did not include positive and negative affect as independent variables, indicating that adjustment for these factors was not responsible for the absence of moderating effects in this study, nor the explanation for differences between these findings and those of previous studies.

In addition to income and education level, there was no evidence of moderation of, or by, gender, education level, Hispanic ethnicity, or marital status. Although some previous studies tested moderation of associations between sense of control and health by gender [4, 7, 10, 14], moderation by age, education level, Hispanic ethnicity, and marital status have

not been reported. In this study, age moderated the association between perceived constraints and disease burden, but the degree of moderation was small. There were also some qualitative differences in associations among racial subgroups, particularly those of race other than black or white. Future studies of these associations would benefit from examining larger numbers of racial minorities and better characterizing the diversity among persons who are neither white nor black.

Study of the moderating effects of demographic factors provides information on how sense of control may act across domains. Elderly persons tend to experience more losses than younger persons, and in multiple domains. Retirement, separation from children, widowhood, reduced income, and social segregation, as well as more health and physical limitations, pose challenges to sense of control later in life. General measures of sense of control, such as the ones used in this study, might have been influenced or dominated by perceptions of control over financial matters, work, or personal relations. If the association between sense of control and health was weaker among older persons than among younger persons, it might indicate that cross-domain influences were important. The finding that the association between sense of control and health was as strong (or stronger) among older persons as among younger individuals suggests that sense of control tends to operate independently across domains. The strength of association between sense of control and health was as strong among poorer and less well-educated persons as among wealthier and better-educated persons, even though these groups might be expected to differ in perceptions of control over financial or work matters or other non-health domains. The absence of moderation by these features also supports the view that sense of control relates to health in a way that was not overly influenced by other domains.

The strengths of this study include the large nationally representative sample, testing for moderation by several demographic characteristics, examination of three health measures, and adjustment for measures of positive and negative affect. However, the study is limited in that the cross-sectional design does not restrict the direction of associations. The sense of control measures were also not specific for health, which may have affected the associations. The similarity of results between personal mastery and perceived constraints may raise the question of whether these scales are duplicative, but the modest correlation between these scales and other empirical data and theoretical considerations provide stronger considerations on which to base this judgment [16, 22, 36]. Results were consistent for three measures of health, but studying additional health measures would have provided a more comprehensive assessment.

Although sense of control was not found to moderate socioeconomic differences in health, a stronger sense of personal mastery and fewer perceived constraints were associated with better self-reported health and a lower likelihood of functional limitations, and fewer perceived constraints were associated with lower disease burdens. Interventions to enhance sense of control would therefore be predicted to have similar effects across demographic groups. Selective targeting of effective interventions to socially or economically disadvantaged groups would be required to narrow sociodemographic disparities in health.

Acknowledgments

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Abbreviations

HRS Health and retirement survey

aOR Adjusted odds ratio
CI Confidence interval

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Table 1

Unadjusted associations between personal mastery, perceived constraints, and measures of health

	Personal mastery Mean (95% CI)	Perceived constraints Mean (95% CI)
Global health		
Excellent, very good, good	4.91 (4.87, 4.94)	2.02 (1.99, 2.06)
Fair or poor	4.32 (4.26, 4.38) ***	2.83 (2.76, 2.90) ***
Functional limitations		
Absent	4.85 (4.82, 4.89)	2.09 (2.06, 2.13)
Present	4.22 (4.15, 4.30) ***	2.92 (2.84, 3.01) ***
Disease burden		
0	4.93 (4.87, 5.00)	1.95 (1.88, 2.02)
1	4.88 (4.83, 4.94)	2.07 (2.02, 2.13)
2	4.73 (4.68, 4.79)	2.21 (2.16, 2.27)
3	4.62 (4.56, 4.69)	2.44 (2.38, 2.52)
4 or more	4.44 (4.36, 4.53) ***	2.70 (2.62, 2.79) ***

P_{across levels} <0.0001

Table 2

Moderation by demographic features of the association between personal mastery and perceived constraints with fair/poor health

	Personal mastery	<i>P</i> [*]	Perceived constraints	<i>P</i> [*]
All	0.86 (0.79, 0.92)		1.12 (1.03, 1.22)	
Age 63 years	0.88 (0.77, 1.01)	0.30	1.20 (1.04, 1.38)	0.16
Age > 63 years	0.84 (0.78, 0.91)		1.06 (0.96, 1.17)	
Women	0.85 (0.77, 0.94)	0.90	1.15 (1.04, 1.27)	0.67
Men	0.86 (0.76, 0.96)		1.08 (0.95, 1.24)	
Education 0–8 years	0.96 (0.80, 1.14)	0.23	1.16 (0.94, 1.45)	0.27
Education 9–12 years	0.83 (0.75, 0.93)		1.04 (0.92, 1.19)	
Education 13 or more years	0.85 (0.75, 0.96)		1.23 (1.05, 1.44)	
Income \$44,797	0.83 (0.75, 0.90)	0.56	1.09 (0.99, 1.20)	0.57
Income > \$44,797	0.92 (0.81, 1.05)		1.20 (1.01, 1.43)	
White	0.86 (0.79, 0.93)	0.36	1.13 (1.02, 1.24)	0.12
Black	0.77 (0.63, 0.94)		1.26 (1.01, 1.57)	
Other race	0.98 (0.70, 1.37)		0.82 (0.58, 1.14)	
Hispanic	1.04 (0.86, 1.25)	0.21	1.06 (0.86, 1.31)	0.95
Not Hispanic	0.84 (0.78, 0.91)		1.13 (1.02, 1.24)	
Not married	0.82 (0.75, 0.90)	0.77	1.08 (0.95, 1.23)	0.28
Married	0.88 (0.79, 0.98)		1.15 (1.04, 1.27)	

Values are adjusted odds ratios (95% confidence limits)

* *P* value for interaction between each sense of control measure and demographic characteristic

Table 3

Moderation by demographic features of the association between personal mastery and perceived constraints with functional limitations Values are adjusted odds ratios (95% confidence limits)

	Personal mastery	<i>P</i> *	Perceived constraints	<i>P</i> *
All	0.83 (0.77, 0.91)		1.16 (1.05, 1.30)	
Age 63 years	0.82 (0.70, 0.97)	0.94	1.15 (0.95, 1.39)	0.69
Age > 63 years	0.85 (0.78, 0.93)		1.16 (1.05, 1.27)	
Women	0.83 (0.75, 0.92)	0.99	1.18 (1.05, 1.34)	0.75
Men	0.83 (0.72, 0.95)		1.13 (0.98, 1.31)	
Education 0–8 years	0.83 (0.68, 1.01)	0.94	1.31 (1.07, 1.62)	0.74
Education 9–12 years	0.81 (0.73, 0.90)		1.06 (0.94, 1.20)	
Education 13 or more years	0.86 (0.74, 1.00)		1.27 (1.06, 1.53)	
Income \$44,797	0.80 (0.73, 0.88)	0.90	1.16 (1.03, 1.29)	0.29
Income > \$44,797	0.96 (0.78, 1.18)		1.24 (1.01, 1.53)	
White	0.84 (0.77, 0.92)	0.04	1.16 (1.05, 1.30)	0.42
Black	0.75 (0.62, 0.89)		1.13 (0.90, 1.40)	
Other race	1.02 (0.70, 1.50)		1.49 (1.12, 1.98)	
Hispanic	0.86 (0.66, 1.11)	0.61	1.33 (0.99, 1.78)	0.69
Not Hispanic	0.83 (0.76, 0.91)		1.15 (1.04, 1.29)	
Not married	0.80 (0.71, 0.91)	0.64	1.21 (1.06, 1.38)	0.98
Married	0.86 (0.77, 0.97)		1.12 (0.98, 1.29)	

* *P* for interaction between each sense of control measure and demographic characteristic

Table 4

Moderation by demographic features of the association between personal mastery and perceived constraints with disease burden

	Personal mastery	<i>P</i> *	Perceived constraints	<i>P</i> *
All	0.98 (0.93, 1.04)		1.08 (1.01, 1.15)	
Age 63 years	1.00 (0.91, 1.09)	0.33	1.07 (0.98, 1.19)	0.04
Age > 63 years	0.96 (0.90, 1.03)		1.10 (1.03, 1.18)	
Women	0.98 (0.90, 1.07)	0.76	1.06 (0.98, 1.16)	0.79
Men	0.98 (0.89, 1.09)		1.10 (0.99, 1.22)	
Education 0–8 years	0.95 (0.82, 1.11)	0.26	1.10 (0.93, 1.30)	0.42
Education 9–12 years	0.97 (0.90, 1.04)		1.08 (0.99, 1.18)	
Education 13 or more years	0.99 (0.92, 1.07)		1.06 (0.96, 1.16)	
Income \$44,797	0.94 (0.88, 1.01)	0.19	1.08 (1.00, 1.17)	0.71
Income > \$44,797	1.04 (0.97, 1.12)		1.07 (0.99, 1.17)	
White	0.99 (0.93, 1.05)	0.12	1.10 (1.03, 1.18)	0.07
Black	0.86 (0.76, 0.99)		1.04 (0.88, 1.21)	
Other race	1.19 (0.92, 1.55)		0.90 (0.72, 1.11)	
Hispanic	1.07 (0.89, 1.29)	0.85	1.02 (0.83, 1.24)	0.81
Not Hispanic	0.98 (0.92, 1.04)		1.08 (1.01, 1.16)	
Not married	0.97 (0.89, 1.07)	0.85	1.10 (0.99, 1.23)	0.95
Married	0.99 (0.93, 1.06)		1.06 (0.99, 1.13)	

Values are adjusted odds ratios (95% confidence limits)

* *P* for interaction between each sense of control measure and demographic characteristic disparities in disease burden compared with whites, but this interaction was also not significant.

Table 5
Moderation by personal mastery and perceived constraints of the association between demographic features and fair/poor health

All	Personal mastery		Perceived constraints	
	Low (4.52)	High (>4.52)	Low (<2.53)	High (2.53)
Age (per year)	1.01 (1.00, 1.02)*	1.01 (1.00, 1.02)*	1.01 (1.00, 1.03)*	1.01 (1.00, 1.02)*
Men (vs. Women)	0.79 (0.67, 0.94)*	0.82 (0.66, 1.01)	0.70 (0.56, 0.88)*	0.94 (0.72, 1.22)
Education 0–8 years	2.37 (1.73, 3.26)***	2.08 (1.46, 2.96)**	2.44 (1.51, 3.96)*	2.10 (1.53, 2.90)***
Education 9–12 years	1.58 (1.33, 1.88)*	1.44 (1.12, 1.86)**	1.92 (1.49, 2.47)*	1.23 (0.97, 1.57)
Education 13 or more years	1.00	1.00	1.00	1.00
Income < \$22,860 [†]	4.06 (3.04, 5.43)***	3.03 (1.93, 4.75)***	3.60 (2.28, 5.67)***	4.83 (3.06, 7.64)***
Income \$22,860–\$44,797	2.34 (1.78, 3.08)*	2.11 (1.45, 3.07)*	2.19 (1.50, 3.20)*	2.63 (1.65, 4.22)**
Income \$44,798–\$84,611	1.77 (1.38, 2.28)*	1.37 (0.95, 1.98)	1.69 (1.17, 2.45)*	1.92 (1.28, 2.87)*
Income > \$84,611	1.00	1.00	1.00	1.00
Black (vs. White)	0.50 (0.39, 0.63)***	0.37 (0.25, 0.55)***	0.58 (0.42, 0.78)**	0.42 (0.28, 0.62)***
Other (vs. White)	0.81 (0.55, 1.19)	0.83 (0.65, 1.13)	0.52 (0.30, 0.90)*	1.26 (0.78, 2.06)
Hispanic (vs. non-Hispanic)	0.57 (0.40, 0.80)**	0.58 (0.37, 0.91)*	0.61 (0.38, 0.95)*	0.56 (0.36, 0.86)*
Married (vs. not Married)	0.86 (0.73, 1.02)	0.86 (0.65, 1.13)	0.96 (0.79, 1.16)	0.74 (0.55, 0.98)*

Values are adjusted odds ratios (95% CIs)

* P 0.05;

** P 0.001;

*** P 0.0001

[†]Quartiles of household income

Table 6

Moderation by personal mastery and perceived constraints of the association between demographic features and functional limitations

	Personal mastery		Perceived constraints	
	Low (4.52)	High (>4.52)	Low (<2.53)	High (2.53)
Age (per year)	1.03 (1.02, 1.05)***	1.03 (1.02, 1.05)***	1.03 (1.02, 1.05)***	1.03 (1.02, 1.05)***
Men (vs. Women)	1.23 (1.02, 1.48)*	1.33 (1.04, 1.70)*	1.25 (0.95, 1.65)	1.21 (0.95, 1.55)
Education 0–8 years	1.27 (0.98, 1.66)*	1.47 (1.02, 2.11)*	1.21 (0.83, 1.79)	1.29 (0.89, 1.86)
Education 9–12 years	0.97 (0.83, 1.14)	0.96 (0.78, 1.19)	1.03 (0.81, 1.31)	0.92 (0.72, 1.18)
Education 13 or more years	1.00	1.00	1.00	1.00
Income < \$22,860 [†]	3.63 (2.73, 4.83)***	3.73 (2.56, 5.44)***	3.44 (2.43, 4.88)***	4.11 (2.29, 7.39)***
Income \$22,860–\$44,797	2.07 (1.60, 2.69)**	1.82 (1.13, 2.94)*	1.91 (1.33, 2.75)*	2.38 (1.41, 4.00)**
Income \$44,798–\$84,611	1.64 (1.28, 2.10)*	1.64 (1.18, 2.28)*	1.41 (1.05, 1.88)*	2.04 (1.23, 3.40)*
Income > \$84,611	1.00	1.00	1.00	1.00
Black (vs. White)	0.57 (0.43, 0.74)***	0.49 (0.33, 0.70)***	0.50 (0.35, 0.72)***	0.62 (0.44, 0.87)*
Other (vs. White)	0.88 (0.54, 1.42)	0.62 (0.34, 1.11)	0.59 (0.30, 1.16)	1.19 (0.72, 1.98)
Hispanic (vs. non-Hispanic)	1.22 (0.83, 1.79)	1.35 (0.80, 2.28)	1.53 (0.89, 2.62)	1.04 (0.61, 1.76)
Married (vs. not Married)	0.92 (0.75, 1.12)	0.88 (0.68, 1.14)	0.89 (0.68, 1.16)	0.95 (0.73, 1.22)

Values are adjusted odds ratios (95% CIs)

* P 0.05;

** P 0.001;

*** P 0.0001

[†] Quartiles of household income

Table 7
Moderation by personal mastery and perceived constraints of the association between demographic features and disease burden

All	Personal mastery		Perceived constraints	
	Low (4.52)	High (>4.52)	Low (<2.53)	High (2.53)
Age (per year)	1.06 (1.05, 1.07)***	1.07 (1.06, 1.08)***	1.07 (1.06, 1.08)***	1.05 (1.04, 1.07)***
Men (vs. Women)	1.08 (0.96, 1.21)	1.07 (0.93, 1.23)	1.01 (0.87, 1.17)	1.22 (1.01, 1.49)*
Education 0–8 years	1.24 (0.95, 1.62)	1.02 (0.77, 1.35)	1.11 (0.79, 1.56)	1.42 (1.01, 1.99)*
Education 9–12 years	1.25 (1.14, 1.37)*	1.20 (1.06, 1.36)*	1.21 (1.08, 1.36)*	1.36 (1.14, 1.63)*
Education 13 or more years	1.00	1.00	1.00	1.00
Income < \$22,860 [†]	1.90 (1.56, 2.31)***	1.76 (1.39, 2.24)*	1.91 (1.48, 2.47)*	1.95 (1.45, 2.63)*
Income \$22,860–\$44,797	1.63 (1.45, 1.84)**	1.60 (1.38, 1.86)*	1.61 (1.38, 1.88)*	1.76 (1.33, 2.32)*
Income \$44,798–\$84,611	1.48 (1.25, 1.75)*	1.46 (1.24, 1.74)*	1.49 (1.25, 1.77)*	1.52 (1.12, 2.07)*
Income > \$84,611	1.00	1.00	1.00	1.00
Black (vs. White)	0.66 (0.55, 0.78)***	0.71 (0.55, 0.90)*	0.61 (0.49, 0.76)***	0.76 (0.57, 1.00)*
Other (vs. White)	0.94 (0.69, 1.27)	0.66 (0.43, 1.01)	0.64 (0.43, 0.95)*	1.53 (0.98, 2.42)
Hispanic (vs. non-Hispanic)	1.31 (1.03, 1.66)*	1.45 (1.05, 2.00)*	1.37 (1.02, 1.83)*	1.28 (0.90, 1.82)
Married (vs. not Married)	0.78 (0.67, 0.91)**	0.78 (0.66, 0.92)*	0.75 (0.63, 0.88)**	0.82 (0.64, 1.05)

Values are adjusted odds ratios (95% CIs)

* P 0.05;

** P 0.001;

*** P 0.0001

[†] Quartiles of household income