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Original Article

Personal Mastery and All-Cause Mortality among Older Americans Living with Diabetes

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ABSTRACT

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Introduction: Higher personal mastery is associated with better physical functioning, wellbeing, and longevity among older populations. However, few studies have focused on whether personal mastery is protective against mortality among older adults living with diabetes over time.

Methods: A total of 1,779 participants were identified from an off-year survey of the Health and Retirement Study. Proportional Hazard Models were used to evaluate the significance of selected variables in predicting the survival of participants over a 13-year period.

Results: A substantial proportion (46.7%) of the diabetic patients had survived by the end of 2016. Adults with lower mastery scores were more likely to die (Hazard Ratio = .94, $p < .001$). Gender differences in the association patterns between personal mastery and survival were identified. Personal mastery had an independent health-protective effect on the survival of diabetes patients over the study period. With lower educational attainment, the foreign-born female diabetics scored higher in personal mastery measure when compared to their male counterparts. In the face of more severe diabetes comorbidity, foreign-born female diabetics also outlived their male counterparts over the study period.

Conclusion: As a crucial psychological resource and a modifiable factor, personal mastery holds a potential for improving the health status among lower SES groups of older adults. Further investigations into the identified gender difference could be applied to break the cycle of poor health among lower Socio-Economic Status groups of older adults.

Keywords: Personal Mastery, Aged, Diabetes, Mortality, Immigrants

Introduction

Diabetes is a significant public health problem worldwide in terms of its incidence and prevalence, costs of care, and mortalities tied to its complications (1). According to an estimate in 2017, about 451 million adults were living with diabetes worldwide and it's expected to increase to 693 million by 2045 (2). The health care spending on diabetes patients was estimated to be 850 billion United States (US) dollars in 2017 (2). In the US, diabetes has become the seventh leading cause of death disease (3) and, based on estimates from the blood samples collected in the 2011-2012 National Health and Nutrition Examination Surveys, a significant proportion of diabetes patients went undiagnosed (4).

Diabetes is especially alarming among older Americans. According to Laiteerapong and Huang (1),

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about 40% of adult diabetes patients in the US were adults aged 65 or older. The number of diabetes patients was projected to increase to 26.7 million or a 55% of prevalence rate by 2050 (5). Rosenquist and Fox (6) indicated that people with diabetes were 2 to 3 times more likely to die when compared to people without diabetes. A diagnosed diabetes patient stays in the disease for an average of 14.7 years and over half of them would live more than 10 years (6). With improvement in the care of diabetes, evidence showed that people with diabetes had survived longer (3). Consequently, both the social and economic burden of caring for diabetes has become a challenge to both their family caregivers and health care systems.

The diabetes among immigrants

Older Americans with diabetes are a racial and ethnic heterogeneous group. Considerable variations in the prevalence of diabetes can be found across Asian, Hispanic, and non-Hispanic whites (7, 8). Significant socioeconomic disparities in diabetes-related mortality have also been documented (9, 10). Moreover, disparities in diabetes prevalence are also observed in the immigrant populations to the US (8). Higher prevalence rates were observed among non-Hispanic black, non-Hispanic Asian, and Hispanic population (4). Data from the 2011-2016 National Health Interview Survey found that, among US adults, 20.4 percent non-Hispanic blacks, and 22.1 percent Hispanics had diabetes. For non-Hispanic whites, the prevalence of diabetes was 12.1 percent. Ethnic differences between Hispanic and non-Hispanic whites would be even greater if the undiagnosed diabetes cases were included (7, 11). Ironically, with higher morbidity, lower levels of education, lower rates of health insurance coverage, and lower socioeconomic status (SES), there appears to be a “Hispanic paradox” or healthy immigrant advantage when compared to the non-Hispanic whites in the US (12, 14).

Using data from national representative samples, studies have found Hispanic older adults live longer than their counterparts of non-Hispanic whites who had higher SES in average (15,16). Particularly, for adults aged 65 or older, foreign-born Hispanics had a substantially lower risk of mortality, compared to non-Hispanic whites. Self-selection (healthier individuals are more likely to migrate) and protection (strong social support and favorable health-related behaviors) have been proposed as potential reasons (16,17). In general, the study of the “immigrant health advantage” has been more consistently found in mortality. For other health status measures results have been mixed (15, 17).

Diabetes mortality and personal mastery

Individuals with diabetes do have an increased risk of mortality compared to individuals without diabetes. It is estimated that people with diabetes have an 8-year shorter life expectancy compared to individuals without diabetes (6). The public health significance of diabetes is not reflected in the number of cases died of the disease. Researchers have argued that the number of deaths attributed to diabetes from death certificate data is likely an underestimate. The definitions of diabetes diagnosis have been changed over the past decades and the role of diabetes is often under-recognized when physicians attribute causes of death to a death certificate (6).

Another reason why diabetes mortality may be under-represented is because diabetes patients are often at a higher risk for cardiovascular or other complications (1). With access to quality care and regular exercises, most diabetes patients could live with the disease for an extensive period to develop comorbidities. As the disease process unfolds, diabetes patients could be exposed to persistent stressors for a long period of time and a sense of control or personal mastery has long been documented to correlate with better health (18).

Studies from the chronic stress literature have recognized that impacts of stressors on health and well-being might be reduced when the individuals have high levels of mastery (19). As a positive psychological resource, personal mastery is a conviction that a person has control over the important circumstances that are impinging on his or her life (18). High personal mastery is associated with better physical functioning, wellbeing, and longevity among older populations (19–21). This psychological resilience has been linked to positive health outcomes among people with chronic conditions, disabilities and their caregivers (22–24). Older adults with a better management of diabetes have to constantly pay attention to glycemic control. They are often told to exercise regularly and eat a healthy diet. As argued by Lachman and Firth (25), a plausible mechanism linking higher control beliefs to better health is engagement in beneficial health-related behaviors. Fewer studies have focused on the association between personal mastery and mortality, but evidence indicates that personal mastery is protective against both all-cause and cardiovascular mortality (26, 27).

The stress associated with managing diabetes could have negative impacts on survival. Several studies have corroborated that there is a positive association between personal mastery or better coping styles and health outcomes among diabetes patients (10, 28, 29). However, few studies have specifically focused on the association between personal mastery and mortality among diabetes patients. Evidence has indicated that there are gender and ethnic variations in control beliefs and personal mastery and women, ethnic, and the less-educated tend to have lower sense of control than those of their counterparts (30). If personal mastery does have an association with lower risk of mortality, how might this protective effect differ across gender and immigration status. In this study, we used data collected from a representative sample of older Americans living with diabetes and linked them to their follow-up survival status. The purpose is to explore the association between personal mastery and all-cause mortality in a sample of diabetes patients from 2003 through the end of 2016.

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Methods

Data and samples

The data were taken from the Diabetes Study 2003, an off-year survey of the Health and Retirement Study (HRS) (31). Questionnaires were mailed to the 2,381 HRS respondents who responded "yes" to the question," Have a doctor ever told you that you have diabetes?" in the 2002 HRS core interview survey. A total of 1,901 respondents (79.7%) returned their questionnaire. The survival information of the respondents was obtained from the 2016 cross-wave tracker file created by the HRS (31) . The death date of deceased participants in the HRS was obtained from both the tracker file. After excluding 122 cases with missing information on items covering the construct of personal mastery, a total of 1,779 participants were available for the current analysis. All identifiers in the data files had been removed before they became available on the HRS website for downloading.

Measures

After linking the participants of the 2003 Diabetes Study to the cross-wave tracker file, survival time since 2003 were calculated in years by subtracting 2003 from the year of death recorded in the tracker file for each of the deceased. If a participant died in 2003, a 0.5 year of survival time would be assigned to them. The observations for respondents who were still alive after the end of 2016 were treated as censored.

Personal mastery was measured by a 7-item scale with a 5-point Likert scale ("strongly disagree" = 1 to "strongly agree" = 5), developed by Pearlin (21). Three items in the scale were positively worded while the remaining 4 were worded negatively. To keep the direction of scoring in the same direction for all items, scoring was reversed for negatively-worded four items "I have little control over the things happen to me," "Sometimes I feel that I am being pushed around in life," "I live life one day at a time and don't think much about the future," and "I often feel hopeless about the future." A summary score of personal mastery was created by summing all 7 items. A higher score implies a stronger personal mastery. In order to reduce the number of cases dropped from current analysis, missing data for this measure were imputed for the 118 respondents who responded to 6 of the 7-item scale by multiplying the score for 6 items by a factor of 1.167 (the quotient of 7 divided by 6). However, the observations that missed 2 or more items on the 7-item scale were deleted.

Covariates related respondent's immigrant and ethnic status included in this study were participants' nativity (1 = "born in the US"; 0 = "foreign-born"), Hispanic status (1= "Hispanics" and 0 = "non-Hispanic"), and African-American status (1 = "yes" and 0 = "otherwise"). Participants' chronological age in the year 2003 was used in this study and gender was coded as (1 = male) and (2 = female). Health insurance is critical in gaining access to diabetes care. In the questionnaire, participants were asked: "at the time your diabetes was first diagnosed, were you covered by health insurance?" and "at the time your diabetes was first diagnosed, did you have any coverage for prescription drugs?" Only participants who answered both items with a "yes," were classified as (having insurance = 1; otherwise = 0). Years of schooling was used an indicator for respondent's SES. Finally, the Total Illness Burden Index (TIBI) was included to predict the mortality of the diabetes patients over the study period. The TIBI is a composite measure assessing comorbid illness in older adults using self-reported symptoms and has been proved a valuable tool in evaluating the severity of comorbidities (30).

Data analysis

Proportional Hazard Models were used to evaluate the significance of each of the predictor variables, which was entered into the models hierarchically. First, respondents' personal mastery score, insurance status, nativity (foreign or US-born), minority status (Hispanic or not and Black or not) were entered into the Cox regression models (Model 1), then, chronological age, gender, years of schooling, and TIBI were entered to predict mortality over the 13-year period (Model 2). Furthermore, the distribution in several predictors included in the survival analyses significantly differ across gender. Separated analysis on the male and female sub-samples were also conducted to examine if there were different association patterns across gender.

Ethical consideration

All identifiers of the survey respondents had been removed before the data became available for downloading from the HRS website. Therefore, there should be no ethical concerns in terms of breaching privacies or confidentialities.

Results

The descriptive characteristics of the sample and study variables are shown in Table 1. It consisted of 861 male and 918 female diabetes patients interviewed in 2003. By the year 2016, among the 1,779 diabetic participants, 948 of them had died (488 males and 460 females). Compared to male diabetes patients, females had more severe diabetes comorbidities, measured the TIBI, and a lower average score of personal mastery in life.

When the male and female diabetes patients were combined (Model 1 of Table 2), having health insurance, being foreign-born, Hispanic status, and higher personal mastery score were significant predictors of mortality over the 13 years. One unit increase in personal mastery score would lead to a six-percent decrease in all-cause mortality (Hazard Ratio = 0.94, $p < .001$) over the study period. Being a Hispanic (Hazard Ratio = 0.76, $p = 0.037$) and those who had insurance coverage (Hazard Ratio = 0.82, $p = 0.002$) were also less likely to die (Model 1 of Table 2). In contrast, diabetes patients who were born in the US were more likely to die (Hazard Ratio = 1.31, $p = 0.049$) over the same period, compared to the foreign-born diabetes patients.

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In the Model 2 of Table 2, when other predictors were added, the significance of health insurance and Hispanic status in predicting mortality disappeared. As expected, age, gender, and education level were strongly associated with mortality. Older and male diabetes patients were more likely to die over time, so were the patients with lower levels of education (years of schooling) and more severe diabetes comorbidities. One year increase in schooling would have a two-percent reduction in mortality (Hazard Ratio = 0.98, p = 0.02) and one-unit increase in the TIBI score would have a one-percent increase in the risk of death (Hazard Ratio = 1.01, p < 0.001) over the study period.

When the same hierarchical modeling was applied to gender-specific sub-samples, different association patterns were identified for the male and female diabetes patients. Looking at the male sub-sample from Model 1 in Table 3, personal mastery was highly predictive of mortality and so were insurance and Hispanic status over the study period. But, when other covariates were entered, the full model (Model 2) in Table 3 revealed that the significance of health insurance and Hispanic status were absorbed and replaced with age and TIBI. However, personal mastery was still a significant predictor of mortality among male diabetes patients.

Among the female diabetes patients, both insurance coverage and personal mastery score were significant predictors of mortality (Model 1 in Table 4). In the full model, being foreign-born, older, more years of schooling, and severity of diabetes comorbidity were significantly associated with survival. Meanwhile, personal mastery score was still a significant predictor of mortality over the 13-year period after taking other covariates into account.

Finally, using the median of personal mastery score as a cut-off, survival functions for participants with higher and lower than median master scores were plotted in Figure 1. Participants with higher mastery scores had a better chance to survive to the end of 2016, when compared to those with lower mastery scores.

Table 1. Percentage distribution of study variables of the 2003 Diabetes Study (n =1779)

Variables	Male (N = 861)	Female (N = 918)
Number of cases died by end of 2016	488	460
Mean age in 2003	70.2 (8.3)	69.0 (9.5)
Years of schooling	12.1 (3.5)	11.1 (3.5)
Born in the United States (yes = 1)	791 (91.9)	819 (89.2)
Black (yes = 1)	127 (14.8)	206 (22.4)
Hispanic (yes = 1)	69 (8.0)	114 (12.4)
Insurance status when diagnosed with diabetes (yes = 1)	558 (64.8)	558 (60.8)
Personal mastery score	24.5 (4.4)	24.0 (4.4)
Total Illness Burden Index	33.6(18.3)	38.2 (18.3)

Note: *p < 0.05, **p < 0.01, ***p < 0.001.
Note: For categorical variables, number of cases and percentage (in parenthesis) are presented. For continuous variables, means and standard deviations (in parenthesis) are presented.

Table 2. Hazard Ratios (95% Confidence Intervals) of all-cause mortality, male and female combined, followed from 2003 through 2016 (n = 1,779)

Predictors	Model 1	Model 2
Health insurance covering prescription (Yes = 1)	0.82 (0.72, 0.93)**	0.98 (0.86, 1.12)
Black (yes = 1)	0.86 (0.72, 1.01)	0.91 (.76, 1.09)
Born in the United States (yes = 1)	1.31 (1.00, 1.71)*	1.37 (1.05, 1.80)*
Hispanic (Yes = 1)	0.76 (0.59, 0.98)*	0.79 (0.60, 1.03)
Personal mastery score	0.94 (0.92, 0.95)***	0.96 (0.94, 0.97)***
Gender (female versus male)	---	0.80 (.71, .92)**
Age in 2003	---	1.08 (1.07,1.09)***
Years of schooling	---	0.98 (0.96, 1.00)*
Total Illness Burden Index	---	1.01(1.01,1.02)***
2 Log Likelihood (degree of freedom)	13500.47(5)	13077.38 (9)

Note: *p < 0.05, **p < 0.01, ***p < 0.001.

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Table 3. Hazard Ratios (95% Confidence Intervals) of all-cause mortality among the male sub-sample, followed from 2003 through 2016 (n = 861)

Variables	Model 1	Model 2
Health insurance covering prescription (Yes = 1)	0.80 (0.67, 0.96)*	0.94 (0.78, 1.14)
Black (yes = 1)	0.86 (0.66, 1.12)	0.93 (0.71, 1.22)
Born in the US (yes = 1)	1.20 (0.82, 1.75)	1.14 (0.77, 1.68)
Hispanic (yes = 1)	0.67 (0.45, 0.99)*	0.74 (0.49, 1.11)
Personal mastery score	0.93 (0.91, 0.95)***	0.95 (0.93, 0.98)***
Age in 2003	---	1.08 (1.07,1.09)***
Years of schooling	---	0.99 (0.96, 1.02)
Total Illness Burden Index	---	1.02 (1.01,1.02)***
2 Log Likelihood (degree of freedom)	6208.92 (5)	6009.61 (8)

Note: *p < 0.05, **p < 0.01, ***p < 0.001.

Table 4. Hazard Ratios (95% Confidence Intervals) of all-cause mortality among the female respondents followed from 2003 through 2016 (n = 918)

Variables	Model 1	Model 2
Health insurance covering prescription (Yes = 1)	0.82 (0.68,0.99)*	1.00 (.83, 1.21)
Black (yes)	0.91 (.72, 1.13)	0.89 (0.70,1.13)
Born in the US (yes = 1)	1.42 (0.98, 2.07)	1.57 (1.08, 2.27)*
Hispanic (Yes = 1)	0.88 (0.63, 1.24)	0.78 (0.54, 1.13)
Personal mastery score	0.94 (0.92, 0.96)***	0.96 (0.94, .98)***
Age in 2003	---	1.08 (1.07,1.10)***
Years of schooling	---	0.96 (0.93, 0.99)**
Total Illness Burden Index	---	1.01 (1.01,1.02)***
2 Log Likelihood (degree of freedom)	5967.18 (5)	5751.32 (8)

Note: *p < 0.05, **p < 0.01, ***p < 0.001.

Discussion

The current study examined the association between personal mastery and all-cause mortality in a sample of diabetes patients followed from 2003 through 2016. Results showed that a substantial proportion (46.7%) of these middle-aged and older adults with diabetes had survived at least 13 years (from 2003 through the end of 2016). In general, male, older, less-educated, US-born, patients with higher TIBI, and patients with lower mastery scores were more likely to die over the study period. Furthermore, the protective effect of personal mastery on all-cause mortality is independent of the predictors of survival that have been included in the analysis. We also found different association patterns between personal mastery and all-cause mortality between the male and female sub-samples.

It has been well-documented that women have longer life expectancy than men. However, it is still somewhat paradoxical that the female diabetics had a significant higher TIBI, indicating a more severe comorbidity tied to their diabetes, and yet they still outlived their male counterparts over the follow-up period. Studies in the relationship between gender and health have documented that women live longer, but they report lower levels of quality of life and poorer physical health in old age (32).

Another identified gender difference is in the relationship between personal mastery and survival. Studies have shown a positive association between higher perceived control and positive health outcomes (27) among older populations. Psychological studies also found that personal mastery promotes longevity through enhancing mental health, buffering against accumulating anxiety and stress, and providing motivational resources to engage in healthy behaviors (27). The female participants in this study had a lower average mastery score, but they were resilient and less likely to die over the study period, when compared to their male counter parts.

Turning to the association between nativity and mortality, when the male and female sub-samples were combined, the foreign-born diabetes patients did have a significant survival advantage over their US-born counterparts. However, when separated by gender, the survival advantage for foreign-born diabetes patients was only seen among the females. According to the literature (30), men usually have a higher mastery score than women, which was the case among the US-born diabetes patients. By contrast,

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among the foreign-born sub-sample, males living with diabetes had a lower, but not statistically significant, average mastery score, when compared to their female counterparts.

Different association patterns across gender was also found between level of education (measured as years of schooling) and mortality. Regardless of US-born or foreign-born, female diabetes patients had lower years of schooling than that of the male. However, among the foreign-born male, education was not associated with their survival after controlling for other mortality risk factors. By contrast, education was a significant predictor of mortality among the foreign-born females. The average years of schooling for the foreign-born female was 8.0, which was significantly lower than that of foreign-born males (10.2 years of schooling). This is consistent with the theory of Resources Substitution (33). It argues that education's beneficial effects are more important to females because females have less health-enhancing resources available to them when compared to their male counterparts. Consequently, females could benefit more from their education, not less.

In this study, we identified a discrepancy between educational attainment and personal mastery among the foreign-born female diabetes patients. As an key indicator for SES resources, education improves people's health by imbuing the person with self-efficacy and increasing personal control over their own life (34, 35). There is also evidence that personal mastery is positively correlated with levels of education (20). However, it is not clear why, with significantly lower educational attainment, the foreign-born female diabetics had developed a higher sense of control in the face of a more severe diabetes comorbidity and had outlived their male counterparts over the study period.

Older adults in America is a heterogeneous group. Just like the younger populations, they are divided along various social boundaries (e.g. gender, immigration status, ethnicity, and social class). As the proportion of the immigrant population to the total US population is growing, the health of immigrants is increasingly an essential part of the overall health profile of the total population (34). Based on our study, it seems that personal mastery an independent health-protective effect on the survival of diabetes patients. More important, as a crucial psychological resource and a modifiable factor, personal mastery could be used to break the cycle of poor health among lower SES groups of older adults. More studies are needed to further explore the dynamics between education and personal mastery among the foreign-born older Americans.

Conclusions

Personal mastery or a sense of control has a significant protective effect on the risk of death among a sample of middle-aged and older diabetes patients. As a crucial psychological resource and a modifiable factor, personal mastery holds potential for improving the health status among lower SES groups of older adults.

Study limitations

There are several limitations of the current study. First, the diabetes status of study participants was obtained from self-reported questionnaire items. A considerable percentage of older Americans did not know that they were diabetic (7). Consequently, only the diabetes patients who had been diagnosed by a doctor were included in the 2003 Diabetes Survey. Second, personal mastery was assessed only at the baseline and longitudinal time-varying measures of personal mastery was not available in the survey. Although empirical evidence showed that a person's mastery was relatively stable over a long period of time (27), it might fluctuate as people getting older or encountering adverse health or other life events. Finally, we were unable to evaluate the association between personal mastery and specific causes of death due to lack of information on specific causes death for the survey participants. However, diabetes mortality is likely an unreliable estimate of death attributable to the disease, exploring the association between personal mastery and all-cause mortality can be somewhat justifiable.

Conflict of interest

The authors have no conflict of interest to declare.

Author contribution

Dr. Tung had the original idea, located the data, and conducted the data analysis.

Dr. Ming-Chin Yeh refined the original idea and edited several previous drafts.

Dr. Randall Ford searched the literature and edited several the previous drafts.

Dr. Gulzar Shah made important revisions to the original ideas and edited several previous drafts.

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