Qual Life Res (2016) 25:1007–1015
DOI 10.1007/s11136-015-1144-y

Indicators of resilience and healthcare outcomes: findings from the 2010 health and retirement survey

Amara E. Ezeamama[1] · Jennifer Elkins[2] · Cherie Simpson[3] · Shaniqua L. Smith[1] · Joseph C. Allegra[1] · Toni P. Miles[1]

Accepted: 25 September 2015 / Published online: 17 October 2015

Abstract
Objective To test the hypothesis that higher levels of resilience indicators are associated with lower overall healthcare utilization (HCU) as well as improvements in self-rated health (SRH), we analyzed a representative sample of 4562 adults 50–70 years old enrolled in the US 2010 health and retirement survey.
Methods Multivariable logistic regression models estimated odds ratios (ORs) and 95 % confidence intervals (CIs) for high versus low resilience in relation to HCU and SRH improvements over 2 years. Resilience indicators included: cumulative lifetime adversity, social support, global mastery and domain-specific mastery. Cumulative lifetime adversity was defined as 0, 1–2, 3–4 or 5+ events. HCU included hospitalization (any vs. none) and physician visits (<20 vs. ≥20) over 2 years.
Findings Hospitalization odds declined by 25 % (OR 0.75, 95 %CI 0.64–0.86), odds of ≥20 physician visits declined by 47 % (OR 0.53, 95 % CI 0.45–0.63) and the odds of SRH improvement increased by 49 % (OR 1.49, 95 % CI 1.17–1.88) for respondents with high versus low health mastery. Cumulative lifetime adversity manifested a dose-dependent positive relationship with HCU. Specifically, hospitalization odds was, respectively, 25, 80 and 142 % elevated for participants that reported 1–2, 3–4 and 5+ versus 0 lifetime adversities. High versus low global, financial and health mastery, respectively, predicted improved SRH, lower physician's visits and hospitalizations.
Conclusion In this sample of adults near or in retirement, resilience predicted lower HCU and improved SRH. Resilience is a dynamic state that can be enhanced in adults with positive impacts on subjective well-being and HCU.

Keywords Midlife · Public health · Comorbid conditions · Resilience · Healthcare utilization · Health and retirement survey

A. Ezeamama and J. Elkins equally share first author status.

Electronic supplementary material The online version of this article (doi:10.1007/s11136-015-1144-y) contains supplementary material, which is available to authorized users.

✉ Toni P. Miles
tonimile@uga.edu

Amara E. Ezeamama
aezeamam@uga.edu

Jennifer Elkins
jelkins@uga.edu

Cherie Simpson
csimpson@mail.nur.utexas.edu

Shaniqua L. Smith
Niqua08@uga.edu

Joseph C. Allegra
jallegra@uga.edu

[1] Department of Epidemiology and Biostatistics, College of Public Health, University of Georgia, 101 Buck Hall, Miller Hall, Room 110, Athens, GA 30602, USA

[2] School of Social Work, University of Georgia, Athens, GA, USA

[3] School of Nursing, University of Texas, Austin, TX, USA

Introduction

There is increasing evidence that cumulative adverse lifetime experiences have a dose-dependent negative impact on psychosocial and physical health risk across the life course [1–9]. This includes cigarette smoking, obesity, physical inactivity, heart disease, cardiovascular disease,

stroke, diabetes, skeletal fractures, liver disease, sleep disturbances and poor self-rated health. Emerging evidence also suggests that adverse childhood experiences are associated with higher levels of healthcare utilization in adulthood [3, 10].

Yet, some low level of lifetime adversity may be protective and decrease healthcare utilization [11, 12]. Accordingly, attention should be paid to the mechanisms contributing to vulnerability and resilience to health and healthcare utilization. An example of increased vulnerability is the exposure to loss of a loved one. The death of a parent, child or spouse increases the risk of healthcare utilization in midlife to later life adults [13]. This risk remains elevated for as much as 10 years [14]. A recent systematic review found an association between childhood trauma and later mental and physical health outcomes in older adulthood [7]. Protective factors included self-esteem, optimism, life satisfaction, agency, social support, meaning-making and spirituality. Factors associated with resilient outcomes in adulthood and older adulthood include psychosocial resources such as meaning-making [15, 16], optimism [17], perceived control [18, 19], social support [17, 20] and family stability [21]. Stress research has provided evidence that resources such as personal mastery and social support can buffer the negative impact of stress on health [22]. The goal of this study is to examine indicators of resilience as predictors of healthcare utilization and improvements in self-rated health in a large population-based survey.

Background

Understood as "a dynamic process encompassing the attainment of positive adaptation within the context of significant threat, severe adversity or trauma" [23]. In other words, resilience is the idea that strategies to overcome and withstand the challenges exist [24]. Despite the growing attention to resilience and recognition that it evolves throughout the developmental life course trajectory, comparatively less attention has focused on resilience processes in older adulthood. In later life, resilience is conceptualized as both a process as well as an outcome and a resource [25]. Developmental and life experiences can also alter the brain's response to stress. The theoretical framework for our analysis is allostasis, a response—psychologically, neurologically and hormonally—to the changes in the environment. Allostatic state is established as the body adapts internally to its environment by changing its physiological milieu to meet the circumstances [26]. Repeated challenges create allostatic load, leading to disease [26]. Multiple factors—genetics, developmental and life experiences—combine to shape stress response [26].

Social support and mastery are two factors underlying resilience. Social support measured as emotional or instrumental supports affects biological systems, leading to changes in health [27]. For example, positive emotional social support has been found to moderate the effects of comorbidities of depression and anxiety on disability in patients with arthritis [28], while lack of social support was associated with increased anxiety in patients with COPD [29]. Social support is a predictor of cardiovascular health [30] and mortality risk [30]. Social support is associated with low resting heart rate in healthy young women [31], and informational support buffered ambulatory blood pressure in healthy adults when exposed to a momentary stressful event [32]. Immune function is altered by social support as seen in the increased rates of infectious illnesses in caregivers with low social support [33] or higher NK cell counts, important to immune function, in workers with high home support [34].

Likewise, higher levels of mastery, the global sense of control one feels over important life circumstances [35], have been shown to be associated with resilient outcomes. For example, older adults with higher levels of mastery reported feeling a younger subjective age [36], and for people with multiple sclerosis, higher levels of mastery were related to higher levels of perceived health [37]. High mastery among cancer patients is associated with better pain management [38, 39]. And like social support, mastery level works in parallel with cardiovascular health [40–42] and immune function [43].

Despite a body of literature linking resilience with good health, its application to public health outcomes has not materialized. Logic would posit that high levels of social support and mastery would diminish healthcare resource utilization. However, the limited evidence is contradictory. In a sample of 149 persons with congestive heart failure, those reporting loneliness had more days hospitalized and more readmissions. Loneliness is related to lower levels of social support [44]. However, in a study of co-worker social support, employees with high levels of support had higher number of doctor visits but not hospitalization. The authors suggested that co-worker support enabled employees to feel comfortable attending physician visits. The current study adds to this understudied aspect of resilience and healthcare utilization by examining indicators of risk (i.e., cumulative lifetime adversity) and resilience (i.e., social support and mastery) consistent with prior literature in a nationally representative sample of US adults aged 50–70 years from the 2010 health and retirement survey. With their responses, we ask two questions:

1. Does cumulative lifetime adversity predict rates of healthcare utilization and subjective assessment of change in self-rated health among peri-retirement aged adults?

2. Does social support and mastery predict 2-year healthcare utilization and subsequent improvements in self-rated health?

Methods

Data source

This study uses data from the Health and Retirement Study (HRS), a longitudinal survey designed to follow a representative sample of adults in the USA over the age of 50 every 2 years. The HRS captures data on changes in the labor force as well as on the health transitions that individuals undergo toward the end of their working lives and into the years that follow. The overall response rate for each wave is higher than 80 %. The HRS-weighted sample is representative of all non-institutionalized individuals in the US population in the age-eligible range. Sampling weights are provided on all HRS data sets to compensate for the unequal probabilities of selection between core and oversample domains. For purposes of these analyses, our sample ($n = 4562$) comprised respondents 50–70 years old, in order to capture those in midlife to late life who participated in the 2010 wave (February 2010–November 2011).

Outcome variables

Healthcare utilization (HCU)

Healthcare utilization was measured with hospitalization and the number of doctor's visits. *Hospitalization* was treated as a categorical (yes/no) response to the question: "Have you been a patient in a hospital overnight?" *Number of Doctor's Visits* was based on response to the question: "Aside from any hospital stays, outpatient surgery, hospital stays after outpatient surgery, how many times have you seen or talked to a medical doctor about your health, including emergency room, clinic visits, or house calls in the last 2 years?" Because the response to this question was not normally distributed, we dichotomized the outcome to $\geq$20 doctor's visits following the conceptual framework in global burden of disease [45].

Change in self-rated health (SRH)

Change in SRH was measured by the following: "compared to your health when we talked with you in 2008, would you say that your health now is better, about the same or worse." Improved SRH was defined by a response of better versus same or worse.

Resilience indicators

Mastery

Mastery was measured via two constructs: global and domain-specific mastery. *Global Mastery* measured sense of efficacy in carrying out goals. It included 5 questions: (1) I can do just about anything I really set my mind to; (2) When I really want to do something, I usually find a way to succeed at it; (3) Whether or not I am able to get what I want is in my own hands; (4) What happens to me in the future mostly depends on me; (5) I can do the things that I want to do. Possible responses on the six-point Likert scale ranged from "strongly disagree" to "strongly agree." An index was created by averaging the scores across the items with higher scores indicative of greater perceived mastery. *Domain-Specific Mastery* in the areas of health, social life and finances was measured via the following single-item measures: (1) how would you rate the amount of control you have over your health these days? (2) How would you rate the amount of control you have over your social life these days? (3) How would you rate the amount of control you have over your finances these days? Possible responses on a 10-point scale ranged from "no control at all" to "very much control"; with higher scores indicative of greater domain-specific mastery.

Social support

Perceived social support was captured via two subscales focusing on positive (3 positively worded items) and negative social support (4 negatively worded items). Possible responses on a four-point Likert scale ranged from "a lot" (score = 4) to "not at all" (score = 1), and the receipt of support was assessed in four domains: spouse/partner, children, other family and friends. Indices of positive and negative social support for each relationship category were created by averaging the scores within domains. For example, for positive social support, this construct included 3 separate questions within each of the 4 domains. Within each domains, response to the questions is averaged such that the theoretic minimum = 1 and the theoretic maximum = 4. Scores are summed across the four domains such that in theory the minimum possible score = 4 and the possible maximum = 16 for any participant. For analytic purposes, indicators of mastery and social support were defined as high (if score > sample mean) or low (if $\leq$ sample mean).

Cumulative lifetime adversity

Cumulative adversity was categorically defined as 0, 1–2, 3–4 or 5+, based on the total number of adverse life events

reported by respondents. These events include: 6 items focusing on lifetime trauma (natural disaster, combat exposure, partner/child substance abuse, physical assault victimization and life-threatening illness/accidents), 4 items focusing on childhood trauma (failing a grade, trouble with police, parental substance abuse and physical abuse) [15], and 6 items focusing on recent stressful life events (job loss/unemployment, moving to a worse residence/neighborhood, victim of robbery, burglary and fraud) [46].

Covariates

Demographic characteristics

Workforce participation was defined as: completely retired, partial retirement, not retired/working, full time and non-workforce. Age was defined categorically: 50–55, 56–60, 61–65, and 66–70 years. Other categorical variables included gender, race (white, black or other) and education (<high school, high school diploma, some/completed college and graduate degree).

Lifestyle covariates

To capture lifestyle behaviors that can influence health, we included *body mass index* (in kg/m^2: <18.5, 18.5–24, 25–29 and 30+), *physical activity* (any vs. none), *comorbid health conditions* (0, 1, 2, 3+), self-reported fall (yes/no), *smoking* (ever/never) and *trouble sleeping* (yes/no). *Comorbid health conditions* were ascertained by summing the numbers of reported chronic conditions mentioned in the 2008 interview: high blood pressure, heart disease, diabetes, arthritis, cancer and diagnosed psychiatric conditions.

Statistical analyses

Indicators of resilience were analyzed as predictors in relation to healthcare utilization and change in SRH over 2 years. First descriptive analyses determined the distribution of baseline resilience factors, frequency of HCU and frequency of SRH improvement over 2 years. Bivariate analyses were implemented to determine crude associations for each outcome with resilience factors, potential confounders and sociodemographic factors. Since resilience measures were analyzed as categorical predictors, Chi-square tests were used to evaluate differences in proportion of HCU and improvement in SRH measures. Factors with a $p \leq 0.2$ were further evaluated in multivariable models as candidate confounders. Multivariable logistic regression models were implemented in Statistical Analysis Software version 9.3 to estimate odds ratios (ORs) and 95 % confidence intervals (CIs) with adjustment for candidate confounders. Lack of information for any confounding covariate was addressed analytically using the missing indicator method.

To determine whether the relationship between health outcomes (healthcare utilization and SRH), the resilience factors—mastery and social support—were mediated by cumulative lifetime adversity, and an alternate multivariable model was fit for each outcome and resilience factor with mutual adjustment for cumulative lifetime adversity. We examined the potential for modification in the association between resilience indicators and each outcome by respondent age, sex, difficulty sleeping and a history of loss based on improvement in model fit determined by differences in likelihood ratio tests (LRTs) for models that included multiplicative interactions (e.g., resilience × sex) and separate main effects for respective factors compared to those without multiplicative interaction terms. When the p value associated difference in LRT between nested models is <0.05, stratified analysis within levels of the effect modifier was implemented to determine the magnitude and direction of heterogeneity.

Results

Table 1 shows characteristics of the 2010 HRS respondents between 50 and 70 years of age used in this analysis. In this sample of 4568 respondents, 75.1 % were non-Hispanic white, 57.8 % were female, 54.3 % had more than a high school education and 52.5 % had one or more comorbid health conditions as of the last HRS interview in 2008. Approximately 76 % of the respondents were classified as overweight or obese. More than 96 % reported some level of physical activity. An estimated 22.4 % of respondents were hospitalized, and approximately 15 % reported ≥20 doctor visits. On the other hand, 12 % reported improved SRH in 2010 relative to the 2008 interview. Approximately 80.2 % of respondents reported one or more lifetime adversities.

Resilience indicators, HCU and change in SRH

From multivariable analyses, high social support was not associated with healthcare utilization or improvement in self-rated health (see Table 2, below). However, respondents with high health mastery had 47 % lower odds of ≥20 doctor visits and 25 % lower odds of hospitalization. Likewise, high financial mastery was associated with 17 % lower odds of ≥20 doctor visits and 16 % lower odds of hospitalization.

On the other hand, cumulative lifetime adversity manifested a dose-dependent positive relationship with both

Table 1 Characteristics of adults, aged 50–70 years in the 2010 HRS ($n = 4562$)**

	N (%)
Sex	
Male	1927 (42.2)
Female	2635 (57.8)
Age categories (years)	
50–55	1020 (22.36)
56–60	1173 (25.71)
61–65	112 (24.38)
66–70	1257 (27.55)
Marital status	
Married	2935 (64.3)
Divorced/widowed/separated	667 (14.6)
Single/unknown	960 (21.5)
Importance of religion	
Very important	2864 (62.8)
Somewhat/not important/don't know	1698 (37.2)
Retirement status	
Completely retired	1388 (30.9)
Partly retired	635 (14.2)
Not retired/working	2335 (52.05)
Non-workforce	128 (2.9)
Education	
<High school	688 (15.2)
High school grade	1381 (30.5)
Some college	1222 (27.0)
College grade	635 (14.0)
Post-grade	607 (13.4)
Comorbid health conditions*	
0	2165 (47.5)
1	1005 (222.0)
2	805 (17.7)
3+	587 (12.9)
BMI	
BMI < 18.5 kg/m^2 (Underweight)	43 (0.96)
BMI 18.5–24 kg/m^2 (Normal weight)	1045 (23.1)
BMI 25–29 kg/m^2 (Overweight)	1617 (35.7)
BMI ≥30 kg/m^2 (Obese)	1825 (40.3)
Physical activity	
None	158 (3.47)
Any	4398 (96.5)
Race	
Hispanic + other	293 (6.4)
Black	844 (18.8)
White	3425 (75.1)
Resilience indicators	
Cumulative lifetime adversity	
0	905 (19.8)
1–2	2073 (45.4)
3–4	1070 (23.5)
5+	514 (11.3)
	Mean (SD)
Social support—positive	7.50 (2.03)
Social support—negative	2.47 (1.09)
Global mastery scale	4.83 (1.09)
Domain-specific mastery—health	7.34 (2.30)
Domain-specific mastery—social life	8.02 (2.20)
Domain-specific mastery—finances	6.87 (2.63)
Outcome parameters	
Hospitalization ($n = 4562$)	1022 (22.4)****
≥20 Doctor visits ($n = 4562$)	678 (14.86)
Improvement in SRH ($n = 3038$)	364 (12.0)***

* Number of comorbid conditions defined for each individual as the cumulative frequency of the following chronic conditions as of the last wave interview (year 2008): high blood pressure, heart disease, diabetes, arthritis, cancer and diagnosed psychiatric conditions. Range of comorbidity frequency: 0–5

** Table description based on presence of information regarding hospitalization, doctor's visits and life-time adversity/chronic stress

*** Percentage is out of those with data on SRH improvement ($n = 3038$)

**** Percentage reflects persons report '*Any*' overnight hospital stay in the prior 2 years

indicators of healthcare utilization. The odds of having 20 or more doctor visits over 2 years were, respectively, 34, 59 and 118 % elevated for respondents with 1–2, 3–4 and 5 or more cumulative adversities compared to those without any lifetime adversity. Similarly, relative to respondent with no lifetime adversity, those reporting 1–2, 3–4 and 5 or more lifetime adversities had 25, 80 and 142 % higher odds of hospitalization, respectively. Respondents reporting high global mastery and high health mastery were, respectively, 29 and 49 % more likely to report improved SRH since the 2008 HRS survey. The association between resilience indicators and number of doctor's visits was generally insensitive to alternative definition of high versus low hospitalization and to the use of linear versus logistic regression models (Table S1). We found no evidence of significant interaction between resilience, social support and mastery indicators in relation to healthcare utilization or improvements in SRH over 2 years.

Non-resilience factors in relation to healthcare utilization and Improvement in Self-Rated Health

Compared to patients without comorbid conditions, the number of comorbid diagnoses was positively associated with both healthcare utilization indicators over 2 years.

Table 2 Resilience indicators in relation to healthcare outcomes since last wave among adults between 50 and 70 years old in the 2010 HRS cohort

Resilience indicators	Healthcare utilization		Improved SRH
	≥20 Doctor visits OR (95 % CI)	Hospitalization OR (95 % CI)	OR (95 % CI)
Cumulative lifetime adversity			
0	1.00	1.00	1.00
1–2	**1.34 (1.04, 1.73)**	**1.25 (1.01, 1.55)**	0.86 (0.70, 1.07)
3–4	**1.59 (1.21, 2.10)**	**1.80 (1.42, 2.68)**	1.11 (0.86, 1.43)
5+	**2.18 (1.60, 2.97)**	**2.42 (1.85, 3.17)**	1.34 (0.96, 1.89)
Social support			
High versus low SS positive	0.83 (0.66, 1.03)	0.94 (0.78, 1.13)	0.94 (0.71, 1.26)
High versus low SS negative	1.08 (0.85, 1.36)	1.16 (0.95, 1.41)	0.86 (0.64, 1.17)
Global mastery			
High versus low mastery	0.89 (0.75, 1.06)	0.99 (0.85, 1.15)	**1.29 (1.02, 1.62)**
Domain-specific mastery			
High versus low health	**0.53 (0.45, 0.63)**	**0.75 (0.64, 0.86)**	**1.49 (1.17, 1.88)**
High versus low social life	1.01 (0.87, 1.20)	1.01 (0.87, 1.17)	1.02 (0.82, 1.27)
High versus low finances	**0.83 (0.70, 0.98)**	**0.84 (0.73, 0.97)**	1.10 (0.87, 1.39)

Estimates are derived from a logistic regression model with ≥20 doctor visits, any hospitalization and improvements in SRH as dependent variables. Multivariable model is adjusted for the following potential confounders: history of loss, age, sex, level of education, smoking, body mass index, physical activity level (any vs. none), US-born versus foreign-born status, fall, trouble sleeping and racial classification (black, white vs. other)

Bold values indicate significant confidence intervals (CI)

Respondent BMI and retirement status were not associated with hospitalization. However, relative to patients with normal BMI, those underweight were 14 % less likely whereas those obese were 22 % more likely to have more than 20 doctor's visits over 2 years (Table 3). On the one hand, self-reported trouble sleeping and falls within 2 years were associated with higher likelihood of more than 20 doctor's visits and hospitalization over 2 years. On the other hand, engagement in any physical activity (Table 3) and high educational level (data not shown) lowered these HCU risks.

The presence of any versus no comorbid conditions was strongly and positively associated with improvements in SRH over 2 years. Specifically, respondents with 1, 2 or 3+ comorbid diagnoses were, respectively, 45, 95 and 110 % more likely than respondents without comorbid diagnoses to report an improvement in SRH since the 2008 survey. The odds of improvement in SRH decreased marginally with age (9 % decline per 5-year age increment) but was marginally elevated for physically active versus non-active respondents (Table 3).

Discussion

This study sought to examine the impact of resilience indicators on HCU and SRH over 2 years in a sample of 50–70 years old peri-retired or retired adults in the USA. In line with our hypotheses, we found that individuals that reported having high levels of domain-specific health and financial mastery were less likely to have ≥20 doctor visits and were less likely to be hospitalized in the prior 2 years. Likewise, respondents reporting high levels of global mastery and domain-specific health mastery were more likely to report improved SRH. On the other hand, increasing number of lifetime adversities experienced increased the likelihood of HCU but was not associated with improvement in SRH over 2 years.

Using various measures, we show that resilience indicators predict near-term use of health care. This is consistent with other reports that mastery is associated with perceived wellness despite living with a chronic debilitating disease [37] and feeling younger than one's years [36]. Similarly, our findings corroborate recently reported findings of Ward's [47] based on analyses of the 2006 cohort of the HRS data set. In that study, people with higher mastery were less likely to report fair/poor health. In addition to lending credence to that cross-sectional finding, by evaluating associations between high versus low levels of mastery and changes in SRH over 2 years, we demonstrate that high levels of mastery may predict future improvements in SRH. Our finding that high levels of mastery predict subsequent improvement in self-rated health reflects the dynamic state of resilience. Physical activity has a consistently protective effect on health outcomes assessed herein. The strong salutary effects of physical activity may

Table 3 Other factors in relation to healthcare outcomes among 50- to 70-year-old adults in the HRS cohort

	≥20 Doctor visits OR (95 % CI)	Hospitalization OR (95 % CI)	Improved SRH OR (95 % CI)
Age (per 5-year increment)	0.98 (0.91, 1.05)	1.09 (0.99, 1.20)	**0.91 (0.83,1.00)**
Sex (female vs. male)	**1.21 (1.18, 1.46)**	1.1 (0.94, 1.1.2)	1.33 (1.04, 1.72)
Education			
<High school	0.93 (0.72, 1.22)	1.10 (0.88, 1.38)	0.77 (0.52, 1.15)
High school grade	1.00	1.00	1.00
Some college	1.16 (0.93, 1.45)	0.98 (0.82, 1.19)	**1.37 (1.02, 1.84)**
College grade	1.07 (0.80, 1.43)	0.82 (0.63, 1.05)	**1.69 (1.18, 2.42)**
Post-grade	0.86 (0.63, 1.17)	**0.68 (0.52, 0.89)**	**1.55 (1.08, 2.21)**
Marital status			
Married	**0.75 (0.45, 1.23)**	1.18 (0.73, 1.89)	0.94 (0.52, 1.70)
Divorced/widowed/separated	**0.70 (0.41, 1.19)**	1.13 (0.69, 1.87)	1.00 (0.54, 1.87)
Single/unknown	**1.00**	1.00	1.00
Importance of religion			
Very important	**1.18 (0.98, 1.43)**	**1.18 (1.00, 1.39)**	**1.32 (1.02, 1.69)**
Somewhat/not important/don't know	**1.00**		
Physical activity (any vs. none)	**0.56 (0.38, 0.83)**	**0.55 (0.38, 0.78)**	2.27 (0.97, 5.05)
Falls (any vs. none)	**1.67 (1.28, 2.19)**	**1.32 (1.02, 1.70)**	0.87 (0.70, 1.15)
Body mass index			
Underweight versus normal	1.08 (0.58, 1.69)	1.54 (0.78,3.14)	1.16 (0.49, 2.79)
Overweight versus normal	**0.86 (0.75, 0.995)**	0.94 (0.77, 1.15)	1.19 (0.97, 1.45)
Obese versus normal	1.22 (1.07,1.38)	1.15 (0.95, 1.39)	0.94 (0.76, 1.15)
Comorbid health conditions			
1 versus 0	**1.64 (1.33, 2.03)**	**1.47 (1.10, 1.96)**	**1.45 (1.02, 2.07)**
2 versus 0	**2.13 (1.72, 2.63)**	**1.62 (1.2, 2.2)**	**1.95 (1.36, 2.06)**
3+ versus 0	**3.37 (2.67, 4.26)**	**2.64 (1.93, 3.61)**	**2.10 (1.41, 3.13)**
Trouble sleeping (yes vs. no)	**1.54 (1.44, 1.65)**	**1.26 (1.14, 1.40)**	0.97 (0.83, 1.15)
Retirement status			
Completely retired	0.88 (0.71, 1.10)	1.55 (0.98, 2.40)	0.91 (0.72, 1.53)
Partly retired	**0.54 (0.42, 0.70)**	1.27 (0.77, 2.05)	0.96 (0.64, 1.43)
Not retired/working	**0.39 (0.31, 0.49)**	1.00 (0.63, 1.58)	0.70 (0.56, 1.19)
Non-workforce	1.00	1.00	1.00

Estimates are derived from a logistic regression model with ≥20 doctor visits, any hospitalization and SRH improvements as dependent variables. In addition to variables shown above, multivariable model is adjusted for the following potential confounders: history of loss, level of education, smoking, US-born versus foreign-born status and racial classification (black, white vs. other)

Bold values indicate significant confidence intervals (CI)

help offset the negative impact of predictable life-stage-specific events such as loss of spouse, economic turmoil and changes in household composition. This relationship may be partially explained by allostatic load [48, 49]. Behavioral and lifestyle covariates such as smoking, alcohol consumption, diet choices or physical activity contribute to allostatic load because of their impact on the physiological response to stress [26]. Developmental and life experiences can alter the brain's response to stress, but the brain, the controlling organ, is resilient—the ability to overcome and withstand the challenges given the right circumstances that prevent allostatic load [24]. There are growing numbers of persons in this life stage in nearly every country on the globe. Through public health action to diminish mortality at early ages, we have created the conditions leading to this growth. Public health action is required now to manage the global transition to a longevity society. Strategies that enhance resilience (e.g., mastery and self-efficacy) in older individuals may translate to better health outcomes by reducing excessive HCU and increasing subjective well-being.

Contrary to expectations, social support was not associated with lower healthcare utilization or improved SRH. There are several possible explanations. First, SRH

improvement may be subject to floor/ceiling effects, i.e., persons with excellent SRH cannot improve. Second, SRH improvement may be insensitive to different types of social support (e.g., emotional, instrumental, informational and validation). Other factors within larger construct of social competence (e.g., social skills, emotional regulation, social cognition and positive communication) may play a more salient role for individuals in midlife. For example, some research focusing on social support networks suggests that social engagement, particularly with friends and neighbors rather than family, is a better predictor of health and well-being in older adulthood [50]. It is also possible that the effects of social support are mediated through other variables via more complex processes and mechanisms. This is consistent with reports of the transactional, reciprocal and synergistic effects of childhood adversity across multiple contextual levels (i.e., individual, family, social network, community and larger societal) over the developmental life course [51, 52]. Measurement issues related to the social support and SRH variables may also offer a partial explanation. Specifically designed future studies that distinguish between types of social support received and/or those that evaluate the social support needs of adults in peri-retirement in terms of types, quality and quantity are likely to clarify the associations between social and health outcomes in this sample. Because social support needs change over time, future studies that evaluate this variable over the life course may be especially informative. Limitations of this study that should be considered when interpreting our results include: (1) the use of change in self-rated health, which is a less robust measure of overall quality of life, and (2) confounding by unmeasured factors that could be differentially associated with the indicators of resilience and healthcare utilization and SRH.

A growing body of research shows that adverse events across the life course influence probability of health problems in old age [1, 4, 7, 24, 53–55]. Thus, it was not surprising that we observed that persons with greater lifetime adversity had a higher likelihood of both HCU indicators. This observation is congruent with the extant literature on the deleterious impact of cumulative adversity and risk [56] as well as a conceptualization of resilience as a dynamic, multidimensional and developmental process rather than a personality trait [57]. Understanding resilience as malleable, rather than static, highlights the potential for targeted preventive interventions for higher-risk individuals. One way to do this is by incorporating formal screening tools for traumatic and stressful life experiences into routine healthcare appointments.

In conclusion, key findings indicate that higher levels of financial and health mastery were associated with lower healthcare utilization and improvement in SRH while greater cumulative lifetime adversity confers higher risk of hospitalization over 2 years in a nationally representative sample of adults near or in retirement. These findings may be mediated by stress levels and allostatic load. Collaborative, transdisciplinary intervention strategies aimed at decreasing or better managing stressors in this population may translate to improvements in measured health outcomes.

References

1. Brown, D. W., et al. (2009). Adverse childhood experiences and the risk of premature mortality. *American Journal of Preventive Medicine, 37*(5), 389–396.
2. Chapman, D. P., et al. (2011). Adverse childhood experiences and sleep disturbances in adults. *Sleep Medicine, 12*(8), 773–779.
3. Chartier, M. J., Walker, J. R., & Naimark, B. (2010). Separate and cumulative effects of adverse childhood experiences in predicting adult health and health care utilization. *Child Abuse and Neglect, 34*(6), 454–464.
4. Felitti, V. J., et al. (1998). Relationship of childhood abuse and household dysfunction to many of the leading causes of death in adults: The Adverse Childhood Experiences (ACE) Study. *American Journal of Preventive Medicine, 14*(4), 245–258.
5. Thurston, R. C., et al. (2014). Abuse and subclinical cardiovascular disease among midlife women: The study of women's health across the nation. *Stroke, 45*(8), 2246–2251.
6. Widom, C. S., et al. (2012). A prospective investigation of physical health outcomes in abused and neglected children: New findings from a 30-year follow-up. *American Journal of Public Health, 102*(6), 1135–1144.
7. Maschi, T., et al. (2013). The aftermath of childhood trauma on late life mental and physical health: A review of the literature. *Traumatology: An International Journal, 19*(1), 49–64.
8. Slopen, N., et al. (2014). Childhood adversity, adult neighborhood context, and cumulative biological risk for chronic diseases in adulthood. *Psychosomatic Medicine, 76*(7), 481–489.
9. Waite, R., Davey, M., & Lynch, L. (2013). Self-rated health and association with ACES. *Journal of Behavioral Health, 2*(3), 197–205.
10. Gawronski, K. A., Kim, E. S., & Miller, L. (2014). Potentially traumatic events and serious life stressors are prospectively associated with frequency of doctor visits and overnight hospital visits. *Journal of Psychosomatic Research,77*(2), 90–96.
11. Seery, M. D., et al. (2010). Lifetime exposure to adversity predicts functional impairment and healthcare utilization among individuals with chronic back pain. *Pain, 150*(3), 507–515.
12. Bellis, M. A., et al. (2014). Adverse childhood experiences: Retrospective study to determine their impact on adult health behaviours and health outcomes in a UK population. *Journal of Public Health, 36*(1), 81–91.
13. Miles, T. P., et al. (2014). In a longevity society, loss and grief are emerging risk factors for health care use findings from the health and retirement survey cohort aged 50 to 70 Years. *American Journal of Hospice and Palliative Medicine,* 1–6.
14. Rostila, M., Saarela, J., & Kawachi, I. (2013). Mortality from myocardial infarction after the death of a sibling: a nationwide follow-up study from Sweden. *Journal of the American Heart Association, 2*(2), e000046.
15. Krause, N., Shaw, B. A., & Cairney, J. (2004). A descriptive epidemiology of lifetime trauma and the physical health status of older adults. *Psychology and Aging, 19*(4), 637.
16. Nygren, B., et al. (2005). Resilience, sense of coherence, purpose in life and self-transcendence in relation to perceived physical

and mental health among the oldest old. *Aging & Mental Health, 9*(4), 354–362.
17. Lamond, A. J., et al. (2008). Measurement and predictors of resilience among community-dwelling older women. *Journal of Psychiatric Research, 43*(2), 148–154.
18. Ward, M. M. (2012). Sense of control and sociodemographic differences in self-reported health in older adults. *Quality of Life Research, 21*(9), 1509–1518.
19. Windle, G., Markland, D. A., & Woods, R. T. (2008). Examination of a theoretical model of psychological resilience in older age. *Aging and Mental Health, 12*(3), 285–292.
20. Netuveli, G., et al. (2008). Mental health and resilience at older ages: Bouncing back after adversity in the British Household Panel Survey. *Journal of Epidemiology and Community Health, 62*(11), 987–991.
21. Lavretsky, H. (2012). Resilience, stress, and mood disorders in old age. *Annual Review of Gerontology and Geriatrics, 32*(1), 49–72.
22. Thoits, P. A. (2010). Stress and health: Major findings and policy implications. *Journal of Health and Social Behavior, 51*(Suppl), 41–53.
23. Cicchetti, D. (2010). Resilience under conditions of extreme stress: A multilevel perspective. *World Psychiatry, 9*(3), 145–154.
24. Karatoreos, I. N., & McEwen, B. S. (2013). Annual research review: The neurobiology and physiology of resilience and adaptation across the life course. *Journal of Child Psychology and Psychiatry, 54*(4), 337–347.
25. Aldwin, C., & Igarashi, H. (2012). An ecological model of resilience in late life. *Annual Review of Gerontology and Geriatrics, 32*(1), 115–130.
26. McEwen, B. S., & Seeman, T. (1999). Protective and damaging effects of mediators of stress: Elaborating and testing the concepts of allostasis and allostatic load. *Annals of the New York Academy of Sciences, 896*, 30–47.
27. Uchino, B. N. (2006). Social support and health: A review of physiological processes potentially underlying links to disease outcomes. *Journal of Behavioral Medicine, 29*(4), 377–387.
28. Benka, J., et al. (2014). Social support as a moderator of functional disability's effect on depressive feelings in early rheumatoid arthritis: A four-year prospective study. *Rehabilitation Psychology, 59*(1), 19–26.
29. Dinicola, G., et al. (2013). The role of social support in anxiety for persons with COPD. *Journal of Psychosomatic Research, 74*(2), 110–115.
30. Holt-Lunstad, J., Smith, T. B., & Layton, J. B. (2010). Social relationships and mortality risk: A meta-analytic review. *PLoS Medicine, 7*(7), e1000316.
31. Hughes, B. M., & Howard, S. (2009). Social support reduces resting cardiovascular function in women. *Anxiety, Stress, and Coping, 22*(5), 537–548.
32. Bowen, K. S., et al. (2014). The stress-buffering effects of functional social support on ambulatory blood pressure. *Health Psychology,33*(11), 1440–1443.
33. Kiecolt-Glaser, J. K., et al. (1991). Spousal caregivers of dementia victims: Longitudinal changes in immunity and health. *Psychosomatic Medicine, 53*(4), 345–362.
34. Miyazaki, T., et al. (2005). Association between perceived social support and Th1 dominance. *Biological Psychology, 70*(1), 30–37.
35. Pearlin, L. I., et al. (1990). Caregiving and the stress process: An overview of concepts and their measures. *The Gerontologist, 30*(5), 583–594.
36. Bergland, A., Nicolaisen, M., & Thorsen, K. (2014). Predictors of subjective age in people aged 40–79 years: A five-year follow-up study. The impact of mastery, mental and physical health. *Aging & Mental Health, 18*(5), 653–661.
37. Krokavcova, M., et al. (2008). Mastery, functional disability and perceived health status in patients with multiple sclerosis. *European Journal of Neurology,15*(11), 1237–1244.
38. Byma, E. A., et al. (2009). The effects of mastery on pain and fatigue resolution. *Oncology Nursing Forum, 36*(5), 544–552.
39. Kurtz, M. E., et al. (2008). Patient optimism and mastery-do they play a role in cancer patients' management of pain and fatigue? *Journal of Pain and Symptom Management, 36*(1), 1–10.
40. Mausbach, B. T., et al. (2008). The moderating effect of personal mastery and the relations between stress and Plasminogen Activator Inhibitor-1 (PAI-1) antigen. *Health Psychology, 27*(2 Suppl), S172–S179.
41. Roepke, S. K., & Grant, I. (2011). Toward a more complete understanding of the effects of personal mastery on cardiometabolic health. *Health Psychology, 30*(5), 615–632.
42. Surtees, P. G., et al. (2010). Mastery is associated with cardiovascular disease mortality in men and women at apparently low risk. *Health Psychology, 29*(4), 412–420.
43. Mausbach, B. T., et al. (2008). A 5-year longitudinal study of the relationships between stress, coping, and immune cell beta(2)-adrenergic receptor sensitivity. *Psychiatry Research, 160*(3), 247–255.
44. Löfvenmark, C., et al. (2009). Perceived loneliness and social support in patients with chronic heart failure. *European Journal of Cardiovascular Nursing, 8*(4), 251–258.
45. Murray, C. J., et al. (2013). The state of US health, 1990–2010: Burden of diseases, injuries, and risk factors. *JAMA, 310*(6), 591–606.
46. Turner, R. J., Wheaton, B., & Lloyd, D. A. (1995). The epidemiology of social stress. *American Sociological Review,60*(1), 104–125.
47. Ward, M. M. (2013). Sense of control and self-reported health in a population-based sample of older Americans: Assessment of potential confounding by affect, personality, and social support. *International Journal of Behavioral Medicine, 20*(1), 140–147.
48. Juster, R.-P., McEwen, B. S., & Lupien, S. J. (2010). Allostatic load biomarkers of chronic stress and impact on health and cognition. *Neuroscience and Biobehavioral Reviews, 35*(1), 2–16.
49. Karlamangla, A. S., et al. (2002). Allostatic load as a predictor of functional decline: MacArthur studies of successful aging. *Journal of Clinical Epidemiology, 55*(7), 696–710.
50. Golden, J., Conroy, R. M., & Lawlor, B. A. (2009). Social support network structure in older people: Underlying dimensions and association with psychological and physical health. *Psychology, Health & Medicine, 14*(3), 280–290.
51. McLaughlin, K. A., et al. (2010). Childhood adversity, adult stressful life events, and risk of past-year psychiatric disorder: A test of the stress sensitization hypothesis in a population-based sample of adults. *Psychological Medicine, 40*(10), 1647–1658.
52. Putnam, K. T., Harris, W. W., & Putnam, F. W. (2013). Synergistic childhood adversities and complex adult psychopathology. *Journal of Traumatic Stress, 26*(4), 435–442.
53. Olofsson, N. (2014). A life course model of self-reported violence exposure and ill-health with a public health problem perspective. *AIMS Public Health, 1*(1), 9–24.
54. Stein, D. J., et al. (2010). Early childhood adversity and later hypertension: Data from the World Mental Health Survey. *Annals of Clinical Psychiatry: Official Journal of the American Academy of Clinical Psychiatrists, 22*(1), 19.
55. Taylor, S. E. (2010). Mechanisms linking early life stress to adult health outcomes. *Proceedings of the National Academy of Sciences, 107*(19), 8507–8512.
56. Montez, J. K., & Hayward, M. D. (2014). Cumulative childhood adversity, educational attainment, and active life expectancy among US adults. *Demography, 51*(2), 413–435.
57. Bonanno, G. A. (2012). Uses and abuses of the resilience construct: Loss, trauma, and health-related adversities. *Social Science and Medicine, 74*(5), 753–756.