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Relationships between resilience indicators and engagement in disease prevention
behavior among adults in the Health and Retirement Study

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Abstract

Relationships between resilience indicators and engagement in disease prevention behavior among adults in the Health and Retirement Study

By Kelsi O. Jackson

Seniors are the fastest growing age demographic in the United States; by 2030, 72 million Americans are projected to be over the age of 65. These rapid demographic changes have called for better understanding of healthy, successful aging. Previous work using data on Americans of retirement age showed that resiliency is associated with lower healthcare utilization which tends to be costly to individuals and burdensome to an already strained healthcare system. The primary goal and hypothesis of this study is to test the association between resiliency and participation in disease prevention behaviors.

The study used a sample of 6,693 respondents from the 2012 wave of the Health and Retirement Study who answered the Psychosocial Leave-Behind questionnaire. Logistic regression was used to evaluate the relationship between indicators of resilience (mastery and social support) with the behavioral outcomes (receiving a flu shot, prostate screening, or mammography). The cancer screening models were restricted by gender. Relationships between the outcomes and workforce participation status, marital status, physical activity, education, history of smoking, comorbidity, body mass index, and cumulative lifetime adversity were also explored. All analyses were conducted using SAS survey procedures to account for complex survey design.

The present findings do not provide consistent evidence that higher resilience corresponds to greater utilization of preventative health behavior. Results indicate that high mastery is associated with greater likelihood of receiving a mammogram, but show lower odds of receiving a flu shot. For social support, the results demonstrated that individuals who scored higher on the negative social support scale are more likely to get a mammogram or flu shot. There is little to suggest that resilient individuals engage in healthy disease prevention behaviors more than their less resilient counterparts. Future studies might look at comparing estimates based on different methodologies for measuring resilience in this population or exploring different variables that better characterize the health behaviors of resilient senior citizens.

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Table of Contents

Chapter I: Background/Literature Review	1
Chapter II: Manuscript	9
Abstract, Author, Title	9
Introduction	10
Methods	13
Results	19
Discussion	22
References	31
Tables	40
Chapter III: Summary, Public Health Implications, Possible Future Directions	45

CHAPTER I: BACKGROUND/LITERATURE REVIEW

No adult escapes life without experiencing adversity. When faced with an external challenge, be it psychological or physical, the body activates a cascade of chemical responses to adapt to the stressor. In this way, our lived experiences become “embodied” and may have a direct effect on our health (1). Some evidence suggests that small doses of adversity, or stress, are good because they help strengthen physiological and behavioral adaptation pathways (2,3). Embodiment of this stress later impacts how an individual will respond to future events. Rarely, however, does everyone experience the same “healthy” doses of adverse events (4,5). Adversity then becomes an indicator of risk exposure: the frequency and intensity of stress accumulation differs for people across their lifetimes (4). For example, adversity may manifest as an acute event like sudden job loss or as a chronic exposure like job strain. The stress associated with these events can act on both a molecular and behavioral level of an individual, altering the individual’s allostatic load or invoking a behavioral response. Allostatic load is the concept that a set of biomarkers, such as blood pressure or inflammatory stress chemicals in the body, can reveal one’s level of embedded responses to harmful socio-environmental situations (1,4). An acute stressor may cause a sharp, short-term spike in biomarkers while a series of acute stressors can lead to a chronic elevation of biomarkers contributing to allostatic load. While bodily response to stress can be protective and adaptive in the short term, continuous physiological response to stress can weaken the body and make an individual more vulnerable to disease (6–9). Job strain stress also invokes a behavioral response that may entail attending a restorative yoga class or smoking a cigarette. Responding to stress by employing a positive coping strategy (the

yoga class) is considered an act of resiliency--despite the biological toll stress takes on the body. The behavioral example highlights how the stress-coping strategy itself can serve as a health benefit (i.e. yoga) or detriment (i.e. smoking).

The destructive influence of stress on health may be viewed as a function of increased allostatic load and negative stress-coping behavior. High allostatic load, stemming from accumulated risk exposure, has been associated with heart disease, obesity, and depression (5). Stress strategies used to cope with high allostatic load may benefit overall health. Ultimately, research on resiliency to life's challenges is important because of its relationship to overall health and health promotion or disease prevention behaviors.

Resilience and Health

Psychology literature points to resilience as a stress-coping ability. This is important because behavioral choices may buffer the negative effects that accumulated stress has on the body (2). Resilience is understood as “a dynamic process encompassing the attainment of positive adaptation within the context of significant threat, severe adversity, or trauma”(5). Thus, resilience can be seen as an outcome (a fixed personality trait) and a resource (a set of adaptation strategies).

It is important to make the distinction between self-efficacy and resilience; the latter cannot exist without the former. Bandura has conceptualized self-efficacy as “an individual's belief in their abilities to mobilize the cognitive resources to exercise control over their response to an event” (10). By this definition, self-efficacy becomes a mechanism by which resilience develops. Much of what we understand about how

resilience develops over the life course stems from early life studies, where it was first considered a fixed personality trait that children carried into adulthood (11). As a process, resilience invokes a host of elements measured by different constructs. The Connor-Davison Resilience Scale (CD-RISC) tested several psychometric properties of resilience, including perceived self-control (or mastery), optimism, faith, social support, and self-efficacy (12). These domains frequently appear in research measuring the relationship between resilience and health. Mastery, in particular, represents a form of self-efficacy related to perceived control and ability. Additionally, these individual elements may vary in how they are employed depending on the risk exposure. For example, an adverse life event, like divorce, may draw upon more social support resources than self-efficacy resources.

This nuance makes it more difficult to discern the health effects of resiliency and cement its importance to overall wellbeing. Several studies have looked at the impact of specific resilience characteristics on health outcomes. Previous work shows that positive social support moderates the effect of depression on disability among arthritic patients and was associated with improved cardiovascular health and blood pressure (13–15). Meanwhile, a lack of social support was associated with increased anxiety among COPD patients (16). Likewise, high levels of perceived mastery over one's life have been linked with better cardiovascular outcomes, self-reported health, and immune functioning (17–19).

While early life studies formulated initial theories on resilience development, less is understood about resilience processes in late adulthood. The exposure to risk--adversity--is often conceptualized as occurring during childhood with observation of its

effects tending to end in middle adulthood (i.e. ages 45-56 years old). However, conventional knowledge informs us that people face adversity far into late adulthood. It is also well-studied that the psychometric constructs of resilience, like mastery and social support, have a nonlinear relationship with age where they increase in early and mid-adulthood and decline in later life (20). More recent work has examined these exposures among senior adults with respect to successful, healthy aging (21).

Successful aging is a growing public health interest, but scholars disagree on how to operationalize “success”. By 2030, 72 million Americans are projected to be over the age of 65, with seniors over 80 years old making the fastest growing age demographic in the country (22). In the context of healthy aging, studies generally define successful aging as management or freedom from chronic disease, high cognitive functioning and psychosocial health, and high self-rated health (22,23). Resilience, part of psychosocial health, has been identified as a key component of successful aging (22,24). Another study highlights social support as an important ingredient to resilience among seniors (25). In addition, it is important to understand how resilience affects healthy aging from a financial viewpoint. This growing population of seniors place increasing strain on the healthcare system. Between 2000 and 2010, U.S. health care expenditures increased by \$1 trillion, much of which was spent on intensive end-of-life care and treating complex conditions among the elderly (26,27). Such intensive care is speculated to have resulted in part from years of unaddressed--and preventable--chronic conditions such as heart disease, hypertension, and diabetes (28). Expensive end-of-life care and complex chronic disease management is costly for the system and individual; Many elderly people relying on Medicare live in poverty due to their health expenditures (29). An early study on

resilience among seniors found that resilience was positively associated with proper chronic disease management, which helps strengthen its significance to successful aging (30).

With understanding of resilience as a major aspect of healthy aging, the following section discusses the foundations of how resilience develops across a lifespan. Three life-course models of biological embedding currently dominate the field and inform the way risk exposure and resilience has been studied, the most influential framework being the latent effects model.

Theories of Biological Embedding and Resilience across the Lifespan

Biological embedding is the process by which socio-environmental circumstances “get under the skin” and lead to long term physical health effects. Assuming a life-course perspective on these socio-environmental effects may inform two different intervention timelines. The latent effects model encourages early life intervention, whereas the chain-of risks and the cumulative effects models suggest that intervention can be beneficial at any time over the course of someone’s lifespan because the effect of adverse events have both immediate and latent effects.

The latent effects model states that there is a critical period in life, early childhood, in which the individual is most sensitive to socio-environmental insults (31). The latent effects refer to how the adult copes (either via behavior or biology) with those early insults. The Adverse Child Events study was seminal to this discussion of the latent effects model (32). In this project researchers asked adults with varying medical conditions about their childhood experiences. They found a dose-response effect of

accumulated negative childhood events and severity of the adult medical condition.

In contrast to the latent effects of adverse events in early life, other scholars posit that a “critical period” is not limited to childhood. A recent study by Case and Deaton found that deaths by alcohol poisonings, drug overdoses (specifically opioids), and suicides drove the increase in morbidity and mortality among middle aged (ages 45-54), non-Hispanic White Americans between 1999 and 2013 (33). Black and Latino men of the same age saw decreases in morbidity and mortality. This result is surprising considering that Black and Latino men often face elevated, chronic levels of discrimination than their white counterparts. Case and Deaton hypothesized that part of the increase in these adverse outcomes among White men were due to the epidemic of self-reported pain, increased opioid availability (primarily via prescription drugs), and financial insecurity. Essentially, they were succumbing to the stress of mid-life exposure to adversity and coping to the stress via destructive behavior like alcohol abuse.

The counter-argument to the early life “critical period” is that the midlife time period can also be extremely sensitive to socio-environmental exposures since it is the point at which many health disparities are most apparent (33). Essentially, Case and Deaton combined the critical period aspect of the latent effects model with the chain-of-risks and cumulative effects models. The methods employed by aging adults to cope with these mid-life stressors directly impacts which resilience processes they choose to re-establish a psychological homeostasis. Their response to the mid-life stressor is also influenced by previous experiences leading up to the stressful event. Stress coping strategies used in midlife, as exemplified in the study, can alter health for the rest of one’s life. Intervention, perhaps resilience positive processes, at this later critical period could

improve health of older adults.

The work by Case and Deaton insinuates that resilience strategies may vary across race and time and may result in differential midlife mortality risk. Evidence that challenges the latent effects model pivots the conversation away from solely investigating childhood exposures and consequent disease. In other words, Case and Deaton suggest that different resilience processes over the lifespan invoke varied behavioral responses that impact mortality and quality of life.

Conclusion

The following study investigates whether participation in preventative health behaviors fits along the resilience-to-health pathway. This work is inspired by the relationship between resiliency and health care use established in the findings by Ezeamama and colleagues. They found that resilience was associated with lower health care utilization and improved self-rated health in the 2010 Health and Retirement Study wave. In their study, health care utilization carries a negative connotation because it refers to frequent or prolonged hospitalizations and frequent doctor visits which tend to be costly to individuals and burdensome on a resource-limited healthcare system. These results situate the importance of resiliency in healthy aging for individuals and for the greater health care system.

Previous evidence points to some health behaviors that increase risk of health care utilization, such as insomnia and physical inactivity (27). The following study evaluates the relationship between resiliency indicators and preventative behaviors, like cancer screening and flu shots that may decrease downstream health care use. Increased participation in preventative behavior may explain why resilient seniors had lower health

care utilization in the study by Ezeamama and colleagues. The seniors' efforts to participate in preventative practices may lead to less need for costly health care interventions. This study will add to the literature by highlighting a potential association between two resiliency indicators and preventative health practices. Specifically, the study tests the relationship between mastery and social support with receiving a mammogram, flu shot, or prostate screening exam. This work hopes to invite future research on how to capture resilience among elderly populations and reasons why individuals with higher resilience may not utilize health care as frequently as their less resilient counterparts. This has potential implications for policy development regarding disease prevention and reforming health care practices as we move into a longevity society.

CHAPTER II: MANUSCRIPT

Relationships between resilience indicators and engagement in disease prevention behavior among adults in the Health and Retirement Study

Kelsi O. Jackson

Abstract

Seniors are the fastest growing age demographic in the United States; by 2030, 72 million Americans are projected to be over the age of 65. These rapid demographic changes have called for better understanding of healthy, successful aging. Previous work using data on Americans of retirement age showed that resiliency is associated with lower healthcare utilization which tends to be costly to individuals and burdensome to an already strained healthcare system. The primary goal and hypothesis of this study is to test the association between resiliency and participation in disease prevention behaviors.

The study used a sample of 6,693 respondents from the 2012 wave of the Health and Retirement Study who answered the Psychosocial Leave-Behind questionnaire. Logistic regression was used to evaluate the relationship between indicators of resilience (mastery and social support) with the behavioral outcomes (receiving a flu shot, prostate screening, or mammography). The cancer screening models were restricted by gender. Relationships between the outcomes and workforce participation status, marital status, physical activity, education, history of smoking, comorbidity, body mass index, and cumulative lifetime adversity were also explored. All analyses were conducted using SAS survey procedures to account for complex survey design.

The present findings do not provide consistent evidence that higher resilience corresponds to greater utilization of preventative health behavior. Results indicate that

high mastery is associated with greater likelihood of receiving a mammogram, but show lower odds of receiving a flu shot. For social support, the results demonstrated that individuals who scored higher on the negative social support scale are more likely to get a mammogram or flu shot. There is little to suggest that resilient individuals engage in healthy disease prevention behaviors more than their less resilient counterparts. Future studies might look at comparing estimates based on different methodologies for measuring resilience in this population or exploring different variables that better characterize the health behaviors of resilient senior citizens.

Introduction

Successful aging emerges as a growing public health interest as the field of public health moves from merely reducing disease prevalence into sustaining health and longevity. Modern medical advances have increased longevity, which has inadvertently led to aging populations becoming an emerging public health issue. Population aging cripples the U.S. healthcare system as the age-stratified disease burden increases. Analysts predict that the U.S. will increase health expenditures on seniors to \$2.2 trillion dollars by 2050 (27). Concerns over ways to reform high expenditures focus on strengthening the health care workforce and reducing the amount of costly encounters seniors have with the healthcare system by modifying health behaviors. Focusing on behavioral modification presents an opportunity to tap into the psychological tools employed by seniors to encourage participation in life-sustaining (and cost-reducing) behavior such as daily exercise or eating a healthy diet.

Life experiences with adversity and stress shape the psychological tools seniors choose as a coping mechanism. Considering that exposure to adverse events is a risk that accumulates over a lifespan, it is necessary to study the stress-coping abilities for people in late adulthood after years of buildup. Accumulated adversity threatens health because of the constant mental and biological stress response to these events. From the biological view, the body's chronic response to adverse events builds up into allostatic load—the accumulation of biomarkers used to respond to stress (such as cortisol or inflammatory chemicals). Several studies have shown that such chronic stress leads to faster cellular aging and deterioration of the body's organs (7,9). In conjunction to accumulating allostatic load, the individual also builds a repertoire of adaptive strategies to the same stressors. Recent work in resilience, or these adaptive abilities, has investigated ways seniors cope with stressors--either proximal or distal--across their lifetime (21). The strategies used to build resilience may shed insight on differences in senior health behaviors.

Moving beyond the well-established link between resilience and disease, recent work has focused on the relationship between resilience and health promoting behavior--an understudied gap in the literature. Studying the behavioral characteristics of resilient individuals presents an opportunity to identify areas of intervention in those who remain vulnerable to adversity, especially in late adulthood. Current scholarship questions where (if at all) adaptive behaviors fit along the resilience-to-health pathway. High mastery (a resilience indicator) was previously associated with better health outcomes, some of which could be attributed to greater physical activity levels (a modifiable behavior) among a cohort of elderly Americans (20). This suggests that resilience may serve to

improve health via behavioral channels. The understudied relationship between resilience and behavioral modification compelled Ezeamama and colleagues to look at the relationship between amount of health care utilization (a costly behavioral outcome), self-rated health (a marker of successful aging) and two indicators of resiliency. They found that resilience was associated with lower health care utilization and improved self-rated health, which situates the importance of resiliency in healthy aging for individuals and for the greater health care system.

The following study seeks to expand upon the relationship between resiliency and health care use presented in the findings by Ezeamama and colleagues (5). Rather than considering health care utilization, this study evaluates the relationship between resiliency indicators (mastery and social support) and engagement in disease prevention behaviors such as receiving routine cancer screenings or a flu shot. Differential participation in preventative behavior may explain why resilient seniors had lower health care utilization in the study by Ezeamama and colleagues. The senior's self-preservation efforts by engaging in preventative practices may lead to less need to health care intervention. This study adds to the literature by examining markers of resilience in relation to three specific health behaviors: receiving a flu shot, mammogram, and prostate exam. These measures of mastery and social support are tested in relation to each of behavioral outcomes. Ultimately, the study aims to spark future discussion on measuring resilience among seniors and reasons why highly resilient individuals may not utilize health care as frequently as their less resilient peers. This has major implications for policy development regarding disease prevention and reforming health care practices as we move into a longevity society.

Methods

Data Source and Study Population

This study utilizes deidentified, publicly available data from the longitudinal Health and Retirement Study (HRS). The survey was designed to follow Americans ages 50 or older at 2-year intervals. Since beginning in 1992, the study has recruited and collected information on five subsequent cohorts. The study administers a core survey and several modules that interviewers leave with participants to complete and return. The psychosocial leave-behind module asks about social relationships, lifestyle, and life experiences. This module contains all items on personal mastery and social support. Module data were combined with the core HRS data file containing the study identification number, items related to health behavior, and demographic information.

The history, sampling design, and methodology behind the HRS surveys are described elsewhere (31). In brief, the weighted HRS sample is representative of all noninstitutionalized Americans of retirement age and their spouses or live-in partners. Black, Hispanic, and Florida residents were specifically oversampled. Sample weights for HRS respondents are included in the core HRS data set and were used to account for the unequal probabilities of selection of some respondents. The sample for the current study includes adults aged 50-70 years old from the 2012 wave who completed information regarding the primary exposures (resiliency indicators) and the preventative health behavior outcomes (N=6,963). All data are cross-sectional. Respondents who were institutionalized, were not alive, or answered none of the resilience indicator items in the leave-behind survey were excluded from the analyses (N=31,221; 81.8%).

Measures

Health Behaviors

Previous literature using HRS data has identified receiving a flu shot and being screened for cancer as preventative health behaviors (34). All health behavior measures were pre-existing variables in the core HRS data. Receipt of a flu shot is treated as a dichotomous (yes/no) response to the question: “Have you had a flu shot in the last two years?” The cancer screening variable is gender-specific. For women, cancer screening is determined by dichotomous (yes/no) variable based on response to “Did you have a mammogram or x-ray of the breast to search for cancer in the last two years?” For men, cancer screening utilization is a dichotomous (yes/no) variable derived from response to the question: “In the last two years, have you had an examination of your prostate to screen for cancer?”

Resilience Indicators

Resilience indicators are measured via mastery constructs and social support (5). Mastery and social support are established components of resilience and were formatted based on earlier work that showed that these components of resiliency were indicative of improved self-rated health (5). The core HRS questionnaire does not include the widely-used 10-item Connor-Davidson Resilience Scale (CD-RISC) used to measure resiliency. This scale had previously been used with high reliability in studies of older adults (23). Items in CD-RISC inspired the use of related items on personal control and goal orientation that were available in the HRS questionnaires.

Mastery is conceptualized as both a global and domain-specific phenomenon.

Items related to global mastery approximate one's perceived control and ability to achieve goals in life. General, or global, mastery was created as a composite score across responses to five items in the leave-behind questionnaire: (i) I can do just about anything I really set my mind to; (ii) When I really want to do something, I usually find a way to succeed at it; (iii) Whether or not I am able to get what I want is in my own hands; (iv) What happens to me in the future mostly depends on me; (v) I can do the things that I want to do. All responses to these items were scored on a six-point Likert scale from 1 (“strongly disagree”) to 6 (“strongly agree”). A higher composite index score suggests greater mastery and sense of self-efficacy in achieving one's goals.

Domain-specific mastery refers to self-efficacy in particular life areas such as social relationships, finances, and general health. Each area is a separate domain and is measured via three individual items: (i) how would you rate the amount of control you have over your social life these days? (ii) How would you rate the amount of control you have over your finances these days? (iii) How would you rate the amount of control you have over your health these days? Possible responses were scored on a likert-scale that ranged from 1 (“no control at all”) to 10 (“very much control.”) Higher scores on a single item indicate a greater level of mastery within that domain.

The continuous global and domain mastery scores were left skewed but with median and mean values that were similar. In keeping with methods established by Ezeamama and colleagues, dichotomous “high versus low” mastery variable was created for logistic regression analyses by separating people above and below the mean index score.

The perceived social support variables measure relationship quality and were derived from positive and negative social support scales present in the psychosocial

leave-behind questionnaire. (35,36). The positive social support scale comprised the following questions: (i) How much do they really understand the way you feel about things, (ii) How much can you rely on them if you have a serious problem, and (iii) How much can you open up to them if you need to talk about your worries? Responses to these questions scored on a likert-scale of 1 (“not at all”) to 4 (“a lot”). Each of three questions was asked separately regarding the respondent’s spouse, children, and other family or friends. This makes for a total of 9 questions asked across three social relationship domains. The negative social support scale comprised the following questions: (i) How often do they make too many demands on you, (ii) How much do they criticize you, (iii) How much do they let you down when you are counting on them, and (iv) How much do they get on your nerves? Responses to these questions scored on a likert-scale of 1 (“not at all”) to 4 (“a lot”).

A summary variable for both scales was formed by summing the responses within each domain, and then averaging across the domains for both scales. Respondents with inapplicable or missing domains (e.g. single adults who did not answer questions related to having a spouse) received a sum of zero for that specific domain. The theoretical maximum for the positive and negative summary scores are 12 and 16, respectively. The continuous score values for positive and negative social support followed a normal distribution. For logistic regression, both social support variables were conceptualized as binary “high versus low” variables. High indicated that an individual fell above the mean scale score and low indicated that the individual fell below the mean.

Cumulative lifetime exposure to adversity

Though related to resiliency, adverse events are considered as a separate covariate

in this study. The literature does not recognize the count of adverse events as an independent indicator of resilience as with mastery or social support, but rather as a marker of vulnerability (5,12). Cumulative lifetime adversity was categorized into groups using counts of 0, 1-2, 3-4, or 5 or more events per respondent. Items referring to adverse events include: 6 items on lifetime trauma (natural disaster, combat exposure, partner/child substance abuse, physical assault, and severe illness/accidents), 4 items on childhood trauma (failing a grade, trouble with police, parental substance abuse and physical abuse), and 6 items on recent stressful life events (job loss/unemployment, moving to a worse residence/neighborhood, victim of robbery, burglary and fraud). Previous literature indicates that these situations are stress-inducing, adverse life events (5,37,38).

Sociodemographic variables

Demographic variables include workforce participation status, age, gender, race, marital status, and education. Marital status and age were formatted differently than in the core HRS data (5). Workforce participation included four categories: retired, partial retirement, not retired/working, and non-workforce. The not retired/working group includes respondents who reported working full- and part-time. Age is also defined categorically into 4 groups: 50-55, 56-60, 61-65, and 66-70 years old. Race is collapsed into Black, White, and Other. Education has four levels: less than high school, GED, high school diploma, some college, and college and above. Marital status was derived from a 6 level categorical variable. For this study it was manipulated to be grouped as married/partnered, single/unknown, or divorce/widowed/separated due to low cell size counts.

Lifestyle covariates and potential confounders

Smoking history, body mass index, physical activity, and count of comorbid conditions may act as potential confounders affecting the relationship between resilience and participating in disease prevention behaviors. Body mass index, smoking history, and count of comorbidities are pre-existing variables in the core HRS dataset. Body mass index has four levels: underweight (<18.5 kg/m²), normal weight (18.5-24 kg/m²), overweight (25-29 kg/m²), and obese (30+ kg/m²). Smoking history is a dichotomous (ever/never) variable. The continuous measure of physical activity (in minutes) had a bimodal distribution and was ultimately collapsed into a binary (any vs. none) variable. Chronic health conditions are a pre-calculated count with 3 levels: zero, one, two, and three or more conditions. The conditions include high blood pressure, arthritis, cancer, diabetes, and heart disease. The count of comorbid conditions ranged from zero to a maximum of five.

Statistical Analyses

All analyses were generated using Statistical Analysis Software version 9.4 (SAS Institute Cary, N.C. Copyright 2016). Resilience indicators (mastery and social support) are presented as main exposures. Descriptive frequencies of the resilience indicators, outcomes, covariates, and sociodemographic data at baseline were constructed using PROC SURVEYFREQ and SURVEYMEANS to account for the complex survey design. Crude relationships between the demographic variables, covariates, and resilience indicators with the behavioral outcomes were tested using bivariate analyses in the PROC SURVEYFREQ procedure. Variables with P-values < 0.25 were kept in the model. Likelihood ratio tests were then used to examine multiplicative interaction between the

resilience indicators and covariates for each outcome. Interaction terms were evaluated at a P-value < 0.05. When applicable, models were stratified on each level of variables that indicated interaction at the 5% significance level. PROC SURVEYLOGISTIC was applied to test the association between resilience indicators and the categorical outcomes (cancer screenings and receiving a flu shot) adjusting for covariates and any potential interaction terms. All logistic regression analyses provided odds ratios estimates with 95% confidence intervals using respondent-level weights included in the HRS data. Standard errors of the variance were calculated with the Taylor-linearization method appropriate to the complex survey design.

Results

This sample contained 6963 respondents between 50-70 years old (Table 1). Respondents were predominantly white (83.6%) and female (54.3%), and approximately 53% of the sample was college educated, 63.7% was married or partnered, 47.7% was completely retired, and 56.4% reported a history of smoking. The majority (85.2%) of respondents reported having at least one comorbid health condition since the 2010 survey wave. For the cancer screening outcomes, 30.6% of women and 34.2% of men had not received their respective mammogram or prostate exam in the previous two years. 22% reported no physical activity at all while 34.5% of respondents did not have a flu shot since 2010. Most people in the study experienced some type of hardship over their lifetime with only 31.1% of the sample reporting no adverse events. Variables that were significant at the 5% significance level in crude bivariate analyses with each health

behavior outcome included marital status, cumulative lifetime adversity, education, workforce participation status, comorbidity, race, BMI, and history of smoking.

All models and odds ratios estimates in Table 2 were adjusted for age, race, workforce participation status, marital status, physical activity, education, history of smoking, comorbidity, BMI, and cumulative lifetime adversity. There was no evidence of interaction between the exposure variables and covariates. Respondents with high mastery had 0.78 times lower odds of receiving a flu shot in the last two years than those with low reported mastery (95% CI: 0.64-0.97) [Table 2]. In other words, low mastery is associated with greater odds of getting a flu shot. For respondents who scored high on the negative social support scale, the odds of receiving a flu shot was 1.46 times higher than the odds for those who experienced less negative social support (95% CI: 1.03-2.05) [Table 2]. Among women, the odds of getting a mammography screening in the past two years was 1.7 times higher for respondents with high mastery than low mastery (95% CI: 1.15-2.51) [Table 2]. The odds of getting a mammography screening in the past two years was 1.73 times higher for female respondents with high scores for negative social support than those with low scores (95% CI: 1.07-2.81) [Table 2]. There was no statistically significant relationship between the domain-specific resiliency indicators of mastery and odds of getting a flu shot or mammogram. The 95% confidence level range for these domains all contained a value of 1 [Table 2]. For men, the indicators for overall mastery and social support had confidence intervals that contained the null. This suggests that these factors were not associated with the likelihood of having a receiving a prostate screening in this sub-population. However, the health-specific mastery domain was important for men. Male respondents who demonstrated high mastery within this domain

had 1.62 times higher odds of getting their prostate screening than men with low health mastery scores (95% CI: 1.04-2.52) [Table 2]. Relative to men without any adverse events, the odds of not getting a prostate exam was stronger among men who experienced 3-4 adverse life events. Though not statistically significant, the odds of engaging in any of the three health behaviors were lower as the number of adverse events increased.

Logistic models were also used to provide information about context on the relationships between other lifestyle and personal characteristics with the behavioral outcomes beyond the relationship between resilience and health behavior. Older age groups had higher odds of receiving their flu shot (OR: 1.40; 95% CI: 1.19-1.64) [Table 3]. As anticipated, high education was associated with increased participation in preventative health behavior. Compared to respondents with less than a high school education, those with a high school diploma were 1.65 times more likely to get their flu shots and 2.05 times more likely to get a prostate exam (95% CI: 1.02-2.67; 95% CI: 1.06-3.96) [Table 3]. Mammography and prostate screening models were run in female and male subpopulations, respectively. For mammography, this relationship was only demonstrated for the comparison of respondents with more than a college degree to those without a high school education (OR: 3.16; 95% CI: 1.39-7.17) [Table 3]. Physical activity was a significant indicator of increased mammography use. Those with any physical activity were almost twice as likely to receive the screening (OR: 1.97; 95% CI: 1.12, 3.47) [Table 3]. Smoking history was only demonstrated to be associated with mammography. The odds of having a mammogram are lower for smokers than never smokers (OR: 0.62; 95% CI: 0.39-0.98) [Table 3]. Men who were single had 0.49 lower odds of prostate screening than men who were married or partnered (95% CI: 0.27-0.90)

[Table 3]. Compared to women with no comorbidities, women with only two or three or more comorbid conditions had higher odds of receiving a mammogram (OR: 2.29, 95% CI: 1.19-4.41; OR: 2.16, 95% CI: 1.08-4.32, respectively).

Discussion

The purpose of this study is to test the relationship between resiliency and utilizing flu shots and preventative cancer screenings. The present findings do not provide consistent evidence that higher resilience, as measured by these indicators, is linked to greater utilization of preventative health behavior. Results indicate that high mastery is associated with greater likelihood of receiving a mammogram, but show lower odds of receiving a flu shot. Resilience, as perceived through mastery, does not influence prostate cancer screening utilization. Mastery across financial, health, and social life categories is not associated with getting a flu shot or mammogram. Interestingly, among men, having a high sense of mastery over their health is associated with prostate screening utilization. However, the positive connotation of this result may be misleading. In the last 20 years prostate screening has been highly controversial. Researchers argue over whether the costs outweigh the benefit of these screenings because their ability to cause unnecessary harm (39,40). Thus, the men receiving the screenings in this study could be at risk of more undue harm. A future study may examine the relationship between resiliency and colorectal cancer screening, a disease for which early detection is more advantageous since it is the leading cause of cancer deaths worldwide (41).

Measurement issues in relation to mastery and social support may partially explain these inconclusive results. Researchers have developed separate ways of

capturing resilience, which is not explicitly measured in the Health and Retirement Study (HRS). This study uses a method proposed by Ezeamama and colleagues. They created two separate constructs for mastery (global and domain specific) that are dichotomized into high and low based on cutoffs for a continuous score. In contrast, other studies using HRS data constructed a continuous, simplified resilience score (SRS) introduced by Manning and colleagues (42). They created an index using items in the psychosocial leave-behind questionnaire designed to approximate the primary psychosocial domains of resilience introduced by the extensively validated Wagnild and Young Resilience Scale (43,44). This scale is based off five psychosocial domains: (1) perseverance or the ability to keep going despite major setbacks; (2) equanimity, which describes being able to adjust to change, often with humor; (3) meaningfulness or the realization that life has a purpose; (4) self-reliance or recognition of one's inner strengths; and (5) existential aloneness or the realization that some experiences must be faced alone (43,44). The SRS is a composite scale that captures mastery and aspects of social support in a single measure whereas the method by Ezeamama and colleagues separate the two constructs (42). A future study might test the differences in estimates produced by using two methods of measuring resilience in the HRS data. It is possible that using the mean cutoff scores to bifurcate mastery into a dichotomous categorical variable misclassified the exposure. Some individuals could have been inadvertently considered to have lower resiliency, when they should have been grouped as having high resilience.

Social support, another resiliency indicator, does not meet expectations for a positive association with any health behavior. The primary premise behind positive social support in resiliency is that increased social support serves as a proxy for resiliency

because some stress coping strategies depend on drawing upon a reservoir of supportive social resources. Negative social support, as presented in the leave-behind questionnaire, inquires about relationships that were more emotionally draining than constructive or supportive. The emotional drain implied by a high score on the negative social support scale would suggest poor psychosocial health and likely low resiliency. Likewise, a low negative social support score suggests some psychosocial benefit. The two scales were validated and shown to capture two distinct underlying constructs. Thus, a low score on one scale does not necessarily beget a high score on the other, and vice versa.

Interestingly, the results showed that the group scoring higher on the negative social support scale is more likely to get a mammogram or flu shot. To complement this finding, individuals who reported low mastery are also more likely to have received a flu shot. These inconclusive results surrounding the influence of social support align with null findings from Ezeamama and colleagues (5). They were not able to discern a relationship between social support and hospitalization or frequent doctor's visits.

Part of this finding may be attributed to the sensitivity of the social support measure or it may simply reflect that the methods used to capture resilience were insufficient. The social support variables were constructed in a way that makes it difficult to derive meaning about the respondent's lived experience. Missing data within any of the social support domains were treated as zeros. Averaging across the domains does not acknowledge the unique contributions from particularly negative or positive relationships. For example, an individual with no kids or spouse may rely more heavily on their friendships. If this individual scored very high on the items related to negative social support from friends, but low on the child and spouse domains, the average across

the domains assumes that the relationship types have relatively equal influence. In reality, people tend to assign hierarchical values to different social bonds. This respondent should have only been scored on the absolute sum within the friend domain and a combined average since each domain is not equally as meaningful to the respondent. For this individual, the extreme experience of negative social support from their friendships is underestimated when the sums are averaged across the three domains.

Likewise, it is possible for someone with all three relationship types to score low on the negative social support scale within the three domains, but receive a similar averaged score as the person for whom only one of the domains is applicable. The lack of variability may explain some of the null findings. In hindsight, missing responses should not have been assigned a numeric value. This likely explains why the averages for negative social support were much lower in the study by Ezeamama and colleagues, which reported lower average social support scores than in the current study findings. This suggests that they were able to assess respondents who fell on the extremes of the social support scales.

Additionally, the HRS questionnaire only assesses the type of social support received by respondents, and not their social support needs. The distinction between the two perspectives of social support may approximate finer aspects of the relationship between resiliency and health behavior choices. Future waves may reveal that an individual's social support needs change with time (20). The population's fluctuating positions on these same social support scales was not explicitly explored, but could reflect the dynamic process of developing resiliency. Whether social support remains static over time or proves to be in flux in this population will require research across

several waves of the Health and Retirement Study (HRS). As stated earlier, the methodology for measuring markers of resilience in this study was not previously validated.

Analysis of the relationships between individual covariates and the behavioral outcomes are congruent with current literature on behavioral profiles of smokers, flu shot recommendations, and the socioeconomic health gradient. The lower odds of flu shots and mammograms by smokers in this study reflect the general tendency for smokers to avoid preventative health practices. Smokers tend to underutilize cancer screenings and, even after making an appointment, they are more likely to skip the scheduled screening than their non-smoker counterparts (45,46). While health insurance providers have historically shied away from insuring smokers, a lack of health insurance is not a likely barrier to health care in this study population (46). Most of the HRS participants are of retirement age and insured through their employer, Medicare, or other type of government program. Unfortunately, government sponsored programs have important gaps and fail to cover extended hospital stays, long-term care, and prescription drugs to manage complex conditions (47). Such exorbitant healthcare costs can propel vulnerable seniors into poverty (47).

Older age groups are more likely to receive a flu shot, which aligns with current Centers for Disease Control recommendations for senior citizens. Seniors are at higher risk for complications from the flu and account for 71 percent to 85 percent of seasonal flu-related deaths and between 54 percent and 70 percent of seasonal flu-related hospitalizations (48). Thus, the high risk leads to more targeted effort to protect seniors against infection, resulting in high vaccination rates. As expected, higher levels of

education are positively correlated with receiving any of these preventative services. Education is a well-established marker of socioeconomic status, and that health outcomes are often patterned along the status gradient (49,50). The increased screening and flu shot utilization among educated adults could be due to better health literacy and access to other socioeconomic resources afforded by acquiring higher education. Still, this population has other modifiable factors have a greater impact on healthy aging than educational achievement alone (51).

Contrary to current research, statistically insignificant findings in this study suggest that marriage is not associated with participation in preventative health behavior. Marriage is viewed as a unique form of social support with a strong influence over individual behavior. Previous work found that married or partnered couples were more likely to exercise, seek cancer screening, and have overall better self-rated health (52–54). However, some researchers highlight that marriage quality varies widely between couples, and the association between this particular social relationship and health outcomes may be overestimated (53,55). Only one subgroup in the study population demonstrates a significant, positive association between marriage and a health behavior. Unmarried men are half as likely to receive a prostate screening compared to their married counterparts, suggesting the potential benefit to being married. The results are also incongruent with what is already known about the dose-response effect of adverse life events on overall health (56–58). The accumulation of adverse events has been previously linked to higher vulnerability to hypertension, post-traumatic stress disorder, and metabolic dysregulation (57–59).

Limitations

Overall, this study was limited by lack of temporality to make causal claims, generalizability, measurement using likert scales, and unmeasured confounding. All data are sourced from a single HRS wave for cross-sectional analysis. Though the questions are framed to retrospectively consider changes over a two-year period, the data lack temporality since all the resilience indicators and outcomes were measured at the same time. Introduced in 2006, the psychosocial leave-behind questionnaire was a relatively new addition to the Health and Retirement Study survey package. Respondent data from the questionnaire was first available in 2010. It will be informative for researchers to be able to measure how perceived mastery and social support changes over time alongside health outcomes. Data collected from future waves of HRS using the psychosocial questionnaire will benefit from more robust longitudinal analyses.

Additionally, one controversial feature of the study is the race classification. The available data only offers three categories for race: Black, White, and Other. Minorities of retirement age were oversampled, but still remained a very small subgroup of the primarily white-identifying HRS population who also completed the psychosocial leave-behind questionnaire. The lack of representation directly affects the ability to capture differential exposure to adverse life events--some of which are impacted by potentially race-based discrimination. Racial discrimination, whether perceived or structural, acts as a potential unmeasured confounder because it affects perceived mastery of one's life, the shaping of social support networks, and it may affect partaking in disease-prevention practices. Race is especially poignant in this population considering that many participants lived throughout racially contentious periods in modern American history

and most respondents were white. Their lived experiences may still be informing their resilience processes and social support networks in late adulthood. Race challenges the conventions for how we measure resilience in the absence of social context. Thus, these estimates of resiliency may be heavily biased. The racial representation and small subsample who completed the psychosocial leave-behind survey compared to the full HRS population both limit the generalizability of these results.

Likert scales are favorable in data collection because they are typically easier for respondents to understand and cheap to administer. Unfortunately, these types of measures make it difficult to make meaningful interpretations. The ordinal nature of the scale assumes that there is balanced distance in meaning between extremes of the likert values. For instance, a person may perceive minimal difference between “neutral” and “not at all” on the negative social support scale, but perceived a large difference between “neutral” and “a lot”. Furthermore, ignoring the likert scale’s ordinal values to create a continuous score with mean or median cutoffs may misinterpret the person’s original responses to the ordinal scale. It rouses concerns over how differently the same people may have answered if given continuous—rather than ordinal—response options (60).

Finally, the estimates produced likely suffer from unmeasured confounding not acknowledged by the variables available in the HRS data and used for this study. Such confounders might be differentially associated with the resilience indicators or behavioral outcomes.

Conclusion

Ultimately, this study does not conclusively support the original hypothesis that resilient adults engage in more preventative health behavior. Furthermore, there is little

evidence to suggest that resilient individuals engage in healthy disease prevention behaviors more often than less resilient counterparts. In fact, on a molecular level it remains impossible to tell whether resilient people are truly different from those who are less resilient. Previous research indicates that individuals who report higher resiliency in the face of adversity tends to have more rapid cellular aging (8,61,62). In short, resilience does not mean that an individual is not impacted by stress. The physical body remains vulnerable despite the mental ability to face life's challenges. Still, health-promoting behavior may be situated along the resilience-to-wellbeing pathway for some people. The relationship was plausible for certain sub-groups in the population, which further underscores the reality that resilience develops differently across identity and varied lived experiences. These results were likely compromised by using a non-validated measure of mastery and social support, two very influential indicators of resilience. There was high potential for respondents to be misclassified between high and low levels of each indicator. Overall, this work elucidates the need for more exploration of resilience as a part of healthy aging processes among this growing population of senior citizens-- nationally and worldwide.

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Tables

Table 1. Characteristics of adults in the 2012 HRS, aged 50-70 years old (N = 6,963)^a

	N (%)	std. error
Age categories		
50-55	720 (19.8)	0.95
56-60	1232 (31.7)	1.32
61-65	1043 (27.7)	0.99
66-70	821 (20.8)	1.05
Gender		
Male	2858 (45.7)	0.53
Female	4105 (54.3)	0.53
Race		
Black	1149 (10.3)	0.69
White	5341 (83.6)	0.74
Other	453 (6.1)	0.54
Marital Status		
Married	4376 (63.7)	0.84
Divorced/widowed/separated	379 (7.0)	0.41
Single/unknown	2208 (29.2)	0.67
Work force participation status		
Completely retired	3913 (47.7)	1.13
Partly retired	552 (8.2)	0.41
Not retired/working	1906 (35.6)	1.13
Non-workforce	592 (8.6)	0.41
Education		
Less than High school	1206 (14.4)	0.69
GED	350 (4.9)	0.41
High school graduate	2068 (27.9)	0.78
Some college	1750 (25.6)	0.60
College graduate and beyond	1588 (27.2)	1.00
Smoking History		
Yes	3911 (56.4)	0.79
No	3012 (43.6)	0.79
Body Mass Index		
Underweight (< 18.5)	175 (2.2)	0.19
Normal (18-24)	1857 (27.1)	0.77
Overweight (25-29)	2530 (36.2)	0.80
Obese (>30)	2401 (34.3)	0.86
Comorbid health conditions		
None	836 (14.8)	0.63
One	1493 (23.5)	0.68
Two	1816 (24.9)	0.64
Three or more	2817 (36.8)	0.84

Table 1. continued

	N (%)	std. error
<i>Outcomes</i>		
Mammogram in last 2 yrs^b		
Yes	2833 (69.4)	0.90
No	1259 (30.6)	0.90
Prostate Cancer Screening in last 2 years^c		
Yes	1885 (65.8)	1.39
No	925 (34.2)	1.39
Flu Shot in Last 2 years		
Yes	4702 (65.5)	0.99
No	2249 (34.5)	0.99
Physical Activity		
None	532 (21.6)	1.06
Any	2040 (78.4)	1.06
<i>Resilience Indicators</i>		
Cumulative lifetime adversity		
0 events	2170 (31.1)	0.78
1-2 events	3104 (44.8)	0.72
3-4 events	1236 (17.5)	0.57
5+ events	453 (6.6)	0.42
Global Mastery Scale		
High mastery	4444 (64.8)	0.67
Low mastery	2519 (35.2)	0.67
Domain Specific Mastery Score		
Health (range 1-10)	7.08	0.05
Social life (range 1-10)	7.76	0.04
Finances (range 1-10)	7.01	0.04
Social Support		
Positive Social Support	8.05	0.04
Negative Social Support	4.6	0.03
^a weighted frequencies		
^b among women		
^c among men		

Table 2. Relationships between resiliency indicators and preventative health behaviors among adults aged 50 - 70 years in the 2012 HRS cohort

Resilience Indicators	Flu Shot		Mammography ^a		Prostate Screening ^b	
	OR	(95% CI)	OR	(95% CI)	OR	(95% CI)
Global Mastery						
High versus low	0.78	(0.64,0.97)	1.70	(1.15,2.51)	0.95	(0.56,1.62)
Domain Specific Mastery						
Health (high vs. low)	1.20	(0.90,1.60)	0.76	(0.47,1.22)	1.62	(1.04,2.52)
Social Life (high vs. low)	0.79	(0.55,1.13)	1.48	(0.81,2.72)	0.98	(0.52,1.85)
Finances (high vs. low)	1.31	(0.94,1.84)	1.40	(0.84,2.33)	1.19	(0.77,1.82)
Social Support (SS)						
Positive SS (high vs. low)	0.97	(0.75,1.26)	1.24	(0.80,1.93)	0.83	(0.47,1.46)
Negative SS (high vs. low)	1.46	(1.03,2.05)	1.73	(1.07,2.81)	0.69	(0.40,1.19)

^a among women

^b among men

*bold indicates significance

Table 3. Relationship between other factors and preventative health behavior outcomes among adults aged 50 - 70 years in the 2012 HRS cohort

Factor	Flu Shot		Mammography*		Prostate Screening *	
	OR	(95% CI)	OR	(95% CI)	OR	(95% CI)
Age (per 5-yr increments)	1.40	(1.19,1.64)	1.12	(0.90,1.39)	1.37	(1.13,1.65)
Gender						
Male vs. Female	0.80	(0.58,1.10)	--	--	--	--
Race						
White = <i>ref.</i>	1.00		1.00		1.00	
Black	0.75	(0.56,1.01)	1.18	(0.73,1.91)	1.07	(0.66,1.75)
Other	1.23	(0.82,1.85)	1.12	(0.48,2.61)	0.45	(0.22,0.92)
Marital Status						
Married/Partnered = <i>ref.</i>	1.00		1.00		1.00	
Divorced/widowed/separated	0.91	(0.67,1.23)	0.68	(0.43,1.08)	0.61	(0.33,1.11)
Single/unknown	1.61	(0.86,3.00)	0.65	(0.31,1.38)	0.49	(0.27,0.90)
Work force participation status						
Non-workforce= <i>ref.</i>	1.00		1.00		1.00	
Completely retired	1.52	(0.91,2.55)	1.35	(0.65,2.78)	0.98	(0.41,2.35)
Partly retired	1.14	(0.69,1.88)	1.35	(0.74,2.46)	0.99	(0.45,2.21)
Not retired/working	0.83	(0.48,1.44)	0.92	(0.35,2.41)	0.98	(0.29,3.27)
Education						
Less than High school= <i>ref.</i>	1.00		1.00		1.00	
GED	2.05	(0.88,4.79)	0.53	(0.20,1.36)	1.98	(0.75,5.24)
High school graduate	1.65	(1.02,2.67)	2.00	(0.96,4.18)	2.05	(1.06,3.96)
Some college	1.88	(1.23,2.87)	1.76	(0.84,3.68)	3.19	(1.66,6.14)
College graduate and beyond	2.76	(1.66,4.58)	3.16	(1.39,7.17)	5.01	(2.55,9.83)
Smoking History						
Yes vs. no	0.96	(0.73,1.27)	0.62	(0.39,0.98)	0.76	(0.50,1.15)
Body Mass Index						
Underweight (< 18.5)	2.87	(1.15,7.18)	0.46	(0.14,1.46)	2.82	(0.45,17.53)
Normal (18-24) = <i>ref.</i>	1.00		1.00		1.00	
Overweight (25-29)	1.16	(0.83,1.62)	1.18	(0.68,2.03)	1.30	(0.79,2.15)
Obese (<30)	1.24	(0.90,1.71)	1.11	(0.59,2.09)	1.62	(0.88,2.97)
Comorbid health conditions						
None = <i>ref.</i>	1.00		1.00		1.00	
One	1.28	(0.87,1.87)	1.49	(0.82,2.71)	2.40	(1.18,4.85)
Two	2.22	(1.38,3.57)	2.29	(1.19,4.41)	2.74	(1.37,5.49)
Three or more	2.87	(1.73,4.78)	2.16	(1.08,4.32)	2.76	(1.18,6.46)
Physical Activity						
Any vs. None	0.92	(0.64,1.32)	1.97	(1.12,3.47)	0.84	(0.52,1.35)
Cumulative lifetime adversity						
0 events = <i>ref.</i>	1.00		1.00		1.00	
1-2 events	1.01	(0.71,1.43)	0.91	(0.62,1.33)	0.63	(0.37,1.09)

Table 3. continued

	Flu Shot		Mammography*		Prostate Screening *	
	OR	(95% CI)	OR	(95% CI)	OR	(95% CI)
Cumulative lifetime adversity						
3-4 events	0.66	(0.42,1.03)	0.93	(0.55,1.57)	0.38	(0.20,0.72)
5+ events	0.77	(0.48,1.22)	0.68	(0.31,1.46)	0.76	(0.41,1.40)

*model stratified by gender, no contrast odds ratio presented.

^a N = 4105

^b N = 2858

CHAPTER III: SUMMARY, PUBLIC HEALTH IMPLICATIONS, & POSSIBLE FUTURE DIRECTIONS

The field of public health has the opportunity to delve deeply into the meaning of successful aging. Soon, the population will demand it. Americans over the age of 65 are expected to comprise nearly a quarter of the U.S. population by 2060 (63). This impending reality forces us to consider areas of improvement in how we handle aging. One area of great focus is how to manage expensive and burdensome health care utilization by American seniors. Fortunately, data provided via the Health and Retirement Study (HRS) that began in 1992 allow for further inquiry into aspects successful aging. The study presented in this paper used HRS data to investigate the association between resilience, a key component of healthy aging, and health behavior habits among senior citizens.

A previous study by Ezeamama and colleagues showed that resiliency is associated with lower healthcare utilization among older adults. The primary goal and hypothesis of this study was to test whether this relationship is due to increased utilization of three prevention behaviors: receiving a flu shot, mammogram, and prostate exam. The study used a sample of 6,693 respondents from a single wave of the HRS using the core and psychosocial leave-behind questionnaires. Logistic regression was used to reveal a potential association between indicators of resilience (mastery and social support) with the behavioral outcomes. The study also considered relationships between the outcomes and workforce participation status, marital status, physical activity, education, smoking history, comorbidities, body mass index, and cumulative lifetime adversity.

According to these findings, higher resilience is not related to greater utilization of preventative health practices. Thus, it remains unclear as to how health prevention behavior fit along the resilience-to-health pathway--or if they belong there at all. Instead of supporting the hypothesized relationship, the results lead to more suspicion that the resilience indicators used in this study require further validation. A follow up study could involve using a different measure for the exposure variable. Estimates of the relationship with the behavioral outcomes could then be compared across the two different methods used to measure resilience. Additionally, future research might explore new covariates that better characterize the health habits of highly resilient senior citizens. The HRS data contain over 600 variables for analysis. This makes for considerable opportunities to finely characterize resiliency in the context of healthy aging.