Social Characteristics and Health Status of Exceptionally Long-Lived Americans in the Health and Retirement Study

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Abstract

OBJECTIVES—To characterize the social characteristics and physical, functional, mental, and cognitive health of exceptional survivors in the U.S., and how the experience of exceptional longevity differs by social status.

DESIGN—Nationally-representative longitudinal study of older Americans.

SETTING—United States.

PARTICIPANTS—1,649 men and women born from 1900 to 1911, including 1,424 non-survivors who died before reaching 97 years of age and 225 exceptional survivors who survived to at least 97 years of age, from the Health and Retirement Study.

MEASUREMENTS—Self-reported data on sociodemographic characteristics, social environment, physical and mental health, and physical and cognitive function.

RESULTS—At baseline exceptional survivors were more likely to live independently, had fewer diseases, better mental health, and better physical and cognitive function compared to those who did not survive to age 97. Compared to their baseline health, exceptional survivors experienced declines in all health domains upon reaching 97 years of age. However, between one-fifth and one-third of exceptional survivors remained disease-free, with no functional limitations or depressive symptoms, and one-fifth retained high cognitive function. Among exceptional survivors, men were healthier than women and whites were generally healthier than non-whites. Highly educated exceptional survivors had better cognitive function than their lesser educated counterparts.

CONCLUSION—On average, exceptional survivors are relatively healthy and high-functioning for most of their lives and experience health declines only upon reaching maximum longevity. However, heterogeneity in the population of the exceptionally old indicates that while many individuals reach maximum longevity in a state of poor health and functioning, a considerable portion of exceptional survivors remain healthy and high-functioning even in very old age.

Keywords

longevity; health; health disparity

INTRODUCTION

Reaching advanced old age is becoming an increasingly common experience in the United States. Among those born in 1900 who reached age 65, 41% of men and 62% of women survived to age 80 and lived, on average, an additional 7 to 9 years.[1] As a result of gains in life expectancy at older ages a growing segment of the U.S. population is experiencing exceptional longevity (i.e. approaching 100 years of age).[2,3]

There are very few studies of exceptionally long-lived individuals, particularly in the U.S., and research findings on the health and functioning of exceptional survivors are inconsistent. Some studies of exceptional survivors find that physical and cognitive health declines dramatically with advanced old age,[4,5] and that those who achieve exceptional longevity are generally unhealthy.[6] However, there is evidence that exceptional survivors are relatively healthy and high-functioning for most of their lives,[7] a robustness necessary for survival to very old age,[8] and experience rapid health declines only near the end of their lives. Although death is often preceded by declining health, the timing of health declines varies and some exceptionally long-lived individuals may be able to delay health declines and remain relatively healthy and high-functioning in advanced old age. A study of men and women aged 97–119 found that there are multiple routes to achieving exceptional longevity and that while the most typical experience involves surviving into advanced old age with disease, there are a number of individuals who achieve exceptional longevity with little or no burden of age-related diseases.[9]

While some exceptionally long-lived individuals will experience diminished health and functioning, others may remain relatively healthy and functional, suggesting there is variability in the experience of exceptional longevity.[8] For instance, studies that reported age-related declines in health and functioning also showed that variability in health conditions increased with age.[4,5] Gender differences in health may represent one source of variation. While relatively fewer men achieve exceptional longevity, those who do are healthier and have better physical and cognitive functioning compared to their female counterparts.[4,10,11] Health conditions of exceptional survivors may also vary by race. Although the majority of studies of exceptional longevity have been limited to Caucasian-only samples, one study of black-white differences in health among adults aged 98 and older living in Georgia found that, compared to whites, African Americans had worse physical and mental health and lower cognitive function.[10]

Much of our understanding of the lives and health of exceptionally long lived individuals has come from European and Japanese data. Two major studies have been undertaken to understand the factors associated with extreme longevity in the U.S.,[12–14] and while these studies have offered heretofore unknown information about the social, psychological, and health characteristics of some of the oldest-old in the U.S., they are based on select samples of people living in the state of Georgia and individuals from centenarian families and thus limit our ability to make generalizations about the experiences of exceptional survivors in the U.S. population.

The current study uses data from a nationally representative sample of older U.S. adults to examine the social characteristics and physical, functional, mental and cognitive health status of those who experienced exceptional longevity. This study assesses: 1) baseline differences in social characteristics and health status between those who became exceptional survivors and those who did not survive to exceptional old age; 2) change in social characteristics and health status of exceptional survivors; and 3) variation in the health and functioning of exceptional survivors by gender, race/ethnicity, and education.

METHODS

Data

We use data from the ongoing Health and Retirement Study, using the portion of the sample that began as the study of Asset and Health Dynamics Among the Oldest Old (AHEAD), which is designed to provide a representative sample of the community-based U.S. resident population aged 70 and older (i.e. born in 1923 or earlier) in 1993.[15] Baseline interviews were conducted in 1993/1994, with follow-up interviews conducted in 1995/1996 and biannually from 1998 to 2008, the last interview year for which data are available. The objective of AHEAD is to monitor changes in physical, functional, and cognitive health in advanced old age. Due to extensive ongoing follow-up, AHEAD provides an ideal opportunity to study U.S. adults as they reach very old age and to gain insights into the lives of exceptionally long-lived individuals.

The analytic sample consists of respondents born between 1900 and 1911 who could have survived to age 97 after the 1995 interview, including *non-survivors* who died prior to age 97 (n=1,424) and *exceptional survivors* who reached 97 years of age (n=225). We only include those individuals who aged to 97 after the 1995 interview because we believe that after two years from the baseline interview in 1993 the sample better reflects the institutionalized as well as the community-dwelling population of older U.S. adults. We define 97 as the minimum age for exceptional longevity because survival to this age is so rare – less than 1% of men and 4% of women born from 1900 to 1910 survived to age 97 according to cohort life tables.[1] Date of birth is self-reported in the baseline interview by the respondent or their proxy (n=240 non-survivors and n=25 exceptional survivors had their date of birth reported by their proxy).

In the analysis, respondent characteristics are assessed at the 1993 baseline interview, and for exceptional survivors characteristics are also assessed in the follow-up interview that corresponds to the year in which they reached 97 years of age. For those who aged to 97 in a non-interview year, characteristics are assessed using the prior interview, when they were age 96. Some respondents did not participate in the interview in the year before or the year in which they turned 97 and were therefore interviewed at ages older than 97. Thus at the follow-up interview in which respondents achieved exceptional longevity they were 96 (n=106), 97 (n=102), and 98–100 (n=17) years of age.

Although the full study period is 1993–2008, the follow-up period for exceptional survivors is 1998 (1995)–2008. Respondents achieved exceptional longevity at different points after the 1995 interview and, therefore, measures are derived from different survey years. Follow-up measures for exceptional survivors are derived from the first interview year of any of the six interviews conducted biannually between 1998 and 2008 in which they became, or were about to become, 97 years of age; measures for four exceptional survivors are from the 1995/1996 interview because this interview occurred the year before they reached age 97. The duration between the baseline interview and follow-up generally ranges from 5–15 years.

Measures

Sociodemographic Characteristics—Demographic factors include gender, race/ethnicity, and education. Race/ethnicity is composed of four groups; White, Black, Hispanic, and Other. Respondent education is measured in years (categorical specifications of education yield similar results). We also examine parental background factors, including parents' longevity and educational attainment. From respondents' reports of their parents' age at death we created separate measures for mother and father indicating that the parent

survived to at least 85 years of age. Based on respondent answers to the question, "Did your mother/father attend 8 years or more of school" we created separate measures for mother and father indicating that the parent had at least 8 years of schooling.

Social Environment—We examine the amount of support available in the social environment by looking at family structure and living arrangements. Family structure variables include marital status, which is represented with four categories that distinguish between those who are married/partnered, divorced/separated, widowed, and have never been married, the number of living children and the number of living siblings. Living arrangements are characterized by a dichotomous variable indicating whether or not the respondent lived alone and an additional dichotomous variable contrasting those who lived in nursing homes with community-dwellers.

Physical Health—Number of comorbidites counts the number of six doctor diagnosed diseases and chronic conditions reported by respondents: high blood pressure or hypertension; diabetes or high blood sugar; cancer or a malignant tumor of any kind except skin cancer; chronic lung disease, such as chronic bronchitis or emphysema (excluding asthma); heart attack, coronary heart disease, angina, congestive heart failure, or other heart problem; and stroke. In addition, we include each of the above conditions as separate measures, as well as whether respondents were ever diagnosed with arthritis or rheumatism. Self-rated health was measured by a single item, "Would you say your health is excellent, very good, good, fair, or poor?" with responses coded so that higher scores represent more positive perceptions of health.

Mental Health—We measure mental health with a brief version of the Center for Epidemiologic Studies Depression (CESD) scale, which includes measures of eight depressive symptoms felt "much of the time" during the past week: felt depressed, felt that everything was an effort, had restless sleep, could not get going, felt lonely, felt sad, felt happy, and enjoyed life.[16] Higher scores indicate more depressive feelings in the past week and thus worse mental health. These items are not asked of proxy respondents and thus a CESD score is not calculated for those respondents whose interview was conducted with a proxy. We also report the percentage of individuals who report having doctor diagnosed emotional, nervous or psychiatric problems.

Functional Limitations—Activities of daily living (ADL) limitations were assessed with a count of the number of six major life activities the respondent had difficulty performing: walking across a room; dressing; bathing; eating; getting in and out of bed; and using the toilet. Mobility difficulty was assessed by summing difficulty in three activities: walking several blocks; walking across the room; and climbing one flight of stairs.

Cognitive Function—Tests used to assess cognitive functioning in the HRS included 10 word immediate and delayed recall tests of memory, a serial 7's subtraction test of working memory, counting backwards to assess attention and processing speed, an object naming test to assess language, and recall of the date and president and vice-president to assess orientation (TICS). [17] Composite scores using all the items create a measure of cognitive functioning which can range from 0 to 35. We used the composite score and two sub-components: the mental status score and word recall score. Cognition tests are not given to proxy respondents and thus cognition scores are not available for those respondents whose interview was conducted with a proxy. HRS cognition measures do not come from what would traditionally be a Mini-Mental State Examination (MMSE). However, in comparison to a neuropsychological examination, the HRS cognitive battery has been shown to do a reasonable job assessing cognitive impairment. [18]

Health Behaviors—Body mass index (BMI), from self-reported weight and height, is computed using the standard formula [weight(kg)/height(meters)^2] and is categorized to reflect distinctions between underweight (BMI<18.5), normal to overweight (BMI 18.5–29.9), and obese (BMI>30). Smoking status is categorized to distinguish between never, former, and current smokers.

Statistical Analyses

We first examined baseline differences in sociodemographic characteristics between non-survivors and those who became exceptional survivors. We then examined baseline differences in social and health characteristics between non-survivors and exceptional survivors. We also examined changes in these characteristics among exceptional survivors from baseline to follow-up. Baseline differences were assessed using ANOVA for interval variables and chi-square for categorical variables. Repeated-measures ANOVA was used to assess change over time among exceptional survivors. Finally, we examined differences in health status among exceptional survivors upon reaching 97 years of age or older by gender, race/ethnicity, and education. Differences were assessed with t tests from ANOVA for interval variables and multiple logistic regression for categorical variables. Analyses were weighted using baseline sample weights that correct for differential probability of household selection and non-response and that make adjustment to the 1990 sex and age distribution of the U.S. All analyses were performed using Stata software version 11[19]

RESULTS

Table 1 shows demographic and background characteristics of community-dwelling older adults born between 1900 and 1911, presented separately for non-survivors and exceptional survivors. Exceptional survivors were slightly older, on average, at baseline than non-survivors (although the analyses presented in this paper are not adjusted for age, we examined differences between non-survivors and exceptional survivors in age-adjusted models and found the same results as those presented). A higher proportion of women reached exceptional old age and they accounted for nearly 80% of exceptional survivors. Non-survivors and exceptional survivors had similar racial/ethnic composition and similar education levels. Exceptional survivors were more likely to have a parent who lived to be at least 85 years of age and have a father with at least 8 years of schooling.

Differences in social environment and health characteristics are shown in Table 2. Results are presented showing baseline differences between non-survivors and exceptional survivors and differences among exceptional survivors from baseline to follow-up. Compared to non-survivors, there were fewer married/partnered and more widowed exceptional survivors at baseline. There were no differences in the number of living children and siblings, but exceptional survivors were more likely to live alone at baseline. None of the respondents lived in nursing homes at the time of the baseline interview because the sample was originally selected to consist only of community-dwelling adults.

At follow-up, when they reached 97 years of age or older, exceptional survivors had fewer family relationships than they had at baseline; they were less likely to be married or partnered, more likely to be widowed, and had fewer living family members. In addition, exceptional survivors were more likely to live alone at follow-up and nearly one-third lived in a nursing home.

At baseline those who became exceptional survivors had fewer comorbidities and higher self-reported health than non-survivors. Compared to non-survivors, exceptional survivors had less heart disease, stroke, lung disease, diabetes, and cancer. Exceptional survivors also had relatively better mental health, as evidenced by their lower levels of depression and

psychiatric problems, fewer ADL and mobility limitations, and higher cognitive function, including higher scores on both mental status and word recall. BMI did not differ between non-survivors and exceptional survivors at baseline, but non-survivors were more likely to be former or current smokers.

Although exceptional survivors had better health at baseline compared to non-survivors, their overall health declined over time. Their average number of comorbidites nearly doubled from baseline to follow-up and they were more likely to have hypertension, heart disease, stroke, lung disease, diabetes, cancer, and arthritis. They also had lower self-reported health at follow-up. The mental health of exceptional survivors declined over time as well. At follow-up they had higher depression scores and were more likely to have been diagnosed with a psychiatric problem. Exceptional survivors also had a greater burden of functional limitations and worse cognitive function at follow-up. They were less likely to be normal or overweight or current smokers. Although the duration between baseline and follow-up varied from about 5–15 years, we found that accounting for length of follow-up did not produce substantively different results from those presented here.

However, not all individuals who survived to exceptional old age were in poor health. Figure 1 shows the proportion of healthy and high functioning non-survivors and exceptional survivors at baseline and the proportion of exceptional survivors who continued to be in good health at follow-up. At baseline 68% of non-survivors and 81% of exceptional survivors had no ADL limitations. At follow-up 18% of exceptional survivors still reported no ADL limitations. About 26% of non-survivors and 36% of exceptional survivors had no diagnosed comorbidities at baseline. At follow-up, 28% of exceptional survivors had no comorbidities. A similar pattern of differences was observed for depression, with about 27% of exceptional survivors reporting no depression at follow-up. We also assessed the proportion of individuals with high cognitive functioning, defined as having a score of 20 or higher out of a possible 35 points combined on the mental status and word recall tests (one-third of respondents had high cognitive functioning at baseline using this definition). Nearly 42% of exceptional survivors were considered to have high cognitive function at baseline, compared to 32% of non-survivors, but by follow-up the number of exceptional survivors with high cognitive function decreased to 22%.

We next examined differences in the health status of exceptional survivors at follow-up, when they reached 97 years of age or older, by gender, race/ethnicity and education. Table 3 shows differences by gender. Women had about the same number of comborbidites on average compared to men, but women were more likely to have been diagnosed with hypertension and stroke. There were no statistically significant sex differences in self-rated health or mental health, but women reported having more functional limitations than men. The results also suggest that women had slightly lower cognitive function compared to their male counterparts, though the differences were not statistically significant. Compared to men, women were more likely to be underweight or obese and less likely to be former or current smokers. Women were also more likely to live in nursing homes.

Table 4 shows differences in health status by race/ethnicity. Small sample sizes among non-white exceptional survivors make it difficult to detect statistically significant differences in health status. However, the results suggest that Black exceptional survivors had worse health compared to Whites. Compared to Whites, Blacks had worse self-reported health and lower cognitive functioning on both mental status and word recall tests. In addition, Blacks were more likely to be underweight or obese. The health status of the few Hispanics in this sample of exceptional survivors suggests that Hispanics had comparable or better health than long-lived Whites.

We also examined differences in health status among exceptional survivors by respondent education (results not shown, but available from the authors upon request). Higher educated exceptional survivors were less likely to have high blood pressure, more likely to report having been diagnosed with cancer, and had higher total cognition in both mental status and word recall. We found no significant education differences in number of comorbidities, self-rated health, mental health, physical functioning and health behaviors

DISCUSSION

Achieving exceptional longevity is expected to become an increasingly common experience as the current generation of children and young adults reaches old age.[20] Meeting the needs of this growing population requires understanding of the ability of exceptionally long-lived individuals to live independent, disability-free, and healthy lives. The objective of this study was to characterize the social environment and the physical, functional, mental, and cognitive health of exceptional survivors in the U.S., and how the experience of exceptional longevity differs across social groups.

We found that at baseline exceptional survivors had much higher levels of health and functioning compared to those who did not survive to achieve exceptional longevity, but exceptional survivors experienced declines across all dimensions of health and functioning over time. However, consistent with prior studies of exceptional longevity we found that between one-fifth and one-third of exceptionally long-lived individuals remained in good health with high levels of functioning.[4,5,8,9,11] There is some debate about the health conditions that accompany exceptional longevity.[6,8] However, heterogeneity in the population of the exceptionally old indicates that while many individuals reach maximum longevity in a state of poor health and functioning, so me exceptional survivors remain healthy and high-functioning even in very old age.

We further examined how the health and well-being of exceptional survivors varies by social characteristics. We confirmed that long-lived men had higher levels of physical and cognitive functioning compared to long-lived women.[9,11] We also showed in this national sample that Blacks tended to have worse physical health and lower cognitive functioning relative to Whites, results that are consistent with those from prior studies of black-white differences among older adults living in the state of Georgia.[10] Our results also suggested that Hispanics and Whites have similar health characteristics and that Hispanics may be slightly healthier than Whites. To our knowledge there are no studies of exceptionally long-lived adults that include Hispanics and the current study, therefore, offers initial insights into the health and well-being of long-lived Hispanics.

We also found that higher educated exceptional survivors were less likely to have been diagnosed with high blood pressure but more likely to have had cancer. More educated individuals may have social and economic resources that enable them to better manage their cancer, thus increasing their chances of surviving with the disease.[21] Higher educated exceptional survivors also had better cognitive functioning than their less educated counterparts, which is consistent with prior research showing that older adults with more education have higher cognitive function and experience less cognitive decline with age. [10,22,23] Our data indicate that the education advantage in cognition persists even into advanced old age.

This study of exceptional survivors has several strengths. First, we used data from the nationally representative AHEAD, which allowed us to examine social group differences in health status among exceptionally long-lived Americans. The population of exceptionally long-lived elderly is becoming more racially and ethnically diverse,[24] and characterizations

of the health, functioning, and well being of exceptional survivors should consider social variation within this increasingly diverse population. Second, we examined a variety of important health indicators that provide a multidimensional picture of the physical, mental and cognitive health and functioning of exceptionally long-lived individuals in the U.S. Another major strength of this study is the use of the longitudinal nature of AHEAD, which allowed us to examine change in the social and health characteristics of exceptional survivors over time. Moreover, these data provided a unique opportunity to contrast the social and health characteristics of those who do not survive to exceptional old age with those who become exceptional survivors.

There are some study limitations. First, although the use of longitudinal data on exceptional survivors yielded insights in to how their health changed as they reached exceptionally old age, we did not have information about the timing of onset for disease and disability. Information about onset and duration of health problems would better elucidate the long-term health experiences that correlate with achieving exceptional longevity.[9] Second, except for the cognition measures, the health and functioning measures we examined are all from self-report and may be subject to reporting bias. However, the measures we examine have all been validated for use in population surveys and are considered robust indicators of health and functioning in older populations.[17]

Our examination of diseases and chronic conditions is not exhaustive and is missing important age-related conditions such as osteoporosis for women. We do, however, assess conditions that are the leading causes of death in the U.S.[25] Finally, there were only 10 Hispanics in our sample of exceptional survivors which may have limited our ability to detect differences in health status. However, this is the first study of exceptional longevity to include Hispanics, who represent a rapidly growing segment of the U.S. population and constitute an increasingly larger portion of the old age population.[24,26]

Age validation is an important issue in studies of extreme longevity because age misreporting escalates in older cohorts. Age misreporting is more likely to occur among the very old due to lack of birth records documenting year of birth.[27,28] This study only included individuals born after 1900, who are more likely to be able to accurately report their birth year.[29,30] Furthermore, birth year was reported accurately by 92% of exceptional survivors and 86% of non-survivors according to Medicare data, a reliable administrative source of birth year information.[31]

Exceptional survivors in U.S. are a growing portion of the old-age population and are becoming an increasingly heterogeneous group with respect to both social and health characteristics. Future examinations of the factors associated with becoming a healthy exceptional survivor can aid our understanding of how some individuals are able to maintain relatively good health and functioning even at the most advanced old ages. The HRS provides an ideal opportunity to study the health and social characteristics of a national sample of exceptional survivors as they achieve exceptional longevity.

Acknowledgments

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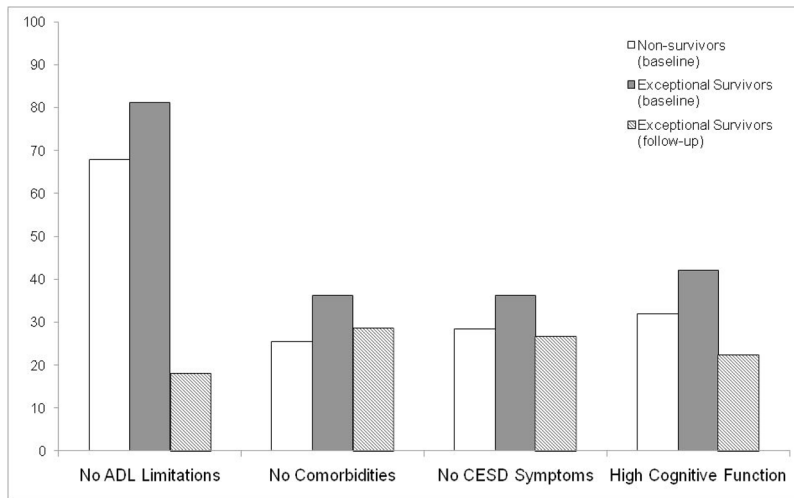
Figure 1.
Healthy and high-functioning individuals among non-survivors at baseline and exceptional survivors at baseline and follow-up.

Percent of non-survivors and exceptional survivors at baseline and exceptional survivors at follow-up who have no limitations in their activities of daily living (ADL), no comorbidities, no depressive (CESD) symptoms, or high cognitive functioning.

Baseline differences between non-survivors and exceptional survivors and differences among exceptional survivors from baseline to follow-up are statistically significant at $p<.05$ (two-tailed test).

Table 1

Demographic and Background Characteristics of U.S. Adults Born 1900–1911 by Survivorship

	Non-survivors		Exceptional Survivors		
	N	Mean/%	N	Mean/%	*p* Value
Age, years		85.3 (2.7)		87.0 (3.5)	*<.000*
Female, %	883	63.5	174	79.5	*<.000*
Race/ethnicity					*.510*
White, %	1150	88.4	174	86.3	
Black, %	190	7.7	38	10.0	
Hispanic, %	65	2.8	10	2.9	
Other, %	19	1.2	3	0.0	
Education, years		10.2 (4.0)		10.7 (3.9)	*.093*
Parent longevity[a]				99.1	
Mother's age at death 85+, %	335 (n=1,422)	23.9	69 (n=225)	31.7	*.013*
Father's age at death 85+, %	228 (n=1,363)	16.7	50 (n=219)	21.9	*.065*
Parent education[a]					
Mother 8+ yrs, %	524 (n=1,182)	46.7	94 (n=200)	47.3	*.876*
Father 8+ yrs, %	518 (n=1,203)	46.1	99 (n=196)	52.6	*.094*
Total	1,424		225		

Notes: Numbers are sample sizes and means (standard deviations) and percentages. P values are obtained using ANOVA for continuous variables and Wald chi-square statistic for categorical variables (two-tailed tests).

[a]Sample sizes in parenthesis denote the number of non-missing cases for each of the parental longevity and education variables.

Table 2

Social Environment Characteristics and Health Status of U.S. Adults Born 1900–1911 at Baseline by Survivorship and at Follow-up for Exceptional Survivors

	Baseline			Follow-up	
	Non-survivors	Exceptional Survivors	*p* Value	Exceptional Survivors	*p* Value
Family Structure					
Marital Status					
Married/partnered	35.9	27.4		7.1	*<000*
Divorced/separated	3.7	4.2	*.028*	4.6	*1.00*
Widowed	56.3	66.4		86.3	*<000*
Never married	4.1	2.0		2.0	*.318*
Number of living children	2.26 (2.08)	2.32 (2.38)	*.684*	2.12 (2.20)	*<000*
Number of living siblings	1.49 (1.72)	1.49 (1.56)	*.971*	0.78 (1.17)	*<000*
Living Arrangements					
Lives alone	45.7	54.8	*.017*	64.8	*.004*
Nursing home	0.0	0.0	*n/a*	37.4	*<000*
Physical Health					
No. Comorbidities (0–6)	1.30 (1.08)	0.85 (0.80)	*<000*	1.55 (1.10)	*<000*
Hypertension, %	45.0	40.4	*.225*	59.6	*<000*
Heart disease, %	36.7	20.6	*<000*	44.2	*<000*
Stroke, %	14.2	7.2	*.008*	21.3	*<000*
Lung disease, %	9.5	3.3	*.012*	7.7	*.003*
Diabetes, %	10.5	4.7	*.016*	9.0	*<000*
Nonskin cancer, %	14.8	9.1	*.040*	15.6	*<000*
Arthritis, %	26.1	26.2	*.960*	74.3	*<000*
Self-rated health (1–5)	2.72 (1.20)	3.18 (1.10)	*<000*	2.75 (1.07)	*<000*
Mental Health					
CESD (0–8)	2.03 (2.05)	1.55 (1.88)	*.002*	1.84 (1.82)	*.006*
Psychiatric problems, %	5.8	1.8	*.010*	13.9	*<000*
Functional Limitations					
ADL (0–6)	0.69 (1.29)	0.37 (0.97)	*<000*	2.39 (2.20)	*<000*
Mobility (0–3)	1.19 (1.11)	0.82 (1.00)	*<000*	1.68 (1.15)	*<000*

	Baseline			Follow-up		
	Non-survivors	Exceptional Survivors	*p* Value	Exceptional Survivors	*p* Value	
Cognitive Function						
Composite Score (0–35)	16.63 (5.58)	18.16 (5.45)	*<.000*	14.95 (5.47)	*<.000*	
Mental status (0–15)	11.09 (3.14)	11.68 (2.89)	*.014*	10.19 (3.37)	*<.000*	
Word recall (0–20)	5.54 (3.33)	6.48 (3.48)	*<.000*	4.75 (2.80)	*<.000*	
Health Behaviors						
BMI Category						
Underweight	7.2	3.6		16.5		
Normal-Overweight	84.8	89.7	*.106*	77.8	*<.000*	
Obese	8.0	6.8		5.7		
Smoking status						
Never smoked	56.3	72.0		72.0		
Former smoker	38.4	26.2	*<.000*	28.1	*<.045*	
Current smoker	5.1	1.7		0.2		
Proxy Respondent	16.8	11.4	*.062*	44.6	*<.000*	

Notes: Numbers are means (standard deviations) and percentages. P values are obtained using ANOVA for continuous variables and Wald chi-square statistic for categorical variables.

[a] p Value for difference between non-survivors and exceptional survivors at baseline interview.

[b] p Value for difference between baseline and follow-up values among exceptional survivors.

ADL = Activities of Daily Living; BMI = Body Mass Index (BMI<18.5 is underweight, BMI 18.5–29 is normal to overweight, and BMI 30 and higher is obese); n/a = not applicable (all respondents were living in the community at baseline).

Table 3

Health Status of U.S. Exceptional Survivors by Gender

	Women		Men		
	N	Mean	N	Mean	*p Value*
Physical Health					
No. Comorbidities (0–6)	174	1.58	51	1.44	*.416*
Hypertension, %	174	61.2	51	46.9	*.081*
Heart disease, %	173	44.7	51	43.3	*.864*
Stroke, %	172	24.5	51	9.1	*.023*
Lung disease, %	173	7.4	51	8.3	*.838*
Diabetes, %	174	7.4	51	14.5	*.130*
Nonskin cancer, %	174	13.9	51	21.6	*.202*
Arthritis, %	174	76.0	51	69.4	*.365*
Self-rated health (1–5)	174	2.75	51	2.80	*.785*
Mental Health					
CESD (0–8)	92	1.89	34	1.73	*.700*
Psychiatric problems, %	172	14.94	51	11.12	*.509*
Functional Limitations					
ADL (0–6)	174	2.60	51	1.56	*.005*
Mobility (0–3)	174	1.76	51	1.38	*.042*
Cognitive Function					
Composite Score (0–35)	91	14.59	34	16.03	*.189*
Mental status (0–15)	91	9.91	34	11.10	*.081*
Word recall (0–20)	92	4.68	34	4.94	*.651*
Health Behaviors					
BMI Category					
Underweight	167	19.05	50	4.56	
Normal-Overweight	167	74.77	50	91.65	*0.007*
Obese	167	6.17	50	3.79	
Smoking status					
Never smoked	174	81.66	51	34.50	
Former smoker	174	18.34	51	64.39	*<.000*

	Women		Men		
	N	Mean	N	Mean	p Value
Current smoker	174	0.00	51	1.11	
Nursing home resident	174	41.65	51	16.93	.002
Proxy Respondent	174	47.56	51	30.94	.043

Notes: Numbers are means and percentages. P values for gender differences are obtained using ANOVA for continuous variables and Wald chi-square statistic for categorical variables.

ADL = Activities of Daily Living; BMI = Body Mass Index (BMI<18.5 is underweight, BMI 18.5–29 is normal to overweight, and BMI 30 and higher is obese).

Table 4

Health Status and Social Characteristics of U.S. Exceptional Survivors by Race/Ethnicity

	N	Mean	Black N	Mean	B-W Diff p Value	Hispanic N	Mean	H-W Diff p Value
Physical Health								
No. Comorbidities (0–6)	174	1.57	38	1.65	.747	10	0.86	.110
Hypertension, %	174	57.0	38	70.8	.211	10	49.2	.694
Heart disease, %	173	44.8	38	51.6	.541	10	11.8	.100
Stroke, %	173	22.2	37	17.8	.632	10	12.5	.560
Lung disease, %	173	7.5	38	7.3	.968	10	12.5	.642
Diabetes, %	174	9.0	38	10.6	.808	10	0.0	.434
Nonskin cancer, %	174	17.1	38	7.3	.230	10	0.0	.243
Arthritis, %	174	73.9	38	85.7	.225	10	60.2	.436
Self-rated health (1–5)	174	2.84	38	2.19	.006	10	2.70	.729
Mental Health								
CESD (0–8)	98	1.78	21	2.28	.360	4	1.50	.808
Psychiatric problems, %	172	13.6	38	18.1	.565	10	9.2	.749
Functional Limitations								
ADL (0–6)	174	2.39	38	2.36	.952	10	2.36	.964
Mobility (0–3)	174	1.67	38	1.82	.548	10	1.49	.692
Cognitive Function								
Composite Score (0–35)	97	15.52	21	10.54	.002	4	12.88	.424
Mental status (0–15)	97	10.53	21	7.75	.006	4	9.63	.665
Word recall (0–20)	98	4.99	21	2.79	.008	4	3.24	.308
Health Behaviors								
BMI Category								
Underweight	170	15.3	34	26.4		10	10.1	
Normal-Overweight	170	81.0	34	49.7	<.000	10	89.9	<.000
Obese	170	3.7	34	23.9		10	0.0	
Smoking status								
Never smoked	174	73.0	38	66.5	<.000	10	63.4	<.000
Former smoker	174	27.0	38	33.5		10	28.7	

| | N | Mean | Black | | B-W Diff | Hispanic | | H-W Diff |
			N	Mean	p Value	N	Mean	p Value
Current smoker	174	0.0	38	0.0		10	8.0	
Nursing home resident	174	39.4	38	23.5	.139	10	9.2	0.119
Proxy Respondent	174	44.0	38	45.1	0.921	10	59.6	0.438

Notes: Numbers are means and percentages. P values for black-white (B-W) and Hispanic-white (H-W) differences are obtained using ANOVA for continuous variables and Wald chi-square statistic for categorical variables.

ADL = Activities of Daily Living; BMI = Body Mass Index (BMI<18.5 is underweight, BMI 18.5–29 is normal to overweight, and BMI 30 and higher is obese).