Published in final edited form as:
Am J Psychiatry. 2013 February 1; 170(2): 188–196. doi:10.1176/appi.ajp.2012.12030386.

Older Age is Associated with More Successful Aging: Role of Resilience and Depression

Dilip V. Jeste, M.D.[1,2,3,*], **Gauri N. Savla, Ph.D.**[1,2,*], **Wesley K. Thompson, Ph.D.**[1,2], **Ipsit V. Vahia, M.D.**[1,2,4], **Danielle K. Glorioso, MSW**[1,2], **A'verria Sirkin Martin, Ph.D.**[1,2], **Barton W. Palmer, Ph.D.**[1,2,4], **David Rock, B.A.**[1,2], **Shahrokh Golshan, Ph.D.**[1,2], **Helena C. Kraemer, Ph.D.**[5], and **Colin A. Depp, Ph.D.**[1,2,4]

[1]Stein Institute for Research on Aging, University of California, San Diego (UCSD)

[2]Department of Psychiatry, UCSD

[3]Department of Neurosciences, UCSD

[4]San Diego Veterans Affairs Healthcare System

[5]Stanford University (Emerita), Department of Psychiatry, University of Pittsburgh

Abstract

Background—There is growing public health interest in understanding and promoting successful aging. While there has been some exciting empirical work on objective measures of physical health, relatively little published research combines physical, cognitive, and psychological assessments in large, randomly selected, community-based samples to assess self-rated successful aging (SRSA).

Methods—In this Successful AGing Evaluation (SAGE) study, we used a structured multi-cohort design to assess successful aging in 1,006 community-dwelling adults in San Diego County, aged 50–99 years, with over-sampling of people over 80. A modified version of random digit dialing was used to recruit subjects. Evaluations included a 25-minute phone interview followed by a comprehensive mail-in survey of physical, cognitive, and psychological domains, including SRSA (scaled from 1 [lowest] to 10 [highest]) and positive psychological traits.

Results—In our sample with mean age of 77.3 years, the mean SRSA score was 8.2, and older age was associated with higher SRSA ($R^2 = 0.027$), despite worsening physical and cognitive functioning. The best multiple regression model achieved, using all the potential correlates, accounted for 30% of variance in SRSA, and included resilience, depression, physical functioning, and age (entering the regression model in that order).

Conclusions—Resilience and depression had a significant association with SRSA with effect sizes comparable to that for physical health. While no causality can be inferred from cross-sectional data, increasing resilience and reducing depression might have as strong effects on successful aging as reducing physical disability, suggesting an important role for psychiatry in promoting successful aging.

Keywords

Aging; Resilience; Optimism; Depression; Cognition; Disability

Address all correspondence to: Dilip V. Jeste, M.D., Stein Institute for Research on Aging, Department of Psychiatry (0664), University of California, San Diego, 9500 Gilman Drive (0664), La Jolla, CA 92093-0664, djeste@ucsd.edu.
*Co-first authors

Disclosures of Conflict of Interest: None of the authors has any disclosures of interest to report.

INTRODUCTION

Presently there are about 40 million Americans over the age of 65, and by 2030 that number is expected to grow to 72 million (http://www.aoa.gov/AoARoot/Aging_Statistics/). The fastest growing segment of the population is that of people over 80 (http://transgenerational.org/aging/demographics.htm). Traditionally, aging has been viewed as a period of progressive decline in physical, cognitive, and psychosocial functioning, and consequently, a growing healthcare burden on the society. Many believe that aging is the top public health problem we face today (1), and the coming wave of aging baby boomers has been dubbed the "silver tsunami". This negative view of old age has been contrasted by some exciting empirical research on older adults who continue to function well and are aging "successfully". However, research advances in successful aging have been hampered by inconsistencies in operationalizing this construct - we found 29 different definitions of successful aging in 28 published studies on this topic (2). Many of these investigations have focused primarily on physical health. The most widely used definition of successful aging, employed in the pioneering MacArthur Studies (3), is based on objective measures used by researchers, to assess freedom from chronic disease and disability, along with high physical and cognitive functioning and social engagement. These studies are important because healthcare utilization and costs for older adults might be determined by such objective measures of successful aging. Moreover, this type of work may yield valuable information on modifiable factors such as diet and exercise, to prevent or reduce physical disability.

At the same time, there is a need for a complementary line of research on subjectively determined successful aging – i.e., older adults' Self-Rated Successful Aging (SRSA), which also enables one to assess psychological functioning and overall health from a holistic perspective. This type of investigation would be consistent with the growing interest in examining patient-reported outcomes in physical and mental health, with the recognition that the most relevant definitions of intervention outcomes often come from the perspectives of the subjects themselves (4). The affected individual may be best positioned to know the subtleties of the range of relevant factors in her/his own life, to assign appropriate weights to these factors in view of personal goals and preferences, and to contextualize those variables within the overall trajectory of past and anticipated future life.

A few studies, which included subjective perceptions on aging, reported that at least some older adults felt they were aging successfully despite having substantive physical challenges (5,6). Self-assessments of successful aging have typically employed single-item SRSA - e.g., questions such as "How do you rate yourself on successful aging on a scale from 1 to 10?" or Likert-scale ratings of agreement with the statement "I am aging well" (7,8). Qualitative studies of successful aging (9,10) have found that older adults center their definitions of SRSA on attitudinal factors rather than merely physical health status.

The partial independence of SRSA from physical functioning suggests that successful aging should be conceptualized as a multidimensional construct. Pruchno et al. (5) found empirical support for a two-factor model of successful aging consisting of subjective and objective components. Doyle et al. (11) reported a multifactorial model of successful aging with interacting components including physical function and risk, activity, social engagement, and psychological traits such as confidence. Similarly, employing factor analysis in a convenience sample of post-menopausal women, our research group noted evidence supporting a model in which positive psychological traits seemed to interact with each individual's evaluation of own physical and mental (but not cognitive) functioning, with the ultimate downstream outcome of importance to the individual being SRSA (12). However, such models have not been examined in large, randomly selected, community samples with

over-representation of old-old people, using multi-pronged assessments. Greater understanding of significant associations of successful aging is likely to help identify potentially modifiable characteristics in the individual's behavior or environment.

The goal of the present investigation was to study SRSA along with several specific domains of aging and positive psychological traits in randomly selected, community-based, middle-aged and older adults with oversampling of those over age 80. Given the normative age-related declines in physical and cognitive functioning, we hypothesized that older age would be associated with worse physical and cognitive functioning and lower SRSA scores. Based on the literature (3,5,7,8,11,12), we also hypothesized that SRSA would be positively related to physical, cognitive, and mental functioning, and to positive psychological traits (13). Finally, we hypothesized that, in a multivariate analysis, physical and mental (but not cognitive) functioning and positive psychological traits would predict SRSA scores, consistent with our previous investigation (12).

METHODS

Study Design and Recruitment

The SAGE (Successful AGing Evaluation) study used a structured multi-cohort design to recruit 1,300 community-dwelling residents of San Diego County, aged 50–99 years, with an over-sampling of people over age 80. Inclusion criteria were: (1) age 50–99 years, (2) having a (landline) telephone at home, (3) physical and mental ability to participate in a telephone interview and to complete a paper and pencil mail survey, (4) informed consent for study participation, and (5) English fluency. Exclusion criteria were: (1) residence in a nursing home, or requiring daily skilled nursing care, (2) self-reported prior diagnosis of dementia, and (3) terminal illness, or requiring hospice care. The study has been approved by the UCSD Human Research Protections Program.

We planned to enroll 200 participants each in the 6^{th} and 7^{th} decades, 250 in the 8^{th} decade, and 325 in the 9^{th} and 10^{th} decades, with approximately equal numbers of men and women in each decade, and ethnic distribution to match that in the San Diego County. To identify the subjects, we contracted with California Survey Research Services (CSRS) (http://www.calsurvey.com/), which had lists of age-targeted samples in the county. These included 15,896 home phone numbers along with the corresponding residents' names and addresses. Participants were recruited using list-assisted random digit dialing procedures and telephone calling (5,14) (Figure 1). We chose no more than one participant from any household. Members of our research team listened in to a subset of the phone calls to ensure fidelity to the specified procedures. The demographics of the targeted sample (age over 50) made a loss of subjects who did not have a land line or relied on cell phones very small (15). The CSRS found difficulties in recruiting the targeted number of people in their 90s who met all the inclusion/exclusion criteria. To make up for a smaller-than-desired number of people in their 90s (238 instead of 325), we recruited additional subjects in their 80s (411 instead of 325).

Telephone Interview

During a 25-minute structured phone interview, the interviewers sought verbal consent from the potential participants, screened them to establish eligibility, and asked questions about participants' demographics, general health, depression and anxiety (with the Personal Health Questionnaire or PHQ – 2 item version), and cognitive function (12-item modified version of the Telephone Interview for Cognitive Status or TICS-m) (16). The TICS-m tests for deficits in orientation, memory, simple attention, working memory, and verbal episodic memory. Several studies have demonstrated that the TICS-m is an effective screening

instrument for cognitive impairment comparable to in-person neuropsychological screening (16,17).

We met our goal of enrolling 1,300 participants who completed the phone interview; 1,006 of them also completed the mail-in survey (described below). These 1,006 subjects were comparable in gender to but slightly older than the 294 participants who completed only the phone interview: mean 77.3 (SD=12.2) versus 75.1 (13.6) years; and were more likely to be Caucasian: 81.0% versus 72.8%. Comparing across age decades, survey completion rates tended to be lowest among 50–59 year-old persons (67%) and highest among 80–89 year-old individuals (84%). This may reflect a tendency for people in their 50s to be busier as most of them were still active in their work life.

A demographic comparison of the 1,006 SAGE respondents with census data on all adults aged ≥18 living in the San Diego County (http://quickfacts.census.gov), revealed a higher proportion of Caucasians (81% versus 64%), and a lower proportion of those who had a Bachelor's degree or higher education (28% versus 34%) in the SAGE Sample than in the County adult population. These differences likely relate to the fact that the SAGE sample was restricted to people >50 years, who were fluent in English and had a home telephone.

Mail-in SAGE Survey

The survey questionnaire included detailed demographics and a number of rating scales and other measures. Below we list the items that are relevant to our hypotheses stated above.

Health-Related Quality of Life and Functioning—Medical Outcomes Study 36-item Short Form (MOS SF-36; Cronbach's alpha = 0.90) (18) was used to measure current physical and mental health functioning.

Subjective Cognitive Functioning—The Cognitive Failures Questionnaire (CFQ; Cronbach's alpha = 0.96) (19) sought to evaluate subjective/self-perceived cognitive deficits.

Depression—Severity of depressive symptoms was evaluated with the Patient Health Questionnaire 9-Item (PHQ-9; Cronbach's alpha = 0.86–0.89) Version (20).

Positive Psychological Constructs—These included the Life Orientation Test for optimism – Revised (LOT-R; Cronbach's alpha = 0.78) (21) and 10-item version of the Connor-Davidson Resilience Scale (CD-RISC; Cronbach's alpha = 0.85) (22).

Self-Rated Successful Aging (SRSA)—Participants were asked to rate to what extent they thought they had aged successfully, on a 10-point Likert-scale, ranging from 1 (least successful) to 10 (most successful) (7). Subjects were instructed to use their own conceptualization of successful aging rather than any investigator-defined construct.

Statistical Analyses

Our primary analyses included the 1,006 participants who completed both the phone interview and the survey. We performed bivariate correlations between chronological age and and physical, cognitive, and mental functioning, severity of depression, levels of optimism and resilience, and SRSA. Next we did bivariate correlational analyses using SRSA as the dependent variable, and with other subject characteristics as independent variables, covarying for age. We then performed multiple regression analyses using all the potential correlates to identify the best multivariable model of SRSA. Missing data were imputed, employing the method of chained equations (23). There were no missing data for

age, gender, and TICS-m total score. The measures of marital status, education, LOT-R total score, CDRS-10 total score, and SRSA each had < 5% missing data. PHQ-9 severity score, SF-36 Physical Component, and SF-36 Mental Component had 5% to 6% missing data. At 14.41%, CFQ-25 total had the highest level of missing data.

We performed a LASSO variable selection procedure (24). In the multiple regression analysis, regression coefficients were made commensurate by standardizing each variable (subtracting the mean and dividing by the standard deviation). Independent variables were ranked by the order in which they entered the LASSO regression. The LASSO is an L1-norm penalized regression method; higher penalties include fewer variables. The penalty was chosen to minimize the Mallow's Cp criterion (25) implemented using least-angles regression package in R (26). It may be noted that the LASSO does not attempt to maximize R-squared, so the reported R-squared is a valid assessment of the variance explained by the resulting model. Furthermore, we cross-checked these results using a random forests regression procedure (27). Random forests produces an out-of-bag estimate of R-squared that is robust to generalization accuracy. We also explored placing all pairwise interactions in the regression search algorithm. To control for Type I errors due to multiple comparisons, we used a conservative alpha level of .005 (two-tailed) to define significance.

RESULTS

Table 1 summarizes sociodemographic and other characteristics related to successful aging for each of the five age decades studied. In the overall sample with a mean age of 77.3 (SD=12.2) years, the mean SRSA score was 8.2 (SD=1.5). Older age was significantly associated with worse physical ($r(945) = -0.354$, $p = .000$), objective cognitive ($r(1004) = -0.458$, $p = .000$), and subjective cognitive functioning ($r(859) = 0.116$, $p = .001$), but better mental functioning ($r(945) = 0.115$, $p = .000$). Age was not related to levels of depression, optimism, or resilience. The bivariate associations of each potential correlate with SRSA score are listed in Table 2. Contrary to our hypothesis, older age was associated with higher SRSA ($R^2=0.027$; $p < .001$). After adjusting for age, higher SRSA was associated with higher education, better objective and subjective cognitive functioning (TICS-m and CFQ-25, respectively), better self-perceived physical and mental health (SF-36 Physical and Mental Component Scores, respectively), less depression (PHQ-9), and higher optimism (LOT-R) and resilience (CDRS-10).

The best multiple regression model achieved with all the variables as potential correlates of SRSA is shown in Table 3. This model accounted for 30% of the variance in SRSA. We cross-checked these results using a random forests regression procedure (27). On a model trained with the same variables obtained from the LASSO, random forests produced an out-of-bag estimate of R-squared of 27%, indicating that the estimated R-squared was not biased upward from over-fitting the data. Our model included resilience (CDRS-10), depression (PHQ-9), physical health (SF-36 Physical Health Component), and age, entering the regression model in that order. Notably, cognitive impairment was not significant in the multiple regression analysis. Thus, while we did not find interactive effects, we did find independent additive effects in multiple regression analyses. These effects are displayed in Figure 2, which illustrates SRSA scores (mean and SE) for pairs of variables by tertiles. These plots demonstrate relative effect sizes of different SRSA correlates when controlling for other variables. Thus, Figure 2a shows that people in the bottom tertile of physical functioning who had high resilience (- i.e., were in the top tertile of resilience) had SRSA scores similar to those of physically healthy people with low resilience. Likewise, Figure 2b shows that people in the bottom tertile of physical functioning but with no or minimal depression had SRSA scores comparable to those of physically healthy people with moderate to severe depression.

DISCUSSION

Contrary to our hypothesis, older age was associated with higher SRSA, despite worse physical and cognitive functioning. The best multivariate model of SRSA included greater resilience, lower depression, better physical health, and older age. Even though in bivariate analyses, SRSA was associated with physical health and cognitive function, which typically decline with age, older age was associated with higher SRSA. Resilience and depression seemed to have effects on SRSA with magnitudes that seemed at least comparable to that of physical health (Figure 2).

The SAGE investigation builds on the foundations of prior research on psychosocial aspects of successful aging (5,14,28,29). To our knowledge, this is the first study of SRSA to employ a large population-based sample of adults over 50, recruited with a structured multi-cohort design using list-assisted random digit dialing procedures. Thus, except for the planned oversampling of adults over age 80, the present sample may be more representative of the broader community-dwelling population of older people than similarly aged samples of convenience. Also, in addition to assessing SRSA, participants were comprehensively characterized on self-reported physical and mental health and positive psychological traits, along with subjective and objective measures of cognitive function.

Our study has several limitations, especially a cross-sectional design and use of self-report-based assessments for most measures. Because of the cross-sectional nature of the data, a “potential survivor bias”, and more specifically a “community survival effect”, may confound interpretation of age effects. Since we excluded people in nursing homes or other institutions, it is possible that the positive association between higher SRSA and older age may be due to attrition of low-functioning (and low-SRSA) older adults due to death or institutionalization. It should be noted, however, that in our sample, older age was associated with worse physical and cognitive functioning – i.e., our elderly group was not comprised of exceptionally healthy seniors. Also, the survey response rates in people who completed our initial phone interview were higher among 80–89 year-old individuals than in 50–59 year-old persons. Therefore, a survivor effect is unlikely to be the primary explanation for our findings. At the same time, the cross-sectional design prevents one from making causal inferences based on observed associations – e.g., whether higher resilience leads to higher SRSA or *vice versa*. Longitudinal follow-up may help specify causal relationships.

Another study limitation is that the data were collected through self-report measures (except for the TICS-m). It may be argued, for example, that optimism and SRSA are both self-rated and highly interrelated. However, optimism was not significant in the multiple regression model of SRSA. With self-reports, it is important to consider the likely influence of a tendency to give socially desirable responses on validity of results. However, in an earlier study of non-randomly selected 1,860 community-dwelling older women, using the Marlowe–Crowne Social Desirability Scale, we did not find evidence for a social desirability bias in most of the self-report measures of successful aging including SRSA and physical and cognitive function (30).

Finally, the relatively weak association between SRSA and objective cognitive functioning might be partially attributable to the use of TICS-m, which is primarily a dementia screening measure. With a comprehensive neurocognitive battery, a stronger association between SRSA and objective cognitive functioning might have emerged.

Notwithstanding these limitations, our findings could be relevant to clinicians and researchers in at least three ways: modification of attitude toward aging, use of SRSA as a meaningful outcome measure, and most importantly, the potential for enhancing SRSA by fostering resilience and treating or preventing depression. First, in terms of attitude toward

aging, most of the public discourse on population aging involves dire predictions and negative stereotypes. Yet, the subjective experience of older people in our study seemed to improve with age even in the midst of physical and cognitive declines. The apparent trajectory of SRSA in middle and old age parallels published findings on well-being. Negative emotions have been reported to display a curvilinear relationship through the life course, with mental distress reaching a maximum in middle age, and then decreasing progressively into later life, with an inverse change in positive emotions (31). This finding of a counterintuitive increase in well-being with aging persists after accounting for confounding influences of cohort, income, education, and marriage. Possible explanations for this paradoxical result include acceptance of physical limitations (32,33), contentedness with overall accomplishments in life (34), a more realistic appraisal of one's own strengths and limitations (31), reduced preoccupation with social comparison (peer pressure), and greater emotional stability (14,35). Clinicians can help reduce societal ageism through their optimistic approach to the care of seniors. Further research on how older adults develop and maintain positive self-appraisals in the presence of biological declines may also inform similar adaptations across the lifespan.

Secondly, the present study illustrates the potential value of a subjective measure of overall functioning in later life - i.e., SRSA. Subjective outcomes are gaining increasing credence in intervention and services research (4). At individual level, self-rated health has been found to be a significant predictor of morbidity and mortality in old age (36). At population level, a recent study (37) correlated data on self-rated quality of well-being in large samples of US citizens living in different parts of the country with objective indicators of quality of life of people in the same region, such as cost of living, environmental "greenness", air quality, and local taxes. The authors found a strong region-by-region match between subjective and objective well-being, attesting to the validity of self-reports of personal constructs. The subjective appraisal of overall aging by older adults themselves may be an important outcome in clinical practice and intervention research. To be useful as a patient-centered outcome, future longitudinal research would need to determine SRSA's responsiveness to change and applicability across cultures and population subgroups including among people with mental illnesses.

Finally, an important implication of the present study relates to the finding that resilience and depression had a significant association with SRSA with an effect size that was comparable to that for physical health. While noting that no causality can be inferred from these cross-sectional data, it is possible to speculate that increasing resilience and reducing depression could potentially have as strong effects on successful aging as reducing physical disability. This finding points to an important role for psychiatry in enhancing successful aging in older adults, even in those with physical disabilities (38). Resilience is often described in response to acute stressors; yet, it may be an important aspect of maintaining well-being in the context of losses in functioning with aging (39). To date there has been only limited research focused on enhancing positive psychological traits such as resilience (40,41). We found a significant association between depression and SRSA despite the relatively low levels of depression in our sample, i.e. only a few of the respondents likely would have met DSM-IV-TR criteria for major depression. Prior literature suggests that older adults are more likely to present with subsyndromal depression than with a major depressive disorder (42). The fact that even low levels of depressive symptoms appeared to influence SRSA suggests potential value of interventions to treat or prevent subsyndromal depression to enhance successful aging. Greater understanding of the psychosocial and neurobiological underpinnings of the interaction between resilience and depression in older age (43) may identify routes to promote successful aging.

In conclusion, the present results have important implications for psychiatry and aging. Perfect physical health is neither necessary nor sufficient for successful aging as defined by the older adults themselves. Their holistic self-appraisal involves strong emphasis on psychological factors such as resilience, optimism, and well-being, along with an absence of depression. Combined with evidence showing that traits such as resilience and optimism are associated with greater longevity and reduced physical morbidity (11), with the reverse being true for depression, psychiatry should take a center stage within medicine and healthcare. Paralleling the recent positive psychology movement (44), time may be ripe for a "positive psychiatry" movement (38).

Acknowledgments

This work was supported, in part, by National Institutes of Health grants T32 MH019934, P30MH066248 and NCRS UL1RR031980, by the John A. Hartford Foundation, and by the Sam and Rose Stein Institute for Research on Aging. We also wish to acknowledge the special help with data management provided by Rebecca Daly, and administrative assistance by Sandra Dorsey.

References

1. Cutler RG, Mattson MP. The adversities of aging. Ageing Res Rev. 2006; 5:221–238. [PubMed: 16950665]
2. Depp CA, Jeste DV. Definitions and predictors of successful aging: A comprehensive review of larger quantitative studies. Am J Geriatr Psychiatry. 2006; 14:6–20. [PubMed: 16407577]
3. Berkman LF, Seeman TE, Albert M, Blazer D, Kahn R, Mohs R, Finch C, Schneider E, Cotman C, McClearn G, Nesselroade J, Featherman D, Garmezy N, McKhann G, Brim G, Prager D, Rowe J. High, usual and impaired functioning in community-dwelling older men and women: Findings from the MacArthur Foundation Research Network on Successful Aging. J Clin Epidemiol. 1993; 46:1129–1140. [PubMed: 8410098]
4. Riley WT, Pilkonis P, Cella D. Application of the National Institutes of Health Patient-reported Outcome Measurement Information System (PROMIS) to mental health research. J Ment Health Policy Econ. 2011; 14:201–208. [PubMed: 22345362]
5. Pruchno RA, Wilson-Genderson M, Cartwright F. A two-factor model of successful aging. J Gerontol B Psychol Sci Soc Sci. 2010; 65:671–679. [PubMed: 20624759]
6. Inui TS. The need for an integrated biopsychosocial approach to research on successful aging. Ann Intern Med. 2003; 139:391–394. [PubMed: 12965963]
7. Montross LP, Depp C, Daly J, Reichstadt J, Golshan S, Moore D, Sitzer D, Jeste DV. Correlates of self-rated successful aging among community-dwelling older adults. Am J Geriatr Psychiatry. 2006; 14:43–51. [PubMed: 16407581]
8. Strawbridge WJ, Wallhagen MI, Cohen RD. Successful aging and well-being: Self-rated compared with Rowe and Kahn. Gerontologist. 2002; 42:727–733. [PubMed: 12451153]
9. Reichstadt J, Depp CA, Palinkas LA, Folsom DP, Jeste DV. Building blocks of successful aging: A focus group study of older adults' perceived contributors to successful aging. Am J Geriatr Psychiatry. 2007; 15:194–201. [PubMed: 17322132]
10. Laditka SB, Corwin SJ, Laditka J, Liu r, Tseng W, Wu B, Beard RL, Sharkey JR, Ivey SL. Attitudes about aging well among a diverse group of older Americans: Implications for promoting cognitive health. The Gerontologist. 2009; 49:S30–S39. [PubMed: 19525215]
11. Doyle YG, McKee M, Sherriff M. A model of successful ageing in British populations. Eur J Public Health. 2012; 22:71–76. [PubMed: 20880990]
12. Vahia IV, Thompson WK, Depp CA, Allison M, Jeste DV. Developing a dimensional model for successful cognitive and emotional aging. Int Psychogeriatr. 2012; 24:515–523.
13. Lamond AJ, Depp CA, Allison M, Langer R, Reichstadt J, Moore DJ, Golshan S, Ganiats TG, Jeste DV. Measurement and predictors of resilience among community-dwelling older women. J Psychiatr Res. 2009; 43:148–154. [PubMed: 18455190]

14. Carstensen LL, Fung HH, Charles ST. Socioemotional selectivity theory and the regulation of emotion in the second half of life. Motivation and Emotio. 2003; 27:103–123.
15. Blumberg SJ, Luke JV. Coverage bias in traditional telephone surveys of low-income and young adults. Public Opin Q. 2007; 71:749.
16. de Jager CA, Budge MM, Clarke R. Utility of TICS-M for the assessment of cognitive function in older adults. Int J Geriatr Psychiatry. 2003; 18:318–324. [PubMed: 12673608]
17. Cook SE, Marsiske M, McCoy KJ. The use of the Modified Telephone Interview for Cognitive Status (TICS-M) in the detection of amnestic mild cognitive impairment. J Geriatr Psychiatry Neurol. 2009; 22:103–109. [PubMed: 19417219]
18. Ware JE, Sherbourne CD. The MOS 36-item short-form health survey (SF-36). I. Conceptual framework and item selection. Med Care. 1992; 30:473–483. [PubMed: 1593914]
19. Broadbent DE, Cooper PF, FitzGerald P, Parkes KR. The Cognitive Failures Questionnaire (CFQ) and its correlates. Br J Clin Psychol. 1982; 21 (Pt 1):1–16. [PubMed: 7126941]
20. Kroenke K, Spitzer RL, Williams JB. The PHQ-9: Validity of a brief depression severity measure. J Gen Intern Med. 2001; 16:606–613. [PubMed: 11556941]
21. Scheier MF, Carver CS, Bridges MW. Distinguishing optimism from neuroticism (and trait anxiety, self-mastery, and self-esteem): A reevaluation of the Life Orientation Test. J Pers Soc Psychol. 1994; 67:1063–1078. [PubMed: 7815302]
22. Campbell-Sills L, Stein MB. Psychometric analysis and refinement of the connor-davidson resilience scale (CD-RISC): Validation of a 10-item measure of resilience. Journal of Traumatic Stress. 2007; 20:1019–1028. [PubMed: 18157881]
23. van Buuren S. Multiple imputation of discrete and continuous data by fully conditional specification. Stat Methods Med Res. 2007; 16:219–242. [PubMed: 17621469]
24. Tibshirani R. Regression shrinkage and selection via the LASSO. Journal of the Royal Statistical Society. 1996; 58:267–288.
25. Mallows CL. Some comments on Cp. Technometrics. 1973; 15:661–665.
26. Hastie, T.; Tibshirani, R.; Friedman, J. Elements of Statistical Learning. New York: Springer; 2002.
27. Breiman L. Random Forests. Machine Learning. 2001; 45:5–32.
28. Vaillant GE, Mukamal K. Successful aging. Am J Psychiatry. 2001; 158:839–847. [PubMed: 11384887]
29. Blazer DG. Successful aging. Am J Geriatr Psychiatry. 2006; 14:2–5. [PubMed: 16407576]
30. Dawes SE, Palmer BW, Allison MA, Ganiats TG, Jeste DV. Social desirability does not confound reports of wellbeing or of socio-demographic attributes by older women. Ageing and Society. 2011; 31:438–454.
31. Blanchflower DG, Oswald AJ. Is well-being U-shaped over the life cycle? Social Science & Medicine. 2008; 66:1733–1749. [PubMed: 18316146]
32. Giblin JC. Successful aging: Choosing wisdom over despair. J Psychosoc Nurs Ment Health Serv. 2011; 49:23–26. [PubMed: 21323262]
33. Hsu HC, Tung HJ. What makes you good and happy? Effects of internal and external resources to adaptation and psychological well-being for the disabled elderly in Taiwan. Aging Ment Health. 2010; 14:851–860. [PubMed: 20665281]
34. Fisher BJ. Successful aging, life satisfaction, and generativity in later life. Int'l J Aging and Human Development. 1995; 41:239–250.
35. Scheibe S, Carstensen LL. Emotional aging: Recent findings and future trends. Journals of Gerontology Series B: Psychological Sciences and Social Sciences. 2010; 65B:135–144.
36. DeSalvo KB, Bloser N, Reynolds K, He J, Muntner P. Mortality prediction with a single general self-rated health question. A meta-analysis. J Gen Intern Med. 2006; 21:267–275. [PubMed: 16336622]
37. Oswald AJ, Wu S. Objective Confirmation of Subjective Measures of Human Well-Being: Evidence from the U.S. A Science. 2010; 327:576–579.
38. Jeste DV, Palmer BW. A call for a new positive psychiatry of ageing. Br J Psychiatry. 2012 in press.

39. Baltes, PB.; Baltes, MM. Psychological perspectives on successful aging: The model of selective optimization with compensation in Successful Aging: Perspectives From The Behavioral Sciences. Baltes, PB.; Baltes, MM., editors. New York: Cambridge University Press; 1990.

40. Fava GA, Tomba E. Increasing psychological well-being and resilience by psychotherapeutic methods. J Pers. 2009; 77:1903–1934. [PubMed: 19807860]

41. Padesky CA, Mooney KA. Strengths-Based Cognitive-Behavioural Therapy: A Four-Step Model to Build Resilience. Clinical Psychology & Psychotherapy. 2012 Jun 1. [Epub ahead of print].

42. Jeste DV, Alexopoulos GS, Bartels SJ, Cummings J, Gallo JJ, Gottlieb GL, Halpain MC, Palmer BW, Patterson TL, Reynolds CF, Lebowitz BD. Consensus statement on the upcoming crisis in geriatric mental health: Research agenda for the next two decades. Arch Gen Psychiatry. 1999; 56:848–853. [PubMed: 12884891]

43. Charney DS. Psychobiological mechanisms of resilience and vulnerability: Implications for successful adaptation to extreme stress. Am J Psychiatry. 2004; 161:195–216. [PubMed: 14754765]

44. Duckworth AL, Steen TA, Seligman MEP. Positive psychology in clinical practice. Annual Review of Clinical Psychology. 2005; 1:629–651.

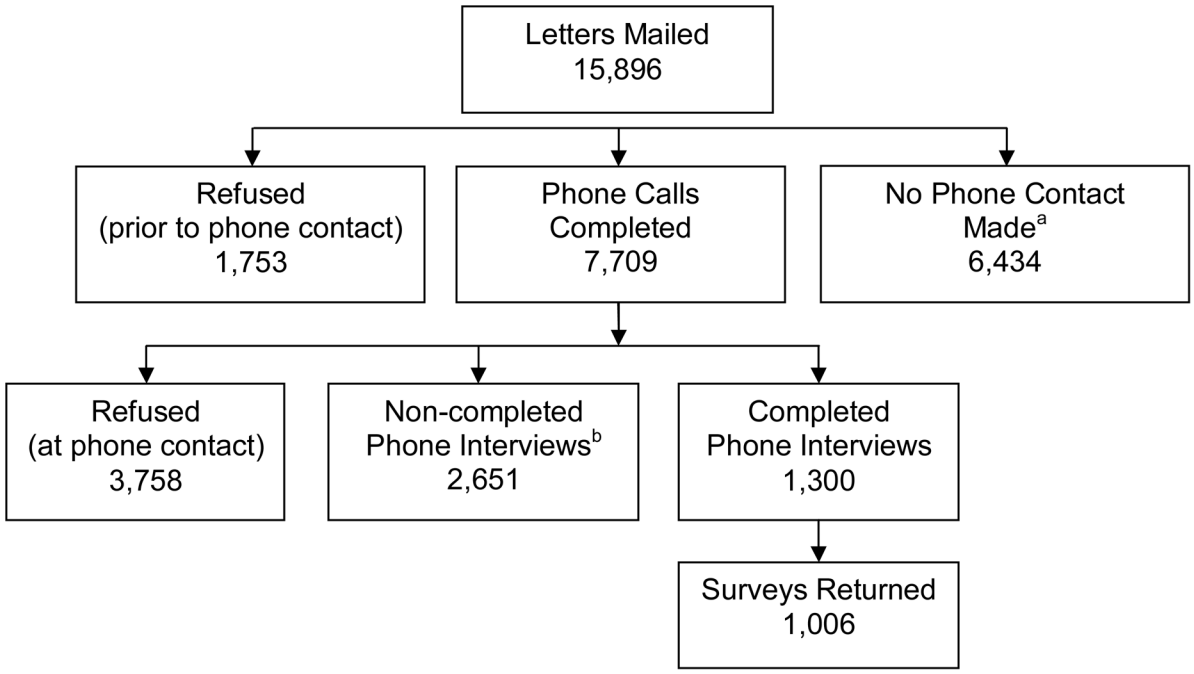

Figure 1. Enrollment of participants in the SAGE study

[a] No answer, answering machine on repeated calls, etc.

[b] Disconnected number, didn't speak English, deceased, hard of hearing, etc.

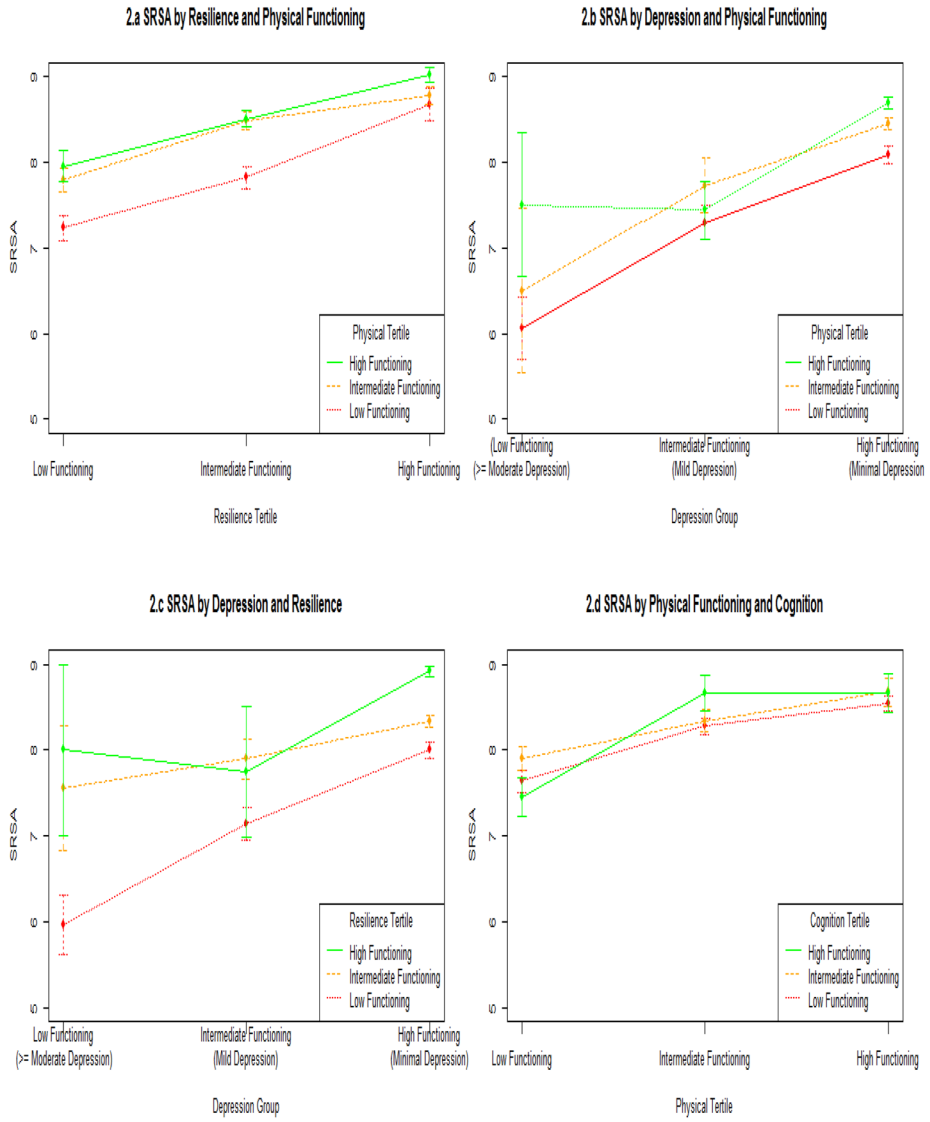

Figure 2. Estimated Self- Rated Successful Aging (SRSA) Scores by Pairs of Correlates

Descriptions of Functional Groupings of Key Variables

		Top Tertile (High Functioning)		Intermediate Tertile (Intermediate Functioning)		Bottom Tertile (Low Functioning)	
Measure	**Scale**	**N**	**Range**	**N**	**Range**	**N**	**Range**
Physical Functioning	SF-36 Physical Component	336	51 – 66	335	39 – 51	335	12 – 39
Resilience	CDRS-10 Total	338	36 – 40	386	29 – 35	282	0 – 28
Depression	PHQ-9 Severity Score	820	0 – 4	141	5 – 9	45	10 – 25
Cognition	TICS-Total Score	120	13–26	275	27–31	611	32–48

Note:

Physical functioning and resilience are categorized into tertiles. However, depression and cognition could not be well represented by tertiles because a majority of the subjects had no clinically significant depressive symptoms or cognitive impairment. We custom-trichotomized groups for the PHQ-9, based on previously used interpretive cut-scores for severity of depressive symptoms (20): scores of 0–4 = no or minimal depression, 5–9 = mild, and > 10 = moderate to severe depression) and for TICS-m scores (16); 32–48 = no cognitive impairment; 27–31 = mild cognitive impairment; 13–26 = Moderate or greater impairment).

Qualitative descriptions of individuals in the top and bottom functioning groups for each variable:

SF-36 Physical:

Participants in the top tertile (high functioning group) had physical activity limitations “none of the time” or “a little of the time” in all domains. In contrast, those in the bottom tertile (low functioning group) had some limitations in one or more domains of general health, physical functioning, bodily pain, role limitations due to physical problems, energy/vitality, and social functioning.

Resilience:

Individuals in the top tertile (high functioning group) responded with “often true” or “true nearly all of the time” on virtually all the items. Whereas those in the bottom tertile (low functioning group) responded with “not true at all” or “rarely true” on a majority of the items related to their ability to adapt and persevere in the face of hardship. Examples of the questions include: “I am able to adapt to change” and “I believe I can achieve my goals.”

Depression (PHQ-9):

Participants in the top (high functioning) group had no to minimal depressive symptoms, whereas most of those in the bottom (low functioning) group suggested moderate to severe depressive symptoms. Individuals in the low functioning group had difficulty sleeping and low energy for more than half the days during the previous two weeks. Many, but not all, of the subjects in the latter group also indicated loss of interest, depressed mood, poor appetite, and low sense of self-worth.

Cognition (TICS-m):

Subjects in the top (high functioning) group had no cognitive impairment except for 10-word immediate and delayed recall. In contrast, those in the bottom (low functioning) group had impairment on 10-word immediate and delayed recall as well as on tasks related to attention/working memory (serial 7 subtractions). However, individuals in the low functioning group were unimpaired on orientation and execution of simple motor commands.

Table 1

Demographic and Successful Aging-related Variables in Five Subject Groups by Decades

	Possible Range of Score	Age 50–59 (n=122)	Age 60–69 (n=162)	Age 70–79 (n=193)	Age 80–89 (n=347)	Age 90–99 (n=192)
Demographics						
Age (years)		55.9 (2.3)	64.4 (2.8)	75 (2.5)	84.3 (2.4)	92.4 (1.9)
Gender						
% Female		47.5%	46.3%	49.7%	51.0%	45.1%
Marital Status						
% Currently Married		60.7%	64.2%	60.1%	41.3%	30.3%
Education						
High School		6.6%	18.5%	28.5%	27.7%	28.2%
Some college		70.5%	55.6%	51.3%	56.9%	54.8%
Post-baccalaureate		23.0%	25.9%	20.2%	15.3%	16.9%
Physical Functioning: SF-36 Physical Component	0–100	49.3 (9.7)	48 (10.1)	44.3 (10.9)	41.7 (10.4)	37.3 (10.1)
Objective Cognitive Functioning: TICS-m Total Score	0–50	36.5 (3.7)	35.8 (4.5)	32.8 (5.1)	32.1 (4.8)	28.8 (5.1)
Subjective Cognitive Functioning: CFQ-25 Total*	0–100	27.5 (11.5)	25.4 (11.7)	31.2 (12.7)	30.4 (10.8)	30.7 (11.7)
Mental Functioning: SF-36 Mental Component	0–100	52.5 (9.3)	55.5 (6.6)	55.2 (8.8)	55.3 (8)	56.4 (7.2)
Depression: PHQ-9 Severity Score*	0–27	3.0 (4.2)	2.4 (3.7)	2.4 (3.5)	2.6 (3.3)	2.5 (2.6)
Positive Psychological Traits						
Optimism: LOT-R Total Score	6–30	22.8 (4.3)	23.9 (3.6)	22.7 (3.1)	22.8 (3.4)	22.7 (3.1)
Resilience: CDRS-10 Total Score	0–40	31.4 (6.4)	32.1 (6.2)	30.8 (7)	30.8 (5.9)	31.1 (6.3)
Self-Rated Successful Aging	0–10	7.7 (1.8)	8.1 (1.6)	8.2 (1.4)	8.2 (1.3)	8.6 (1.4)

Note:

Values represent proportion or group means (and SDs); higher values indicate higher functioning except for items marked with *.

SF-36 = 36-item Short-Form Health Survey;

TICS = Telephone Interview for Cognitive Status;

CFQ-25 = Cognitive Failures Questionnaire 25-item Version;

PHQ-9 = Personal Health Questionnaire 9-item Version;

LOT-R = Life Orientation Test - Revised Version;

CDRS-10 = Connor Davidson Resilience Scale 10-item Version.

Table 2

Bivariate Correlates of Successful Aging, Adjusted for Age

Correlate		F-statistic (df1/df2)	p-value	R-squared
Gender		0.1 (1, 1003)	0.739	.026
Marital Status		3.3 (1, 1003)	0.068	.035
Education		3.1 (10, 994)	<0.001	.043
	Coefficient	**t-Statistic (df)**	**p-value**	**R-squared**
Age[a]	.020	5.4 (1004)	<.001	.027
Physical Functioning: SF-36 Physical Component Score	.056	13.6 (1003)	<0.001	.177
Objective Cognitive Functioning: TICS-m Total Score	.033	3.4 (1003)	0.001	.037
Subjective Cognitive Functioning: CFQ-25 Total*	−.030	−7.9 (1003)	<0.001	.083
Mental Functioning: SF-36 Mental Component Score	.049	8.9 (1003)	<0.001	.097
Depression: PHQ-9 Severity Score	−.166	−13.3 (1003)	<0.001	.172
Optimism: LOT-R Total Score	.135	10.7 (1003)	<0.001	.125
Resilience: CDRS-10 Total Score	.098	14.8 (1003)	<0.001	.200

[a]The values for age are equivalent to a simple bivariate correlation, whereas all other values represent the association after accounting for age effects.

Note: Please see Table 1 Note for key to abbreviations.

Table 3

Multiple Regression Model of Successful Aging

Variable[a]	Estimate	Std. Error	p-value
Resilience: CDRS-10 Total Score	0.396	0.044	< 0.0001
Depression: PHQ-9 Severity Score[b]	0.258	0.047	< 0.0001
Physical Functioning: SF-36 Physical Component	0.405	0.044	< 0.0001
Age	0.397	0.042	< 0.0001

Note:

Residual standard error: 1.231 on 1001 degrees of freedom

Multiple R-squared: 0.300

[a] All variables were standardized by subtracting mean and dividing by standard deviation.

[b] Depression score was reversed by multiplying by negative one for purposes of comparison with other variable coefficients.