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Psychological stress declines rapidly from age 50 in the United States: Yet another well-being paradox

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Abstract

Objectives—Although there is evidence that evaluative subjective well-being (e.g., life satisfaction) shows a U-shaped pattern with highest satisfaction in the youngest and oldest years and lowest in the middle years of adulthood, much less is known about experiential well-being. We explore a negative indicator of experiential well-being (perceived stress), examine its association with age, and explore possible determinants of the age pattern.

Methods—Using Gallup-Healthways survey data of over 1.5 million U.S. respondents, we analyzed a question about asking about stress yesterday and demographic determinants of the pattern. To confirm this pattern, data on stress was analyzed from the American Time Use Survey and data on distress was analyzed from the Health and Retirement Survey.

Results—We show that ratings daily, perceived stressfulness of yesterday yields a paradox, with high levels from the 20's through about age 50, followed by a precipitous decline through the 70's. Data from the other two surveys confirmed the age pattern for stress. Regressions with the Gallup-Healthways data statistically controlled several third-variables, yet none substantially altered the pattern.

Conclusion—We argue that this new experiential well-being pattern informs us about aging in the US and the “paradox” calls out for explanation.

Keywords

Age; determinants; experiential well-being; stress; survey

Introduction

Over the last two decades considerable effort has gone into understanding how aging relates to well-being. To date we know that in English-speaking, developed, Western countries

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evaluative well-being (e.g., life satisfaction) generally follows a U-shaped association with age, where the lowest levels of well-being are in the early to mid-50s [1,2]. In this paper, we examine the age association of another dimension of SWB, experiential well-being¹, that refers to perceptions of everyday tensions, miseries, and joys [3]. Because experiential well-being can fluctuate in response to daily events, it is commonly assessed with brief recall periods, often for a single day.² Perceived stress is one of the negative aspects of experiential wellbeing. It is defined as a subjective experience based on a respondent's understanding of the word "stress" and is based on the pioneering work of Lazarus and others [5]. An extensive literature shows that perceived stress is linked to health outcomes, including endocrine [6], immune [7,8], autonomic nervous system processes [9], and morbidity [10–12]. Thus, there are compelling reasons to evaluate the pattern of perceived stress over the life span and to explore what might cause it. Despite this, connections between psychological stress and aging have received surprising little attention in the research literature. A notable exception is a study examining 355,334 participants in the Gallup-Healthways Well-being Survey [1], a U.S. telephone interview survey that includes both evaluative and experiential measures of well-being. The observed age pattern for daily stress was remarkably strong: stress was relatively high from age 20 through 50, followed by a precipitous decline through age 70 and beyond. This is consistent with other daily studies that find a reduction in both frequency and severity of stressors as people advance past middle age [13,14].

This paper has three goals. First, we seek to confirm the prior findings on perceived stress and age with a much larger sample (over 1.5 million) from the same Gallup-Healthways survey mentioned above, covering the years 2010 through 2015. Second, we seek to confirm the pattern in two additional large-scale surveys that employed somewhat different methodologies. Third, we attempt to identify potential explanatory mechanisms that produce the age—stress relationship. Several variables in the Gallup-Healthways dataset that are associated with age will be examined and tested for their ability to impact the observed age—stress pattern.

Methods

Gallup-Healthways Well-being Index Survey

Since January 2008, the Gallup Organization and Healthways Inc. have conducted a telephone survey of approximately 1,000 people per day using sampling that includes both landlines and cell phones. Because there were political questions placed prior to the well-being assessments in the first two years of the survey, that may have contaminated the well-being assessments through a context effect [15], the data analyzed here includes surveys that were collected from January 2010 through 2015 (through mid-year). The 2010 paper on age-gradients [1] included only data collected in 2008. A total of 1,503,337 interviews were included in the present study. Documentation on the interview is contained at <http://>

¹Experiential well-being is similar to hedonic well-being, which is essentially affect or mood, but goes beyond it in including misery and subjective pain.

²Many concerns with the measurement of SWB have been documented and are an active area of investigation and this is not reviewed here. The interested reader is directed to a recent OECD report on measuring subjective well-being [4]

wordview.gallup.com and the specific wording of the perceived stress question was “Did you experience the following feelings during A LOT OF THE DAY yesterday? How about _____?” Where “Stress” was one of several adjectives presented. The response options were “No” and “Yes.”

To examine age differences in stress in the Gallup Healthways survey, linear weighted regression models were used in which stress was regressed on dummy coded 1-year age categories. Age was treated as a categorical predictor variable to allow the estimation of age trends without imposing any a priori assumptions about the functional form of the age-stress relationship. The regression models included sampling weights provided by Gallup-Healthways to adjust the sample to the population distribution of age in the US population.

American Time Use Survey (ATUS)

The ATUS is conducted by the Bureau of Labor Statistics (BLS) every two years and interviews a subsample of the Current Population Survey. It is a time use survey wherein respondents parse “yesterday” into segments based on activity content and duration, allowing for a detailed examination of how Americans spend their time. At the behest of the National Institute on Aging (NIA), the BLS added an experimental module in the ATUS to assess emotions (with “stress” being one of the emotions) associated with 3 randomly selected activities from those identified for each participant (usually about 15 activities)³, similar to the procedures developed for the Day Reconstruction Method [16]. The response options for the stress item were: 0 (“means you were not stressed at all”) to 6 (“means you were very stressed”). The analyses included 12,034 respondents who completed the emotion questions in the 2010 telephone interview.

Age effects in stress were estimated in regression analyses using 4-year age groups as categorical predictor variable. Clustered robust standard errors were employed to account for the nesting of 3 nonindependent responses per person. Weights developed by BLS were used to handle deviations from a representative sample and for weighting to correct the sampling of episodes of different lengths.

Health and Retirement Study (HRS)

The HRS is a longstanding panel study of the impact of retirement in the United States; participants were recruited at about age 50 and followed every two years thereafter. We used the data from 5,693 respondents from the 2012 administration who completed a “leave-behind” paper-and-pencil questionnaire and who answered the following question between ages 50 and 79. They were asked, “During the past 30 days, to what degree did you feel distressed” using a 5 -point (very much – not at all) scale. We suggest that stress and distress are sufficiently similar so that the expectation is that they would be related to age in the same way.

³Because limited interview time was available for the module, three activity episodes were randomly selected from each respondent and are analyzed here. There was a minor programming error in the selection of the episodes for the Well-being Module, which prevented the selection of the last event of the day for the sample.

Age effects in stress were examined with linear regression models regressing distress on 5-year age categories. HRS-supplied sampling weights were used to achieve representativeness of the U.S. population. Statistical analyses were performed using STATA version 14.

Results

Perceived Stress in Gallup-Healthways survey, American Time Use Survey, and Health and Retirement Study

In the Gallup-Healthways survey, more than 45% of young respondents reported “stress during A LOT OF THE DAY yesterday,” whereas the incidence was only 25% in the older years. Figure 1 presents means (and 95% confidence intervals in grey) for each year of age ($F(65, 1365788) = 857.2, p < .0001$, with age in years as a nominal predictor variable). Without any control variables, Figure 1 shows that the decline in percentage of respondents reporting stress begins in the mid 40s, accelerates downward at about age 57, and continues at slower rates at around age 75. An effect size based on the most extreme differences over age was computed by examining the proportion reporting stress in a young group (20–30) versus an older group (70–80). This yields an effect size h (which is comparable to Cohen’s d for proportions [17]) of .57 based on proportions of .474 and .207 respectively, and an absolute risk reduction of .28. Various demographic and other variables are included in more extensive regressions later, because without a theoretical basis “controlling” for standard demographics may muddle interpretation of results. For example, income may be considered a mechanism through which age is associated with stress; simply controlling income as a “standard” demographic variable would eliminate detection of downstream effects directly linked to income.

While the perceived stress-age gradient is pronounced, there may be concerns that it is based on a question with a particular wording (“a LOT of stress”) and a reporting timeframe (1-day), which could limit the generalizability of the result to other wordings and time frames. It would therefore be reassuring to have corroborating evidence of the age-stress pattern from other studies using alternative methodologies. We present two additional sets of findings from (1) the American Time Use Survey (ATUS) that assessed perceived stress pertaining to specific episodes throughout the day, and from (2) the Health and Retirement Survey (HRS) that assessed a construct closely related to stress – distress. Each study had a substantial, representative sample.

From the ATUS, average stress levels for age groups of 4 years are shown in Figure 2A. Although the association is noisier than the previous one, it is clear that stress has a slight, positive linear trend from the first to the second age grouping (age 18–21 to 22–25), a slight upward trend until age 54, followed by a large drop starting with the 54–57 age group until the late 70s ($F(15, 12,019) = 13.2, p < .0001$, with age group as a nominal predictor variable). Overall, the decline in stress (effect size Cohen’s d) is .61 standard deviations from the age group with the highest stress (50–53) to the group with lowest stress (74–77), a substantial association confirming the pattern from the Gallup-Healthways study.

The third results we present are from the HRS, though with an attenuated age range of 50 years and older (see Methods). A clear drop in distress was observed from the youngest two groups (50–59) to the older groups (60–79), so the pattern is largely supportive of the Gallup data ($F(5, 5687) = 6.3, p < .0001$; with 5-year age groups as a nominal predictor variable, see Figure 2). The decline in distress (effect size d) is about .14 standard deviations from the group with the highest stress (50–54) to the group with the lowest stress (70–74).

Overall, these three studies present a generally consistent picture of how perceived stress and distress decline from middle age to older age; and, in two of these studies with wide age ranges, perceived stress was higher and relatively stable from younger to middle adult age.

Searching for correlates of the stress-age gradient

We now turn to possible explanations for the stress-age association. Many conditions and circumstances spring to mind that could be related to the decline in perceived stress, and several of these variables are available in the Gallup-Healthways survey. We first identify potential explanatory variables in this data set and then evaluate their effects on the age-stress association. Our exploration is naturally limited to those that appear likely to have an effect – that is, to be associated with both age and with perceived stress. A brief description of the variables is shown in Table 2.

The overall analysis strategy was to evaluate the extent to which statistically controlling the effect of an explanatory variable impacts the predicted age differences in perceived stress. To reduce noise in the relationship between stress and categories of age, we modeled age using 4-year groupings (e.g., 20–23, 24–27 years), creating a larger sample size for each age group resulting in more stable estimates.

Regarding control variables for the analyses, we contend that a small set of demographic variables that are generally fixed early in life should serve as controls prior to testing explanatory variables. Only variables that change over the course of the adult life span (i.e., those listed above) should be treated as variables that could explain the age-stress pattern. Thus, four demographic variables are included as controls in the modeling of the stress—age pattern prior to testing the effect of explanatory variables. The variables and their regression coefficients for the prediction of stress were: White race, .086 ($t = 62.4, p < .0001$; higher stress for Whites); College Graduate, $-.002$ ($t = -1.4, p = \text{ns}$; no difference in stress by education); Protestant, $-.018$ ($t = -15.7, p < .001$; lower stress for Protestants); and, Female, .059 ($t = 55.7, p < .0001$; higher stress for females).

To test the impact of the explanatory variables, we compared the regression coefficients for the prediction of stress from age between 2 separate models: one model did not include the explanatory variable (i.e., controlling only for the demographic variables), and the second model included the explanatory variable as an additional covariate. We employed STATA's "SUEST" (seemingly unrelated estimation) command to test whether the regression coefficients of age differed between the two models [18,19]. The SUEST procedure combines information from the two models, then tests the null hypothesis that the 16 regression coefficients for 4-year age groups are equivalent across the two models. The statistic for determining the difference in the models is a chi-square test ($df = 15$), which can

provide a traditional probability value associated with the test, but does not return variance accounted for or effect size results.

For analyses yielding the most pronounced differences between the age coefficients, we plot the stress-age association to visualize the patterns both before and after removing the effects of an explanatory variable, and inspect the plot for a change in the stress-age slope. Changes in the age pattern indicate that the explanatory variable is accounting for some degree of association between stress and age. If the age decline is entirely eliminated by the addition of a variable, then we will conclude that the variable explains the pattern; lesser reductions in the slope would lead to more limited conclusions. There are at least two plausible effects that an explanatory variable could have on the age-stress association [20]: confounding, where the explanatory variable reduces the association of stress with age, which would flatten the age pattern; and negative confounding (or suppression), where the explanatory variable *enhances* the association between age and stress. It is also plausible that more complex patterns involving both confounding and suppression could occur; the analytic strategy employed allows for nonlinear associations, because age group is treated as a nominal variable and not a continuous variable.

For each explanatory variable, Table 1 presents sample size, percent of the sample with an affirmative response, and chi-square statistic from SUEST for the difference in the age coefficients for models without and with the explanatory variable. The table is organized according to the type of impact the explanatory variable had on the age coefficients: confounding means that the age-stress pattern was flattened after entering the explanatory variable; suppression means that the pattern was enhanced (that the slope was more pronounced); the remaining types represent mixtures that include a combination of confounding and suppression effects when comparing younger to middle age and middle to older ages, respectively.

The explanatory variable that showed the most pronounced impact on the age—stress relationship is whether or not a health problem was reported (shown in Figure 3). The age pattern *strengthens* with the inclusion of health problem into the regression, indicative of negative confounding: stress is relatively higher (compared to the model that does not control for health problems) through about age 40 and relatively lower in the 60s and older. However, the difference in the stress-age patterns between the models is only modest in magnitude. The effects of other variables are extremely modest relative to the decline in stress over the entire age range (see Figure 3). Additionally, we tested the joint effect of including all explanatory variables in the model: the pronounced decline in stress over age remained virtually unchanged (results not shown). As an example of the lack of impact of one of the potential explanatory variables (having a health problem or not), we have plotted the age gradients of stress for participants without and with health problems in Figure 4. As is evident, the two curves are very similar in shape, especially with regard to the large decline in stress after age 50, even though the levels of the curves are quite different (more stress for those who reported health problems).

Discussion

Analyses reported in this paper demonstrate that the association between age and daily stress is robust: a large decline in stress from about age 50 through age 85 is shown in a large sample of the Gallup-Healthways survey. This pattern is confirmed in analyses of the American Time Use Survey and in the Health and Retirement Survey, replicating earlier analyses from a much smaller Gallup-Healthways sample [1] and demonstrating its generalizability.

The stress-age pattern, in part, inversely mirrors the well-known U-shape for evaluative well-being. However, unlike evaluative well-being, which decreases from young to middle adulthood, stress is relatively constant from the 20s through the 50s. The age-stress profile is therefore another, distinctive “paradox” of well-being: given the increasing morbidity with age, one would reasonably expect accelerating levels of stress with increasing age. This pattern calls out for explanation. What is it about the social environment or the biological aging process that results in less stress as one advances past middle age? Could identifying the determinants of the age gradient in stress inform efforts to design policies and interventions to enhance well-being?

To explore plausible causes of the age-related stress decline, we modeled the age-pattern both without and with variables that could plausibly explain the pattern and tested for differences in the age regression coefficients. Although there were many significant effects – some indicative of positive confounding and others indicative of negative confounding (suppression), none of the variables tested provided a compelling explanation for the pattern had very little impact on its interpretation. Remarkably, factors such as employment, social support, marital status, health conditions, health insurance, and church attendance, which conceptually appeared to be logical candidates given their association with age and stress, did not appreciably flatten the slope of stress over age. Thus, regardless of one’s social and health situation, stress is reported much less frequently from middle age onward. This certainly does not imply that other variables would fare as poorly at explaining the age differences in stress; on the contrary, we hope these findings compel researchers to continue the search.

We recognize an important omission in the list of explanatory variables examined: none of them captured the psychological changes that are part of the aging process and that have been described in Carstensen’s socioemotional selectivity theory [21,22] and Baltes “wisdom” and emotional intelligence theory [23]. Both theories posit cognitive and behavioral changes in older people that lead to enhanced emotional regulation and stability, more satisfying social relations, and an awareness of one’s mortality. While there is some support for the theories, they are silent on the shape of the age pattern and why for both evaluative well-being and experienced stress there is a distinctive shift in middle age at about age 50.

Another consideration that might explain the weak results for explanatory factors is that well-being and perceived stress may be biased by age-related differences in self-reporting, a concept that has recently been discussed [24,25]. Older age may affect self-reports, because

age is associated with decreased memory capacity, differences in how questions are interpreted, less responsiveness to context effects, more difficulty with open-ended questions, and difficulty interpreting numeric response options (32). Additionally, systematic age differences in how survey respondents compare themselves with some standard [26], such as their peers, their view of an ideal self, or even to themselves prior to a life event, could yield differential age gradients. Mode of administration is another example wherein respondents are less likely to acknowledge negative states to live interviewers versus questionnaires, especially as age increases [27]. This could be an explanation for the difference in effect sizes observed between the two interview studies and the questionnaire method in the HRS survey.

Finally, we acknowledge that all of the results presented here are based on cross-sectional data, opening the possibility that the findings may, in part, be caused by cohort effects. While there are longitudinal studies that appear to dispel this notion [2,28], we also note that some longitudinal research has failed to replicate cross-sectional age patterns of wellbeing [29]. In addition, even though the analyses were based on nationally representative samples, we cannot exclude the possibility of age-specific selection biases. For example, older people who experience high stress levels (e.g., due to serious illnesses) may be generally underrepresented in national surveys. Thus, we recommend keeping an open mind about these potential alternative explanations.

In summary, the results presented here highlight an unknown process that starts in the early 50s and sets off a steep decline in perceived stress over the next 20+ years. Thus, the puzzle of the stress-age relationship is very much alive and warrants further investigation.

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Conflict of interests

A.A.S. is a Senior Scientist with the Gallup Organization and a consultant with Adelphi Values, inc.

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Highlights

Daily stress shows a pronounced decrease from 50 to 85 years of age

The age-stress relationship was replicated across three large studies

Factors such as employment, health, or social support cannot explain the pattern

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Figure 1. Proportion reporting stress in Gallup-Healthways Survey, years 2010–2015, Stress by year-of-age groups. Grey areas represent 95% confidence intervals.

Figure 2.

Stress by age group for American Time Use Survey (panel A) and Distress by age group for the Health and Retirement Survey (panel B). Grey areas represent 95% confidence intervals.

Figure 3.

Gallup-Healthways Survey, without the explanatory variable in the model (blue line) and with the explanatory in the model (red line), where Health Problem (Panel A), Asthma (panel B), or Married (Panel C) is the explanatory variable.

Figure 4.

Stress by age for the Gallup-Healthways Survey separately for participants without and with self-reported health problems.

Table 1

Explanatory variables, Ns, percent with characteristic, and test for difference in age coefficients in models without and with the explanatory variable

Explanatory Variable	N	Percent with characteristic	X ² statistic (df = 15)
Confounding Association			
Asthma	1,390,629	11.6	952.8
Have Health Insurance	1,391,078	83.6	657.5
Weekly church	1,019,501	47.4	638.1
Kids at home	1,390,991	37.0	100.0
Suppression (Negative Confounding)			
Health Problem	1,387,185	22.1	15,888.6
Health rated as Good or better	1,391,592	79.9	7,945.0
High Blood pressure	1,389,627	30.5	5,934.2
High Cholesterol	1,387,609	26.6	4,581.6
Safe to Walk in neighborhood	1,134,667	72.3	2,599.5
Heart Attack	1,390,581	4.1	2,077.3
Diabetes	1,390,277	11.5	1,992.7
Cancer	1,390,181	7.3	1,052.0
Employment	1,115,322	51.6	858.5
Confounder for Young—Middle Aged; Suppressor for Middle—Old Ages			
Married	1,389,229	56.0	2,431.8
High Income	834,208	48.4	1,934.7
Suppressor for Young—Middle Aged; Confounder for Middle—Old Ages			
Depression diagnosis	1,390,200	17.6	4,382.9
Someone to count on	324,155	84.1	1,595.4

Note. All X² values are significant at $p < .0001$.

The sample size varies for the candidate variables, because of missing observations and because Gallup-Healthways did not administer exactly the same set of questions over the period from 2010 to 2014.

Table 2

Description of Potential Explanatory Variables

Concept	Measurement
Married	Being married or with a partner is generally considered a positive factor for mental and physical health and likely provides some buffering from the experience of stress [30]. The variable is coded 1 for if the respondent reported being married or living with a partner and 0 otherwise. The proportion of married individuals increases from the early 20s to the early 30s, levels off through the late 60s and then declines with advancing age (data not shown).
Employment	Employment is a prime candidate variable because of its clear association with age and because major social and activity changes often accompany retirement. In one survey perceived stress was positively associated with unemployment [31]. The variable used here is if a respondent reported being employed fulltime (1), or not (0), including part-time employment, or being out of the work force. Employment rises from the early to late 20s, levels out for the next 24 years until age 52, and then drops quickly thereafter.
Self-rated Health	Health status is another variable that shifts with age and is a reasonable candidate for this inquiry [32], as declining health is usually cited as a central factor yielding the well-being paradox [33]. The Gallup survey included the familiar self-rated health question, and we have dichotomized responses into Excellent, Very Good, and Good (1) versus Fair and Poor (0). There is a linear decline in individuals reporting good health from 87% in the early 20s to about 75% in the early 60s, then a slight rise, followed by a continued decline through 72% in older ages.
Health Problem	Another health-related variable is whether or not a respondent reported a “health problem.” This variable was coded as 1 if a health problem was reported and 0 otherwise. Incidence rises from younger adulthood, though there is a plateau in growth between ages 60 and 75.
Health Insurance	Having health insurance is likely related to age and stress, and recent experimental evidence suggests that having insurance improves well-being [34,35]. A variable was created that is coded 1 for those who report having health insurance and 0 for not having it. Having health insurance increases over the age range and ranges between 70% to over 90% old age
Social Support	Social support has long been known to buffer the effects of stressful environments [36]. The Gallup survey asked if the respondent had family or friends they could count on (coded 1) or not (0), which captures an important component of the construct [37]. This variable has a U-shaped relationship with age with the nadir (about 80%) at 52–55 years and about 10% higher at both ends of the age distribution.
Neighborhood Safety	Studies have shown that perceived safety of one’s neighborhood is related to well-being and stress [38], and the survey asked about feeling safe walking in one’s neighborhood (1) versus not (0). This variable has an inverted-U age-pattern, with perceptions of safety reaching its peak (77%) between ages 48–51, and the lowest levels of perceived safety in old age (60%).
Children at Home	Children living at home and its association with well-being has been a topic previously explored [39], though usually the focus is on middle aged with children living at home versus without children and not on how children might impact the stress-age gradient over the adult lifespan. A variable was constructed that was coded (1) if children were currently living at home versus not (0). This variable has an inverted U-shaped age pattern, with a peak at ages 36–39 (75%) and a decrease through older age (to under 10%). Income has been associated with well-being and stress [40], though in complex ways, in that both variables appear to increase with higher income. A median split on household income (below median (0) vs. above median (1)) was used here, and the age pattern was that of an inverted-U with above median income rates being highest (> 50%) from age 36 through 59.
Religious Belief	Religious beliefs have also been shown to be positively correlated with well-being [41]. The response to a question about how often the respondent attends church, synagogue, or mosque was coded as 1, if attendance was every week or almost every week, and 0 for lower attendance rates. It increased with age from 35% in the youngest to 70% in the oldest participants, with a plateau in the 40s.
Self-reported Medical Diagnoses (7)	The Gallup survey also asked about whether a significant medical diagnosis had ever been given to respondents, including high blood pressure (steady increase over age), high cholesterol (steady increase over age), diabetes (steady increase), depression (inverted U-pattern), heart attack (steady increase), asthma (decline through age 30, then flat with an increase at 56–59, followed by decline), and cancer (steady increase).