

Stress and Subjective Age: Those With Greater Financial Stress Look Older

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Abstract

Subjective indicators of age add to our understanding of the aging process beyond the role of chronological age. We examined whether financial stress contributes to subjective age as rated by others and the self. The participants ($N = 228$), aged 26–75, were from a Boston area satellite of the Midlife in the United States longitudinal study. Participants reported how old they felt and how old they thought they looked, and observers assessed the participants' age based on photographs (other look age), at two occasions, an average of 10 years apart. Financial stress was measured at Time 1. Controlling for income, general stress, health, and attractiveness, participants who reported higher levels of financial stress were perceived as older than their actual age to a greater extent and showed larger increases in other-look age over time. We consider the results on accelerated aging of appearance with regard to their implications for interpersonal interactions and in relation to health.

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other-look age, felt age, look age, financial stress, health

The large individual differences in aging processes are usually described in terms of chronological age. Yet, multiple theoretical and empirical studies highlight the predictive role of “subjective constructions” (Diehl et al., 2014) and “subjective experiences” (Kotter-Grühn, Kornadt, & Stephan, In press) of age and aging. Subjective indicators of age as rated by others and the self, such as how old people are perceived by others, how old they feel, and how old they think they look, appear to be robust markers of aging processes over and above chronological age. Age as estimated by others (other-look age), usually based on facial photographs, is negatively associated with morbidity and mortality (Christensen et al., 2009; Gunn, Larsen, Lall, Rexbye, & Christensen, 2016). Similar associations are found with self-rated measures of subjective age indexed by the age that people feel (felt age) and by the age people think they look (look age). One of the consistent findings is the association between subjective age and health (Hubely & Russell, 2009), with lower subjective age related to better health and lower mortality rates (Stephan, Chalabaev, Kotter-Grühn, & Jaconelli, 2013; Uotinen, Rantanen, & Suutama, 2005; Westerhof, Barrett, & Steverink, 2003). Despite the relevance of the multiple dimensions of subjective age in understanding aging-related processes across adulthood, only a few studies have focused on their determinants (Kotter-Grühn et al., In press). These studies have focused especially on felt age and have shown, for instance, the contribution of personality (Hubely & Hultsch, 1994; Stephan, Demulier, & Terracciano, 2012), perceived mastery (Infurna, Gerstorf, Robertson, Berg, & Zarit, 2010), depressive symptoms (Infurna et al., 2010), and health (Barrett, 2003; Bowling, See-Tai, Ebrahim, Gabriel, & Solanki, 2005; Stephan et al., 2012; Teuscher, 2009) to self-ratings of subjective age. Although being perceived as looking older than one’s actual age is likely to have an important impact on the nature of older adults’ social and professional interactions (Kotter-Grühn & Hess, 2012), there is even more limited work with respect to the predictors of other-look age. The limited empirical evidence suggests the role of health-damaging behaviors such as sun exposure and smoking that can lead to older age appearance (Freiman, Bird, Metelitsa, Barankin, & Lauzon, 2004; Mayes et al., 2010). In light of the limited work on the predictors of the multiple facets of subjective age, the current study aims

to fill this gap in the literature with a specific focus on financial stress as a potential predictor of all three subjective age indicators (i.e., other-look age, felt age, and look age).

The Role of Financial Stress

Among the array of stressors that people may confront in their daily lives, financial difficulties represent a frequent and potent source of stress (Fox & Chancey, 1998) with implications for health and well-being. As early as 1881, George Beard recognized the salience of financial stress stating that “worry is the one great shortener of life under civilization; and of all forms of worry, financial is the most frequent, and for ordinary minds, the most distressing” (Beard, 1881, p. 274). More recently, according to the “Stress in America. Paying with Our Health” survey (American Psychological Association [APA], 2015), money is rated as the most significant source of stress in people’s lives. Research shows that financial problems negatively impact self-esteem (Krause, Jay, & Liang, 1991), self-rated health (Kahn & Fazio, 2005), and life satisfaction (Krause, 2005). Stress about finances is prevalent nationwide, has stayed the same or increased in salience over the past 8 years, and represents a significant barrier to living a healthy lifestyle (APA, 2015). For example, those with higher levels of financial stress are more likely to adopt unhealthy behaviors. This pattern is confirmed by other studies showing that the negative effects of financial difficulties on health are prominent over and above other sources of stress (Pyykkönen et al., 2010). For instance, higher financial stress was significantly associated with lower physical functioning (Kahn & Fazio, 2005), higher blood pressure (Steptoe, Brydon, & Kunz-Ebrecht, 2005), increased odds of having metabolic syndrome (Pyykkönen et al., 2010), and poor sleep quality (Hall et al., 2008). The symptoms associated with such poor health conditions and sleep inefficiency, as well as their physiological consequences, could generally lead individuals to feel and look older than they actually are (Barrett, 2003; Bowling et al., 2005; Schafer & Shippee, 2010; Sherman, 1994; Stephan et al., 2012; Teuscher, 2009).

The hypothesized association between financial stress and subjective age is compatible with the findings regarding the role of stress in general. A few studies have focused on the association between exposure to acute or chronic stress and subjective age. Higher levels of stress have been shown to be associated with older felt age relative to a given chronological age. Stress exposure in the early life course (e.g., childhood neglect) was found to increase subjective age (subjective weathering) in adulthood (Foster, Hagan,

& Brooks-Gunn, 2008). Moreover, stressful events in adulthood (e.g., death of a child) were related to greater changes in felt age over time (Schafer & Shippee, 2010). There is also evidence at the cellular level (e.g., telomere, hair follicle) that people age at different rates and that chronically stressed people have an older biological age (Epel et al., 2004; Simon et al., 2006). In recent studies, participants felt older and believed they appeared older on days when they experienced a larger number of stressful events (Bellingtier, Neupert, & Kotter-Grühn, 2015; Kotter-Grühn, Neupert, & Stephan, 2015).

In terms of other-look age, a recent study carried out by Noordan et al. (2012) showed that increases in morning cortisol level, a biomarker of stress, were associated with increased other-look age. The association of stress and appearance could be explained by premature aging of the skin (Noordam et al., 2012) or earlier graying hair (Wood et al., 2009). This relationship has been also featured in the media, especially with a focus on the aging process of prominent public figures. Based on the appearance of U.S. presidents at the beginning and end of their terms, for example, some have suggested that the stress of that role could lead to premature aging (e.g., Sellers, 2009; Smith, 2009). It is thought that due to stress, physical signs of aging seem to occur faster for presidents, although no comparisons have been made with changes in appearance for other men of similar ages. It is possible that what is observed in presidents is the result of normal physical aging and associated changes in appearance over a 4- to 8-year period for those in their 50s and 60s (the age of most presidents). The association between stress and changes in physical appearance with aging remains an interesting empirical question, which we address in the current study.

The Role of Sociodemographic Factors

A robust finding is that adults over 25 tend to feel younger than their chronological age, and this gap widens with aging (Barrett, 2003; Goldsmith & Heiens, 1992; Montepare, 1991; Montepare & Lachman, 1989). Rubin and Berntsen (2006) found that, on average, after age 40, older adults feel 20% younger than their actual age and that this percentage remains relatively stable across age-groups. Lower socioeconomic status (SES) is also associated with increased felt age (Barrett, 2003), although this association is explained, in part, by individual differences in health. Similarly, according to Rexbye et al. (2006), those with lower SES were also perceived as looking older than their actual age. In terms of sex differences, some studies have found that women tend to have lower subjective age (Barrett, 2005;

Montepare & Lachman, 1989), whereas others have found no sex differences (Barak, Mathur, Lee, & Zhang, 2001; Montepare, 1991).

Current Study

The main goal of our study was to examine whether financial stress contributes to individual differences and change in subjective age over and above the role of income and general stress in other areas of life. We expected those with higher levels of financial stress to be perceived as looking older than they actually are to a greater extent and to report older felt and look age relative to their chronological age. In examining the role of financial stress, an important strength of our approach is the use of longitudinal data. Measures of subjective age and other-look age were taken at two points in time, an average of 10 years apart, allowing the examination of predictors of change in subjective age. We expected larger increases in subjective age among participants with higher levels of financial stress at baseline.

Although some work has applied a life span framework to study subjective age (e.g., Montepare, 2009; Rubin & Berntsen, 2006; Stephan et al., 2012) to the best of our knowledge, no other study has assessed both self-ratings (felt age, look age) and other ratings (age one looks to others) of subjective age together in younger, middle-aged, and older participants with a longitudinal design. Therefore, an additional goal of this study was to focus on all three components of subjective age and to describe their associations with each other and with sociodemographic factors.

Method

Participants

The participants were from the Boston Longitudinal Study (BOLOS), a Boston area oversample of the Midlife in the United States (MIDUS) random digit dial sample conducted in 1995–1996 (Time 1) and 2004–2005 (Time 2; see Agrigoroaei & Lachman, 2011). At Time 1, approximately 12 months after MIDUS data were collected, 302 adults, ranging in age from 25 to 75 years (mean [M] = 48.89, standard deviation [SD] = 13.74) participated in BOLOS, and photographs were taken for 228 of them. Within 1 year of completion of the second wave of MIDUS, 180 of them were recontacted (81% contact rate) and 151 (68%) participated at Time 2 and 107 had photographs. Their ages at Time 2 ranged from 34 to 84 years (M = 59.99, SD = 12.81). Compared with those who did not participate in BOLOS Time 2,

longitudinal participants from the Boston area had a higher level of education $t(300) = -2.77, p = .006$ and Time 1 income $t(300) = -2.52, p = .012$. They did not significantly differ on the following variables measured at Time 1: chronological age, subjective age indicators, financial and general stress, attractiveness, self-rated health, and sex distribution. The study was approved by the institutional review board at the University.

Measures

Chronological age and subjective age were measured in BOLOS at both Time 1 and Time 2. All the other measures were from the first wave of the parent MIDUS study except for the stress measures which were based on indicators from both BOLOS and MIDUS at Time 1.

Sociodemographic variables. We examined age, sex ($-1 = \text{men}$ and $1 = \text{women}$), level of education in years (ranging from 6 to 20 years), and household total income level in dollars.

Subjective age variables

Other-look age. A set of raters who varied in age estimated how old the participants looked based on their front view pictures (see section Photograph Ratings).

Felt age. Respondents reported how old they felt: “I feel as though I am ... years old.”

Look age. Participants indicated how old they thought they looked: “I look as though I am ... years old.”

Attractiveness. The level of attractiveness of the participants was estimated by a group of raters (see section Photograph Ratings).

Photograph Ratings

Stimuli. For this study, we used photos (i.e., slides at Time 1 and digital pictures at Time 2) of the BOLOS participants. The camera’s zoom lens was focused on the participants, so that just the participants’ head, neck, and top of shoulders were in the parallax square of the lens. In order to make the Time 1 and Time 2 photos as similar as possible in terms of framing and lighting, photos were cropped to the same size and color corrected for redness where necessary using Adobe Photoshop **AQ2**. There were 228 participants with pictures at Time 1 and 107 with pictures at Time 2. A total of

101 participants had pictures at both times. The participants with and without pictures at both occasions were not statistically different in terms of chronological age, other-look age, felt age, look age, financial stress, general stress, attractiveness, self-rated health, and sex. However, those with pictures at both times were more educated $t(226) = -2.32, p = .021$ and had higher income $t(226) = -2.60, p = .010$ than those with pictures only at Time 1.

Raters. Nineteen adults took part in the rating of photographs. The raters were between 17 and 79 years old ($M = 40.95, SD = 27.01$) and 10 were women. The average age was 18.82 ($SD = 1.25$; range 17–22) for the younger raters ($n = 11$) and 71.38 ($SD = 6.80$; range 58–79) for the older raters ($n = 8$). Younger raters were in college and older raters held a bachelor's degree or higher. They were paid US\$10 for their participation.

Procedure. The raters looked at a total of 335 photos of participants, from Time 1 and Time 2, and indicated their perceived age and attractiveness. The instructions and the photos were presented on the computer. The instructions were "You will be seeing a series of photographs and will be asked to rate them on different things. The first question is age. Please indicate what age you think the person is in each of the following photographs. If you make a typo you can correct it by backspacing before you hit the enter key." The participants saw each of the 335 photographs separately with the question: "What age do you think this person is?" appearing in the upper left-hand corner of the screen. Participants were able to type the number in a box and continue at their own pace, taking breaks if necessary. Then participants rated the photos on attractiveness: "Now please rate each photo on the following scale compared to other people of about the same age. Please make your rating by clicking on the number." A scale ranging from 1 (*not at all attractive*) to 7 (*very attractive*) was presented with each photo. The actual age of the person in the photograph was presented on the screen, so that they could make attractiveness ratings relative to others of a similar age. For both ratings (i.e., age and attractiveness), the order of the photographs was randomized by the software, intermixing Time 1 and Time 2 pictures, as well as sex and ages of the targets.

As indicators of interrater reliability, Cronbach's α s were computed for the full set of raters, separately by raters' age (i.e., younger vs. older) as well as by targets' age (i.e., younger, middle-aged, and older participants). The reliabilities range from .84 to .98 for other-look age and between .64 and .87 for perceived attractiveness. The correlation between younger and older raters average scores was $r(226) = .96, p < .001$ for other-look age and $r(225) = .71, p < .001$ for attractiveness. For both assessments, the 19 raters'

scores were averaged and used as indicators of other-look age and attractiveness.

Stress

Financial stress. This measure was based on the average of 3 items (Cronbach's $\alpha = .77$). In BOLOS, the participants indicated how much stress they experience with their finances on a scale ranging from 1 to 4 (1 = *a lot*, 2 = *some*, 3 = *a little*, and 4 = *none*). In MIDUS, the participants were asked two questions: "In general, would you say you (and your family living with you) have (1) more money than you need, (2) just enough for your needs, or (3) not enough to meet your needs"? and "How difficult is it for you (and your family) to pay your monthly bills"? (from [1] *very difficult* to [4] *not at all difficult*). The first and the last items were reverse coded, so that higher values indicate higher levels of financial difficulties. The final score was the standardized average of the z-scored individual items.

General stress. A stress composite (Cronbach's $\alpha = .78$) from BOLOS was computed to capture the level of perceived stress in multiple areas of life. Specifically, participants rated how much stress they experienced in the following areas: job, home/residence, children, spouse/partner, parents, friends, health, mental health, sleep, energy level/stamina, and getting done everything they need to on a scale ranging from 1 to 4 (1 = *a lot*, 2 = *some*, 3 = *a little*, and 4 = *none*). All items were reverse scored, so that higher scores denote higher levels of general stress. The final score was computed as the mean of all individual items.

Health. Three general health measures were assessed in MIDUS at Time 1. To obtain a general subjective evaluation of health, participants rated their physical health on a 5-point scale: "In general, would you say your physical health is 1 (*poor*), 2 (*fair*), 3 (*good*), 4 (*very good*), or 5 (*excellent*)"? To index functional health (Ware & Sherbourne, 1992), participants rated whether their health limited them in doing nine different activities (e.g., limited bathing or dressing, limited climbing stairs) using a 4-point scale (1 = *a lot*, 2 = *some*, 3 = *a little*, and 4 = *not at all*). The final score was the average of the 9 items, so that higher scores indicated better functional health. The third measure captured the number of chronic health problems (Lachman & Weaver, 1998). Participants indicated whether they had experienced or been treated for any of 28 conditions over the past 12 months (e.g., asthma, high blood pressure or hypertension, diabetes, cancer, heart trouble,

etc.). We assigned a score of 1 for the presence of any of the listed chronic conditions. The final score could range from 0 to 28.

Data Analysis

The associations between financial stress and the indicators of subjective age were examined using cross sectional (within the first occasion of measurement) and longitudinal data (predicting change). We used hierarchical multiple regressions for each subjective age indicator. In the first step, the predictors were chronological age, sex, education, and total household income. For the model predicting other-look age, the level of attractiveness was also included as covariate. The three health indicators (i.e., self-rated health, functional health, and chronic health problems) were included in Step 2. Then the general stress composite was included in Step 3. In the last step, the added predictor was financial stress.

At Time 1, we were interested in whether higher levels of financial stress were associated with being perceived by others, feeling, and perceiving oneself as older than one's actual age. As in previous studies (Rubin & Berntsen, 2006), dependent variables were the proportional discrepancy scores.¹ They were computed by subtracting participant's chronological age from felt age, look age, and other-look age, and these differences were divided by chronological age. For these proportional discrepancy scores, positive values indicate that participants feel, think they look, and appear older relative to their chronological age. Negative values indicate that participants feel, think they look, and appear younger relative to their chronological age. For example, a proportional score of $-.20$ obtained for felt age indicate that the participant feels 20% younger. At Time 1 for felt age, the proportional discrepancy scores ranged from $-.74$ to 2.54 ($M = -0.11$, $SD = 0.32$). The range was $-.39$ to $.96$ for the discrepancy between look age and chronological age ($M = -0.07$, $SD = 0.14$) and $-.17$ to $.63$ ($M = 0.09$, $SD = 0.13$) for the discrepancy between other-look age and actual age.

Consistent with the cross-sectional statistical models, the dependent variables for the longitudinal data were proportional discrepancy scores obtained by subtracting Time 2 chronological age from Time 2 felt age, look age, and other-look age, respectively, and dividing by chronological age. To examine the predictors of change between Time 1 and Time 2, the Time 1 proportional discrepancy scores were included as covariates. The other predictors were chronological age, sex, education, total household income, self-rated health, functional health, chronic health problems, financial stress, and general stress composite, all measured at Time 1 and included using the same stepwise

approach. Models also controlled for the lapse of time between Time 1 and Time 2 (ranging from 8 to 13 years, $M = 9.55$, $SD = 0.94$). Attractiveness was included as a predictor in the model with other-look age as an outcome. Note that when we examined whether there were any age or sex interactions with financial or general stress, none of the effects were significant. Therefore, we do not report these results.

To analyze age and sex differences in subjective and other-look age and to compare the three indicators (i.e., other-look age, felt age, and look age) to each other, a mixed analysis of variance (ANOVA) model was used, with two between-subjects factors (i.e., age-groups: younger [26–39], middle aged [40–59], older [60–75], and sex) and one within-subjects factor (i.e., measure: other-look age, felt age, and look age).

Results

The M s, SD s, and the correlations between the study variables are presented in Table 1.

The Role of Financial Stress for Subjective Age

Cross-sectional findings. We examined the relationship between financial stress and the subjective age proportional discrepancies while controlling for socio-demographic variables, income, health, general stress, and attractiveness (for the other-look age outcome). As shown in Table 2, Step 4, financial stress was not a significant predictor for the felt age ($\beta = -.04$, $p = .566$) or look age ($\beta = .11$, $p = .140$) outcomes. However, felt age was predicted by the level of general stress ($\beta = .16$, $p = .013$). Those with higher levels of general stress tended to feel older than they actually are. Regarding other-look age, as expected, financial stress was significantly related to how old people were perceived by others relative to their actual age ($\beta = .15$, $p = .028$). Those with higher levels of stress over finances tended to be perceived as looking older than their chronological age to a greater extent. The results also revealed that for other-look age, the significant predictors were chronological age ($\beta = -.66$, $p < .001$), education ($\beta = .14$, $p = .016$), and attractiveness ($\beta = -.27$, $p < .001$). Older age, lower education, and greater attractiveness were associated with looking younger compared to their actual age to a greater extent. Among the three physical health predictors, significant associations were only obtained for chronic health problems. Those with more chronic conditions felt older ($\beta = .14$, $p = .038$) and thought they look older ($\beta = .15$, $p = .032$).

Table 1. Means, Standard Deviations, and Correlations Between the Study Variables. **[AQ3]**

	Mean	SD	1	2	3	4	5	6	7	8	9	10	11	12
1. Chronological Age	50.39	13.70												
2. Other-look age	53.90	12.11	.92***											
3. Felt age	42.94	14.44	.60***	.58***										
4. Look age	46.30	13.92	.87***	.86***	.67***									
5. Attractiveness	3.26	.57	-.24***	-.33***	-.16*	-.24***								
6. Sex (-1 = men and 1 = women)	—	—	-.14*	-.16*	-.10	-.13*	.03							
7. Education	14.68	2.87	-.10	-.07	-.13	-.09	.24***	.01						
8. Income	70,887.05	59,614.83	.01	-.02	-.13	.003	.06	.00	.36***					
9. Self-rated health	3.70	.94	-.13	-.13	-.18**	-.20**	.21**	.06	.30***	.19**				
10. Functional health	3.58	.60	-.19**	-.19**	-.18**	-.28***	.28***	.03	.27***	.15*	.46***			
11. Chronic health problems	2.16	2.17	.27***	.26***	.27***	.30***	-.18**	-.04	-.13	-.11	-.41***	-.45***		
12. Financial stress	0	1	-.28***	-.21**	-.09	-.20**	.05	.06	-.15*	-.47***	-.08	-.16*	.11	
13. General stress	1.98	.43	-.29***	-.26***	-.06	-.22*	-.02	.11	.18**	.04	-.02	-.10	.15*	.36***

Note. $n = 221$. All the variables were from Time 1.

*** $p < .001$. ** $p < .01$. * $p < .05$.

Table 2. Summary of Hierarchical Regression Analyses at Time 1.

Predictor	Proportional Discrepancy Score Outcome											
	(Other-Look Age—Chronological Age)/ Chronological Age				(Felt Age—Chronological Age)/Chronological Age				(Look Age—Chronological Age)/Chronological Age			
	Step 1	Step 2	Step 3	Step 4	Step 1	Step 2	Step 3	Step 4	Step 1	Step 2	Step 3	Step 4
Chronological age	-.66***	-.66***	-.68***	-.66***	-.28***	-.31***	-.26***	-.27***	-.11	-.17***	-.17***	-.15*
Sex (-1 = men and 1 = women)	-.08	-.08	-.08	-.08	.05	.05	.03	.03	.05	.05	.05	.05
Education (years)	.13*	.12*	.14*	.14*	.02	.04	.02	.02	.02	.08	.08	.08
Income (dollars)	-.14*	-.14*	-.14*	-.07	-.14*	-.12	-.12	-.14*	-.04	-.01	-.01	.04
Attractiveness	-.24***	-.25***	-.26***	-.27***	-.09	-.09	-.09	-.09	-.13	-.13	-.13	-.13
Self-rated health	-.02	-.02	-.02	-.03	-.09	-.07	.08	.08	-.07	-.07	-.07	-.07
Functional health	.06	.06	.05	.07	.07	.18**	.14*	.14*	.15*	.15*	.15*	.15*
Chronic health problems	.02	.02	.03	.03	.15*	.15*	.16*	.16*	-.01	-.01	-.01	-.04
General stress	.15*	.15*	.15*	.15*	.15*	.15*	.15*	.15*	.15*	.15*	.15*	.15*
Financial stress	.15*	.15*	.15*	.15*	.15*	.15*	.15*	.15*	.15*	.15*	.15*	.15*
	R ² = .441	R ² change = .002	R ² change = .004	R ² change = .012	R ² = .105	R ² change = .038	R ² change = .018	R ² change = .001	R ² = .019	R ² change = .067	R ² change = .000	R ² change = .007
	F(5, 217) = 34.19***	F change (3, 214) = .31	F change (1, 213) = 1.40	F change (1, 212) = 4.88*	F(4, 276) = 8.05***	F change (3, 273) = 3.99**	F change (1, 272) = 5.96*	F change (1, 271) = .33	F(4, 274) = 274	F change (3, 271) = 6.60***	F change (1, 270) = .01	F change (1, 269) = 2.19

Note. All the predictors were measured at Time 1.
*** $p < .001$. ** $p < .01$. * $p < .05$.

Longitudinal findings. As presented in Table 3/Step 4, the proportional discrepancy between felt age and chronological age measured at Time 2 was related to the proportional discrepancy measure at Time 1 ($\beta = .22, p = .009$), self-rated health ($\beta = -.20, p = .027$), and chronic health problems ($\beta = .29, p = .002$). Those with lower self-rated health and the participants with more chronic problems tended to feel older than their actual age at Time 2, while controlling for baseline. For look age, the only significant predictor was the corresponding measure at Time 1 ($\beta = .40, p < .001$). The other-look age proportional discrepancy at Time 2 was significantly predicted by the baseline discrepancy measure ($\beta = .56, p < .001$), education ($\beta = .20, p = .044$), and, as expected, financial stress ($\beta = .21, p = .041$). While adjusting for baseline, those with higher levels of financial stress at Time 1 were perceived as looking older relative to their actual age at Time 2.² For purposes of visual representation in Figure 1, we computed the difference of other-look age at Time 2 – other-look age at Time 1 and examined this change score in relation to high and low stress over finances (based on a median split). This figure shows that those with higher financial stress were seen as older at Time 2 relative to Time 1 to a greater extent than those with lower financial stress.

Age and Sex Differences in Subjective Age Measures

The mixed ANOVA model revealed a significant main effect of measure, $F(2, 440) = 120.28, p < .001$, partial $\eta^2 = .35$, suggesting that the three measures capture different aspects of subjective age. On average, participants say they feel younger than they think they look ($M = 42.14$ vs. $M = 45.54$). Moreover, they think they look younger than others think they look ($M = 45.54$ vs. $M = 53.21$). The effect of age, $F(2, 220) = 205.65, p < .001$, interacted with measure, $F(4, 440) = 6.68, p < .001$, partial $\eta^2 = .06$. Middle-aged and older adults felt younger than they thought they looked, but this difference was not significant for younger adults (see Figure 2).

In addition, women had significantly lower values of subjective age than men, $F(1, 220) = 4.94, p = .027$, partial $\eta^2 = .02$, $M = 45.91$ vs. $M = 48.02$. The results also revealed a significant age by sex interaction, $F(2, 220) = 3.70, p = .026$, partial $\eta^2 = .03$. Among older participants, on average, subjective age was higher for men than for women. The three-way interaction and the interaction between measure and sex were not significant. We also examined age and sex differences in the three subjective indicators using discrepancy scores. We found the same pattern of results, although the effect of sex was not significant.

Table 3. Summary of Hierarchical Regression Analyses Predicting Change Between Time 1 and Time 2.

Predictor	Proportional Discrepancy Score Outcome											
	(Other-Look Age—Chronological Age)/ Chronological Age (Time 2)				(Felt Age—Chronological Age)/Chronological Age (Time 2)				(Look Age—Chronological Age)/Chronological Age (Time 2)			
	β	β	β	β	β	β	β	β	β	β	β	β
	Step 1	Step 2	Step 3	Step 4	Step 1	Step 2	Step 3	Step 4	Step 1	Step 2	Step 3	Step 4
Corresponding proportional discrepancy score at Time 1 ^a	.61***	.62***	.59***	.56***	.27**	.23**	.23**	.22**	.44***	.41***	.40***	.40***
Time lapse between Time 1 and Time 2	-.02	-.02	-.03	-.05	-.03	-.01	-.01	.004	-.02	-.02	-.02	-.03
Chronological age	.08	.08	.03	.03	-.02	-.10	-.11	-.14	-.08	-.10	-.11	-.09
Sex (–1 = men and 1 = women)	-.04	-.08	-.06	-.06	-.12	-.11	-.11	-.12	.09	.07	.08	.08
Education (years)	.11	.12	.17	.20*	-.06	-.01	-.01	-.03	.02	.06	.07	.07
Income (dollars)	-.01	-.01	-.02	.08	.04	.06	.06	-.02	.03	.04	.03	.07
Attractiveness	-.08	-.06	-.08	-.08								
Self-rated health	.06	.06	.05	.05	-.20*	-.20*	-.20*	-.20*	-.10	-.10	-.10	-.10
Functional health	-.20*	-.20*	-.22*	-.19	.13	.13	.13	.12	-.12	-.12	-.12	-.12
Chronic health problems	-.05	-.05	-.04	-.04	.29**	.29**	.29**	.29**	-.01	-.01	-.01	-.01

(continued)

Table 3. (continued)

Predictor	Proportional Discrepancy Score Outcome											
	(Other-Look Age—Chronological Age)/ Chronological Age (Time 2)				(Felt Age—Chronological Age)/Chronological Age (Time 2)				(Look Age—Chronological Age)/Chronological Age (Time 2)			
	β	β	β	β	β	β	β	β	β	β	β	β
	Step 1	Step 2	Step 3	Step 4	Step 1	Step 2	Step 3	Step 4	Step 1	Step 2	Step 3	Step 4
General stress			-.12	-.19			-.01	.04			-.03	-.05
Financial stress				.21*				-.17				.08
	$R^2 = .379$	R^2 change = .030	R^2 change = .011	R^2 change = .027	$R^2 = .090$	R^2 change = .115	R^2 change = .000	R^2 change = .017	$R^2 = .216$	R^2 change = .028	R^2 change = .001	R^2 change = .003
	$F(7, 93) = 8.10^{***}$	F change (3, 90) = 1.52	F change (1, 89) = 1.76	F change (1, 88) = 4.29*	$F(6, 131) = 2.16$	F change (3, 128) = 6.20**	F change (1, 127) = .02	F change (1, 126) = 2.78	$F(6, 131) = 6.01^{***}$	F change (3, 128) = 1.61	F change (1, 127) = .12	F change (1, 126) = .57

Note. All the predictors were measured at Time 1.

^a(Other-look age—Chronological age)/Chronological age or (Felt age—Chronological age)/Chronological age or (Look age—Chronological age)/Chronological age.

*** $p < .001$. ** $p < .01$. * $p < .05$

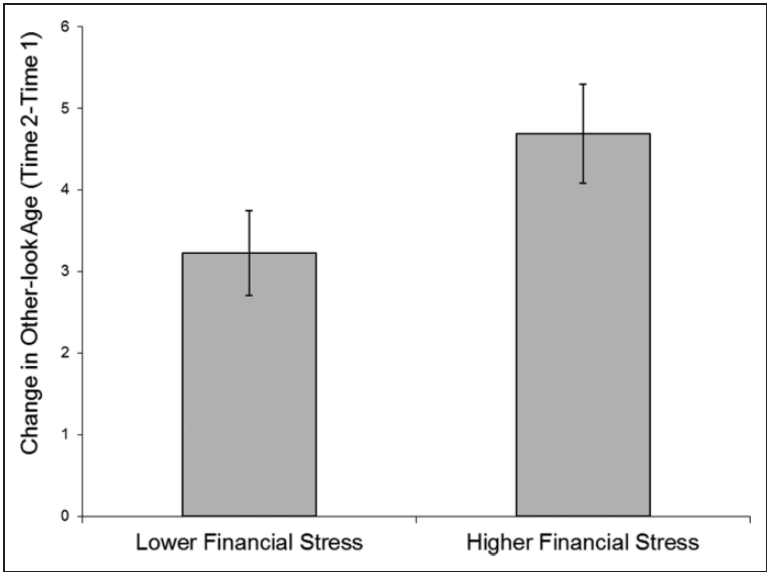


Figure 1. The estimated means of change in other-look age as a function of financial stress. Means were obtained in the model adjusted for other-look age at Time 1, time lapse between Time 1 and Time 2, chronological age, sex, education, income, health variables, attractiveness, and general stress. Error bars are standard errors of the mean.

Discussion

The present study focused on other-look age, felt age, and look age to examine whether financial stress is a predictor of individual differences in level and change over time. The contribution of financial stress to subjective age was examined with cross-sectional and longitudinal designs while controlling for income, health, and general level of stress. We also compared subjective age as assessed by others and the self and considered whether there are variations by age-group and sex. The results revealed significant cross sectional and longitudinal associations between financial stress and other-look age. As predicted, financial stress played a specific role for other-look age. Perceived stress over finances appears to be particularly relevant for age-related appearance as perceived by others. Those with higher levels of stress over finances were perceived as being older than their chronological age to a greater extent than those with less financial stress, while adjusting for income. The same pattern of results was obtained

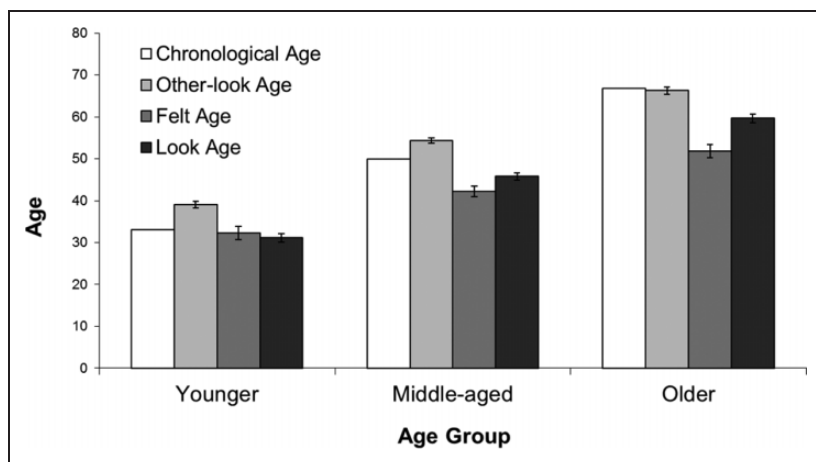


Figure 2. Chronological and subjective ages of younger (26–39), middle aged (40–59), and older (60–75) participants.

longitudinally, when we examined change in other-look age over time. Participants with higher stress over finances at Time 1 appear to “age faster” over 8–10 years. Controlling for the proportional discrepancy between other-look age and actual age at Time 1, those with higher stress over finances were perceived older than their chronological age at Time 2, compared to those with lower stress over finances. We expected all the subjective age measures to be associated with financial stress. Interestingly, financial stress was associated only with the other-look age facet of subjective age. Perhaps those with greater financial stress may not have the assets, time, or motivation for maintaining their appearance. Yet, we found this relationship even when controlling for income. Further investigation is needed in order to examine why perceived financial difficulties are not used as a source of information when people assess how old they feel and look. The differential relationships with other variables emphasize the need to consider the multidimensional nature of subjective age.

General overall stress, but not financial stress, was related to one’s self-ratings of felt age. Thus, it is the combined stress of work, interpersonal relationships, and health that are tied to how old one feels. This overall stress from social relationships in the family and at work may be experienced on a regular basis through interpersonal contact. Thus, these sources of stress can make a difference in one’s own perceptions of age based on the nature of these interactions. Moreover, the association between general stress and felt

age was only obtained with cross-sectional analyses. This suggests that the association between general stress and how old people feel operates across brief periods of time. This idea is in line with the recent studies showing a daily association between stress and felt age (e.g., Kotter-Grühn et al., 2015).

When the three indicators (i.e., other-look age, felt age, and look age) were compared, participants felt younger than they thought they looked and also thought that they looked younger than others thought they did. However, this was only the case for middle-aged and older adults and not for younger adults. This illustrates the distinction between different aspects of subjective age and the usefulness of considering them together in one study. Thus, our study highlights, as some of the previous work (Montepare, 1996; Pitt-Catsouphes, Matz-Costa, & James, 2012), the utility of a multidimensional approach to the study of subjective age. Sex was not a significant predictor of subjective age in any of the models, consistent with much of the previous research (e.g., Barak et al., 2001; Montepare, 1991). This study contributes to the existing literature by highlighting the role of financial stress, beyond the contributions of other aspects of stress, in understanding individual differences in age-related appearance. Specifically, despite the relatively small effect sizes (see Tables 2 and 3), our results show that financial stress has consequences in terms of appearance and change therein. Irrespective of income level, attractiveness, health, and other sources of stress, those with higher financial stress were perceived as being older than their chronological age. In turn, such differences in age-related appearance can have important implications for interpersonal interactions. Age perceived by others is a social cue people use to adjust their behaviors and attitudes (e.g., Berry & McArthur, 1986), so that how old one looks may affect how one is viewed or treated in different settings. Those with higher levels of stress over finances, for example, could be seen and treated as older than they actually are. Other-look age is also a useful cue in the health-care system, where it is often used as an indicator of physical health. In the current study, we examined multiple indicators of physical health (i.e., self-rated health, functional health, and number of chronic problems) in relation to other-look age, and in the longitudinal model, a significant association was obtained for functional health (Steps 2 and 3). For the participants with better functional health at Time 1, the other-look age proportional discrepancy scores at Time 2 were lower than for those with poorer functional health. The findings suggest that functional health is something that people can “see” and contributes to how old one looks. In contrast, self-rated health and chronic health conditions, which are not always manifested in appearance or visible to others, were associated with changes in self-assessments of how old people feel.³

The present findings also have implications that can address some of the popular views on aging and stress based on images of famous persons such as the U.S. presidents. Although it has been suggested in the media that presidents show accelerated aging based on their appearance due to stress of the job (e.g., Sellers, 2009; Smith, 2009), Olshansky (2011) noted that U.S. presidents live longer on average than other individuals of the same age. Nevertheless, it is possible that stress could lead to changes in physical appearance without affecting longevity. In the present study, we examined changes in perceived age for participants who were not presidents but were of similar age and varied in their experiences of stress. The results show that stress is related to changes in perceived age among the men and women in our sample. Our results are consistent with the view that financial stress can make you look older. Even though the presidents do not typically experience personal financial stress, as measured in this study, the great financial pressures and stress they face for the nation could have similar consequences for their facial appearance. However, these physical appearance changes are not necessarily tied to health or longevity, that is, presidents may age faster in their appearance than others who have less stress even if they do not experience health problems or die prematurely (Olshansky, 2011).

Although this study showed that financial stress predicted changes in other-look age, the results have to be considered in a general, temporal context. First, the consequences and the meaning of financial stress can change across the life span. Second, in this study, the financial stress data were collected in 1995–1996, a period of relative prosperity, possibly characterized by lower personal financial strain compared to other, more recent periods of recession. Yet individual differences in financial well-being were still existent. Future studies could explore if significant cohort differences occur in terms of financial stress and its association with subjective age. Moreover, the findings are not conclusive with regard to directionality or causality. As a first look at an alternative directional model, we examined whether other perceived age at Time 1 predicted change in financial stress and found it was not a significant predictor. This does not completely confirm the causal direction, however it does strengthen our conclusions and leads to new empirical questions for future research. Age morphing simulations in the lab that age one's facial features (Hershfield et al., 2011) represent a creative way to examine the consequences of perceived age by the self and by others. For example, the exposure to images of a future, older self affects one's savings for retirement (Hershfield et al., 2011). Along the same lines, future studies could examine to what extent variations in one's age observed by others is related to one's own and other's behaviors and

attitudes. Looking older, relative to others of the same age, could be associated with negative attitudes and discriminatory behaviors (e.g., ageism, job discrimination, poor physician–patient interactions, prejudicial health care, financial fraud) but also potentially with positive outcomes, such as respect and interactions that recognize one’s wisdom and life experience. Researchers could also examine what other psychosocial and behavioral factors, in addition to financial stress, are “visible” in faces and what indicators people use in judging age and its associated characteristics in their social and professional interactions.

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Notes

1. An alternative measure used in the literature is the discrepancy (Rubin & Berntsen, 2006), that is the simple difference between subjective age and actual age (e.g., [felt age—chronological age]). When we retested all our models using this measure, the patterns of results related to the predictive role of the stress measures did not change.
2. There is evidence that financial stress is chronic to some extent. We explored the stability of financial stress over time and the Time 1–Time 2 correlation was $r(110) = .73, p < .001$. Additional analyses indicated that when we predicted change in other-look age and we replaced the Time 1 financial stress measure by the Time 2 financial stress measure, the financial stress at Time 2 was a significant predictor.
3. A related research question is whether physical health mediates the association between financial stress and multiple facets of subjective age. Multiple mediational models, with self-rated health, functional health, and chronic health as mediators, were tested and did not reveal significant indirect effects.

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