

Running head: THE COMBINED EFFECTS OF DAILY STRESSORS

The Combined Effects of Daily Stressors and Major Life Events on Daily Subjective Ages

Jennifer A. Bellingtier, Shevaun D. Neupert, and Dana Kotter-Grühn

Department of Psychology, North Carolina State University, Raleigh, NC, 27695, USA

**This is a pre-copyedited, author-produced version of an article accepted for publication in *Journal of Gerontology: Psychological Sciences* following peer review. The version of record [Bellingtier, J. A., Neupert, S. D., & Kotter-Grühn, D. (2017). The combined effects of daily stressors and major life events on daily subjective ages. *Journal of Gerontology: Psychological Sciences*, 72(4), 613-621. <https://doi.org/10.1093/geronb/gbv101>] is available online at: <https://doi.org/10.1093/geronb/gbv101>.**

Corresponding author: Jennifer A. Bellingtier, phone: 319-400-4869, fax: 919-515-1716, email: [jabellin@ncsu.edu](mailto:jabellin@ncsu.edu)

### **Abstract**

**OBJECTIVES:** Stressors may be a contributing factor in determining how old an individual feels, looks, or would like to be. Currently, little research has been devoted to understanding the relationship between stressors and subjective age in older adults. We focus on the combined impact of major life event stressors and daily stressors on multiple indicators of subjective age: felt age, ideal age, and look age. Furthermore, we examine the process by which daily stressors relate to subjective ages by testing whether positive affect, control, and negative affect mediate this relationship.

**METHODS:** Using a daily diary design, the current study measured older adults' (60-96 years old) stressors, subjective ages, personal control, and affect.

**RESULTS:** Felt, ideal, and look ages each demonstrated a unique pattern of interactions between daily stressors and major life event stressors. Furthermore, our findings suggest that on the daily level, the relationship between stressors and felt age is mediated by negative affect but not by control and positive affect.

**DISCUSSION:** Findings indicate the need to consider the broader contextual picture of stressors, as well as their differential impact on multiple indicators of subjective age.

**Keywords:** Subjective Age, Daily Stressors, Stressful Life Events, Control, Affect

### The Combined Effects of Daily Stressors and Major Life Events on Daily Subjective Ages

A stressful day can make people feel older than their years. Although many have experienced the feeling, little research has been devoted to understanding the relationship between stressors and subjective age. Subjective age refers to how old or young individuals seem to themselves including how old one feels, looks, or would like to be (Kastenbaum, Derbin, Sabatini, & Artt, 1972). Although experience may confer wisdom and grace, a youthful identity is valued in many societies (Butler, 2005), and adults tend to report feeling younger than their chronological age (Barak & Stern, 1986).

Stress, or any event resulting in mental or physical distress (Aldwin, 2007), may be a factor individuals consider when determining their subjective ages. Increased exposure to stressors may artificially age, or “weather”, an individual. Geronimus (1992) originally proposed the “weathering hypothesis” to explain increased infant mortality rates among African-American mothers compared to same-aged European-American mothers. The accumulated stress of years of racial and social inequality had an aging effect on African-American mothers, such that their physical age was older than that of their European-American counterparts. Foster, Hagan, and Brooks-Gunn (2008) extended the thinking on weathering from biological markers of physical age to subjective age. They showed that increased early-life stress amplified individual’s perceptions of their age. In this case, young women who experienced higher levels of adolescent stress reported feeling older than their years.

Few studies have explicitly examined the link between stress and subjective age in older adults. Schafer and Shippee (2010) examined changes in subjective age (defined as felt age, or how old one feels) over a ten-year timeframe using data from the National Survey of Midlife Development in the United States (MIDUS; Brim et al., 1996; Ryff et al., 2006). They found that

stressors increased middle-aged adults' felt age. In order to better understand the relationship between stressors and subjective age, a resource deterioration model was investigated. This model posits a mediational relationship, such that stress diminishes an individual's psychosocial resources, which then leads to reductions in well-being (Ensel & Lin, 1991). Congruent with this model, personal control and positive affect, both psychosocial resources, mediated the relationship between stressors and felt age (Schafer & Shippee, 2010). In addition, our work has documented a within-person association between felt age and daily markers of well-being, including negative affect and total daily stressors (Kotter-Grühn, Neupert, & Stephan, 2015). Specifically, older adults felt older on days when they experienced more stressors or higher negative affect.

Daily exploration is critical because daily stressors, the annoying hassles of everyday life, can have a strong relationship with how one feels, which can be greater than the impact of major life-events (Almeida, 2005; Kanner, Coyne, Schaefer, & Lazarus, 1981). Indeed, previous research looking at the impact of major life-events such as retirement and widowhood (Ward, 2013) and death of a parent or sibling (Schafer & Shippee, 2010) found them to be unrelated to changes in subjective ages. Although major life-events may not predict changes in subjective age independently, they can set the backdrop against which daily stressors are experienced. For example, mothers who previously experienced life-event stressors exhibited flattened levels of cortisol in response to daily stressors when compared to mothers without life-event stressors (Wong, Seltzer, Greenberg, & Hong, 2012). Stressors come in many varieties, and in order to understand their impact, it may be necessary to consider a broader picture of stressor exposure (Wheaton, 1999).

### **Daily Stressors, Major Life-Event Stressors, and Subjective Age**

The first aim of the current study is to explore the interaction between major life-event stressors that have occurred over the past year and daily stressors reported on eight consecutive days. We suspect that this relationship may vary based on the dimension of subjective age measured. Embracing current calls to adopt multidimensional approaches towards subjective age (Diehl, Wahl, Brothers, & Miche, 2015), we explore three facets of subjective age: felt age, ideal age, and look age.

**Felt Age.** Prior work examining the relationship between stressors and subjective age has focused exclusively on felt age. Numerous studies have documented a relationship between youthful felt ages and desirable developmental outcomes: increased positive affect (Westerhof & Barrett, 2005), increased self-efficacy (Boehmer, 2007), flourishing mental health (Keyes & Westerhof, 2012), and longer life expectancies (Kotter-Grühn, Kleinspehn-Ammerlahn, Gerstorf, & Smith, 2009). As the presence of stressors tends to be negatively associated with many of these indicators of well-being (Lazarus, 2006), it follows that the presence of stressors may also predict a tendency to feel older. However, when examining major life-event stressors the association has generally failed to emerge except in limited specific circumstances (c.f., Schafer & Shippee, 2010), thus we do not expect to find it here. Nonetheless, individuals who have experienced major life-event stressors can react differently to daily stressors than individuals without this stressful history (Wong et al., 2012). Subjective ages may reflect a process of “anchoring and adjusting” one’s perception of age based on internal and external cues (Montepare, 2009, p.43). Life-event stressors may serve as an “anchor” for the felt age of older individuals, a major reminder of their place in the life course. Although this may not result in older felt ages in comparison to individuals who have not experienced these stressors, it may create a situation where they perceive less room for daily “adjustments.” Individuals without

major life-event stressors may therefore be more strongly impacted by daily stressors, and thus more likely to report older felt ages on days with daily stressors.

**Ideal Age.** Ideal age (also called desired age) reflects how old one would like to be. Ideal age captures a broader assessment of one's life (Ward, 2010), potentially making it less likely to be influenced by any one stressor (i.e., it may require one to consider both recent and past events). Furthermore, younger ideal ages (i.e., wanting to be younger than one's actual age), are related to *lower* levels of well-being perhaps reflecting a dissatisfaction with one's current age (Ward, 2010). Experiencing multiple types of stressors has also been associated with decreases in well-being (McElroy & Hevey, 2014). We predict that individuals high in both life-event and daily stressors may desire to return to a younger, presumably perceived as more positive (Ward, 2013), period in the lifespan and report younger ideal ages than individuals with less stressors.

**Look Age.** Look age refers to how old people believe they appear. Individuals often blame stress for changes in physical appearance. When recently asked what he would do differently if he could go back to his first day on the job, President Obama remarked that he would consider dying his hair sooner (Condon, 2015), presumably reflecting the toll of his stressful position. In the lab, stress has also been linked to a greying mane (Hara et al., 2011). Although stress may impact appearance, it is not clear whether those impacts would be felt immediately—if a single stressful day could produce an older perceived look age. We predict that a stressful day will be more likely to result in an older look age for individuals who have previously experienced major life-event stressors. We do not suspect that look age will be associated with daily stressors for individuals lacking this context.

### **Personal Control and Affect as Mediators**

The second aim of this study was to reexamine the process by which daily stress may relate to subjective ages. Shafer and Shippee (2010) demonstrated that the relationship between stress and felt age over a ten-year period was mediated by positive affect and personal control. Following this model, we also include measurements of positive and negative affect (Watson, Clark, & Tellegen, 1988), and personal control (Eizenman, Nesselroade, Featherman, & Rowe, 1997) as mediators at the daily level. Positive affect and control are thought to be psychosocial resources that enable individuals to maintain youthful identities (Ensel & Lin, 1991). In the Shafer and Shippee study, when stressors were present, individuals reported lower levels of resources (e.g., low positive affect), and low levels of resources predicted higher estimates of felt age. We expect a comparable mediating effect for positive affect and personal control on the daily level. We further suspect that on a daily level, individuals' subjective age may be influenced by negative affect. This assumption is based on findings from previous studies in which negative affect was associated with older subjective ages (Mock & Eibach, 2011; Westerhof & Barrett, 2005) and was linked to higher levels of stress (Montpetit, Bergeman, Deboeck, Tiberio, & Boker, 2010; Watson, 1988). Taken together, we predict that when a significant relationship exists between daily stressors and subjective age, it will be mediated by positive affect, personal control, and negative affect.

## **Method**

### **Participants**

Data were drawn from the Anticipatory Coping Every Day (ACED) study (Neupert, Ennis, Ramsey, & Gall, 2015), consisting of 43 community dwelling older adults (39 women) ranging in age from 60-96 years (see Table 1). Participants self-identified as European-American ( $n = 20$ ), African-American ( $n = 22$ ), and Asian ( $n = 1$ ). Their education level ranged from high

school graduate (most common) to Ph.D. or other professional degree, with the average being some college education. Nearly all participants reported their employment status as retired ( $n = 41$ ). Participants were compensated with a \$20 gift card.

Similar to past research, paired-samples t-tests revealed that participants' chronological age ( $M = 74.65$ ,  $SD = 8.19$ ) was significantly older than the age they felt ( $M = 60.86$ ,  $SD = 10.94$ ,  $t(42) = 8.01$ ,  $p < .001$ ,  $r = .33$ ), their ideal age ( $M = 54.85$ ,  $SD = 13.87$ ,  $t(42) = 9.65$ ,  $p < .001$ ,  $r = .35$ ), and their look age ( $M = 63.69$ ,  $SD = 9.01$ ,  $t(42) = 8.52$ ,  $p < .001$ ,  $r = .52$ ). The subjective age measures were themselves modestly correlated within-individuals (felt and ideal:  $\gamma_{10} = .26$ ,  $t = 4.96$ ,  $p < .001$ ; look and felt: ( $\gamma_{10} = .31$ ,  $t = 9.37$ ,  $p < .001$ ; look and ideal:  $\gamma_{10} = .19$ ,  $t = 5.48$ ,  $p < .001$ ).

Based on previous work examining the weathering hypothesis, which posits that the accumulated stress experienced by African-Americans due to racism and prejudice can have an aging effect, we examined our data for differences between our African-American and European-American participants. There were no differences between European-American and African-American participants in regards to number of reported total daily stressors ( $t(40) = 1.11$ ,  $p = .271$ ,  $\eta^2 = .04$ ), major life-event stressors ( $t(40) = -1.03$ ,  $p = .308$ ,  $\eta^2 = .03$ ), felt age ( $t(40) = -.60$ ,  $p = .555$ ,  $\eta^2 = .01$ ), nor look age ( $t(40) = 1.11$ ,  $p = .273$ ,  $\eta^2 = .03$ ). However, African-Americans ( $M = 71.86$ ,  $SD = 8.48$ ) were significantly younger than European-Americans ( $M = 77.90$ ,  $SD = 6.94$ ,  $t(40) = 2.51$ ,  $p = .016$ ,  $\eta^2 = .14$ ), and African-Americans ( $M = -15.57$ ,  $SD = 12.74$ ) reported significantly less discrepancy between their chronological age and ideal age than European-Americans ( $M = -23.40$ ,  $SD = 12.75$ ,  $t(40) = -1.99$ ,  $p = .054$ ,  $\eta^2 = .15$ ). On average, African-Americans reported that they would choose to be 15.57 years younger than their chronological age, whereas European-Americans would choose to be 23.40 years younger



than their chronological age. This resulted in African- ( $M = 56.30$ ,  $SD = 12.06$ ) and European-Americans ( $M = 54.50$ ,  $SD = 15.14$ ) desiring to be roughly the same ideal age, approximately 55 years old ( $t(40) = -.43$ ,  $p = .672$ ,  $\eta^2 = .76$ ).

### **Procedure**

A nine day daily-diary survey assessed participants' stressors, control beliefs, positive and negative affect, and subjective ages. Surveys were given to participants at senior-centers and club meetings in conjunction with a cognitive screening (Short Blessed Test: Katzman, 1983). Only individuals who scored below 8 on the screening were included. Participants completed the survey on a daily basis in their own homes. Individuals were instructed to fill in the date, start time, and end time daily for each survey and to complete the surveys on consecutive days. In line with previous paper and pencil diaries with older adults documenting high compliance rates (e.g., Normative Aging Study; Neupert, Almeida, Mroczek, & Spiro, 2006a, 2006b, Neupert, Mroczek, & Spiro, 2008) participants were not given daily reminders, but were told to skip a day and move on to the next if a day was missed. All participants completed at least six days.

The first survey completed on Day 1 contained baseline assessments of individual difference variables including major life-event stressors; the remaining 8 days contained our diary measures. Participants returned their surveys by mail at the end of the study. The compliance rate was 98.2%, with 380 out of a possible 387 days completed. It is important to note that the aims for the present study rely on day-level information, so power was primarily derived from the number of days (Snijders, 2005). Post hoc estimates of power (Faul, Erdfelder, Lang, & Buchner, 2007) for the most complex analysis (i.e., within-person main effects, between-person main effects, and the cross-level interaction) indicated that we had a power level of .82 when assuming a small effect size (.15).

### **Daily Diary Measures**

**Daily Stressors.** Daily stressors were measured using the Daily Inventory of Stressful Events (DISE; Almeida et al., 2002). Participants indicated whether or not they had experienced seven types of stressors within the past 24 hours, these included: disagreements, potential disagreements, stressful events in the workplace/volunteer setting, stressors at home, network stressors, (e.g., stressors occurring to one's family and friends), personal health stressors, (e.g., problems receiving treatment, medication-related issues, and illnesses) and other stressors.<sup>1</sup> Individuals received a summed total stressor score for each day with higher scores indicating more stressors.

**Daily Personal Control.** Personal control was assessed by a four-item inventory, which asked participants to indicate how much control they felt over four areas (memory, physical activity, schedule, things overall) in the past 24-hours (Eizenman, Nesselroade, Featherman, & Rowe, 1997). Five answer choices were provided, ranging from "0-not at all" to "4-in complete control". Scores were averaged across items, and participants received a daily score indicating their average level of control (for Day 1,  $\alpha = .71$ ).

**Daily Positive and Negative Affect.** Positive and negative affect were assessed using the Positive and Negative Affect Schedule (PANAS; Watson, et al., 1988). The PANAS consists of two 10-item mood scales. Positive affect was measured by words such as excited, attentive, and enthusiastic, whereas negative affect was measured by words such as hostile, scared, and distressed. Participants were asked to indicate the extent to which they felt these emotions in the past 24-hours. Responses were measured on a five-point Likert scale, such that higher scores indicated more of the affect. Scores for each item were averaged, and participants received a daily score for positive and negative affect (for Day 1: PA  $\alpha = .89$ ; NA  $\alpha = .84$ ).

**Daily Subjective Age.** Subjective age was assessed with three items: How old do you feel today? (felt age); If you could choose your age, how old would you want to be today? (ideal age); and How old would you say you look today? (look age) (cf. Kastenbaum, et al., 1972). Participants indicated their response by filling in the appropriate number of years. We used discrepancy scores calculated by subtracting chronological age from each subjective age score. Positive scores indicated a subjective age older than the participant's chronological age. Negative scores were more common and indicated that participants reported a subjective age younger than their chronological age.

### **Major Life-Event Stressors**

The Elders Life Stress Inventory (ELSI; Aldwin, 1991) measures 31 major life-event stressors that older adults may experience. Among the most commonly reported stressors were: death of a friend, death of a close family member, deterioration in finances, and deterioration in health. Participants checked yes or no to indicate if they had experienced any of these stressors in the past 12 months.

### **Analysis**

Data were analyzed using multilevel modeling (MLM; Raudenbush & Bryk, 2002). In our first models we predicted daily changes in each of our three subjective age measures (felt age, ideal age, look age) using total daily stressors (Level 1) and major life-event stressors (Level 2), as well as several between-person covariates considered by Schafer and Shippee (2010): chronological age, education, income, gender<sup>2</sup>, race, and retirement status (Level 2). Chronological age was a significant covariate for felt age ( $\gamma_{01} = -.60$ ) and look age ( $\gamma_{01} = -.52$ , but not ideal age ( $\gamma_{01} = -.49$ )<sup>3</sup> and this covariate was retained in all subsequent analyses whereas the other non-significant covariates have been removed from our models.<sup>4</sup> We also tested linear

time (i.e., day of study) as a within-person (Level 1) covariate. It was not significantly related to any of the indicators of subjective age so it was not retained in the models. In addition, all models were conducted with group-mean centered (Raudenbush & Bryk, 2002) within-person scores to adjust for the fact that some participants might be exposed to more daily stressors on a regular basis than others. The pattern of results remained unchanged so we report the uncentered results for ease of interpretation.

### Results

We conducted unconditional models to assess the level of variability within (Level 1) and between (Level 2) individuals in the subjective age measures. As previously noted in Kotter-Grühn et al. (2015), 77% of variability in felt age was between people and 23% of variability was within people. For ideal age 83% of variability was between people, and 17% of variability was within people. For look age, 81% of variability was between people, and 19% of variability was within people. All three subjective age measures demonstrated significant variability ( $p < .0001$ ) within people, suggesting significant day-to-day variability in all indicators of subjective age.

Our first aim concerned the daily association between daily stressors, major life-event stressors, and three separate measures of subjective age when controlling for chronological age. Each additional daily stressor predicted a 2.41 years increase in felt age ( $\gamma_{10} = 2.41, t = 2.90, p = .004$ ; cf. Kotter-Grühn et al., 2015) and a 2.01 years increase in look age ( $\gamma_{10} = 2.01, t = 3.67, p = .0003$ ). For example, on days when individuals experienced two stressors, they felt approximately five years older and believed they looked over four years older than they did on a stressor-free day. There was not a significant main effect of daily stressors on ideal age ( $\gamma_{10} = 1.12, t = 1.35, p = .178$ ). Most participants reported experiencing life-event stressors, however

16% reported none. As predicted, there were no main effects for major life-event stressors: felt age ( $\gamma_{02} = -.58, t = -.75, p = .459$ ), ideal age ( $\gamma_{02} = 1.08, t = 1.09, p = .282$ ), and look age ( $\gamma_{02} = -.55, t = -.99, p = .330$ ). These models included the interaction of life-event stressors and daily stressors.

As can be seen in Figure 1, main effects were qualified by significant cross-level interactions within all dimensions of subjective age: felt age ( $\gamma_{11} = -.48, t = -2.05, p = .041$ ), ideal age ( $\gamma_{11} = -.62, t = -2.66, p = .008$ ), and look age ( $\gamma_{11} = -.80, t = -5.20, p < .0001$ ). Individuals who had not experienced a major life-event stressor in the past year tended to feel older on days with daily stressors, but individuals who had experienced life-event stressors did not show this trend. In regards to ideal age, individuals experiencing both daily stressors and major life-event stressors desired to be younger than individuals only experiencing daily stressors. Finally, individuals high in major life-event stressors perceived themselves to look younger on days high in daily stressors, but those low in life-event stressors did not follow this trend. These models explained 12%, 2%, and 20% of the within-person variance and 15%, 2%, and 22% of the between-person variance in felt, ideal, and look age, respectively (Snijders & Bosker, 2012).

For our second aim, we tested whether the relationship between daily stressors and subjective age was mediated by daily measures of control and affect when including the contextual effect of major life event stressors and controlling for age differences. Following the conventions for lower level mediation in multilevel modeling outlined by Kenny, Korchmaros, and Bolger (2003), mediation effects were only assessed in situations where daily stressors significantly predicted changes in subjective age. In our study this applied to felt age as predicted by total stressors (when we removed the cross level interaction of major life-event stressors and daily stressors, the main effect of daily stressors on look age was no longer significant,  $\gamma_{10} = -$

0.35,  $t = -1.09$ ,  $p = 0.2752$ ). The first step of mediation found that total stressors were significantly related to felt age ( $\gamma_{10} = 1.01$ ,  $t = 2.12$ ,  $p = .0345$ ). In the second step of mediation, a higher number of total stressors was significantly related to higher positive affect ( $\gamma_{10} = .10$ ,  $t = 3.00$ ,  $p < .003$ ) and higher negative affect ( $\gamma_{10} = .10$ ,  $t = 6.44$ ,  $p < .0001$ ), but not control ( $\gamma_{10} = -.07$ ,  $t = -1.86$ ,  $p = .064$ ). In the third step of mediation, total stressors ( $\gamma_{10} = 1.09$ ,  $t = 2.27$ ,  $p = .024$ ) remained significant while positive affect ( $\gamma_{20} = -.72$ ,  $t = -.91$ ,  $p = .364$ ) did not significantly relate to felt age (Sobel test,  $z = -.87$ ,  $p = .398$ ). Thus, we found no evidence for mediating effects of positive affect or control. However, the relationship between total stressors and felt age ( $\gamma_{10} = .67$ ,  $t = 1.36$ ,  $p = .175$ ) was fully mediated by negative affect ( $\gamma_{20} = 3.92$ ,  $t = 2.41$ ,  $p = .017$ ). A follow-up Sobel test confirmed mediation ( $z = 2.26$ ,  $p = .024$ ), and this model accounted for 10% of the within-person and 12% of the between-person variance.

### Discussion

The present study expands current understandings of the relationship between stressors and subjective age at the daily level. Specifically, this is the first study to consider the combined impact of major life-event stressors and daily stressors on multiple measures of subjective age. Furthermore, we examined the mediational role of personal control and affect. Additionally, this is the first study to demonstrate significant daily within-person variance in ideal age and look age.

Our initial aim concerned the interaction of daily stressors and major life-event stressors. The latter had often proven unrelated to judgments of subjective age (Ward, 2013), but they had yet to be examined in conjunction with daily stressors. We believe major life-event stressors can serve as a context for understanding the impact of daily stressors (Wheaton, 1999). Supporting this view, we found that major life-event stressors do not independently predict changes in

subjective ages, but in each case significantly and uniquely qualify the relationship between daily stressors and each measure of subjective age: felt, ideal, and look ages.

We predicted that felt age might be more strongly anchored for individuals who had previously experienced life-event stressors (Barrett & Montepare, 2015), whereas individuals who lacked this context would show a greater response to daily stressors. Our results support this view: individuals high in major life-event stressors showed little change in their felt age ratings in response to daily stressors, but individuals without major life-event stressors felt considerably older when faced with daily stressors. This finding supports the premise that it is important to consider both distal and proximal sources of influence when assessing felt ages (Montepare, 2009). It also qualifies findings of a main effect for daily stressors on felt ages (Kotter-Grühn et al., 2015). Daily stressors appear to have a larger impact for individuals who have not experienced major life-event stressors in the past year. On the other hand, individuals who have experienced a major loss or change may find their daily stressors less influential in determining how old they feel.

Ideal age captures a broader assessment of one's life, and is less swayed by minor events (Ward, 2010). Therefore, we expected that alterations in ideal age would require a higher combination of stressors. Individuals who had experienced both major life-event stressors and daily stressors desired to be younger than individuals without this combination of stressors, although this accounted for a relatively small proportion of the variance. Coveting a younger age may reflect a desire to escape from the multitude of stressors one faces. Humans show a tendency to idealize the past, and see earlier times through rose-colored glasses (Mitchell, Thompson, Peterson, & Cronk, 1997). It is interesting to note that on average our sample desired to be 55 years old. This may reflect an interest in returning to a period of "peak functioning" as

the midlife years have been described (Lachman, 2004) or a desire to return to a more rosy historical moment. This cohort of adults would have hit midlife in the late 1990s, a period of economic prosperity and before the war on terror. When faced with both life-event stressors and daily stressors, older adults may be more inclined to seek the solace of a younger, perhaps perceived as more positive, age.

Look age captures an assessment of our physical appearance, how old we look when gazing into a mirror (Kastenbaum et al., 1972). Stress is associated with changes in physical appearance such as grey hairs (Hara et al., 2011). We anticipated that daily stressors would not be enough to change assessments of look age, absent the contextual stress of major life-events. Contrary to our expectations, individuals without major life-event stressors trended towards older assessments of look age on days with daily stressors, perhaps reflecting a similar pattern of adjustment seen in felt age (i.e., look ages are more malleable for individuals who have not experienced a major life-event stressor in the past year). Surprisingly, individuals who had previously experienced major life-event stressors perceived themselves to look younger on days with daily stressors. These individuals may be better able to put daily stressors into perspective, or to use them as opportunities to successfully manage stressors. Alternately, look ages have been found to more closely match observers' estimates of ages than individuals' chronological ages (Kotter-Grühn & Hess, 2012). Perhaps stressful days also contain more opportunities for interactions with others, which then impact judgments of look age.

In order to understand how stressors potentially impact subjective age, we tested three mediators: positive affect, negative affect, and control. Schafer and Shippee's (2010) ten-year study found that positive affect and control served as mediators between stress and subjective age. In the present study control was unrelated to daily stressors. Daily fluctuations in control



beliefs may be less meaningful for subjective age than more global trait-like measures. Although changes in daily stressors were related to changes in positive affect, positive affect did not mediate the relationship between the total number of stressors and felt age. Furthermore, on a daily basis positive affect and stressors were positively correlated in direct contradiction of the resource deterioration model (Ensel & Lin, 1991), which hypothesizes that stressors would lead to a reduction in positive affect.

Empirical evidence provides mixed results in regards to the daily relationship between stress and positive affect. Stawski, Sliwinski, Almeida, and Smyth (2008) found lower levels of positive affect in older adults, but not younger adults, on stressor days. Röcke, Li, and Smith (2009) found the reverse: positive affect was lower in younger adults on stressor days, but unaffected in older adults. Similar to our findings, Uchino, Berg, Smith, Pearce, and Skinner (2006) found higher levels of positive affect in older adults when they had recently experienced a stressor. Thus a clear relationship has yet to be established on the daily level. One possibility could be that older adults who experience stressors, but have success in managing them, may experience an uptick in positive affect. Thus stressors that are successfully managed may lead one to feel older in a positive sense, such that one has overcome a difficulty and is now older and wiser as a result of the experience. Although positive affect did not mediate relationship between stressors and felt age in our sample, it may be worth re-examining in future studies.

We did find evidence for a mediation role of negative affect in regards to total stressors and felt age. Adding negative affect into our model completely mediated the relationship between daily stressors and felt age. Stress has been previously linked to higher levels of negative affect on the daily level (Röcke, et al., 2009; Uchino, et al., 2006), and higher negative affect is associated with higher subjective age estimates between (Mock & Eibach, 2011;

Westerhof & Barrett, 2005) and within people (Kotter-Grühn et al., 2015). It appears that the negative mood that often accompanies stressors, although not necessarily wholly attributable to stressors, may be responsible for the higher gauging of felt age.

Our findings should be viewed in light of the following limitations. First, our sample consisted of American older adults with a high percentage of female participants. Stressors may not have the same impact on the subjective age ratings of younger adults, a more gender balanced sample, or individuals residing in countries with more positive views of aging. However, our results in regards to the aging effects of stressors on felt age are consistent with findings from a larger MIDUS sample (Schafer & Shippee, 2010). Next, although we had sufficient variability to examine within-person effects, our variability was lowest for ideal age, which may be why we were able to account for a relatively small proportion of the within-person variance in this variable. Finally, our data are correlational and thus cannot make statements about the direction of effects. For instance, it may be that on days when individuals feel older they are more likely to experience stressors.

Moving forward, future work should consider other stressor types. Although we have added nuance to the understanding of the impact of stressors by considering both daily stressors and major life-event stressors, chronic stressors should also be examined as part of the broader stressor context. These reoccurring problematic stressors can permeate daily life and serve as an additional context from which to understand other stressors (Wheaton, 1999). Additionally, although many dimensions of subjective age do not show a gender difference, look age has shown discrepancies in the past (Henderson, Goldsmith, & Flynn, 1995), thus our finding regarding the interactions of daily stressors and major life-event stressors on look age should be further investigated with men.

In regards to our mediational analyses, we were able to show that mediational relationships that work across a decade (cf. Schafer & Shippee, 2010) do not necessarily hold on a day-to-day basis. However, there is a vast chasm of time between a day and a decade. The mediating role of negative affect, found here at the daily level, should be reexamined on a longer time frame. It may be that negative affect has its greatest impact on the daily level, and that as time passes older adults are able to reevaluate the stressor thereby removing some of its negative impact (Urban, Charles, Mogle, & Almeida, 2014). Additionally, the mediational role of positive affect and control might re-emerge when measured monthly or yearly. Ultimately, understanding the associations between stressors and subjective ages may allow us to identify new pathways through which we can optimize life-satisfaction.

In conclusion, this is the first study to concurrently examine the impact of daily stressors and major life-event stressors on subjective age. Our findings indicate that the impact of major life-event stressors may be missed when it is studied individually. Furthermore, our findings suggest that on the daily level, the relationship between stressors and felt age is explained by negative affect. Finally, by taking a multidimensional approach to the measurement of subjective age, we were able to show that stressors have unique impacts on felt, look, and ideal ages.

Word count: 5,248

### **Funding**

This work was supported by a Faculty Research and Professional Development grant from North Carolina State University (to the second author); the Deutsche Forschungsgemeinschaft/German Research Foundation (KO 3579/3-1 to the third author); and an Emeritus Fund award from North Carolina State University (to the first author).

### References

- Aldwin, C. M. (1991). The Elders Life Stress Inventory (ELSI): Research and clinical applications. In P. A. Keller, S. R. Heyman, P. A. Keller, S. R. Heyman (Eds.), *Innovations in clinical practice: A source book, Vol. 10* (pp. 355-364). Sarasota, FL, US: Professional Resource Press/Professional Resource Exchange.
- Aldwin, C. M. (2007). *Stress, coping, and development: An integrative perspective (2nd ed.)*. New York, NY, US: Guilford Press.
- Almeida, D. M. (2005). Resilience and Vulnerability to Daily Stressors Assessed via Diary Methods. *Current Directions in Psychological Science, 14*(2), 64-68. doi:10.1111/j.0963-7214.2005.00336.x
- Almeida, D. M., Wethington, E., & Kessler, R. C. (2002). The Daily Inventory of Stressful Events: An interview-based approach for measuring daily stressors. *Assessment, 9*, 41-55. doi:10.1177/1073191102009001006
- Barak, B., & Stern, B. (1986). Subjective age correlates: A research note. *The Gerontologist, 26*(5), 571-578. doi:10.1093/geront/26.5.571
- Barrett, A. F., & Montepare, J. M. (2015). "It's About Time": Perspectives to the Study of Subjective Age. In M. Diehl, H. Wahl (Eds.), *Annual review of gerontology and geriatrics, Vol. 35, 2015: Subjective Aging: New Developments and Future Directions* (pp. 1-28). New York, NY, US: Springer Publishing Co. doi:10.1891/0198-8794.35.55
- Boehmer, S. (2007). Relationships between felt age and perceived disability, satisfaction with recovery, self-efficacy beliefs and coping strategies. *Journal of Health Psychology, 12*, 895-906. doi:10.1177/1359105307082453

Brim, O.G., Baltes, P. B., Bumpass, L.L., Cleary, P.D., Featherman, D.L., Hazzard, W. R., ...

Shweder, R. A. (1996). *National survey of midlife development in the United States (MIDUS), 1995-1996*. Boston, MA: Harvard Medical School, Department of Health Care Policy.

Butler, R. N. (2005). Ageism: Looking back over my shoulder. *Generations*, 29, 84–86.

Condon, S. (2015, March 18). Obama: I should've "closed Guantanamo on the first day". *CBS News*. Retrieved from <http://www.cbsnews.com>.

Diehl, M., Wahl, H. W., Brothers, A., & Miche, M. (2015). Subjective aging and awareness of aging: Towards a new understanding of the aging self. In M. Diehl, H. Wahl (Eds.), *Annual review of gerontology and geriatrics, Vol. 35, 2015: Subjective Aging: New Developments and Future Directions* (pp. 1-28). New York, NY, US: Springer Publishing Co. doi:10.1891/0198-8794.35.1

Eizenman, D. R., Nesselroade, J. R., Featherman, D. L., & Rowe, J. W. (1997). Intraindividual variability in perceived control in a older sample: The MacArthur successful aging studies. *Psychology and Aging*, 12, 489-502. doi:10.1037/0882-7974.12.3.489

Ensel, W. M., & Lin, N. (1991). The life stress paradigm and psychological distress. *Journal of Health and Social Behavior*, 32, 321-341. doi:10.2307/2137101

Faul, F., Erdfelder, E., Lang, A G., & Buchner, A. (2007). G\*Power 3: A flexible statistical power analysis program for the social, behavioral, and biomedical sciences. *Behavior Research Methods*, 39, 175-91.

Foster, H., Hagan, J., & Brooks-Gunn, J. (2008). Growing up fast: Stress exposure and subjective 'weathering' in emerging adulthood. *Journal of Health and Social Behavior*, 49, 162-177. doi:10.1177/002214650804900204

- Geronimus, A. T. 1992. The weathering hypothesis and the health of African American women and infants. *Ethnicity and Disease* 2, 222-231.
- Hara, M. R., Kovacs, J. J., Whalen, E. J., Rajagopal, S., Strachan, R. T., Grant, W., & ... Lefkowitz, R. J. (2011). A stress response pathway regulates DNA damage through  $\beta_2$ -adrenoreceptors and  $\beta$ -arrestin-1. *Nature*, 477, 349-353. doi:10.1038/nature10368
- Henderson, K. V., Goldsmith, R. E., & Flynn, L. R. (1995). Demographic characteristics of subjective age. *The Journal of Social Psychology*, 135, 447-457.  
doi:10.1080/00224545.1995.9712214
- Hubley, A. M., & Russell, L. B. (2009). Prediction of subjective age, desired age, and age satisfaction in older adults: Do some health dimensions contribute more than others? *International Journal of Behavioral Development*, 33, 12-21.  
doi:10.1177/0165025408099486
- Kanner, A. D., Coyne, J. C., Schaefer, C., & Lazarus, R. S. (1981). Comparison of two modes of stress measurement: Daily hassles and uplifts versus major life events. *Journal of Behavioral Medicine*, 4, 1-39. doi:10.1007/BF00844845
- Kastenbaum, R., Derbin, V., Sabatini, P., & Artt, S. (1972). "The ages of me": Toward personal and interpersonal definitions of functional aging. *The International Journal of Aging and Human Development*, 3, 197-211. <http://dx.doi.org/10.2190/TUJR-WTXK-866Q-8QU7>
- Katzman, R., Brown, T., Fuld, P., Peck, A., Schechter, R., & Schimmel, H. (1983). Validation of a short Orientation-Memory-Concentration Test of cognitive impairment. *The American Journal of Psychiatry*, 140, 734-739.
- Kenny, D. A., Korchmaros, J. D., & Bolger, N. (2003). Lower level mediation in multilevel models. *Psychological Methods*, 8, 115-128. doi:10.1037/1082-989X.8.2.115

- Keyes, C. M., & Westerhof, G. J. (2012). Chronological and subjective age differences in flourishing mental health and major depressive episode. *Aging & Mental Health, 16*, 67-74. doi:10.1080/13607863.2011.596811
- Kotter-Grühn, D., & Hess, T. M. (2012). The impact of age stereotypes on self-perceptions of aging across the adult lifespan. *The Journals Of Gerontology: Series B: Psychological Sciences and Social Sciences, 67B*, 563-571. doi:10.1093/geronb/gbr153
- Kotter-Grühn, D., Kleinspehn-Ammerlahn, A., Gerstorf, D., & Smith, J. (2009). Self-perceptions of aging predict mortality and change with approaching death: 16-year longitudinal results from the Berlin Aging Study. *Psychology and Aging, 24*, 654-667. doi:10.1037/a0016510
- Kotter-Grühn, D., Neupert, S. D., & Stephan, Y. (2015). Feeling old today?: Daily health, stressors, and affect explain day-to-day variability in subjective age. *Psychology and Health*. <http://dx.doi.org/10.1080/08870446.2015.1061130>
- Lachman, M. E. (2004). Development in midlife. *Annual Review of Psychology, 55*305-331. doi:10.1146/annurev.psych.55.090902.141521
- Lazarus, R. S. (2006). *Stress and emotion: A new synthesis* (2nd ed). New York, NY: Springer Publishing Co.
- McElroy, S., & Hevey, D. (2014). Relationship between adverse early experiences, stressors, psychosocial resources and wellbeing. *Child Abuse & Neglect, 38*(1), 65-75. doi:10.1016/j.chiabu.2013.07.017
- Mitchell, T. R., Thompson, L., Peterson, E., & Cronk, R. (1997). Temporal adjustments in the evaluation of events: The 'rosy view.'. *Journal of Experimental Social Psychology, 33*, 421-448. doi:10.1006/jesp.1997.1333



- Mock, S. E., & Eibach, R. P. (2011). Aging attitudes moderate the effect of subjective age on psychological well-being: Evidence from a 10-year longitudinal study. *Psychology and Aging, 26*, 979-986. doi:10.1037/a0023877
- Montepare, J. M. (2009). Subjective age: Toward a guiding lifespan framework. *International Journal of Behavioral Development, 33*, 42-46. doi:10.1177/0165025408095551
- Montpetit, M. A., Bergeman, C. S., Deboeck, P. R., Tiberio, S. S., & Boker, S. M. (2010). Resilience-as-process: Negative affect, stress, and coupled dynamical systems. *Psychology and Aging, 25*, 631-640. doi:10.1037/a0019268
- Neupert, S.D., Almeida, D.M., Mroczek, D.K., & Spiro, A. III. (2006a). The effects of the Columbia shuttle disaster on the daily lives of older adults: Findings from the VA Normative Aging Study. *Aging & Mental Health, 10*, 272-281.  
doi:10.1080/13607860500409682
- Neupert, S.D., Almeida, D.M., Mroczek, D.K., & Spiro, A. III. (2006b). Daily stressors and memory failures in a naturalistic setting: Findings from the VA Normative Aging Study. *Psychology and Aging, 21*, 424-429. doi:10.1037/0882-7974.21.2.424
- Neupert, S.D., Ennis, G.E., Ramsey, J.L., & Gall, A.A. (2015). Solving Tomorrow's Problems Today? Daily Anticipatory Coping and Reactivity to Daily Stressors. *Journal of Gerontology: Psychological Sciences*. doi: 10.1093/geronb/gbv003
- Neupert, S.D., Mroczek, D.K., & Spiro, A. III. (2008). Neuroticism moderates the daily relation between stressors and memory failures. *Psychology and Aging, 23*, 287-296.  
doi:10.1037/0882-7974.23.2.287
- Raudenbush, S. W., & Bryk, A. S. (2002). Hierarchical linear models. Thousand Oaks, CA: Sage.

- Röcke, C., Li, S., & Smith, J. (2009). Intraindividual variability in positive and negative affect over 45 days: Do older adults fluctuate less than young adults?. *Psychology and Aging, 24*, 863-878. doi:10.1037/a0016276
- Ryff, C., Almeida, D. M., Ayanian, J. S., Carr, D. S., Cleary, P. D., Coe, C., ... Williams, D. (2006). *Midlife development in the United States (MIDUS II), 2004-2006*. Madison: University of Wisconsin Survey Center.
- Schafer, M. H., & Shippee, T. (2010). Age identity in context: Stress and the subjective side of aging. *Social Psychology Quarterly, 73*, 245-264. doi:10.1177/0190272510379751
- Snijders, T.A. (2005). Power and sample size in multilevel modeling. In B.S. Everitt & D.C. Howell (Eds.), *Encyclopedia of Statistics in Behavioral Science*, Vol. 3 (pp. 1570-1573). Chicester (etc.): Wiley.
- Snijders, T. A., & Bosker, R. J. (2012). *Multilevel analysis: an introduction to basic and advanced multilevel modeling*. (2nd ed). London: Sage Publications Ltd.
- Stawski, R. S., Sliwinski, M. J., Almeida, D. M., & Smyth, J. M. (2008). Reported exposure and emotional reactivity to daily stressors: The roles of adult age and global perceived stress. *Psychology and Aging, 23*, 52-61. doi:10.1037/0882-7974.23.1.52
- Uchino, B. N., Berg, C. A., Smith, T. W., Pearce, G., & Skinner, M. (2006). Age-related differences in ambulatory blood pressure during daily stress: Evidence for greater blood pressure reactivity with age. *Psychology and Aging, 21*, 231-239. doi:10.1037/0882-7974.21.2.231
- Urban, E., Charles, S., Mogle, J., Almeida, D. (2014). The role of temporal reports in age differences in emotional well-being. Paper presented at the Gerontological Society of America Annual Meeting, Washington, DC.

- Ward, R. A. (2010). How old am I?: Perceived age in middle and later life. *The International Journal of Aging & Human Development*, 71, 167-184. doi:10.2190/AG.71.3.a
- Ward, R. A. (2013). Change in perceived age in middle and later life. *The International Journal of Aging & Human Development*, 76, 251-267. doi:10.2190/AG.76.3.e
- Watson, D. (1988). Intraindividual and interindividual analyses of positive and negative affect: Their relation to health complaints, perceived stress, and daily activities. *Journal of Personality and Social Psychology*, 54, 1020-1030. doi:10.1037/0022-3514.54.6.1020
- Watson, D., Clark, L. A., & Tellegen, A. (1988). Development and validation of brief measures of positive and negative affect: The PANAS scales. *Journal of Personality and Social Psychology*, 54, 1063-1070. doi:10.1037/0022-3514.54.6.1063
- Westerhof, G. J., & Barrett, A. E. (2005). Age Identity and Subjective Well-Being: A Comparison of the United States and Germany. *The Journals Of Gerontology: Series B: Psychological Sciences and Social Sciences*, 60B, S129-S136.  
doi:10.1093/geronb/60.3.S129
- Wheaton, B. (1999). The nature of stressors. In A. V. Horwitz, T. L. Scheid, A. V. Horwitz, T. L. Scheid (Eds.), *A handbook for the study of mental health: Social contexts, theories, and systems* (pp. 176-197). New York, NY, US: Cambridge University Press.
- Wong, J. D., Seltzer, M. M., Greenberg, J. S., Hong, J., Almeida, D. M., & Coe, C. L. (2012). Stressful life events and daily stressors affect awakening cortisol level in midlife mothers of individuals with autism spectrum disorders. *Aging & Mental Health*, 16, 939-949.  
doi:10.1080/13607863.2012.688191

### Footnotes

<sup>1</sup> For a description of daily stressor frequencies in the ACED sample see Neupert et al., 2015.

Overall, participants reported at least one daily stressor on 36% of study days and multiple stressors on 15% of study days, similar to reported levels (39% and 10% respectively) of daily stressors in the National Study of Daily Experiences (Almeida, Wethington, & Kessler, 2002).

<sup>2</sup> Given the low number of men in our sample, all analyses were rerun with men ( $n = 4$ ) excluded. All pattern of results (including interactions) remained.

<sup>3</sup> As chronological age was not a significant covariate of ideal age, we examined a model excluding it. This did not change the pattern of results, and we therefore report findings from the model including chronological age to maintain consistency across subjective age variables.

<sup>4</sup> There was one other significant covariate. Specifically, race was a significant covariate for look age ( $\gamma_{03} = 5.45$ ). A model including race as a covariate did not change the pattern of results. To maintain consistency across subjective age variables, we report the model excluding race.

Table 1

*Descriptive Statistics For Study Variables*

Variable	<i>M</i>	<i>SD</i>	<i>Range</i>
Total Daily Stressors	.65	.86	3.38
Life Event Stressors	2.44	2.11	10.00
Personal Control	3.04	.58	2.00
Positive Affect	3.20	.81	3.72
Negative Affect	1.13	.19	.90
Chronological Age	74.65	8.19	36.00
Felt Age	60.86	10.94	50.33
Felt Age Discrepancy	-13.84	11.28	47.21
Ideal Age	54.85	13.87	64.79
Ideal Age Discrepancy	-19.80	13.45	55.45
Look Age	63.69	9.01	38.63
Look Age Discrepancy	-10.97	8.44	35.50

*Note.* Except in the case of life event stressors which were measured once at baseline, means, standard deviations, and ranges are person-level average scores (averaged across all eight assessments). Discrepancy scores were calculated by subtracting chronological age from subjective age.

**Figure Caption**

*Figure 1.* Interaction between major life event stressors (as measured by ELSI) and daily stressors for subjective ages (Panel A: Felt Age; Panel B: Ideal Age; Panel C: Look Age). Low and high ELSI were operationalized as one standard deviation below and above the mean, respectively. All interactions are significant.