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Associations among Fluid and Crystallized Cognition and Daily Stress Processes in Older Adults

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Abstract

The current study examined associations among fluid and crystallized cognition, and daily stress processes in older adults. Older adults (N=107) completed measures of daily stressors, and affect on six occasions over two weeks, as well as measures of fluid and crystallized cognition. Higher crystallized cognition was associated with a greater likelihood of exposure to daily stressors, including arguments and avoided arguments. Higher fluid cognition was associated with diminished emotional reactivity to daily stressors for negative but not positive affect. Discussion focuses on the roles of fluid and crystallized cognition for understanding daily stress processes, daily activity and lifestyle, and health.

Keywords

Daily Stress; Fluid and Crystallized Cognition; Positive and Negative Affect

Daily stressors are relatively minor events that frequently arise in everyday life. These everyday hassles that have more proximal and immediate effects on health and well-being than more severe yet less frequently encountered major life events, and may accumulate over time to exert more durable long-term effects on health and well-being (Almeida, 2005; Lazarus, 1999; Zautra, 2003). Daily stress research focuses on understanding exposure, as well as how people react emotionally to everyday stressors (Almeida, 2005; Bolger & Zuckerman, 1995). Although considerable research has focused on sociodemographic factors related to daily stress processes, recent findings have shown cognition during midlife to be an important predictor of daily stress processes (Stawski et al., 2010). The current study aims to extend previous research on the association between cognitive function and daily stress processes during midlife to old age.

The constructs of exposure and emotional reactivity are central to the study of daily stress processes. Exposure refers to the likelihood of reporting experiencing a stressor on a given day, whereas emotional reactivity refers to changes in positive and negative affect as a function of reported daily stress (Almeida, 2005; Bolger & Zuckerman, 1995). Furthermore, a central goal of daily stress research has been to identify resilience and vulnerability factors

that are associated with exposure and emotional reactivity (Almeida, 2005; Bolger & Zuckerman, 1995).

To this end, researchers have investigated a host of sociodemographic and psychological factors that are associated with both exposure and emotional reactivity including age (Almeida & Horn, 2004; Chiriboga, 1997; Röcke et al., 2009; Sliwinski et al., 2009; Stawski et al., 2008; Zautra et al., 1991), sex (Almeida & Kessler, 1998; Bolger et al., 1989; Folkman et al., 1987), education (Almeida et al., 2005; Grzywacz et al., 2004), neuroticism (Bolger & Zuckerman, 1995; Mroczek & Almeida, 2004), and perceived stress (Stawski et al., 2008). Beyond these factors, recent research has shown evidence of associations between cognition and daily stress, with older adults reporting more memory failures (Neupert et al., 2006), and exhibiting poorer working memory performance (Sliwinski et al., 2006) on higher stress days compared to lower stress days. Furthermore, results from the National Study of Daily Experiences revealed that individual differences in fluid cognition are associated with increased exposure and dampened emotional reactivity to daily stressors during midlife (Stawski et al., 2010). Specifically, midlife adults with higher fluid cognitive ability were more likely to report experiencing daily stressors, particularly being overloaded with responsibilities at work and at home. Interestingly, higher fluid cognitive ability was associated with diminished emotional reactivity, however, this effect was specific to stressor-related increases in negative affect as stressor-related decreases in positive affect were unaltered. Thus, the available evidence suggest that individual differences in cognition exhibit a complex association with daily stress processes such that *higher* cognitive ability is associated with *increased* exposure but *decreased* reactivity.

One limitation of Stawski et al.'s study was its exclusive focus on fluid cognition and failure to consider crystallized cognition. Whereas fluid cognition reflects the capacity to solve novel problems, and process and integrate information, crystallized cognition reflects the knowledge and skills acquired through education and cultural experiences (Baltes et al., 1999; Horn & Cattell, 1967; Horn & Hofer 1992). Fluid and crystallized cognition exhibit different developmental trajectories with fluid cognition peaking around age 20 and declining into old age, and crystallized peaking around age 20 and exhibiting less age-related decline old age (e.g., McArdle et al. 2002). Furthermore, fluid and crystallized cognition have been shown to exhibit differential sensitivity in response to cognitive intervention (Stine-Morrow & Basak, 2011), and each has been shown to be uniquely predictive of everyday cognition (e.g., Allaire & Marsiske, 1999; 2002) and activity engagement (e.g., Parisi et al., 2009). Thus, fluid and crystallized cognition may each play an important role for understanding individual differences in daily stress processes, and health more generally.

Fluid cognition is purported to be useful in novel and complex contexts, such as situations which are potentially stressful or require adaptation (e.g., Gottfredson & Deary, 2004), and some have suggested that fluid cognition is a fundamental cause of health disparities (Gottfredson, 2004). Consistent with this notion, higher fluid cognition in adulthood and aging has been linked to better psychological well-being (Isaacowitz & Smith, 2003), greater perceived control (Lachman & Leff, 1989), less frequent hospitalization (Chodosh et al., 2004), increased longevity (Gottfredson & Deary, 2004), lower levels of disablement (Smits et al., 1997), diminished mortality risk (Bosworth & Siegler, 2002; Deary et al., 2004), and diminished emotional reactivity to daily stressors (Stawski et al., 2010). Crystallized cognition has received less empirical attention with respect to health outcomes, focusing more on health knowledge (Beier & Ackerman, 2003), lifestyle choices/activity engagement (Hultsch et al., 1993), with no evidence we are aware of linking crystallized cognition to daily stress processes. Given the previous work linking cognition to health,

well-being and daily stress, both fluid and crystallized cognition appear to be potentially important predictors of daily stress processes, but possibly for different reasons.

Fluid and crystallized cognition may exhibit positive associations with exposure to daily stressors such that individuals possessing higher levels of fluid and crystallized cognition may self-select into more challenging and demanding environments (e.g., Parisi et al., 2009) increasing their potential exposure to daily stressors, which would be consistent with previous research (Stawski et al., 2010). With respect to emotional reactivity to daily stressors, fluid and crystallized cognition could act to buffer against emotional reactions. Higher fluid cognition may afford the ability to adapt to novel and stressful situations when they happen, thereby blunting the emotional impact, whereas higher levels of crystallized cognition may be associated with diminished emotional reactions because accumulated knowledge and expertise in dealing with daily stressors better equips a person to adapt to stressful situations. Taken together, examining both fluid and crystallized cognition is an important next step to better understand the unique contributions of these domains of cognition as they relate daily stress processes, and subsequently considering the potential mechanisms for these links.

The current study was conducted to accomplish two goals. First, we sought to examine the unique influences of both fluid and crystallized cognition on exposure and emotional reactivity to daily stressors. Second, we wanted to extend research on cognition and daily stress processes during midlife to older adults.

Method

Participants

A total of 107 older adults participated in the study. Sixty three were community-dwelling adults from the greater Syracuse, NY area, recruited via advertisements in newspapers and at senior centers, and forty four were residents of a senior community in the same area. The mean age of the sample was 80.01 years ($SD=6.25$, Range=66–95; 28% male), with an average of 15.01 years of education ($SD=2.42$, Range=8–22). All participants were mentally intact as indexed by fewer than 8 errors on the Blessed Mental Status Exam (Blessed, Tomlinson, & Roth, 1968).

Materials

Fluid cognition was measured using the Woodcock-Johnson Analysis Synthesis test (Woodcock et al., 2001), which requires participants to solve logical puzzles using color code rules. *Crystallized cognition* was measured using the Mill Hill Vocabulary Test (Raven, Court & Raven, 1986). *Daily positive and negative affect* were measured using a version of Philadelphia Geriatric Center Positive and Negative Affect Scales (Lawton et al., 1992) where participants indicated the extent to which they were experiencing five positive and five negative adjectives, right now, at this very moment. *Daily physical symptoms* were assessed using a brief checklist of symptoms experienced in the past 24 hours (Larsen & Kasimatis, 1991).

Daily stress was measured using a version of the Daily Inventory of Stressful Events (Almeida et al., 2002). Participants reported whether they experienced three categories of daily stressors within the past 24 hours including interpersonal tensions (Did you have an argument or disagreement with anyone?; Did anything else happen that you could have argued or disagreed about, but you decided to let it pass?), network stressors (Did anything happen to a close friend or relative that turned out to be stressful for you?), and health-related stressors (Did anything stressful happen regarding your personal health?). Participants rated the severity of the experiences on a 4-point scale (1 = *not at all* to 4 =

very). Daily stressors were quantified in three ways. First, a dichotomous variable was used to characterize days as either stressor days (at least one stressor was reported) or non-stressor days, and serves as the primary index of daily stressor exposure. Second, a summed severity score of the daily stressors was calculated to provide a severity-weighted estimate of daily stress and to index differential severity of stressor days.

Procedure

After being given an introduction to the study, participants provided informed consent and were tested on six occasions during an 8 to 14 day period. Half of the session took place in the morning (before 11:00) and half took place in the afternoon (after 1:00). Participants were tested individually, and by the same research assistant on each of the sessions. Positive and negative affect were measured at the beginning of each session, while daily stressors were assessed at the end of the session, with the fluid and crystallized cognition tasks being administered at the beginning of the first session.

Analytic Strategy

Since days were nested within persons, all analyses were conducted using multilevel models with full information maximum likelihood estimate. Exposure to daily stressors was modeled using 2-level logistic multilevel models (SAS PROC NLMIXED) such that the log odds of the probability of reporting a stressor to have occurred was modeled as a function of the person-level predictors of fluid and crystallized cognition. Emotional reactivity to daily stressors was also modeled using 2-level linear multilevel models (SAS PROC MIXED). Here, a person's affect on a given day was modeled as a function of whether they reported experiencing any stressors (a time-varying covariate), which indexes the extent to which affect changes as a function of the daily stressors (non-stressor days vs. stressor days), and is our operational index of emotional reactivity to daily stressors (Hoffman & Stawski, 2009). Using a dichotomous index of daily stress (0=non-stressor day, 1=stressor day), the intercept in our model reflects affect on non-stressor days and the time-varying daily stressor effect reflects the change in affect associated with stressor days (compared to non-stressor days). Fluid and crystallized cognition were included as person-level predictors of the within-person association between daily stressors and daily affect to test whether emotional reactivity was moderated by individual differences in fluid and crystallized cognition. Two sets of models were estimated. The first set included either fluid (Model 1) or crystallized (Model 2) cognition as predictors of exposure and emotional reactivity to daily stressors to assess their total effects, the second set included them as simultaneous predictors (Model 3) to examine their unique (partial) effects on exposure and emotional reactivity. All models included linear and quadratic time trends to account for any systematic mean change across session, age, sex, physical symptoms and education as covariates. See Stawski et al. (2010) for more details regarding the analyses.

Results

Descriptive statistics and correlations among study variables are shown in Table 1. Initial analyses indicated that participants from the senior residence were significantly older than the community dwelling participants (85 vs. 76, $p < .01$) and had lower Analysis-Synthesis scores (21 vs. 23, $p = .01$), but that the groups did not differ on any other demographic, cognition, daily stress or affect index. All subsequent analyses adjust for senior residence vs. community dwelling. Analysis-Synthesis and Vocabulary scores were positively correlated ($r = .38$, $p < .05$). With respect to daily stressors, at least one stressor was reported on 45% of days, with arguments reported on 6% of days, avoided arguments on 13% of days, network stressors on 18% of days, and health-related stressors on 8% of days. Multiple stressor days were relatively rare (16% of days).

Predictors of Exposure to Daily Stressors

Table 2 shows the effects of Analysis-Synthesis and Vocabulary on the likelihood of reporting experiencing a daily stressor. The results were unchanged whether Analysis-Synthesis and Vocabulary were included separately or simultaneously, so we focus on the results of the model with their simultaneous inclusion (Model 3). Higher Vocabulary, but not Analysis-Synthesis scores, were associated with a significantly greater likelihood of reporting experiencing any daily stressors, and this was specific to reports of arguments and avoided arguments.

Predicting Emotional Reactivity to Daily Stressors

Table 3 shows the effects of Analysis-Synthesis and Vocabulary on emotional reactivity (daily stressor-related changes in negative and positive affect). Preliminary analyses indicated the pattern of results was the same whether the dichotomous or severity-weighted daily stress scores were used, or whether we covaried for severity. As such, we only report results using the dichotomous daily stress index. Furthermore, the results were the same regardless of whether fluid and crystallized cognition were included separately or simultaneously, so we focus on the results including them simultaneously (Model 3). For negative affect, the main effect of Analysis-Synthesis was significant, indicating that higher fluid cognition was associated with lower levels of negative affect on non-stressor days. For the within-person daily stress effect, our estimate of emotional reactivity, negative affect was significantly higher on stressor days compared to non-stressor days. Analysis-Synthesis was a significant predictor of the within-person daily stress effect indicating that higher Analysis-Synthesis scores were associated with smaller increases in negative affect. The daily stressor-related increase in negative affect for individuals 1 standard deviation below the mean (estimate=1.35, $p<.01$) on Analysis-Synthesis performance was 2.4 times greater than the increase for individuals 1 standard deviation above the mean (estimate=.56, $p<.01$). We did further explore the moderating effects of fluid and crystallized cognition on daily stressor-related increases in negative affect for each stressor type, but none of the effects were significant. The general trend in these analyses indicated that better fluid cognition was associated with smaller stressor-related increases in negative affect. However, with fewer instances of stressors occurring when considering by stressor type, the standard errors of the estimates increased.

For positive affect, higher Analysis-Synthesis scores were associated with significantly higher levels of positive affect on non-stressor days. Importantly, the within-person daily stressor effect was significant, indicating that positive affect was significantly lower on stressor days compared to non-stressor days, however, neither Analysis-Synthesis nor Vocabulary scores significantly predicted daily stressor-related decreases in positive affect.

Supplementary Analyses

We explored potential age (linear and non-linear) differences in the effects of fluid and crystallized cognition on reported exposure and emotional reactivity to daily stressors but found little evidence (all $ps>.17$). We also explored whether the interaction of fluid and crystallized cognition was predictive of exposure and emotional reactivity to daily stressors, but found no evidence suggesting that the observed effects of fluid and crystallized cognition operate largely independent of one another (all $ps>.18$).

Discussion

There were two main findings from the current study. First, higher crystallized cognition was associated with an increased likelihood of reported exposure to daily stressors among older adults, specifically arguments and avoided arguments. Second, higher fluid cognition

was associated with lower levels of negative affect and dampened emotional reactivity for negative but not positive affect. It is also important to note that all of the associations between fluid and crystallized cognition and daily stress processes were independent of the influences of sex, physical symptoms and education, were age invariant, and operated independently of one another.

With respect to stressor exposure higher crystallized, but not fluid cognition was associated with an increased likelihood of stressor exposure, particularly increased exposure to arguments and avoided arguments. One possible explanation for the positive association between crystallized cognition and the frequency of interpersonal stressors is that those older adults with higher crystallized cognition lead a more active social lifestyle (e.g., Hultsch et al., 1992; Hultsch et al., 1999; Parisi et al., 2009; Perlmutter & Nyquist, 1990; Schooler & Mulatu, 2001; Schooler et al., 1999) and consequently have more opportunities for exposure to both positive and negative social interactions. Our failure to find a positive association between fluid cognition and exposure to daily stressors seems to be inconsistent with results from Stawski et al. (2010) which showed that higher fluid cognition was associated with increased exposure to daily stressors. However, a more nuanced examination of the findings suggests consistency between the studies.

Stawski et al. (2010) found that higher fluid cognition was specifically associated with increased exposure to work-related stressors, but not arguments, avoided arguments or network stressors. Our results were similar to the earlier work by Stawski in that we also did not observe significant associations between fluid cognition and arguments, avoided arguments, and network stressors in the current study. We did largely replicate the relationship between fluid cognition and stressor frequency reported by Stawski et al (2010) in the current study because that relationship was driven by work-related stressors and our sample consisted of mostly retired persons (only two participants were working and then only part time and neither in their primary profession).

During midlife, an engaged lifestyle may largely reflect work-related responsibilities, whereas during old age, an engaged lifestyle may largely reflect social engagement, and the importance of fluid cognition for understanding individual differences in occupational and complex life contexts individuals select into (e.g., Kuncel, Ones & Sackett, 2010), may decrease with age. If daily stressors do, at some level, reflect the extent to which one leads a more active and engaged lifestyle, then the observed positive association with cognition is consistent with previous research showing similar associations with living active lifestyles (Hultsch et al., 1999; Parisi et al., 2009; Perlmutter & Nyquist, 1990; Schooler & Mulatu, 2001; Schooler et al., 1999).

With respect to emotional reactivity higher fluid cognition was associated with diminished emotional reactivity, specifically daily stressor-related increases in negative affect, which is consistent with Stawski et al. (2010). Crystallized cognition did not serve to buffer emotional reactions to daily stressors. Knowledge and experience with daily stressors are likely important in dealing with subsequent daily stressors, however vocabulary, as a proxy for crystallized cognition, may not capture this adequately. An important avenue for future research could be to explicitly measure knowledge and experience in dealing with stressors to see if this domain specific knowledge may be a more sensitive index for testing this hypothesis. Together, these results suggest that native mental flexibility is more beneficial than acquired knowledge, as measured by the Analysis-Synthesis and Vocabulary tasks, respectively, for tempering emotional to daily stressors in old age. This is consistent with broader theoretical perspectives on the role of fluid cognition in health and well-being (e.g., Gotfredson 2004; Perlmutter & Nyquist, 1990).

We did explore age differences in the effects of fluid and crystallized cognition on daily stress processes but did not find evidence for age moderation. Our 30-year age range may have constrained our ability to detect age differences, but Stawski et al (2010) also found the effects of fluid cognition on daily stress processes to be largely age invariant across a 50-year age range, suggesting that cognition-daily stress links may be fairly stable across midlife and old age. Furthermore, we failed to observe any evidence of fluid and crystallized cognition interacting to predict exposure or emotional reactivity to daily stressors. Thus, fluid and crystallized cognition appear to operate independently of one another and exhibit unique effects on exposure and emotional reactivity to daily stressors.

This study has a few limitations are worth noting. First, fluid and crystallized cognition were operationally defined using single tasks, and incorporating better measurement of these constructs would be of benefit. Second, emotional reactivity was defined as the within-person slope between retrospective reports of daily stressors and affect. Future research using experimental and experience sampling techniques will help to improve the temporal resolution of stressor-affect linkages, and how cognition might influence such links. Finally, longitudinal designs examining lead-lag associations between cognition and daily stress processes will help elucidate more complex dynamic relationships exist.

Despite these limitations, the results of this study demonstrate that both fluid and crystallized cognition are important predictors of daily stress processes in old age. While daily stressors do have proximal and distal effects on health and well-being, the types of experiences they represent, social interactions, personal and professional demands and responsibilities, provide insights into the lifestyles people lead, and the experiences that impact their health and well-being. Although cognition does not buffer against exposure to daily stressors, it does have virtue in handling minor stressors that can proliferate and compromise health across adulthood and old age. Furthermore, while fluid cognition has been linked to health and well-being, and crystallized cognition to activity and lifestyle choices, there appear to be promising horizons for future research aimed at understanding more dynamic associations among cognition, well-being, and lifestyle throughout adulthood and aging.

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References

- Allaire JC, Marsiske M. Everyday cognition: Age and intellectual ability correlates. *Psychology and Aging*. 1999; 14:627–644. [PubMed: 10632150]
- Allaire JC, Marsiske M. Well- and ill-defined measures of everyday cognition: Relationship to elders' intellectual ability and functional status. *Psychology and Aging*. 2002; 17:101–115. [PubMed: 11931279]
- Almeida DM. Resilience and vulnerability to daily stressors assessed via diary methods. *Current Directions in Psychological Science*. 2005; 14:64–68.
- Almeida, DM.; Horn, MC. Is daily life more stressful during middle adulthood?. In: Brim, OG.; Ryff, CD.; Kessler, RC., editors. *How healthy are we? A national study of well-being at midlife*. Chicago: The University of Chicago Press; 2004. p. 425-451.
- Almeida DM, Kessler RC. Everyday stressors and gender differences in daily distress. *Journal of Personality and Social Psychology*. 1998; 75:670–680. [PubMed: 9781406]
- Almeida DM, Neupert SD, Banks SR, Serido J. Do daily stress processes account for socioeconomic health disparities? *Journals of Gerontology: Social Sciences*. 2005; 60B:34–39.

- Almeida DM, Wethington E, Kessler RC. The Daily Inventory of Stressful Experiences (DISE): An Interview-Based Approach for Measuring Daily Stressors. *Assessment*. 2002; 9:41–55. [PubMed: 11911234]
- Baltes PB, Staudinger UM, Lindenberger U. Lifespan psychology: Theory and application to intellectual functioning. *Annual Review of Psychology*. 1999; 50:471–507.
- Beier ME, Ackerman PL. Determinants of health knowledge: An investigation of age, gender, abilities, personality, and interests. *Journal of Personality and Social Psychology*. 2003; 84:439–447. [PubMed: 12585815]
- Bolger N, Davis A, Rafaeli E. Diary methods. *Annual Review of Psychology*. 2003; 54:579–616.
- Bolger N, DeLongis A, Kessler RC, Shilling EA. Effects of Daily Stress on Negative Mood. *Journal of Personality and Social Psychology*. 1989; 57:808–818. [PubMed: 2810026]
- Bolger N, Schilling EA. Personality and problems of everyday life: The role of neuroticism in exposure and reactivity to daily stressors. *Journal of Personality*. 1991; 59:356–386.
- Bolger N, Zuckerman A. A framework for studying personality in the stress process. *Journal of Personality and Social Psychology*. 1995; 69:890–902. [PubMed: 7473036]
- Bosworth HB, Siegler IC. Terminal change in cognitive function: An updated review of longitudinal studies. *Experimental Aging Research*. 2002; 28:299–315. [PubMed: 12079580]
- Chiriboga, DR. Crisis, challenge, and stability in the middle years. In: Lachman, ME.; James, JB., editors. *Multiple paths of midlife development*. Chicago, IL: University of Chicago Press; 1997. p. 293–322.
- Chodosh J, Seeman TE, Keeler E, Sewall A, Hirsch SH, Guralnik, Reuben DB. Cognitive decline in high-functioning older persons is associated with an increased risk of hospitalization. *Journal of the American Geriatrics Society*. 2004; 52:1456–1462. [PubMed: 15341546]
- Deary IJ, Whiteman MC, Starr JM, Whalley LJ, Fox HC. The impact of childhood intelligence on later life: Following up the Scottish mental surveys of 1932 and 1947. *Journal of Personality and Social Psychology*. 2004; 86:130–147. [PubMed: 14717632]
- Folkman S, Lazarus RS, Pimley S, Novack J. Age differences in stress and coping processes. *Psychology and Aging*. 1987; 2:171–184. [PubMed: 3268206]
- Gottfredson LS. Intelligence: Is it the epidemiologists' elusive "fundamental cause" of social class inequalities in health? *Journal of Personality and Social Psychology*. 2004; 86:174–199. [PubMed: 14717635]
- Gottfredson LS, Deary IJ. Intelligence predicts health and longevity, but why? *Current Directions in Psychological Science*. 2004; 13:1–4.
- Grzywacz JG, Almeida DM, Neupert SD, Ettner SL. Socioeconomic status and health: A micro-level analysis of exposure and vulnerability to daily stressors. *Journal of Health and Social Behavior*. 2004; 45:1–16. [PubMed: 15179904]
- Hoffman L, Stawski RS. Persons as contexts: Evaluating between-person and within-person effects in longitudinal analysis. *Research in Human Development*. 2009; 6:97–120.
- Horn JL, Cattell RB. Age differences in fluid and crystallized intelligence. *Acta Psychologica*. 1967; 26:107–129. [PubMed: 6037305]
- Horn, J.; Hofer, SM. Major ability and development in the adult period. In: Sternberg, RJ.; Berg, CA., editors. *Intellectual Development*. Cambridge: Cambridge University Press; 1992.
- Hultsch DF, Hammer M, Small BJ. Age differences in cognitive performance in later life: Relationships to self-reported health and activity life style. *Journal of Gerontology: Psychological Sciences*. 1993; 48:P1–P11.
- Hultsch DF, Hertzog C, Small BJ, Dixon RA. Use it or lose it: Engaged lifestyle as a buffer of cognitive decline in aging? *Psychology and Aging*. 1999; 14:245–263. [PubMed: 10403712]
- Isaacowitz DM, Smith J. Positive and negative affect in very old age. *Journal of Gerontology: Psychological Sciences*. 2003; 58B:143–152.
- Kuncel NR, Ones DS, Sackett PR. Individual differences as predictors of work, educational, and broad life outcomes. *Personality and Individual Differences*. 2010; 49:331–336.
- Labouvie-Vief G. Dynamic integration: affect, cognition, and the self in adulthood. *Current Directions in Psychological Science*. 2003; 12:201–206.

- Lachman ME, Leff R. Perceived control and intellectual functioning in the elderly: A 5-year longitudinal study. *Developmental Psychology*. 1989; 25:722–728.
- Lawton MP, Kleban M, Dean J, Rajagopal D, Parmelee P. The factorial generality of brief positive and negative affect measures. *Journal of Gerontology: Psychological Sciences*. 1992; 47:228–237.
- Lazarus, RS. *Stress and emotion: A new synthesis*. New York: Springer; 1999.
- McArdle JJ, Ferrer-Caja E, Hamagami F, Woodcock RW. Comparative longitudinal structural analyses of the growth and decline of multiple intellectual abilities over the life span. *Developmental Psychology*. 2002; 38:115–142. [PubMed: 11806695]
- Mroczek DK, Almeida DM. The effect of daily stress, personality, and age on daily negative affect. *Journal of Personality*. 2004; 72:355–378. [PubMed: 15016068]
- Nesselroade, JR. The warp and woof of the developmental fabric. In: Downs, R.; Liben, L.; Palermo, DS., editors. *Visions of Aesthetics, the Environment and Development: The Legacy of Joaquim F. Wohwill*. Hillsdale, NJ: Lawrence Erlbaum Associates; 1991. p. 213–240.
- Neupert SD, Almeida DM, Mroczek DK, Spiro A III. Daily stressors and memory failures in a naturalistic setting: Findings from the VA Normative Aging Study. *Psychology and Aging*. 2006; 21:424–429. [PubMed: 16768588]
- Parisi JM, Stine-Morrow EAL, Noh SR, Morrow DG. Predispositional engagement, activity engagement and cognition among older adults. *Aging, Neuropsychology and Cognition*. 2009; 16:485–504.
- Perlmutter M, Nyquist L. Relationships between self-reported physical and mental health and intelligence performance across adulthood. *Journal of Gerontology*. 1990; 45:145–155.
- Raven, JC.; Court, JH.; Raven, J. *Manual for Raven's Progressive Matrices and vocabulary scales*. Oxford, England: Oxford Psychologists Press; 1986.
- Röcke C, Li S-C, Smith J. Intraindividual variability in positive and negative affect over 45 days†: Do older adults fluctuate less than young adults? *Psychology and Aging*. 2009; 24:863–878. [PubMed: 20025402]
- Schooler C, Mulatu MS. The reciprocal effects of leisure time activities and intellectual functioning in older people: A longitudinal analysis. *Psychology and Aging*. 2001; 16:466–482. [PubMed: 11554524]
- Schooler C, Mulatu MS, Oates G. The continuing effects of substantively complex work on the intellectual functioning of older workers. *Psychology and Aging*. 1999; 14:483–506. [PubMed: 10509702]
- Sliwinski MJ. Measurement-burst designs for social health research. *Social and Personality Psychology Compass*. 2008; 2:245–261.
- Sliwinski MJ, Almeida DM, Smyth JM, Stawski RS. Intraindividual change and variability in daily stress processes: Findings from two diary burst studies. *Psychology and Aging*. 2009; 24:828–840. [PubMed: 20025399]
- Sliwinski MJ, Smyth JM, Hofer SM, Stawski RS. Intraindividual coupling of daily stress and cognition. *Psychology and Aging*. 2006; 21:545–557. [PubMed: 16953716]
- Smits CHM, Deeg DJH, Jonker C. Cognitive and emotional predictors of disablement in older adults. *Journal of Aging and Health*. 1997; 9:204–221. [PubMed: 10182404]
- Stawski RS, Almeida DM, Lachman ME, Tun P, Rosnick CB. Fluid cognitive ability is associated with greater exposure and smaller emotional reactions to daily stressors. *Psychology and Aging*. 2010; 25:330–342. [PubMed: 20545418]
- Stawski RS, Sliwinski MJ, Almeida DM, Smyth JM. Reported Exposure and Emotional Reactivity to Daily Stressors: The Roles of Adult-Age and Global Perceived Stress. *Psychology and Aging*. 2008; 23:52–61. [PubMed: 18361654]
- Stine-Morrow, EAL.; Basak, C. Cognitive interventions. In: Schaie, KW.; Willis, SL., editors. *Handbook of the Psychology of Aging*. 7th Ed.. New York: Elsevier; 2011. p. 153–171.
- Tennen H, Affleck G, Armeli S, Carney MA. A daily process approach to coping: Linking theory, research, and practice. *American Psychologist*. 2000; 55:626–636. [PubMed: 10892205]
- Woodcock, RW.; McGrew, KS.; Mather, N. *Woodcock-Johnson Tests of Cognitive Abilities (WJ-III)*. Itasca, IL: Riverside; 2001.

- Zautra, AJ. Emotions, stress, and health. New York, NY: Oxford University Press; 2003.
- Zautra AJ, Finch JF, Reich JW, Guarnaccia CA. Predicting the everyday life events of older adults. *Journal of Personality*. 1991; 59:507–538. [PubMed: 1960641]

Table 1

Descriptive Statistics and Correlations.

	M	SD	Range	1	2	3	4	5	6	7	8	9
1 Age	80.01	6.25	66–95	-								
2 Education	15.01	2.42	8–22	-.13	-							
3 Sex (%Male)	28%			-.11	.14	-						
4 Analysis-Synthesis	22.41	4.73	11–32	-.33**	-.00	.29**	-					
5 Mill Hill Vocabulary	35.13	3.76	22–40	.05	.02	.44**	.38**	-				
6 Percentage of Stressor Days	45%	32%	0–100	-.12	.07	.01	.14	.17+	-			
7 Stressor Severity (Sum) ^a	1.57	1.06	0–4	-.09	.01	.02	.08	.22*	.86**	-		
8 Negative Affect ^a	5.99	1.25	5–11.5	.17+	.01	-.08	-.28**	.04	.33**	.39**	-	
9 Positive Affect ^a	18.15	3.07	10.83–24.5	-.20*	.02	-.02	.22**	-.05	-.08	-.07	-.24**	-

Note:

^a Average value across study days. Sex (0=Female, 1=Male).

⁺ p<.10,

* p<.05,

** p<.01.

Table 2

Fluid and Crystallized Cognition Predicting Exposure to Daily Stressors – Odds Ratios (95% Confidence Intervals)

	Any Stressors		
	Model 1	Model 2	Model 3
Analysis-Synthesis	1.06 (.97–1.14)		1.03 (.94–1.12)
Vocabulary		1.12 (1.01–1.25) *	1.11 (1.01–1.24) *
	Arguments		
	Model 1	Model 2	Model 3
Analysis-Synthesis	1.07 (.96–1.19)		1.02 (.91–1.14)
Vocabulary		1.27 (1.05–1.53) *	1.26 (1.03–1.53) *
	Avoided Arguments		
	Model 1	Model 2	Model 3
Analysis-Synthesis	1.03 (.95–1.12)		1.00 (.92–1.08)
Vocabulary		1.15 (1.03–1.29) *	1.15 (1.02–1.30) *
	Network Stressors		
	Model 1	Model 2	Model 3
Analysis-Synthesis	1.03 (.96–1.12)		1.04 (.96–1.13)
Vocabulary		1.00 (.89–1.09)	1.00 (.90–1.10)
	Health-Related Stressors		
	Model 1	Model 2	Model 3
Analysis-Synthesis	1.06 (.96–1.19)		1.07 (.96–1.18)
Vocabulary		1.07 (.95–1.24)	1.09 (.95–1.25)

Note:

*
p<.05,

**
p<.01.

WP=Within-Person.

All models adjust for linear and quadratic session trends, age, sex, education, physical symptoms, and residential status (senior residence vs. community).

Table 3

Fluid and Crystallized Cognition Predicting Emotional Reactivity to Daily Stressors – Unstandardized Estimates (Standard Errors)

Negative Affect			
	Model 1	Model 2	Model 3
Intercept	5.16 (.25) **	5.16 (.25) **	5.18 (.25) **
Analysis-Synthesis	-.08 (.02) **		-.09 (.03) **
Vocabulary		.00 (.03)	.04 (.03)
Daily Stress (WP)	.98 (.19) **	.88 (.18) **	.96 (.19) **
A-S × Daily Stress (WP)	-.07 (.03) *		-.08 (.03) *
Voc × Daily Stress (WP)		.03 (.04)	.06 (.05)
Positive Affect			
	Model 1	Model 2	Model 3
Intercept	19.35 (.52) **	19.33 (.54) **	19.30 (.52) **
Analysis-Synthesis	.14 (.06) **		.16 (.06) **
Vocabulary		.00 (.10)	-.07 (.11)
Daily Stress (WP)	-.74 (.19) **	-.63 (.18) **	-.70 (.18) **
A-S × Daily Stress (WP)	.05 (.05)		.07 (.05)
Voc × Daily Stress (WP)		-.09 (.06)	-.10 (.08)

Note:

*
p<.05,

**
p<.01.

WP=Within-Person, A-S: Analysis-Synthesis, Voc.: Vocabulary.

All models adjust for linear and quadratic session trends, age, sex, education, physical symptoms, and residential status (senior residence vs. community).