

## **ABSTRACT**

RAMSEY, JENNIFER LYNN. Daily Co-Occurrence of Affect and Intraindividual Variability in Daily Stress Processes in Young-Old and Old-Old Adults. (Under the direction of Shevaun D. Neupert, Ph.D.).

Studies examining age differences as well as the adaptive advantages of co-occurrence of affect for older adults are mixed. Some studies show that greater co-occurrence of affect is associated with greater overall psychological resilience, lower levels of stress and lower levels of neuroticism. Other studies failed to find adaptive advantages. Some studies find that older adults are more likely than younger adults to experience co-occurrence whereas others find no age differences. Research also suggests that stress residue may differentially impact an individual's ability to respond in a resilient and adaptive manner when faced with continuing stress. The present study examined the relationships among daily co-occurrence of affect, age, health stressors, total stressors, physical health symptoms, stress residue, and negative affect in 249 young-old (60-79 years) and 64 old-old (80-89 years) adults responding to a daily diary study of the VA Normative Aging Study. I found no age differences in co-occurrence of affect between the two age groups. Co-occurrence of affect was unrelated to total number of stressors and number of physical health symptoms reported. I did find an Age x Co-Occurrence x Health Stressor interaction indicating that old-old adults with higher co-occurrence of affect were less emotionally reactive to health stressors than those with low levels. I also found that the effect of daily co-occurrence on stress residue did not differ by age, but older adults in general with higher levels of co-occurrence of affect tended to exhibit less stress residue compared to older adults with lower levels of co-occurrence of affect. I suggest that co-occurrence of affect serves an adaptive function in

older age and that young-old and old-old adults show a different pattern of emotion responses depending on stressor domain and temporal indices of stressor exposure.

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Daily Co-Occurrence of Affect and Intraindividual Variability in Daily Stress Processes in  
Young-Old and Old-Old Adults

by  
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## **BIOGRAPHY**

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## INTRODUCTION

Daily co-occurrence of affect may be an important factor in enabling older adults to maintain adaptive functioning when faced with age-related declines (Carstensen, Pasupathi, Mayr, & Nesselrode, 2000; Ong & Bergeman, 2004). Co-occurrence of affect may function in an adaptive capacity (Carstensen et al., 2000; Ong & Bergman, 2004), and these adaptive advantages are commonly examined in regards to psychological resiliency, or the ability to sustain physical health and well-being. Adaptive advantages are also examined in regards to decreases in negative affect in response to stressors. Stress can influence the way in which individuals experience emotions. Thus, the effects of daily co-occurrence of affect may be especially apparent when employing stress response as the dependent variable.

Daily co-occurrence of affect is just one manner of measuring the multifaceted concept of emotional complexity. Currently, emotional complexity is most commonly operationalized in two distinct ways. The co-occurrence index (Ong & Bergeman, 2004), or poignancy (Carstensen et al., 2000) refers to an individual's ability to experience both positive and negative emotions during a specific time frame. Alternatively, differentiation (Carstensen et al. 2000; Ong & Bergeman, 2004) measures the degree to which individuals are able to distinguish among discrete emotions. Differentiation and co-occurrence have been consistently shown to measure separate aspects of emotional complexity (Carstensen et al., 2000; Hay & Diehl, 2011; Ong & Bergman, 2004). Findings showing that co-occurrence and differentiation are distinct provide rationale for the decision to examine the potential adaptive advantages provided by co-occurrence to the exclusion of the differentiation measure of

emotional complexity. The unrelated nature of co-occurrence and differentiation should result in independent results in regards to the effects of emotional complexity on indices of psychological and physical functioning. As the current study employs co-occurrence as the sole measure of emotional complexity, prior findings specific to the co-occurrence index will be discussed without reference to findings regarding differentiation.

Stress has been shown to affect the structure of emotional experience such that emotions tend to be experienced as one-dimensional when individuals are exposed to stressful situations (Reich, Zautra, & Davis, 2003). Individuals report higher negative affect relative to positive affect in response to stress (Mroczek & Almeida, 2004). Presumably, negative emotions would not be as prominent in individuals with higher levels of co-occurrence of affect. The reasoning behind this supposition is that these individuals would experience positive emotions along with negative emotions. These positive emotions may serve to dampen the detrimental effects of the negative emotions on reactivity to stressful situations (Levenson, 1999). It follows then, that individuals with higher levels of co-occurrence of affect could show less reactivity in response to daily stressors. Extreme emotional responses in which an individual experiences high levels of negative affect in relation to positive affect are maladaptive. The ability to experience positive and negative emotions concurrently even in times of stress inhibits these extreme responses. Thus, individuals reporting higher levels of co-occurrence of affect should exhibit greater resiliency than those reporting lower levels of co-occurrence of affect (Larsen & Cutler, 1996; Ong & Bergeman, 2004). There is evidence showing that resilient individuals are more likely to

experience their positive and negative emotions as blended, or occurring at the same time (Tugade & Fredrickson, 2004). Importantly, this suggests an evolutionarily-based physiological mechanism behind this adaptive function. In instances involving threatening stimuli, such as a negative stressor, positive and negative affect can operate in conjunction with one another. In these situations, the function of negative affect is to counteract homeostasis and elicit a response to the threatening stimuli while positive affect functions to return the individual to a homeostatic state in order to avoid the detrimental consequences of prolonged arousal (Levenson, 1999; Tugade & Fredrickson, 2004). Certain individual difference characteristics, namely neuroticism, have also been shown to influence daily emotional experiences (Carstensen et al., 2000; Ong & Bergman, 2004). Individuals with higher neuroticism scores also tend to report more stressors and greater reactivity to stressors (Mroczek & Almeida, 2004; Neupert, Mroczek, & Spiro, 2008). As such, researchers frequently control for the effects of neuroticism when examining co-occurrence of affect on stressor response.

In regards to age differences in daily co-occurrence of affect, older adults may be at risk for age-related declines in cognitive and physical functioning, whereas emotional functioning and regulation may continue to improve into old age (Carstensen, Pasupathi, Mayr, & Nesselroade, 2000; Labouvie-Vief & Medler, 2002). Emotional complexity has been suggested as a means through which emotion regulation improves with age (Carstensen et al., 2000; Labouvie-Vief & Medler, 2002). Some argue that older adults have had many opportunities to simultaneously experience both positive and negative emotions and thus

gained a certain amount of expertise in understanding, interpreting, and integrating this emotional duality (Labouvie-Vief & Medler, 2002).

Two lifespan developmental theories posit that emotional development continues to improve into adulthood but differ in regards to when emotional functioning and related adaptive advantages reach their peak. Dynamic integration theory (DIT; Labouvie-Vief, 2005) incorporates some of the same co-occurrence and differentiation aspects as emotional complexity. DIT posits that representations increase in cognitive complexity as the affective dynamics of self in relation to the social world are reorganized in concurrence with the differentiation of new cognitive and affective systems (Labouvie-Vief, 2005). This increase in cognitive complexity enables increases in the complexity of emotion representations such that these emotion representations shift from simple automatic schemas to more differentiated representations which enable complex emotional experiences. This process eventually evolves into higher-order integrations (Labouvie-Vief, 2005). This increased complexity of cognitive operations is associated with more complex, and thus adaptive emotional responses and more flexibility in coping abilities (Diehl, Coyle, & Labouvie-Vief, 1996). DIT posits that the function of emotional representations across the lifespan should show an inversed U-shape. This would indicate that emotional and intellectual functioning peaks in middle age (Labouvie-Vief, 2005). If functioning does peak in middle age, then there should be a decline in co-occurrence of affect across older adults. When this cognitive-developmental approach is taken, studies examining developmental trajectories of emotional complexity show the expected age pattern such that emotional complexity peaks in late

middle age and declines in older age (Labouvie-Vief, Chiodo, Goguen, Diehl, & Orwoll, 1995; Labouvie-Vief, Diehl, Jain, & Zhang, 2007; LaBouvie-Vief, Hakim-Larson, DeVoe, & Schoeberlein, 1989). Another lifespan developmental theory focuses on gains and losses in emotional functioning across the lifespan. This theory differs from Dynamic Integration Theory in that the salience of goals in later life is proposed as the mechanism through which older adults can maintain adaptive functioning (Carstensen, Isaacowitz, & Charles, 1999)

Socioemotional selectivity theory focuses on the shift in the salience of social goals in later life (Carstensen, Isaacowitz, & Charles, 1999). According to this theory, older adults are motivated by the perceived limited time remaining in life to gain satisfaction. They gain satisfaction by prioritizing emotionally meaningful goals over informational goals. As such, older adults will attempt to find meaning in existing relationships or situations that are not inherently positive. This results in more frequent complexity of emotional experience. Carstensen et al. (2000) conducted an experience-sampling study of adults ranging in age from 18 to 94. Significant positive correlations were found between age and the number of principle components (more components indicate higher levels of emotional complexity). Additionally, age was significantly and positively correlated with the covariation score. This covariation score is calculated in the same way as the co-occurrence of affect score in the current study. Young and middle-aged adults showed a stronger negative correlation between positive and negative affect than older adults, indicating that younger and middle-aged adults showed less blending of positive and negative affect than older adults. Carstensen et al. (2011) conducted a follow up study with the same participants which included wave 2

(five years after initial experience sampling occasion) and wave 3 (ten years after the initial experience sampling occasion). They found a significant age-related change in the covariation score such that with every year of age the intraindividual correlation between positive and negative affect shifted from a negative correlation to a correlation closer towards 0. This shift from a negative correlation to a correlation closer to 0 is interpreted as representing higher levels of emotional complexity in older age

The different trajectory of emotional functioning at later portions of the lifespan that these two theories indicate suggests that levels and effects of co-occurrence of affect differ by age. Prior research on age differences in co-occurrence provides inconsistent evidence for whether or not older adults experience more mixed emotions than younger adults. Some studies found older adults are more likely than younger adults to experience co-occurrence of positive and negative affect (Carstensen et al., 2000; Magai, Consedine, Krivoshekova, Kudadjie-Gyamfi, & McPherson, 2006). Other studies found no age differences in the tendency to experience positive and negative emotions concurrently (Ong & Bergeman 2004; Gröhn, Rebucal, Diehl, Lumley, & Labouvie-Vief, 2011; Hay & Diehl, 2011).

Similar to the results pertaining to age differences in co-occurrence of affect, evidence for the adaptive value of co-occurrence of affect in later portions of the lifespan are mixed. Ong and Bergeman (2004) examined the complexity of positive and negative emotions in a sample of 40 adults ranging in age from 60 to 85 years over a 30-day period. They examined stress, neuroticism, trait resiliency, physical health and well-being as possible factors associated with emotional complexity. Ong and Bergeman used the Positive and

Negative Affect Schedule (PANAS; Watson et al., 1988) to measure daily positive and negative affect. They determined the co-occurrence of positive and negative affect by averaging the intraindividual correlation between positive and negative affect across the 30 days. Results showed that individuals who exhibited a greater co-occurrence of positive and negative affect also tended to show greater overall psychological resilience, lower levels of stress, and lower levels of neuroticism. These results suggest co-occurrence of affect is an important factor in enabling an individual to be resilient during periods of stress.

Grühn et al. (2012) examined the adaptive value of co-occurrence in sample of 109 adults ranging in age from 23 to 90 years who reported their negative and positive affect via the PANAS five times a day for one week. They measured co-occurrence in the same manner as Ong and Bergeman (2004). Results showed that co-occurrence was not correlated with life satisfaction, depressive symptoms, anxiety, or neuroticism. This failure to find significant relationships between co-occurrence, life-satisfaction, and person-level characteristics is inconsistent with the findings previously discussed. Other research suggests that co-occurrence of affect does provide an adaptive advantage, but that this advantage may be specific to regulatory abilities.

Hay and Diehl (2011) used data drawn from a study on daily emotional experience in adulthood to further examine relationships among age, co-occurrence and emotion regulation. Participants included 239 male and females ranging in age from 18 to 89 who reported their daily positive and negative affect for 30 consecutive days via the PANAS. Hay and Diehl measured co-occurrence by averaging the intraindividual correlation between

positive and negative affect across the 30 days. Results showed that individuals reporting higher levels of co-occurrence were faster to recover from high negative affect states than those with lower levels of co-occurrence. This suggests that higher levels of co-occurrence reduce the potential for negative reactivity.

The studies discussed examined between-person differences in the relationships between co-occurrence and person-level characteristics such as psychological resilience and life satisfaction. The current study seeks to elaborate upon these findings by examining such relationships at the within-person level. To this end, I examined whether or not co-occurrence of affect is related to within-person changes in stressor response, stressor occurrence, and physical health symptoms, as well as individual differences in neuroticism and age.

### **Present Study**

The present study extends previous work on the relationships between age, co-occurrence of affect, stress, and health in three unique ways. First, it examines possible age differences in emotional complexity for young-old and old-old adults. Previous research grouped both young-old and old-old adults together. It may be more beneficial to separate young-old and old-old adults when examining the potential benefits of co-occurrence of affect. Old-old adults are those 80 years of age or better (Baltes, 1997). The lifespan is continuously increasing for this age group and there are dramatic declines in functional status from the third (young-old) to fourth (old-old) age. Both age groups represent the later portion of the lifespan. Depending on which lifespan developmental theory is referenced, older adults

in general either experience more mixed emotions or experience declines in emotional functioning, (Carstensen et al., 1999; Labouvie-Vief, 2005). Due to the different trajectories of emotional functioning across the lifespan predicted by SST and DIT, and the inconsistent findings regarding age differences in emotional complexity, age differences were examined without favoring a particular hypothesis. Instead, the study seeks to examine whether there are age differences in co-occurrence of affect in young-old as compared to old-old adults. As such, age is treated as a categorical variable in all analyses where old-old and young-old adults are compared directly. The differences between the age groups are of more interest and importance than comparisons from one-year of age to the next.

The study also examines whether stress and health are related to co-occurrence of affect by examining the possible relationship between, and age differences in, stress and health scores within people over eight consecutive days. It is important to note that co-occurrence of affect will be discussed in terms of “high” and “low” levels as opposed to increasing and decreasing levels. The cross-sectional nature of the computation of the intraindividual correlation for co-occurrence makes such statements about increases and decreases in co-occurrence of affect between the two age groups impossible.

I hypothesized that both stress and health would be related to co-occurrence of affect; with individuals reporting lower stress and better physical health also reporting higher levels of co-occurrence of affect. This hypothesis is based on the previously cited research which suggests that both stress and health are predictors of emotional complexity; individuals exhibiting less stress also exhibited higher levels of emotional complexity, and individuals in

good health also reporting higher levels of emotional complexity (Carstensen et al., 2000; Ong & Bergeman).

Second, the study examines co-occurrence of affect as a potential moderator for reactivity to stressors in the health domain in young-old and old-old adults. Previous studies did not examine stressor response from a within-person perspective nor did they account for the existence of varying stressor domains. The relationship between stress and health outcomes can depend on stressor domain and salience of the stressor domain of interest (Aldwin, 2007). Health stressors may be especially salient to the current sample as older adults, and old-old adults in particular, are known to be at increased risk for health problems (Wolff, Starfield, & Anderson, 2002). Additionally, health stressors have been associated with increased psychological distress (Hay & Diehl, 2010). Whereas young-old and old-old adults may not differ in their ability to experience positive and negative affect on the same day, the adaptive advantages daily co-occurrence of affect provides may differ by these age groups.

I hypothesized that daily co-occurrence of affect would moderate age differences in reactivity to stressors in the health domain with old-old adults with higher levels of daily co-occurrence being less emotionally reactive to health stressors. Old-old adults are likely to experience more dramatic declines in cognitive functioning, and thus experience losses in cognitive resources such as speed of processing and working memory (Bopp & Verhaeghen, 2005; Park, Lautenschlager, Hedden, Davidson, Smith, & Smith, 2002). They also experience declines in physical functioning and losses in physical resources such as motor

skills (Baltes, 1997). As such, old-old adults may be more likely to rely on abilities not subject to such increasing impairments. If emotional functioning continues to improve with age as research guided by socioemotional selectivity theory suggests, and older age is associated with greater likelihood of experiencing positive and negative emotions at the same time, then the adaptive value of co-occurrence of affect may be greater in the oldest-old (Carstensen et al., 2000).

Finally, the study examines potential age and co-occurrence of affect differences in stress residue (Almeida, Stawski, & Cichy, 2011). Following the recommendations of Almeida et al., (2011), I operationalized stress residue as the within-person relationship between a stressor on one day and affect on a subsequent day, controlling for affect on the previous day and same-day reactivity (the within-person relationship between same-day stressor and affect). Prior studies have not necessarily accounted for the different temporal dimensions of the stress process (Aldwin, 2007; Wheaton, 1999). Stress research suggests that lasting or continuous stress may impact health and well-being outcomes in a different manner than a discrete or short term stressor (Aldwin, 2007).

The Strength and Vulnerability Integration Theory (SAVI: Charles, 2010) is a recent developmental theory which specifically addresses age differences in application of emotion regulation strategies and resulting well-being based on cadence of the stress process. Similar to socioemotional selectivity theory, SAVI proposes age-related increases in emotional well-being through more frequent and effective application of attentional strategies, reappraisals, and behaviors which enable older adults to avoid negative events or de-escalate such events

when they do occur (Charles, Mather, & Carstensen, 2003; Coats & Blanchard-Fields, 2008; Wrosch, Heckhausen, & Lachman, 2000). These strategies are hypothesized to produce age-related advantages in emotional well-being, such as improved emotion-regulation and emotional well-being, but SAVI suggests that there are limits to these benefits (Carstensen et al., 1999; Charles 2010). SAVI posits that time functions as a moderator to increase or mitigate age-related benefits in emotional functioning. Specifically, SAVI predicts that the age-related increases in emotion regulation abilities will be minimized immediately prior to or following a stressor but reappear as time passes and that situations of chronic stress will mitigate age-related emotion-response advantages (Charles, 2010). SAVI does not make any predictions specifically regarding the adaptive advantages co-occurrence of affect may provide or how levels of co-occurrence of affect may change with age. However, if co-occurrence of affect is a strategy that improves emotional well-being, and the ability to experience positive and negative affect concurrently improves with age as socioemotional selectivity theory suggests, then the potential benefits co-occurrence of affect provides older adults may be moderated by time in the same manner as SAVI predicts (Carstensen et al., 1999; Charles, 2010).

Thus, the present study seeks to examine whether the time-based predictions of SAVI hold for the potential age-related benefits higher levels of co-occurrence of affect provide in reducing negative reactivity to stressors. The current study was not initially designed as an ecological momentary assessment. However, SAVI's predictions regarding the reemergence of age-related benefits in emotional well-being can still be tested by examining stress residue.

Almeida et al. (2011) posit that stress residue from one day to the next may differentially impact an individual's ability to respond in a resilient and adaptive manner when faced with stress which continues to be present across days even if the original stressor no longer remains. Due to the lack of empirical research on stress residue, there is no rationale for specifying a stressor domain that would impact older adults to a greater extent than other domains. As such, this study examined the potential impact of co-occurrence of affect on total stressor exposure as opposed to stressors in a specific domain. I hypothesized that older adults with higher levels of daily co-occurrence of affect would have less stress residue, as SAVI predicts that age-related benefits in emotional functioning reemerge as time passes from initial stressor exposure and research has shown that individuals who possess greater co-occurrence of positive and negative affect tend to show greater overall psychological resilience and lower levels of stress (Charles, 2010; Ong & Bergeman, 2004).

I also hypothesized that the effect of daily co-occurrence of affect on stress residue would be greater for old-old adults than young-old adults as old-old adults may be more likely to attempt to minimize losses and maximize gains by relying on emotional-functioning, in this case daily co-occurrence of affect. This hypothesis is based on the assertion that emotional-functioning may continue to improve whereas other domains of functioning, such as cognitive and physical functioning, are subject to declines during later portions of the life span (Baltes, 1997; Charles, 2012; Carstensen et al., 1999; Carstensen et al., 2000).

## METHOD

### Participants

The current study uses data drawn from the Veterans Affairs Normative Aging Study (NAS), a longitudinal study which began in the 1960s and examined normal aging processes in men (Spiro & Bossé, 2001). Specifically, the data used for analyses are based on a 2002-2003 daily diary investigation of stressors and well-being which included 333 NAS respondents and their wives (Neupert, Almeida, Mroczek, & Spiro, 2006). Participants included 249 young-old adults ranging in age from 60-79 years ( $M=71.6$ ,  $SD = 4.90$ ) and 64 old-old adults ranging in age from 80-89 years ( $M = 82.9$ ,  $SD = 2.62$ ). Males made up 56.5% of the participants and 43.5% were female. I conducted a chi-square test of independence between age group and gender. Gender was equally distributed among both age groups,  $X^2(1, N = 2496) = 1.65, p = .199$ .

### Procedure

Participants completed questionnaires assessing stressors, physical health symptoms, positive and negative affect, memory failures, pain and social support on eight consecutive days (Neupert et al., 2006). The questionnaires were mailed and husbands and wives were instructed to complete them separately on eight consecutive evenings and to return the questionnaires in a self-addressed stamped envelope when finished. Respondents who completed 5 or more of the 8 study days received \$30; those who completed 4 or fewer days received \$15. There were more male than female participants as husbands were the original

participants and their wives were invited to participate later in the study.

### **Diary Measures**

**Daily Stressors.** I assessed the number of daily stressors using a 7-item paper-pencil version of the Daily Inventory of Stressful Events (DISE) (Almeida, Wethington, & Kessler, 2002). Participants answered questions regarding arguments, potential arguments, stressors that occurred at work and volunteer settings and at home, network stressors (stressors that occurred to a network of friends and family), health-related events, and other stressors (stressors that did not fit into the other categories) each day. This semi-structured inventory possesses construct validity with stressor content and focus variables accounting for 8% of the variance in physical symptoms and 12% of variance in negative mood (Almeida et al., 2002). For the purposes of this study, I calculated one composite score representing the sum of the total number of stressors reported on each of the eight days. Higher scores indicate more stressors and lower scores indicate fewer stressors. The daily health stressor item is from Neupert et al. (2006). Participants provided a yes or no response to the question ‘Did anything happen in the last 24 hours regarding your personal health?’

**Daily physical symptoms.** I measured daily physical health via a 16-item shortened version of Larson and Kasimatis’s (1991) physical symptom checklist (Neupert et al., 2006). Examples of symptoms include headaches, backaches, sore throat, and poor appetite. Respondents received a score of zero when they had not experienced a symptom and a score of 1 for each symptom experienced. For the purposes of this study, I calculated one composite score for the sum of the total reported physical symptoms for each day. Higher

scores indicate more reported physical symptoms, or poorer physical health. The construct validity of this measure of physical health is evidenced by the significant positive association between stressor exposure and physical health ( $\gamma_{10} = 0.14$ ,  $t = 6.08$ ,  $p < 0.001$ ) in a study on the effects of the Columbia Shuttle disaster on older adult participants in the VA Normative Aging Study (Neupert et al., 2006).

**Daily Affect.** I measured respondents' daily affect using The Positive and Negative Affect Schedule (PANAS; Watson et al., 1988). The PANAS consists of two 10-item mood scales, each containing words describing different feelings and emotions (Watson et al.). Participants indicated to what extent they experienced each emotion during each of the eight consecutive days. Responses ranged from 1 (*slightly or not at all*) to 5 (*extremely*). For the purposes of this study, I determined the co-occurrence of positive and negative affect (co-occurrence of affect) by averaging the intraindividual correlation between positive and negative affect (Ong & Bergeman, 2004). Thus, each person received a single score for co-occurrence of affect. In accordance with the procedure as outlined by Ong and Bergeman, higher positive correlations were taken to be indicative of higher levels of co-occurrence of affect.

Internal consistencies for the current study were high when averaging across all persons on day 1 (positive affect:  $\alpha = .90$ ; negative affect:  $\alpha = .87$ ). These Cronbach alphas are in line with the internal consistency measures reported by Grühn et al. (2012) (positive affect:  $\alpha = .90$ ; negative affect:  $\alpha = .87$ ).

**Neuroticism.** I measured neuroticism via the EPI-Q (Flodererus, 1974). This is a shortened version of the Eysenck Personality Inventory. The measure contains 18 dichotomous items (9 assessing Extroversion and 9 assessing Neuroticism). Possible scores ranged from 0-9, with a higher score indicating a higher level of neuroticism. This measure has demonstrated suitable reliability ( $\alpha = .71$ ) and validity (Neupert, Spiro & Mroczek, 2008).

## RESULTS

Prior to conducting analyses designed to address the research hypotheses as previously outlined, I conducted descriptive analyses to obtain information regarding average values for variables of interest, distributions of those variables, and aggregated between-person associations. See Table 1 for descriptive characteristics and Table 2 for intercorrelations among study variables. For the young-old adults, age was positively correlated with co-occurrence of affect and negatively correlated with positive affect and neuroticism. Physical health symptoms were positively correlated with health stressors, negative affect, total stressors and neuroticism and were negatively correlated with positive affect. Health stressors were positively correlated with negative affect and total stressors. Positive affect was negatively correlated with neuroticism. Negative affect was positively correlated with total stressors and neuroticism. Total stressors were also positively correlated with neuroticism. Importantly, non-significant correlations indicated that positive and negative affect were not related to each other and that negative affect was not related to daily co-occurrence. For the old-old adults, non-significant correlations indicate there were no age differences in co-

occurrence of affect, positive affect, negative affect, health stressors, total stressors, physical health symptoms, or neuroticism. Not surprisingly, physical health symptoms were positively correlated with health stressors, negative affect, and total stressors. Health stressors were positively correlated with total stressors. Co-occurrence was slightly negatively correlated with negative affect. Neuroticism was positively correlated with negative affect and negatively correlated with positive affect. Negative affect was also positively correlated with total stressors. Finally, non-significant correlations indicated that positive and negative affect were unrelated.

Table 1

*Descriptive Characteristics For the Variables of Interest By Age Group (Young-Old and Old-Old Adults)*

Variable	<u>Young-Old</u>			<u>Old-Old</u>		
	<i>M</i>	<i>SD</i>	Range	<i>M</i>	<i>SD</i>	Range
Age	71.60	4.90	60-79	82.90	2.60	80-89
Physical Health	1.49	1.26	0-6	1.89	1.18	0-4.88
Health Stress	.11	.19	0-1	.18	.25	0-1
Co-Occurrence	-.07	.46	-.97-1	-.02	.51	-.92-.99
Positive Affect	2.85	.86	1.01- 4.95	2.53	0.94	1-4.43
Negative Affect	1.25	0.33	1- 4.09	1.38	0.56	1-4.29
Total Stress	0.77	0.75	0-4.88	0.99	0.92	0-3.63
Neuroticism	-0.11	1.96	-2.23-6.77	.35	2.44	-2.23-5.77

*Note.*  $N = 249$  young-old adults, 64 old-old adults.

Table 2

*Correlations Among All Variables of Interest for Young-Old Adults (top quadrant) and Old-Old Adults (bottom quadrant)*

	1	2	3	4	5	6	7	8
1. Age	–	.05	.05	.17**	-.2**	-.12	-.03	-.13*
2. Physical Health	.01	–	.42***	-.03	-.15*	.28***	.22**	.14*
3. Health Stress	-.14	.32*	–	-.07	-.01	.33***	.54***	.07
4. Co-Occurrence	-.05	.05	.01	–	-.11	.08	-.06	.01
5. Positive Affect	-.15	-.10	-.24	-.18	–	-.04	-.07	-.29***
6. Negative Affect	.09	.33*	.16	.26*	-.08	–	.49***	.31***
7. Total Stress	-.19	.30*	.71***	.10	-.14	.39**	–	.22**
8. Neuroticism	.03	.18	.19	.08	-.33*	.45**	.20	–

*Note.* \* $p < .05$ ; \*\* $p < .01$ ; \*\*\* $p < .001$ .  $N = 249$  young-old adults, 64 old-old adults.

#### *Research Question 1:*

*Are there age differences in co-occurrence of affect for young-old and old-old adults?*

An Independent Samples  $t$ -test was conducted to address the first research question and determine whether levels of daily co-occurrence of affect varied by age. As the variances were not equal in both groups,  $F = 1.21$ ,  $p = .006$ , the Satterthwaite method was reported. There was not a statistically significant difference between the mean daily co-occurrence of affect score for young-old and old-old adults,  $t' = -1.74$ ,  $p = .08$ . In other words, young-old ( $M = -.07$ ) and old-old adults ( $M = -.03$ ) did not significantly differ in their mean levels of

daily co-occurrence of affect. I conducted additional Independent Samples t-tests to examine the possibility that there were age differences in positive and negative affect. Results showed a significant difference between mean positive affect scores for young-old and old-old adults,  $t' = 5.94, p < .001$ . As such, young-old adults ( $M = 2.85$ ) tended to have significantly higher mean positive affect scores than old-old adults ( $M = 2.54$ ). There was also a significant difference in mean negative affect between the two age groups,  $t' = -4.13, p < .001$ , with old-old adults ( $M = 1.38$ ) showing higher mean negative affect than young-old adults ( $M = 1.25$ ).

*Research Question 2:*

*Is there a relationship between stressors, health and co-occurrence of affect? What is the direction of this relationship?*

I addressed Hypothesis 2 regarding the relationship between stressors and daily co-occurrence of affect and health and daily co-occurrence by determining each individual's average scores of stressors and health. I then assessed each variable's correlation with daily co-occurrence of affect. Neither stressors,  $r(331) = -.02, p = .73$ , nor health,  $r(305) = -.01, p = .89$  were significantly related to daily co-occurrence of affect.

*Research Question 3:*

*Does co-occurrence of affect moderate age differences in emotional reactivity to stressors in the health domain?*

I employed multilevel modeling to address the third hypothesis of daily co-occurrence of affect as a moderator of age differences in emotional reactivity to stressors in the health

domain. It is recommended to conduct a preliminary analysis to ensure that there is sufficient variability between and within individuals in the outcome variable to warrant continuation with analyses (Nezlek, 2001; Raudenbush & Bryk, 2002). This preliminary analysis is termed a fully unconditional model in which no term other than the intercept is included at any level (Nezlek, 2001). The fully unconditional model used to examine the between-person and within-person variability in daily negative affect was:

$$\text{Level 1: Negative Affect}_{it} = \beta_{0it} + r_{it}$$

$$\text{Level 2: } \beta_{0i} = \gamma_{00} + u_{0i}$$

This model provides a point estimate and confidence interval for the grand mean,  $\gamma_{00}$ . The model also provides information about Level 1 and level 2 variability in the outcome variable through two parameters:  $\sigma^2$  (within-person variability) and  $\tau_{00}$  (between-person variability). These parameters were used to calculate the intra-class coefficient which is a measure of the proportion of variance in the outcome variable that is between individuals. This correlation can be calculated using the following formula:

$$\rho = \tau_{00} / (\tau_{00} + \sigma^2)$$

Results indicated that  $\tau_{00}$  was .1404 and  $\sigma^2$  was .1025. Thus the intra-class correlation coefficient was .58, meaning that 58% of variability in daily negative affect was between people. I calculated the proportion of variance in the outcome variable that was within-people using the following formula:

$$1 - \rho$$

Results yielded a correlation coefficient of .42, indicating that 42% of the variance in the outcome variable was within people. This suggests that individuals tended to vary around their own averages to a similar extent as they differed from others, meaning there was sufficient variability in the outcome variable to warrant further analyses.

The following model was used to determine whether daily-co-occurrence of affect functioned as a moderator for age differences in reactivity to health stressors. Between-person differences in neuroticism were controlled for by entering the variable into the model. Age, daily co-occurrence, and neuroticism were centered around their grand means such that the grand mean of daily negative affect ( $\gamma_{00}$ ) indicates the level of daily negative affect for the average aged person with average levels of co-occurrence of affect when no health stressors occurred.

$$\text{Level 1: NegativeAffect}_{it} = \beta_{0it} + \beta_{1it}(\text{healthstress}) + r_{ij}$$

$$\text{Level 2: } \beta_{0i} = \gamma_{00} + \gamma_{01}(\text{age}) + \gamma_{02}(\text{co-occurrence of affect}) + \\ \gamma_{03}(\text{neuroticism}) + \gamma_{04}(\text{age} * \text{co-occurrence of affect}) + u_{0i}$$

$$\beta_{1i} = \gamma_{10} + \gamma_{11}(\text{age}) + \gamma_{12}(\text{co-occurrence of affect}) + \\ \gamma_{13}(\text{age} * \text{co-occurrence of affect}) + u_{1i}$$

In Level 1, Negative affect for person  $i$  on day  $t$  is a function of the intercept  $\beta_{0it}$ , which is the expected level of negative affect for person  $i$  on days with no health stressors (health stress = 0).

The slope  $\beta_{1it}$ , is the reactivity slope and it is the expected change in negative affect associated with the occurrence of health stressors, or the change associated with the

difference between exposure to no health stressors and exposure to health stressors (health stress = 1). The error term,  $r_{it}$ , represents the amount person  $i$  fluctuates around the mean.

In the Level 2 equations,  $\gamma_{00}$  is the grand mean of negative affect for the average aged person with average levels of co-occurrence of affect,  $\gamma_{01}$  is the main effect of age,  $\gamma_{02}$  is the main effect of co-occurrence of affect for the average aged person,  $\gamma_{03}$  is the main effect of neuroticism, and  $\gamma_{04}$  represents the interaction between age and co-occurrence of affect. In the next equation,  $\gamma_{10}$  is the average reactivity slope or change in negative affect between days with and without health stressors for the average aged person,  $\gamma_{11}$  represents the cross-level interaction examining age differences in the within-person slope (reactivity) of health stressors and negative affect,  $\gamma_{12}$  represents the cross-level interaction examining co-occurrence of affect differences in the within-person slope of health stressors and negative affect, and  $\gamma_{13}$  represents the cross-level interaction examining age and daily co-occurrence differences in the within person slope of health stressors and daily negative affect. The degree to which people vary from the sample mean of negative affect is represented by  $u_{0i}$ , and the degree to which people vary from the slope is represented by  $u_{1i}$ .

Health stressors were associated with participants' daily negative affect scores ( $\gamma_{10} = .14$ ,  $t = 4.03$ ,  $p < .001$ ) with occasions of a health stressor also reporting higher negative affect on that same day. Age ( $\gamma_{01} = .002$ ,  $t = .67$ ,  $p = .50$ ) was not associated with average levels of daily negative affect. Co-occurrence of affect ( $\gamma_{02} = .099$ ,  $t = 2.23$ ,  $p = .02$ ) was associated with average level of daily negative affect with individuals reporting higher levels of co-occurrence of affect also reporting higher levels of daily negative affect. This significant

relationship between co-occurrence of affect and daily negative affect was likely driven by the old-old adults as this relationship was not significant for the young-old adults (see Table 2). Neuroticism was associated with daily negative affect ( $\gamma_{03} = .07, t = 6.52, p < .001$ ) with individuals reporting higher levels of neuroticism also reporting more daily negative affect. There was an Age X Co-occurrence of affect interaction on the average level of daily negative affect ( $\gamma_{04} = .02, t = 2.42, p = .02$ ). The relationship between health stress and daily negative affect did depend on age ( $\gamma_{11} = -.01, t = -2.27, p = .02$ ), but did not depend on co-occurrence of affect ( $\gamma_{12} = .05, t = .70, p = .48$ ). Finally, the relationship between health stress and daily negative affect did simultaneously depend on age and co-occurrence of affect (i.e., Health Stressor X Age X Co-Occurrence of Affect:  $\gamma_{13} = -.34, t = -2.13, p = .03$ ). I calculated the percent of within-person variance accounted for by health stressors by obtaining the change in within-person variance estimates ( $\sigma^2$ ) from the fully unconditional model to the current constrained model and then dividing the result by the unconstrained estimate as illustrated by the following formula:

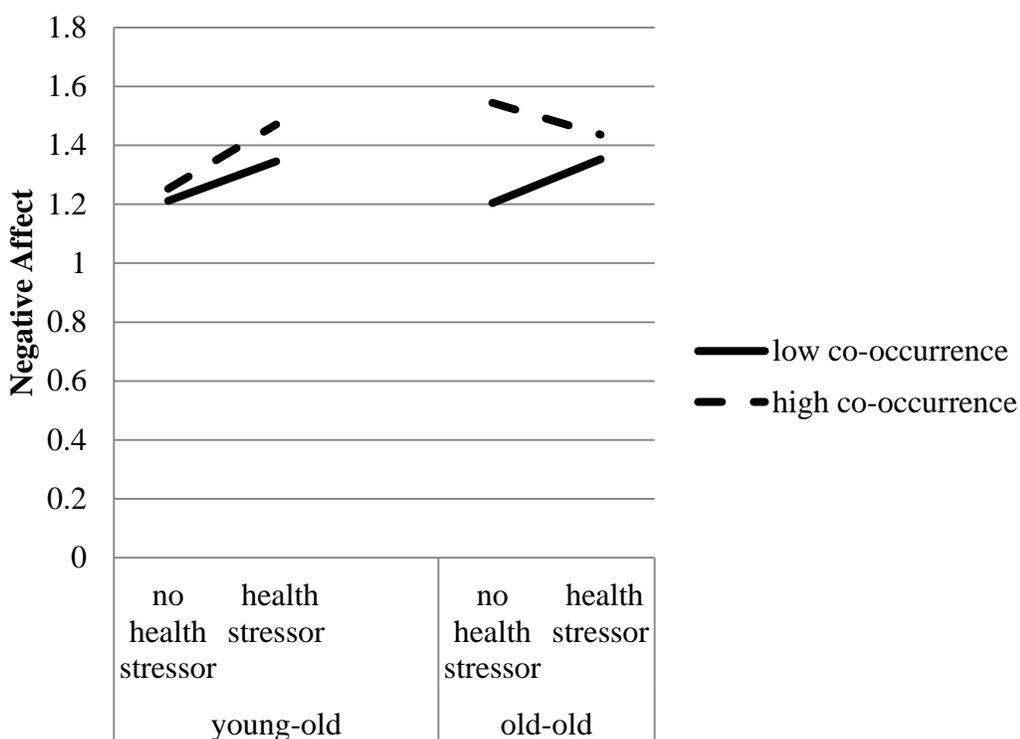
$$(\sigma_{uc}^2 - \sigma_c^2) / \sigma_{uc}^2$$

I calculated the percentage of between-person variance accounted for by the Level 2 predictors in a similar manner using the following formula:

$$(\tau_{00uc} - \tau_{00c}) / \tau_{00uc}$$

This model accounted for 14% of the within-person  $[(.1025 - .0879) / .1025]$  and 22% of the between-person  $[(.1404 - .1099) / .1404]$  variance in negative affect.

In order to interpret the three-way cross level interaction (Health Stressor X Age X Co-Occurrence of Affect), I conducted two additional models; one for young-old adults and one for old-old adults. I then plotted the slopes of reactivity from the two additional models for low co-occurrence of affect (operationalized as one standard deviation below the average mean of the sample), and high co-occurrence of affect (one standard deviation above the average mean of the sample). As predicted, older adults with higher levels of co-occurrence of affect were less reactive in the presence of health stressors (see Figure 1)



*Figure 1.* Co-occurrence as a moderator for the relationship between health stress and daily negative affect (Health Stressor X Age X Co-Occurrence of Affect).

The simple slope for old-old adults with high co-occurrence of affect was not significant, ( $\gamma_{10} = 1.77, t = -1.31, p = .19$ ).

To rule out the possibility that fluctuations in negative affect and positive affect were more important than mean co-occurrence of affect, I calculated each individual's within-person standard deviation scores for both positive and negative affect. These scores were then simultaneously entered into the previous model. Results did not change and the three-way cross level interaction (Health Stressor X Age X Co-Occurrence of Affect) remained significant when fluctuations in positive and negative affect were included as covariates.

*Research Question 4:*

*Do individuals with higher levels of daily co-occurrence have less stress residue and will these effects differ by age?*

I employed an additional multilevel model to examine whether older adults in general who have higher levels of co-occurrence of affect would have a lesser emotional response to stress residue compared to older adults with lower levels of co-occurrence of affect. I conducted analyses with the stressor variable group-mean centered, such that the between-person differences in level of daily stressors were removed from the estimate of the within-person relationship between stressors and negative affect.

Level 1:  $\text{NegativeAffect}_{it} = \beta_{0it} + \beta_{1it}(\text{today's stress}) + \beta_{2it}(\text{yesterday's stress}) + \beta_{3it}(\text{yesterday's negative affect}) + r_{ij}$

Level 2:  $\beta_{0i} = \gamma_{00} + \gamma_{01}(\text{co-occurrence of affect}) + \gamma_{02}(\text{neuroticism}) + u_{0i}$

$\beta_{1i} = \gamma_{10} + u_{1i}$

$$\beta_{2i} = \gamma_{20} + \gamma_{21} (\text{co-occurrence of affect}) + u_{2i}$$

$$\beta_{3i} = \gamma_{30} + u_{3i}$$

Co-occurrence of affect ( $\gamma_{01} = .082, t = 2.14, p = .03$ ) was associated with daily negative affect and that there was a Yesterday's Stress X Co-occurrence of affect effect on average level of daily negative affect ( $\gamma_{21} = -.052, t = -2.66, p = .008$ ). In order to interpret this interaction, I plotted the slope in reactivity for low co-occurrence of affect (operationalized as one standard deviation below the average mean of the sample), and high co-occurrence of affect (one standard deviation above the average mean of the sample). Older adults with a higher co-occurrence of affect tended to exhibit less stress residue compared to older adults with a lower co-occurrence of affect. This model accounted for 44% of the between-person and 6% of the within-person variance in daily negative affect (see Figure 2.)

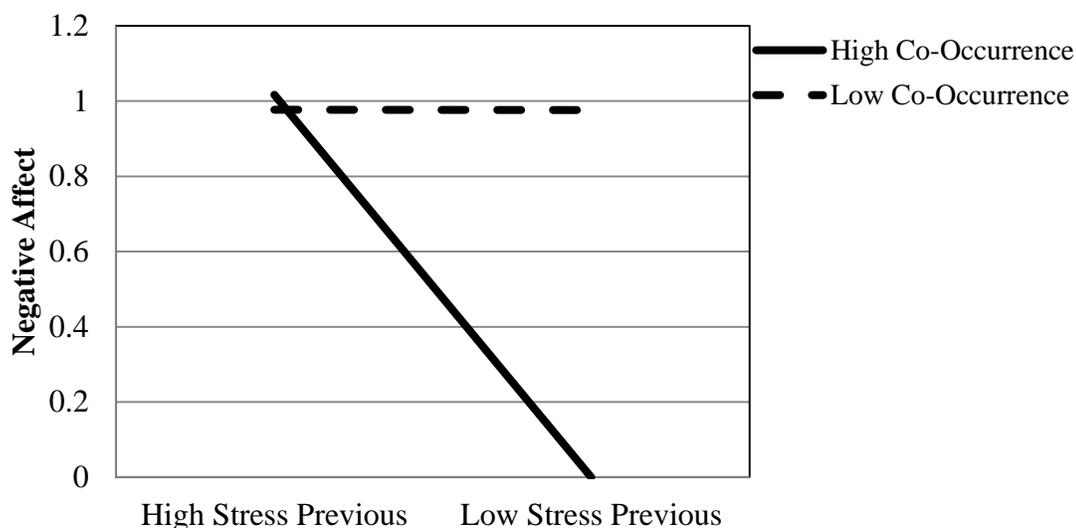


Figure 2. Co-Occurrence of affect X Yesterday's Stress in Older Adults.

I also employed a multilevel model to test the fourth research question regarding the relationships between stress residue, age and co-occurrence of affect. I used the following model to determine the relationships among the variables of interest:

Level 1:  $NegativeAffect_{it} = \beta_{0it} + \beta_{1it}(\text{today's stress}) + \beta_{2it}(\text{yesterday's stress}) + \beta_{3it}(\text{yesterday's negative affect}) + r_{ij}$

Level 2:  $\beta_{0i} = \gamma_{00} + \gamma_{01}(\text{age}) + \gamma_{02}(\text{co-occurrence of affect}) + \gamma_{03}(\text{neuroticism}) + \gamma_{04}(\text{age} * \text{co-occurrence of affect}) + u_{0i}$

$\beta_{1i} = \gamma_{10} + u_{1i}$

$\beta_{2i} = \gamma_{20} + \gamma_{21}(\text{age}) + \gamma_{22}(\text{co-occurrence of affect}) + \gamma_{23}(\text{age} * \text{co-occurrence of affect}) + u_{2i}$

$\beta_{3i} = \gamma_{30} + u_{3i}$

I entered negative affect into the model as a Level 1 dependent variable with Level 1 independent variables including today's stress ( $\beta_{1it}$ ), yesterday's stress ( $\beta_{2it}$ ), and yesterday's negative affect ( $\beta_{3it}$ ). Level 2 predictors included main effects for age ( $\gamma_{01}$ ) and co-occurrence of affect ( $\gamma_{02}$ ), as well as interactions of Co-Occurrence of Affect X Yesterday's Stress ( $\gamma_{22}$ ), Age X Yesterday's Stress ( $\gamma_{21}$ ), Co-Occurrence of Affect X Age ( $\gamma_{04}$ ), and Yesterday's Stress X Age X Co-Occurrence of Affect ( $\gamma_{23}$ ). As in the previous model, I controlled for between-person differences in neuroticism ( $\gamma_{03}$ ). I conducted analyses with the stressor variable group-mean centered, such that the between-person differences in level of daily stressors were removed from the estimate of the within-person relationship between stressors and negative affect.

Neither age ( $\gamma_{01} = .066, t = 1.43, p = .15$ ) nor co-occurrence of affect ( $\gamma_{02} = .038, t = .87, p = .38$ ) were associated with daily negative affect. There was an Age X Co-occurrence of Affect effect on average level of daily negative affect ( $\gamma_{04} = .197, t = 2.08, p = .04$ ). There was not an Age X Yesterday's Stress effect on level of daily negative affect ( $\gamma_{21} = -.03, t = -1.45, p = .15$ ), nor was there a Co-Occurrence of Affect X Yesterday's Stress effect on level of daily negative affect ( $\gamma_{22} = -.03, t = -1.31, p = .19$ ). Finally, there was not a Yesterday's Stress X Age X Co-Occurrence of Affect effect on level of daily negative affect ( $\gamma_{23} = -.09, t = -1.86, p = .06$ ). The effect of co-occurrence of affect on stress residue did not differ by age. This model accounted for 7% of the within-person  $[(.1025 - .0961)/.1025]$  and 41% of the between-person  $[(.1404 - .0824)/.1404]$  variance in negative affect.

## DISCUSSION

The current study took a within-person approach when examining age differences in and the effects of daily co-occurrence of affect on reactivity to stressors, physical health symptoms, health stressors, and stress residue in young-old and old-old adults.

In regards to Hypothesis 1, old-old adults and young-old adults differed in mean levels of positive and negative affect. The failure to find significant age differences in levels of daily-co-occurrence is suggestive of two different developmental trajectories. First, in accordance with SST, emotional functioning may continue to improve or be maintained in later portions of the life span such that both age groups show similar levels of co-occurrence of affect (Carstensen et al. 1999). Second, in line with DIT, these age groups may exhibit similar levels of co-occurrence of affect because both groups represent later portions of the lifespan

and, as such, would have presumably already experienced declines in cognitive and emotional functioning (Labouvie-Vief, 2005). A longitudinal study would be necessary for determining whether levels of co-occurrence of affect increase or decrease as individuals transition from the third to the fourth age (Baltes, 1997).

However, consistent with the Hypothesis 3, co-occurrence of affect moderated the relationship among age, health stressors, and negative affect even when controlling for neuroticism. Old-old adults with higher levels of co-occurrence of affect reported less negative affect on days when health stressors were reported compared to young-old adults with higher levels of co-occurrence of affect. This finding, combined with the failure to find significant age differences in levels of co-occurrence of affect, may also suggest that old-old adults are more efficient at employing regulatory strategies potentially associated with higher levels of co-occurrence of affect. Thus, old-old adults show more adaptive advantages associated with higher levels of co-occurrence due to greater efficiency in their processing and application of strategies, and not solely due to greater levels of co-occurrence of affect.

These results provide support for the assertion that co-occurrence of affect functions in an adaptive capacity (Carstensen et al., 2000; Ong & Bergman, 2004). Importantly, the finding that only old-old adults with higher levels of co-occurrence of affect were less reactive on days when health stressors occurred suggests that young-old and old-old adults do not experience emotions in the same manner and should be examined separately. This is in line with Baltes's (1997) assertion that individuals 80 years of age and better are developmentally distinct from other age groups. Of course, even though I chose 80 years of age as the cut-off

for young-old and old-old adults based on previously reviewed literature, this is still arbitrary (Baltes, 1997). By setting the cut-off earlier in the lifespan, more individuals could be included in the old-old adult group. The greater number of old-old adults could provide more power and the relationship between negative affect and co-occurrence of affect in this group could fail to reach significance as the magnitude of the relationship using 80 years of age as the cut-off is small ( $n = .23$ ). This finding also provides evidence that higher levels of co-occurrence of affect provides an adaptive advantage specific to old-old adults exposed to stressors in the health domain. The finding that these adaptive advantages were specific to stressors in the health domain further highlights the importance of differentiating among stressor domains and identifying domains of stress that are salient to the sample of interest. It suggests that the relationship between stress and health outcomes can depend on stressor domain and salience of the stressor domain (Aldwin, 2007).

While these results suggest that higher levels of co-occurrence of affect provide an adaptive advantage by reducing reactivity to health stressors, several alternative explanations are possible. Older adults may interpret a certain degree of health stressors as normative and better accommodate health limitations (Piazza, Charles & Almeida., 2007). Additionally, the importance of a serious health event has been shown to decrease with age (Wurm, Tomasik, & Tesch-Römer, 2008). Old-old adults may be less emotionally reactive to a health stressor as health problems can be perceived as normal and expected, or an on-time event, at this point in development (Neugarten, 1968).

Hypothesis 4 was partially supported as older adults with higher levels of co-occurrence of affect tended to exhibit less stress residue and older adults with lower levels of co-occurrence of affect tended to exhibit more stress residue. These results are in line with SAVI's prediction that the benefits of strategies employed to de-escalate reactivity to negative events reemerge as time passes from the initial onset of the stressor. These results also provide evidence that the ability to experience positive and negative affect during the same 24 hour period can improve the use and selection of adaptive strategies employed by older adults which serve to increase emotional-well-being by mitigating the effects of negative reactivity to stressful events.

Results showing that age did not moderate the relationship between co-occurrence of affect and stress residue suggest that old-old adults did not tend to benefit from higher-levels of co-occurrence of affect to a greater extent than young-old adults. This result is surprising given that co-occurrence of affect moderated the effects of health stress on reactivity to a different extent in the two age groups. Taken together, these two sets of findings imply that old-old and young-old adults show different patterns of emotional responses to domain specific stressors they are experiencing currently. However, they do not differ in emotional responses to overall stressors after time has passed from initial exposure to these stressors. As such, age differences in emotional responses to stressful events should not only be contextualized in terms of domain and salience of the stressor but also in terms of recency of the stressful event (Aldwin, 1999; Charles, 2010).

Results failed to support Hypothesis 2 as neither daily stressors nor daily health were significantly related to daily co-occurrence of affect. This implies that co-occurrence of affect functions to mitigate the negative impact of stressors by reducing negative reactivity to stressors in the health domain for old-old adults and reducing the likelihood that older adults in general will experience stress residue. However, co-occurrence of affect does not affect the number of reported physical health symptoms nor current stressor exposure. As such, co-occurrence of affect may function as a form of emotion-focused coping (Lazarus, 1999). Emotion-focused coping involves attempts to regulate emotions associated with a situation in order to lessen any negative emotional impact resulting from that situation (Lazarus, 1999). This would explain why only analyses with reactivity to stressors as the focus showed significant effects of co-occurrence of affect. Co-occurrence of affect has been shown to be related to emotion-regulation (Carstensen et al., 1999; Hay and Diehl, 2011; Ong & Bergeman, 2004). The exact nature of this relationship remains unclear, but emotion-regulation strategies have been shown to impact the use and effectiveness of coping strategies (Aspinwall & Taylor, 1997).

There are some important limitations to this study. Namely, half of the individual difference variable (co-occurrence of affect) is made up of daily the dependent variable (negative affect), which increases the likelihood of potential circularity. However, the co-occurrence of affect variable is based on rank order stability within a person over time, so actual mean values are only present in the dependent variable. The independent variable, co-occurrence of affect, does not include mean level information present in the dependent

variable (daily negative affect). Additionally, the measure of co-occurrence of affect was unrelated to the negative affect measure in the young-old adults, who comprised the majority of the sample. Even though negative affect and co-occurrence of affect are related in the old-old, the magnitude is small.

Another potential limitation is that this study examines benefits of daily co-occurrence over a shorter time span, 8 days as opposed to 30 days (Ong & Bergeman, 2004). However, the ability to find effects of daily co-occurrence of affect in such a short time frame suggests that researchers could examine this construct in a more efficient manner. This could also greatly reduce the time commitment required of participants.

Another potential limitation is that both the daily dependent variable and the co-occurrence of affect variable were calculated based on participants' responses to the PANAS (Watson et al., 1988). The conceptual structure of emotion this measure provides has been criticized as being prespecified by the selection of emotion terms (Lane & Pollerman, 2002). As this measure does not allow the participant to select the emotions terms describing his or her emotions, a certain amount of information that may be important in detecting individual differences in emotional experiences can be lost (Lane & Pollerman). Additionally, the positive affect adjectives included in the PANAS could be considered as action or motivational adjectives. Thus, these terms are semantically different than lay perspectives on what positive affect is thought to be. However, the PANAS is a commonly used assessment because it is time-efficient and has been shown to have good reliability and validity. As the PANAS has been used to measure co-occurrence of affect in previous studies (Ong &

Bergeman 2004; Grühn, et al., 2011; Hay & Diehl, 2011), generalizations and direct comparisons among the results described in this study and previously describe studies are possible. Even so, future studies would benefit from the development of distinct indicators of various emotional constructs that could eliminate the potential issues of circularity raised by employing the same measure for the dependent variable and co-occurrence of affect variable. Future studies could also benefit from accounting for the possibility that measures such as the PANAS, which specify emotion terms in advance, reduce the extent to which individual differences in emotional experiences can be examined.

An important direction for future research would be to examine the exact nature of the relationship among co-occurrence of affect, emotion-regulation strategies, and coping strategies. This could clarify whether co-occurrence of affect does indeed function as a coping strategy, whether it functions as an emotion regulation strategy that enables the effective application of coping strategies, or whether co-occurrence is unrelated to the effective selection and use of coping strategies.

Another goal is to examine long term changes in daily processes to determine if co-occurrence of affect changes longitudinally over time to determine whether the effects of co-occurrence of affect become stronger for old-old adults. I was not able to address issues concerning cause and effect or isolate the direction of co-occurrence of affect. The 2003 daily diary assessment is part of a larger measurement burst design. Burst 1 was examined in the

current study but burst 2 has been collected and there is funding for bursts 3 and 4, so questions regarding directions of effects can be addressed in the future

Though there are several limitations to this study, the findings have added to the understanding of the relationships among co-occurrence of affect, age, temporal response patterns to stressors, and psychological resiliency to stressors in important ways.

Specifically, the findings from this study support the assertion that co-occurrence of affect serves an adaptive function in older age. Additionally, the study further highlights the importance of differentiating between domain specific and global stressors and identifying the cadence of these stressors. Specifically, the patten of emotion responses for young-old and old-old adults differed by stressor type (health stressors versus global stressors) and temporal indices (concurrent versus lagged effects) of stressor exposure.

## REFERENCES

- Aldwin, C. M. (2007). Theoretical approaches to coping. *Stress, coping, and development: An integrative perspective*. (pp. 98-126).
- Almeida, D.M., Stawski, R., Cichy, K. (November, 2011). Variations within the eye of the beholder: Assessing event variability in stressor appraisals. In C. Berg (Chair), *Regulating Daily Affect and Stress Across the Lifespan*. Symposium conducted at the annual meeting of the Gerontological Society of America, Boston, MA.
- Almeida, D. M., Wethington, E., & Kessler, R. C. (2002). The Daily Inventory of Stressful Events (DISE): An interview based approach for measuring daily stressors. *Assessment, 9*, 41–55.
- Aspinwall L. G., Taylor S. E. (1997). A stitch in time: self-regulation and proactive coping. *Psychological Bulletin, 121*, 417–436.
- Baltes, P. B. (1997). On the incomplete architecture of human ontogeny: Selection, optimization, and compensation as foundation of developmental theory. *American Psychologist, 52*, 366-380.
- Bopp, K. L., & Verhaeghen, P. (2005). Aging and verbal memory span: A meta-analysis. *Journal of Gerontology: Psychological Sciences, 60B*, 223-233.
- Carstensen, L. L., Pasupathi, M., Mayr, U., & Nesselroade, J. R. (2000). Emotional experience in everyday life across the adult lifespan. *Journal of Personality and Social Psychology, 79*, 644-655.

- Carstensen, L. L., Turan, B., Scheibe, S., Ram, N., Ersner-Hershfield, H., Samanez-Larkin, G. R., Brooks, K. P., & Nesselroade, J. R. (2011). Emotional experience improves with age: Evidence based on over 10 years of experience sampling. *Psychology and Aging, 26*, 21-33.
- Charles, S. T., Mather, M., & Carstensen, L. L. (2003). Aging and emotional memory: The forgettable nature of negative images for older adults. *Journal of Experimental Psychology: General, 132*(2), 310–324.
- Coats, A. H., & Blanchard-Fields, F. (2008). Emotion regulation in interpersonal problems: The role of cognitive-emotional complexity, emotion regulation goals, and expressivity. *Psychology and Aging, 23*(1), 39–51.
- Diehl, M., Coyle, N., & Labovie-Vief, G. (1996). Age and sex differences in strategies of coping and defense across the life-span. *Psychology and Aging, 11*, 127-139.
- Grühn, D., Diehl, M., Lumley, M., Labovie-Vief, G. (2012). Time-based indicators of emotional complexity: Interrelations and Correlations. doi: 10.1037/a0030363.
- Hay, E. L., & Diehl, M. (2010) Reactivity to Daily Stressors in Adulthood: The importance of stressor type in characterizing risk factors. *Psychology and Aging 25*, 118-131.
- Hay, E. L. & Diehl, M. (2011). Emotion complexity and emotion regulation across adulthood. *European Journal of Ageing, 8*, 157-168.
- Labovie-Vief, G. (2005). Self-with-other representations and the organization of the self. *Journal of Research in Personality, 39*, 185-205.

- Labouvie-Vief, G., Chiodo, L. M., Goguen, L. A., Diehl, M., & Orwoll, L. (1995).  
 Representations of self across the life span. *Psychology and Aging, 10*, 404-415.
- Labouvie-Vief, G., Diehl, M., Jain, E., & Zhang, F. (2007). Six-year change in affect  
 optimization and affect complexity across the adult life span: A further examination.  
*Psychology and Aging, 22*, 738-751.
- Labouvie-Vief, G., Hakim-Larson, J., DeVoe, M., & Schoeberlein, S. (1989). Emotions and  
 self-regulation: A life span view. *Human Development, 32*, 279-299.
- Labouvie-Vief, G., & Medler, M. (2002). Affect optimization and affect complexity: Modes  
 and styles of regulation in adulthood. *Psychology and Aging, 17*, 571-588.
- Lane, R. D., & Pollerman, B. Z. (2002). The complexity of emotion representations. In L. F.  
 Barret, & P. Salovey (Eds.), *The wisdom in feeling: Psychological processes in  
 emotional intelligence* (pp. 271-296). New York, NY: Guilford Press.
- Lazarus, R. S. (1999). *Stress and emotion: A new synthesis*. New York: Springer.
- Lindquist, K., & Barrett, L. F. (2008). Emotional complexity. Chapter in M. Lewis, J. M. In  
 Haviland-Jones, & L.F. Barrett (Eds.), *The handbook of emotion, 3rd edition* (p. 513-  
 530). New York: Guilford.
- Magai C, Consedine, N. S., Krivoshekova, Y. S., Kudadjie-Gyamfi E., &  
 McPherson, R. (2006) Emotion experience and expression across the adult life span:  
 insights from a multimodal assessment study. *Psychology and Aging, 21*, 303–317.
- Mroczek, D. K. & Almeida D. M. (2004) The effect of daily stress, personality, and age on  
 daily negative affect. *Journal of Personality, 72*, 355–378.

- Neugarten, B. L. (1968). Adult personality: Toward a psychology of the life cycle. In B. L. Neugarten (Ed.), *Middle age and aging: A reader in social psychology* (pp. 137–147). Chicago: University of Chicago Press.
- Neupert, S. D., Almeida, D. M., Mroczek, D. K., & Spiro III, A. (2006). 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.
- Neupert, S. D., Mroczek, D. K., & Spiro III, A. (2008). Neuroticism moderates the daily relation between stressors and memory failures. *Psychology and Aging, 23*(2), 287–296.
- Nezlek, J. B. (2001). Multilevel random coefficient analyses of event- and interval-contingent data in social and personality psychology research. *Personality and Social Psychology Bulletin, 27*, 771–785.
- Ong, A. D., & Bergeman, C. S. (2004). The complexity of emotions in later life. *Journal of Gerontology: Psychological Sciences, 59B*, 117-122.
- Park, D. C., Lautenschlager, G., Hedden, T., Davidson, N. S., Smith, A. D., & Smith, P. K. (2002). Models of visuospatial and verbal memory across the adult life span. *Psychology and Aging, 17*, 299-320.
- Piazza, J. R., Charles, S. T., & Almeida, D. M. (2007). Living with chronic health conditions: age differences in affective well-being. *Journal of Gerontology: Psychological Sciences, 62B* (6), 313–321.

- Raudenbusch, S. W., & Bryk, A. S. (2002). Hierarchical linear models: Applications and data analysis methods (2nd ed.). Newbury Park, CA: Sage.
- Reich, J. W., Zautra, A. J., & Davis, M. (2003). Dimensions of affect relationships: Models and their integrative implications. *Review of General Psychology, 7*, 66–83.
- Spiro, A., III, & Bosse, R. (2001). The Normative Aging Study. In G. Maddox (Ed.), *Encyclopedia of aging* (3<sup>rd</sup> ed., pp. 744-746). New York: Springer.
- Terracciano, A., McCrae, R. R., Hagemann, D., & Costa, P. T. (2003). Individual difference variables, affective differentiation, and the structure of affect. *Journal of Personality, 71*, 669-703.
- 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.
- Wheaton, B. (1985). Models for the stress-buffering functions of coping resources. *Journal of Health and Social Behavior, 26*, 352-364.
- Wolff, J. L., Starfield, B., & Anderson, G. (2002). Prevalence, expenditures, and complications of multiple chronic conditions in the elderly. *Archives of Internal Medicine, 162*, 2269-2276.
- Wrosch, C., Heckhausen, J., & Lachman, M. E. (2000). Primary and secondary control strategies for managing health and financial stress across adulthood. *Psychology and Aging, 15*(3), 387–399.

Wurm, S., Tomasik, M. J., & Tesch-Römer, C. (2008). Serious health events and their impact on changes in subjective health and life satisfaction: the role of age and a positive view on ageing. *European Journal of Ageing*, 5(2), 117-127.

## APPENDICES

**Appendix A**  
The Positive and Negative Affect Schedule

Using the following scale, indicate to what extent you have felt these emotions in the past 24 hours.

	Very slightly or not at all	A little	Moderately	Quite a bit	Extre mely
Interested	1	2	3	4	5
Distressed	1	2	3	4	5
Excited	1	2	3	4	5
Upset	1	2	3	4	5
Strong	1	2	3	4	5
Guilty	1	2	3	4	5
Scared	1	2	3	4	5
Hostile	1	2	3	4	5
Enthusiastic	1	2	3	4	5
Proud	1	2	3	4	5
Irritable	1	2	3	4	5
Alert	1	2	3	4	5
Ashamed	1	2	3	4	5
Inspired	1	2	3	4	5
Nervous	1	2	3	4	5
Determined	1	2	3	4	5
Attentive	1	2	3	4	5
Jittery	1	2	3	4	5
Active	1	2	3	4	5
Afraid	1	2	3	4	5

## Appendix B

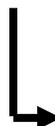
### Daily Inventory of Stressful Events (DISE)

In the **past 24 hours**, did you have an **argument or disagreement with anyone?**

\_\_\_\_\_ NO

\_\_\_\_\_ YES

NO YES



a. **Who** was it with?

- \_\_\_ Spouse
- \_\_\_ Your Child(ren)
- \_\_\_ Your Grandchild(ren)
- \_\_\_ Other Family Member
- \_\_\_ Friend
- \_\_\_ Neighbor
- \_\_\_ Co-worker
- \_\_\_ Someone Else \_\_\_\_\_

b. What was the **main topic** of the argument?

- \_\_\_ Money/Financial Issues
- \_\_\_ Family obligation/responsibilities
- \_\_\_ Household-related tasks
- \_\_\_ Work /Volunteer-related tasks
- \_\_\_ Scheduling
- \_\_\_ Other \_\_\_\_\_

c. How **stressful** was this for you?

\_\_\_ Not At All \_\_\_ A Little \_\_\_ Somewhat \_\_\_ Very

d. How much **control** do you feel you had over this situation?

\_\_\_ None \_\_\_ A Little \_\_\_ Some \_\_\_ A lot

e. Is the issue **resolved**? \_\_\_ No \_\_\_ Yes

In the **past 24 hours**, did anything happen (other than what you have already mentioned) that you **could have argued or disagreed** about, but you decided to let it pass?

\_\_\_\_\_ NO

\_\_\_\_\_ YES

NO YES



a. **Who** was it with?

- Spouse
- Your Child(ren)
- Your Grandchild(ren)
- Other Family Member
- Friend
- Neighbor
- Co-worker
- Someone Else \_\_\_\_\_

b. What was the **main topic** of the potential argument or disagreement?

- Money/Financial Issues
- Family obligation/responsibilities
- Household-related tasks
- Work /Volunteer-related tasks
- Scheduling
- Other \_\_\_\_\_

c. How **stressful** was this for you?

- Not At All     A Little     Somewhat     Very

d. How much **control** do you feel you had over this situation?

- None     A Little     Some     A lot

e. Is the issue **resolved**?     No     Yes

In the **past 24 hours**, did anything happen **in your workplace or volunteer setting** (other than what you have already mentioned) that most people would consider stressful?

\_\_\_\_\_ NO

\_\_\_\_\_ YES

NO YES



a. **Who** else was involved?

\_\_\_ No one else

\_\_\_ Spouse

\_\_\_ Your Child(ren)

\_\_\_ Your Grandchild(ren)

\_\_\_ Other Family Member

\_\_\_ Friend

\_\_\_ Co-worker

\_\_\_ Someone Else \_\_\_\_\_

b. Was there an argument or disagreement?

\_\_\_ No \_\_\_ Yes

c. What was the **main source** of the stress?

\_\_\_ Income or job security

\_\_\_ Mistakes

\_\_\_ Having too much to do

\_\_\_ Scheduling

\_\_\_ Other \_\_\_\_\_

d. How **stressful** was this for you?

\_\_\_ Not At All \_\_\_ A Little \_\_\_ Somewhat \_\_\_ Very

e. How much **control** do you feel you had over this situation?

\_\_\_ None \_\_\_ A Little \_\_\_ Some \_\_\_ A lot

f. Is the issue **resolved**? \_\_\_ No \_\_\_ Yes

In the **past 24 hours**, did anything happen **at home** (other than what you have already mentioned) that most people would consider stressful?

\_\_\_\_\_ NO

\_\_\_\_\_ YES

NO YES



a. **Who** else was involved?

- No one else  
 Spouse  
 Your Child(ren)  
 Your Grandchild(ren)  
 Other Family Member  
 Friend  
 Neighbor  
 Co-worker  
 Someone Else \_\_\_\_\_

b. Was there an argument or disagreement?

- No       Yes

c. What was the **main source** of the stress?

- Household maintenance  
 Neighborhood concerns  
 Having too much to do  
 Scheduling conflicts  
 Financial issues  
 Pet problems  
 Other \_\_\_\_\_

d. How **stressful** was this for you?

- Not At All    A Little    Somewhat    Very

e. How much **control** do you feel you had over this situation?

- None       A Little       Some       A lot

f. Is the issue **resolved**?  No       Yes

In the **past 24 hours**, did anything happen **to a close friend or relative** (other than what you have already mentioned) that turned out to be stressful for you?

\_\_\_\_\_ NO

\_\_\_\_\_ YES

NO YES



a. What relation is this person to you?

- Spouse
- Your Child(ren)
- Your Grandchild(ren)
- Other Family Member
- Friend
- Neighbor
- Co-worker
- Someone Else \_\_\_\_\_

b. What happened to this person?

- Financial problem
- Legal problem
- Health or safety issue
- Work-related issue
- Death
- Emotional problem
- Relationship problem
- Other \_\_\_\_\_

c. How **stressful** was this for you?

- Not At All    A Little    Somewhat    Very

d. How much **control** do you feel you had over this situation?

- None    A Little    Some    A lot

e. Is the issue **resolved**?    No    Yes

In the **past 24 hours**, did anything stressful happen (other than what you have already mentioned) **regarding your personal health**?

\_\_\_\_\_ NO

\_\_\_\_\_ YES

NO YES



a. **Who** else was involved?

- No one else  
 Spouse  
 Your Child(ren)  
 Your Grandchild(ren)  
 Other Family Member  
 Friend  
 Neighbor  
 Co-worker  
 Someone Else \_\_\_\_\_

b. Was there an argument or disagreement?

\_\_\_\_\_ No \_\_\_\_\_ Yes

c. What was the **main problem**?

- Accident  
 Potential accident  
 Medication-related issue  
 Health insurance issue  
 Illness  
 Receiving treatment  
 Problems during health care visit  
 Other \_\_\_\_\_

d. How **stressful** was this for you?

\_\_\_\_\_ Not At All \_\_\_\_\_ A Little \_\_\_\_\_ Somewhat \_\_\_\_\_ Very

e. How much **control** do you feel you had over this situation?

\_\_\_\_\_ None \_\_\_\_\_ A Little \_\_\_\_\_ Some \_\_\_\_\_ A lot

f. Is the issue **resolved**? \_\_\_\_\_ No \_\_\_\_\_ Yes

In the **past 24 hours**, did **anything else happen** (other than what you have already mentioned) that most people would consider stressful?

\_\_\_\_\_ NO

\_\_\_\_\_ YES

NO YES



a. **Who** else was involved?

\_\_\_ No one else

\_\_\_ Spouse

\_\_\_ Your Child(ren)

\_\_\_ Your Grandchild(ren)

\_\_\_ Other Family Member

\_\_\_ Friend

\_\_\_ Neighbor

\_\_\_ Co-worker

\_\_\_ Someone Else \_\_\_\_\_

b. Was there an argument or disagreement?

\_\_\_ No \_\_\_ Yes

c. What was the **main source** of the stress?

\_\_\_ Weather

\_\_\_ Traffic/transportation

\_\_\_ Political