INTERINDIVIDUAL DIFFERENCES AND INTRAINDIVIDUAL CHANGE IN THE INTRAINDIVIDUAL RELATIONSHIP BETWEEN STRESS AND NEGATIVE AFFECT: AGE, RESILIENCE, AND STRESS INFLUENCES

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INTERINDIVIDUAL DIFFERENCES AND INTRAINDIVIDUAL CHANGE IN THE INTRAINDIVIDUAL RELATIONSHIP BETWEEN STRESS AND NEGATIVE AFFECT: AGE, RESILIENCE, AND STRESS INFLUENCES

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Exploration of development requires the use of research designs and process-oriented methodologies that can capture daily fluctuations within individuals, systematic changes within individuals, and differences between individuals (Nesselroade, 1991). Because the daily relationship between stress and negative affect (NA) relates to long-term mental and physical health outcomes, gaining a better understanding of the environmental and person-related contextual factors that relate to daily variability, systematic change, and individual differences in this daily stress-NA relationship can not only illustrate the resilience process as a whole, but also inform intervention and preventative care strategies aimed toward promoting positive well-being. Examining the stress-NA relationship with multiple time scales and multi-level modeling, therefore, illustrates how the day-to-day relationship between stress and NA changes over time as well as how global characteristics, such as overall stress levels,
dispositional resilience, and age relate to differences in the way in which the stress-NA relationship changes.

The purpose of the current study was threefold: 1) To establish the relationships among daily fluctuations in stress, yearly changes in stress, average stress levels and daily NA, and explore how age changes and age differences influence these relationships, 2) To explore the relationships among the daily stress-NA relationship, yearly changes in dispositional resilience, average dispositional resilience levels, and age differences, and 3) To depict the relationships among age changes, age differences, yearly changes in dispositional resilience, and the daily stress-NA relationship.

Participants from the midlife and later-life waves of the Notre Dame Study of Health & Well-Being (NDHWB; N = 958) completed daily “burst” assessments of stress and NA as well as global questionnaires that assessed dispositional resilience. Three-level multi-level models were used to analyze the data, and ultimately depicted how cross-sectional age, within-person age changes, dispositional resilience differences, within-person fluctuations in dispositional resilience, and global stress differences impact the daily stress-NA relationship. Thus, the current study provides a holistic illustration of resilience as a dynamic process and depicts how interventions and prevention strategies can best promote resilience.
This is for my supportive and loving family.
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CHAPTER 1:  
INTRODUCTION

Developmental research works to establish *nomothetic properties*, or general laws of development, as well as *idiographic tendencies*, or unique characteristics of the individual (Nesselroade, Gerstorf, Hardy & Ram, 2007). Because the current study seeks to better understand resilience as a process that can differ and change within individuals, we focus on exploring idiographic tendencies. Individuals illustrate a great deal of heterogeneity and plasticity as they develop (Baltes, 1987); as such, when studying developmental processes, researchers must not only account for between-person differences as well as within-person fluctuations and change, but also explore the relationships between them (Nesselroade, 1991). Specifically, *intraindividual variability*, or within-person, short-term state fluctuations, must be understood in the context of *intraindividual change*, defined as the long-term, more systematic changes in development, as well as *interindividual differences*, or trait-like differences between people (Nesselroade, 1991; Ram & Gerstorf, 2009; Ram, Gerstorf, Lindenberger, & Smith, 2011). Examining intraindividual variability in the context of intraindividual change and interindividual differences allows researchers to understand how developmental processes operate (Nesselroade, 1991; Ram & Gerstorf, 2009). In other
words, researchers can explore how daily fluctuations relate to systematic changes over time, and how these fluctuations and changes differ according to cross-sectional between-person differences (Ram & Gerstorf, 2009; Ram et al., 2011). Consequently, the current study seeks to understand interindividual differences, intraindividual change, and intraindividual variability in the daily stress-NA relationship as a way to better understand the resilience process.

Developmental processes are also embedded in the contextual circumstances of the individual, including historical time (Baltes, 1987; Nesselroade et al., 2007; Thelen & Smith, 2007). Although researchers can capture intraindividual variability on much shorter timescales, capturing intraindividual change requires studying longer periods of time. Thus, different developmental processes and different aspects of those processes might best be captured using different metrics to represent the cadence and direction of change. Bergeman, Blaxton, and Joiner (under review) explain that different levels consist of different developmental structures, and the dynamic nature of these structures, as well as the relationship between them, constitutes a system. By assessing how various structures and systems dynamically relate to one another, researchers can better understand how individuals self-regulate (Boker, Montpetit, Hunter, & Bergeman, 2010). For example, researchers can examine the complexity of emotional experiences by assessing various developmental structures, such as mood states or physiological indicators of emotional experience, and observing how these structures fluctuate and change in relation to each other and environmental influences, such as stressful life events, to inform development. Bergeman and colleagues explain that
because these systems fluctuate and change at different speeds, researchers must use different timescales to fully understand the relationships. For example, micro-level changes in two structures captured at micro-time, such as daily NA and daily stress, constitute a meso-level system of stress reactivity. Researchers explain that a more coupled relationship between daily NA and daily stress indicates greater stress reactivity whereas a less coupled relationship indicates greater stress resistance (Montpetit, Bergeman, Deboeck, Tiberio, & Boker, 2010). Changes in this stress-reactivity system may occur at the daily level (micro-time), which then may inform the macro-level system (such as global health). Consequently, by examining developmental processes over the course of multiple timescales, researchers can understand how multiple-scaled systems interact with one another at different measurements of time (Bergeman et al., under review; Gerstorf, Hoppmann, & Ram, 2014; Hollenstein, Lichtwarck-Aschoff, & Potworowski, 2013) to inform other broad systems. In this way, researchers can understand how intraindividual variability, intraindividual change, and interindividual differences relate to each other to inform developmental processes (Nesselroade, 1991; Ram & Gerstorf, 2009).

Although some research explores relationships between meso-level systems at micro-time and macro-level outcomes, the mechanisms by which these levels relate to each other remain unclear (Gerstorf et al., 2014). In other words, the meso-level system at meso-time, or the more systematic intraindividual change, often goes uncaptured. In order to model how a meso-level system captured at micro-time informs a macro-level system, researchers must also capture the meso-level system at meso-time to illustrate
how intraindividual change may be a function of changes occurring in intraindividual variability. Thus, by capturing intraindividual change, researchers can better understand the possible mechanisms linking the micro- and macro-level. In sum, by utilizing multiple time-scales, researchers can situate intraindividual variability in the context of intraindividual change and interindividual differences to thoroughly capture developmental processes. Although this framework can be applied to many developmental processes, the current study focuses on using multiple timescales to understand resilience processes.

1.1 Resilience as Process

Researchers define resilience as a dynamic, adaptational process in which the individual successfully adapts to risks or threats (Lerner et al., 2012; Masten, 2001). One way that researchers can begin to capture resilience as a process is by examining daily stress reactivity (Diehl, Hay, & Chui, 2012; Montpetit et al., 2010), defined as short-term intraindividual fluctuations in the relationship between stress and NA. Because research shows that this daily stress-NA link contributes to long-term changes in mental and physical health (Charles, Piazza, Mogle, Sliwinski, & Almeida, 2013, Piazza, Charles, Sliwinski, Mogle, & Almeida, 2012), examining stress reactivity at the daily level constitutes one important idiographic piece of the resilience process. In addition, the way in which individuals experience and cope with daily stressors is more predictive of overall health and well-being than reports of chronic or global stress (Diehl et al., 2012).
Consequently, daily stress reactivity constitutes a meso-level system that underlies the resilience process.

Because repeated experience with daily stress often proliferates into chronic stress (Pearlin & Skaff, 1995), studying the person-related or environmental factors that exacerbate or mitigate the impact of daily stress on emotional outcomes not only provides a more complete illustration of a resilience process, but also informs intervention techniques and preventative care aimed at disrupting the link between chronic stress and negative outcomes (Diehl et al., 2012). In this way, researchers can not only model the day-to-day relationship between stress and NA prospectively and in real time as an indicator of stress reactivity, but also examine how certain variables disrupt or exacerbate this stress sensitivity. Consequently, in order to fully capture resilience as a developmental process, that fluctuates, changes, and depends on individual differences (Nesselroade, 1991), researchers must capture the dynamic relationship between individual risks or threats and the adaptation to those risks or threats over time. In other words, to illustrate resilience as a developmental process, researchers must consider different forms of change, including daily fluctuations within individuals, systematic change within individuals, and differences between individuals (Lerner et al., 2012; Nesselroade, 1991) to more thoroughly illustrate the idiographic tendencies of the dynamic resilience process (Masten, 2001).
1.2 The Daily Stress-NA Relationship

Research indicates that greater daily stress relates to greater NA (Bolger, DeLongis, Kessler, & Schilling, 1989; Caspi, Bolger, & Eckenrode, 1987; Diehl & Hay, 2010; Gunthert et al., 2002; Montpetit et al., 2010; Ong, Bergeman, Bisconti, & Wallace, 2006; Scott, Sliwinski, & Blanchard-Fields, 2013; Stawski, Sliwinski, Almeida & Smyth, 2008; Zautra, Johnson, & Davis, 2005), at both the within and between-person levels (Gunthert et al., 2002; Sliwinski, Almeida, Smyth, & Stawski, 2009). Almeida (2005) presents a model that depicts several contextual factors that either exacerbate or mitigate the relationship between daily stress and well-being outcomes, including sociodemographic variables, psychosocial variables, health variables, stressor characteristics, subjective appraisal variables, and daily well-being variables. For the purposes of the current study, we will focus on how age, dispositional resilience, and global stress perceptions relate to differences in the stress-NA relationship.

1.2.1 Age Differences and Changes

When considering the effects of age on developmental processes, researchers can assess both cross-sectional age differences as well as the within-person aging process. In terms of cross-sectional age differences, research has shown that individuals become more heterogeneous as they age (Baltes, 1987; Baltes, Reese, & Nesselroade, 1988), indicating that between-person differences may be more pronounced in older samples. One reason for this is that individuals can take many different paths throughout development, illustrating a great deal of plasticity (Baltes, 1987). These age-
related changes indicate the need to examine within-person fluctuations and changes over time. In addition, cross-sectional age differences may influence within-person aging processes. Specifically, research indicates that individuals of different starting ages may change differently over time (Baltes, 1987). Consequently, when examining developmental processes, researchers must not only consider cross-sectional age differences and within-person age-related changes, but also the relationship between age differences and age-related changes. In this way, researchers can better elucidate the cohort effects, idiographic trajectories irrespective of cross-sectional age, and idiographic trajectories within each cohort that are associated with developmental processes.

Age differences and changes uniquely impact emotional regulation, stressful experiences, and the relationship between stress and NA (Charles & Carstensen, 2007; Charles & Piazza, 2009; Urry & Gross, 2010). Generally speaking, theories suggest that age changes relate to better overall emotional regulation. For example, the Selective Optimization with Compensation Model suggests that individuals develop greater adaptive capacity across their lifespan (Baltes, 1987). That is, although people lose abilities across the lifespan they optimize performance by compensating for these changes. In terms of emotional regulation specifically, Urry and Gross (2010) suggest that as older adults’ cognitive, physical, and social resources decline, they place more emphasis on successful emotional regulation, and select strategies that allow them to optimize their emotional regulating to enhance their quality of life and life satisfaction, which compensates for the increase in losses that they experience. In line with the
Selective Optimization with Compensation model (Baltes, 1987), Strength and Vulnerability Integration (SAVI) theory suggests that the age-related increases in emotional regulation skills relate to optimizing increases in wisdom, gained from time lived, as well as a compensating shifting value toward accomplishing emotion-related goals, developed due to a decreasing amount of time left to live (Charles & Piazza, 2009). Thus, theory in this area indicates that as individuals age, they optimally adapt to their changing circumstances in a way that promotes more ideal emotional functioning.

Empirical research indicates that there are cross-sectional age differences in daily reports of NA (Carstensen, Pasupathi, Mayr, & Nesselroade, 2000). After exploring how emotional experiences change across the lifespan, researchers found that age relates to frequency of negative emotions even after controlling for many other demographic variables (Carstensen et al., 2000). Specifically, age was curvilinearly associated with the frequency of experiencing negative emotions, with an inverse relationship from 18 – 60 and a slight positive relationship from 60 onward. In addition, older age was associated with a greater probability of maintaining positive emotion states and maintaining an absence of negative states. Similarly, a study exploring age differences and daily NA revealed that age positively related to maintaining a low NA state, and positively related to moving from a high NA state to a low NA state (Hay & Diehl, 2011). Moreover, another study revealed that older adults reported less daily NA compared to younger adults (Stawski et al., 2008). These findings indicate that cross-sectional differences in age contribute to different emotional experiences. It remains unclear whether within-person age-related changes can explain the resulting cross-
sectional age differences, highlighting the need to consider age differences, age-related changes, and the relationship between them.

Further theoretical research suggests that the declines in brain functioning may actually promote improved emotional regulation (Charles & Carstensen, 2007). Charles and Carstensen (2007) explain that age differences in brain structure and functioning, cardiovascular functioning, and neuroendocrine activity may explain the better emotional regulation associated with aging. For example, decreases in cardiovascular responses, synaptic density, and neurotransmitters may contribute to less emotional reactivity as individuals age. Other researchers tested the idea that older adults compensate for losses in cognitive-affective complexity, defined as the tendency to explore affect, by engaging in affect optimization, defined as the tendency to dampen NA (Labouvie-Vief, Diehl, Jain, & Zhang, 2007). The researchers examined participants twice (two weeks apart) every two years over the course of six years. In this way, they were able to assess age differences as well as within-person age-related changes. Results regarding affect optimization revealed a significant increase over the six-year period. In addition, the intercept interacted with the slope, illustrating that those with lower affect optimization scores showed greater growth in affect optimization compared to those with higher scores. Age also interacted with the intercept, illustrating that older individuals tended to report higher initial levels of affect optimization, but this relationship leveled off at age 60. Age and slope interacted, indicating that those participants younger than 60 showed slower growth in affect optimization, those between 60 and 70 showed no growth, and those 80 years and
older showed faster growth. These findings indicate that cross-sectional differences in age as well as the aging process itself relate to changes in the NA experience.

Not only do age differences relate to changes in the experience of NA, but they also relate to changes in stressful experiences. Theoretically, aging processes are associated with shifts in both objective stressors and how the individual cognitively appraises their situation (Lazarus & Delongis, 1983), which impacts how they cope with the stressor. Empirical evidence suggests that younger individuals experience more hassles involving finance, work, family, friends, home maintenance, and personal life (Folkman, Lazarus, Pimley, & Novacek, 1987). On the other hand, older adults report fewer daily stressors (Almeida, 2005; Charles et al., 2010; Neupert, Almeida, & Charles, 2007; Stawski et al., 2008; Stefaniak, Blaxton, & Bergeman, in prep) and less perceived stress severity across eight days of a study (Almeida, 2005) as well as across 56-days of daily diaries (Stefaniak et al., in prep) compared to midlife and young adults. These findings indicate age differences in the subjective and objective experience of stress.

These age differences in emotional experiences and stressful experiences may contribute to differences in the stress-NA relationship. In fact, one study showed that the number of stressors on a given day as well as the severity of that stress positively related to NA for younger adults, but not for older adults (Stawski et al., 2008). Another study revealed that age group buffered the relationship between daily stress and NA (Brose, Schmiedek, Lövdén, & Lindenberger, 2011). Specifically, older age buffered the relationship between interindividual stressor-related intrusive thoughts and NA, intraindividual unspecific intrusive thoughts and daily NA, and stressor-related intrusive
thoughts and daily NA (Brose et al., 2011). Scott et al., (2013) explored the timing of the buffering effect of age on the relationship between daily stress and emotions in a sample of adults aged 20 – 81 ($M = 49; SD = 19.3$). Results revealed a weaker association between recent experience of a stressor and NA among older adults compared to younger. This difference between older and younger adults disappeared three to six hours later. Furthermore, this study revealed that midlife adults experienced the most exacerbated relationship between previous stress severity and NA. These results suggest that older adults are immediately less reactive to stress compared to younger adults. Although most research indicates that greater age relates to weaker relationships between daily stress and daily NA, another study revealed that older age exacerbated the relationship between daily stress and daily NA (Mroczek & Almedia, 2004). These conflicting results indicate a need for further research.

Although less research has examined how longitudinal changes in age contribute to differences in the stress-NA relationship, Sliwinski et al. (2009) found that variability in the stress-NA relationship tends to increase with age. The researchers examined two daily diary studies to explore the longitudinal relationship between daily stress and NA. Intraindividual variability in the relationship between stress and NA increased across 10 years in one study and increased across five bursts over two years in another study, indicating that longitudinal changes in age relate to greater fluctuations in the daily stress-NA relationship. The researchers also examined the correlation between the within-person relationship between daily stress and daily NA at Time 1 and Time 2 as an indicator of emotional reactivity stability. In the first study, the correlation was highest
for adults in their 30’s and 40’s, but then declined from midlife (60’s) onward, indicating that the synchrony between stress and NA is greater and more consistent among younger adults, but then decreases over time. In other words, the relationship between daily stress and NA within individuals at Time 1 was less related to the same relationship at Time 2 for the midlife and older adults in the study, suggesting that the stability of emotional reactivity decreases over time for midlife and older adults. Although this research illustrates unique effects of both cross-sectional differences in age as well as longitudinal changes in age, the studies examined each have limitations. Specifically, one of the studies analyzed five bursts of data but the bursts spanned only two years. The other study, although it spanned 10 years, only analyzed two bursts of data, making it difficult to distinguish between systematic changes and more random variability.

Further research seeks to explain individual differences in the relationships among age, stress, and emotional regulation (Almeida, Piazza, Stawski, & Klein, 2011; Charles & Carstensen, 2010). Because both emotional changes and stress-related changes occur over time, the aging process uniquely impacts the relationship between emotional regulation and other contextual variables. Pearlin (2010) describes this as a reciprocal relationship between the life course and the stress process in which each mutually informs the other. For example, Strength and Vulnerability Integration theory emphasizes that whether or not an older adult reaps the benefits of age-related gains or experiences the frustrations of age-related losses depends on the context of that individual (Charles & Piazza, 2009). Moreover, theorists focused on aging emphasize that a great deal of heterogeneity exists among older adults in overall development
(Baltes, 1987; Baltes et al., 1988). Therefore, in order to understand the effects of age on the daily stress-NA relationship, researchers must not only examine how cross-sectional differences in age as well as within-person changes in age relate to differences in the stress-NA relationship, but also how these age differences and changes moderate each other and other factors that either exacerbate or mitigate the daily stress-NA relationship.

1.2.2 Global Stress Perceptions

Greater overall stress not only contributes to greater future stress (Pearlin & Skaff, 1995), but also exacerbates the association between daily stress and NA (Almedia, 2005; Bolger et al., 1989; Hay & Diehl, 2011; Scott et al., 2013; Sliwinski et al., 2009). Pearlin and colleagues describe a stress proliferation process, which suggests that previous stressors may continue to impact the individual, resulting in the development of new stressors or chronic stress (Pearlin, Aneshensel, & Leblanc, 1997; Pearlin & Skaff, 1995). When examining a model relating daily stressors to negative mood, considering whether a stressor had occurred previously significantly improved model fit (Bolger et al., 1989). Further research shows that high global perceptions of stress exacerbated the relationship between recent experience of a stressor and NA as well as recent stress severity and NA (Scott et al., 2013; Sliwinski et al., 2009), and between-person stress, or greater average levels of stress, exacerbated the relationship between weekly stress and NA (Zautra et al., 2005). In addition, chronic stress enhanced the relationship between both the current day’s stress as well as the previous day’s stress and negative mood.
(Caspi et al., 1987), and participants with on-going stressors reported more affective distress in response to daily stressors than participants who did not report on-going stressors (Almeida, 2005), suggesting that chronic stress enhances individuals’ sensitivity to daily stress.

Although greater overall stress exacerbates the daily stress-NA relationship, lower overall stress mitigates it, and the effect of greater global stress on the daily stress-NA relationship differs from the effect of experiencing greater daily stressors. Specifically, lower mean daily stress relates to a lower likelihood of maintaining a NA state and a higher likelihood of moving from a higher NA state to a low one (Hay & Diehl, 2011), indicating that less chronic stress relates to less feelings of NA as well as greater flexibility in overcoming feelings of NA. Interestingly, another study revealed an interaction between multiple stressors, in which experiencing one stressor actually mitigated the effect of the other, suggesting that multiple stressors experienced on one day do not necessarily impact mood in an additive way (Bolger et al., 1989). Taken together, the results of these studies suggest that global perceptions of stress sensitize individuals’ perceptions of future stress, resulting in stronger relationships between daily stress and NA, but this relationship does not necessarily hold at the daily level. Individuals appear to have a threshold for how much multiple stressors experienced on one day can impact NA. Consequently, this finding suggests that assessing whether individuals experienced a stressor on a given day might better relate to NA than assessing the relationship between the number of stressors experienced on one day and the consequent effects on NA.
In examining how age moderates the relationships among global stress, daily stress, and emotions, researchers found that global perceptions of stress exacerbated the relationship between daily stress and NA for younger adults, but not for older adults (Stawski et al., 2008). These findings suggest that older adults may be less affected by global stress perceptions compared to younger adults. Interestingly, when global perceptions of stress were included in the model, the inverse relationship between age and number of stressors disappeared (Stawski et al., 2008), suggesting that global stress perceptions may account for the mitigating effects of age and daily stress. In addition, although within-person unspecific intrusive thoughts and stressor-related intrusive thoughts exacerbated the relationship between daily stress and NA, the exacerbating effect of stress-related intrusive thoughts was smaller for older adults (Brose et al., 2011), suggesting that older adults may resist the effects of stress more than younger adults. These findings illustrate that individual differences in age moderate the exacerbating effect of global stress perceptions on the daily stress-NA relationship, raising the question of whether longitudinal age changes would also influence this relationship.

1.2.3 Trait Dispositional Resilience

Researchers suggest that resilience processes rely on a variety of factors, including individual trait-like characteristics, defined as dispositional resilience (Bergeman & Wallace, 1999; Ong, Bergeman, & Boker, 2009; Orr & Westman, 1990). Measures of dispositional resilience assess individuals’ commitment, control, and
challenge (Rossi, Bisconti, & Bergeman, 2007), or their beliefs in their personal, social, and work-related value, meaning, and purpose, their beliefs in their capability to influence and change their environment, and their openness to change and perceptions of growing opportunities respectively (Bartone, Ursano, Wright, & Ingraham, 1989; Bergeman & Wallace, 1999; Rossi et al., 2007). Theoretically, dispositional resilience can promote better adaptations to stress and contribute to greater stress resistance and recovery (Ong et al., 2009), suggesting that individuals with higher levels of dispositional resilience experience better emotional regulation and a mitigated relationship between daily stress and NA (Montpetit et al., 2010).

Dispositional resilience may not only influence the way in which individuals perceive their stressful circumstances (Bergeman & Wallace, 1999), but empirical research has also shown that dispositional resilience buffers the effects of stress on emotional well-being (Bergeman & Deboeck, 2014; Montpetit et al., 2010; Ong et al., 2006). For example, Rossi et al. (2007) illustrates that dispositional resilience accounts for the relationship between perceived stress and life satisfaction in a sample of recent widows. Other studies show that dispositional resilience influences daily experiences of stress, with dispositional resilience relating to less daily hassles (Pinquart, 2009), predicting a less coupled relationship between within person stress and daily NA (Montpetit et al., 2010), and buffering the relationship between daily perceived stress and NA (Ong et al., 2006). These findings highlight the importance of considering dispositional resilience as a person-related factor that may alter the daily relationship between stress and NA.
The current study examines whether there are age differences or changes in how dispositional resilience impacts the daily stress-NA relationship. Research shows that dispositional resilience relates to better emotional regulation, and theories on aging suggest that emotional regulation improves with age, but older adults differ markedly from each other in developmental trajectories, particularly of emotional regulation (Baltes, 1987; Baltes et al., 1988; Charles & Carstensen, 2007; Charles & Piazza, 2009; Urry & Gross, 2010). Consequently, there is a need to explore whether dispositional resilience relates to differences in the daily stress-NA relationship as well as whether the effect of dispositional resilience on the daily stress-NA relationship changes as individuals age. In addition, we will explore whether age differences impact the daily stress-NA relationship and whether age differences impact longitudinal age-related changes in how dispositional resilience relates to intraindividual variability in the daily stress-NA relationship.

1.3 The Current Study

Conducting longitudinal research at the daily level allows researchers to understand the real time relationships between interindividual differences and intraindividual change and variability in various constructs while accounting for the contextual circumstances influencing developmental processes (Hoffman, 2007; Hoffman & Stawski, 2009; Molenaar, 2004; Nesselroade, 1991). Specifically, longitudinal research allows researchers to 1) identify intraindividual change, 2) identify interindividual differences in that intraindividual change, 3) understand relationships
among behavioral changes in attributes of interest, 4) understand causes of intraindividual change, and 5) understand interindividual differences in the causes of intraindividual change (Baltes & Nesselroade, 1979). In this sense, longitudinal research exploring the stress-NA relationship can inform our understanding of how individuals systematically change over time, which individual characteristics relate to stronger or more subdued relationships between daily NA and stress, how changes in stress relate to changes in NA, which contextual factors trigger systematic changes in stress and NA over time, and whether individual characteristics interact with contextual factors that trigger changes in stress and NA over time.

Bergeman et al. (under review) emphasize that, because the dynamic components of resilience unfold at different speeds, researchers must capture these components at different timescales to provide a more complete illustration of the resilience process. Process-oriented research on resilience thus far tends to focus on micro-time, leaving many questions unanswered as to how those processes operating at micro-time relate to meso-time and macro-time processes and vice versa (Bergeman et al., under review; Hollenstein et al., 2013). Consequently, by using multiple timescales, the current project will explore intraindividual variability in the daily stress-NA relationship in a context of intraindividual change and interindividual differences to understand how individuals are not only different from each other, but how they, themselves, change over time.

Research designs utilizing multiple timescales and process-oriented methodologies allow us to more fully understand these relationships, and explore new
research questions. We therefore considered the daily relationship between stress and NA in the context of fluctuations in dispositional resilience, intraindividual change in age (time), and interindividually differences in age, dispositional resilience, and global stress, which suits the study of resilience processes particularly well (Lerner et al., 2012). In this way, we situated intraindividual variability in the daily stress-NA relationship within a broader context of intraindividual change and interindivudual differences. By exploring intraindividual change and interindivudual differences in the intraindividual variability in the daily stress-NA relationship, this project can ultimately inform intervention techniques and preventative care aimed at creating and maintaining emotionally healthy lifestyles.

1.3.1 Analytical Approach

Multi-level modeling effectively allows researchers to parse the between-person from the within-person effects, and examine developmental processes using the unique individual as the context in which these processes operate – ultimately examining idiographic tendencies of individuals (Curran & Bauer, 2011; Hoffman, 2007; Hoffman & Stawski, 2009; Molenaar & Campbell, 2009). Because research shows that between-person findings do not necessarily apply to the within-person level (Brose, Schmiedek, Lövdén, Molenaar, & Lindenberger, 2010; Molenaar, 2004; Molenaar & Campbell, 2009), and the directionality of between-person effects might even differ from the directionality of within-person effects (Curran & Bauer, 2011; Hoffman & Stawski, 2009), findings distinguishing groups of individuals do not necessarily hold when considering
how a single individual fluctuates over time. Multi-level modeling allows researchers to explore how between-person and within-person effects differ from each other, either in magnitude or direction (Wang & Maxwell, 2015). In addition, multi-level modeling allows researchers to assess multiple aspects of within-person effects by examining intraindividual variability and intraindividual change (Ram & Gerstorf, 2009), and explore how intraindividual variability, intraindividual change, and interindividual differences impact one another (Hoffman, 2007). Consequently, use of this methodology effectively allows us to explore resilience as a developmental process, differing among individuals and fluctuating and changing over time within them.

1.3.2 Aims

The current study consisted of three exploratory aims all designed to better understand how daily stress reactivity contributes to the resilience process. Few studies have examined how the daily stress-NA relationship changes over time, so the aims are largely exploratory, but some preliminary hypotheses are offered. Aim 1 of the study was to understand how cross-sectional differences in age and global stress as well as longitudinal age changes relate to intraindividual variability and interindividual differences in the daily stress-NA relationship. We hypothesized that cross-sectional age as well as longitudinal age changes would buffer the daily relationship between stress and NA. In addition, as indicated by previous studies, we hypothesized that greater global stress perceptions would exacerbate the daily relationship between stress and NA. Aim 2 involved understanding how cross-sectional differences in dispositional
resilience and within-person fluctuations in dispositional resilience relate to intraindividual variability and interindividual differences in the daily stress-NA relationship and whether cross-sectional age differences moderate these relationships. We hypothesized that both yearly fluctuations and global differences in dispositional resilience would buffer the daily stress-NA relationship. Finally, Aim 3 involved understanding how age-related changes in dispositional resilience related to differences in the daily stress-NA relationship and whether these age-related changes differ as a function of cross-sectional age differences. This aim allowed us to understand whether the hypothesized buffering effect of cross-sectional age and longitudinal age changes on the daily stress-NA relationship were functions of increases in dispositional resilience, or whether dispositional resilience, age differences, and longitudinal age changes separately contribute to changes in the daily stress-NA relationship.

In order to fully explore these aims, we used multi-level modeling techniques to model intraindividual variability in the stress-NA relationship. We explored whether the stress-NA relationship changes over time, if it changes differently for individuals of different ages, whether global stress perceptions exacerbated the stress-NA relationship, and whether this exacerbating effect depended on age differences and/or changes (Aim 1). We sought to understand how dispositional resilience related to stress-NA variability over time and whether individual differences in age related to differences in the relationships among dispositional resilience, daily stress, and daily NA (Aim 2). Finally, we assessed whether the effect of dispositional resilience on the daily stress-NA relationship changed as individuals aged and whether interindividual
differences in age related to differences in how dispositional resilience predicted changes in the stress-NA relationship over time (Aim 3).
CHAPTER 2:

METHOD

2.1 Participants

The participants included 958 individuals from the Notre Dame Study of Health & Well-Being (NDHWB), a study currently in its 10th year that includes both 56-day daily “burst” diaries assessed once every two years as well as global questionnaires assessed yearly. The current study used data from the midlife and later-life cohorts at Waves 1, 3, 5, and 7. The design of the NDHWB involved sampling with replenishment, so new participants could join the study at different waves, even if they had not been present at Wave 1. In addition, participants could drop out of the study, but come back in at later waves. All missing data were assumed to be random. Thirty percent of participants completed all four years of data, 17% completed three years, 21% completed two years, and 32% completed one year. Participants at Wave 1 ranged in age from 31 – 90 (M = 59.00), SD = 9.72). Frequencies for the sample on gender, race, education, marital statues, and income are presented in Table B.1.

2.2 Procedure

Participants completed the global questionnaire at all waves, which included questionnaires regarding demographic information as well as measures of dispositional
resilience. Waves 1, 3, 5, and 7 were used in the current study because these waves also included the daily “burst” assessments. After completing the global questionnaire, participants were invited to participate in the daily “burst” assessments. They were instructed to complete their daily diary at the end of each day and mail the diaries back at weekly intervals over the course of eight weeks. The daily diaries included measures assessing NA as well as daily stress levels. Participants received $10 in compensation after each week of completing the diaries for a total of $80 across the 56 days. During Years 5 and 7 for midlife and Year 7 for later life, the participants received a bonus of $20 if they completed all eight weeks of the daily diaries.

2.3 Measures

2.3.1 Daily Negative Affect

Participants reported daily NA using the NA subscale from the Positive and Negative Affect Schedule (PANAS; Watson, Clark, & Tellegen, 1988) by indicating the extent to which they felt each of 10 emotions on a scale ranging from 1-5 (not at all, a little, moderately, quite a bit, extremely). Sample emotions included “ashamed,” and “afraid.” A 20% missing data rule was applied to incomplete responses on the measure. Cronbach’s alpha in the present sample on Wave 1 Day 1 is .87.

2.3.2 Daily Stress

Participants reported daily stress levels by completing the Perceived Stress Scale (Cohen & Williamson, 1988). The current study modified 10 of the items to assess
perceived levels of stress over the course of one day. Response options ranged from 1 – 4 (strongly disagree, disagree, agree, strongly agree). The measure includes items such as “Today I felt confident about my ability to handle my personal problems,” or “Today I felt I was unable to control the important things in my life. A 20% missing data rule was applied to incomplete responses on the measure. Cronbach’s alpha in the present sample on Wave 1 Day 1 is .88.

2.3.3 Global Dispositional Resilience

Participants reported global dispositional resilience using the Dispositional Resilience scale (Bartone, Ursano, Wright, & Ingraham, 1989). The scale assesses participants’ Commitment, Control, and Challenge using three subscales. The measure includes items such as, “Most of my life is spent doing things that are worthwhile” (Commitment subscale), “It is exciting to learn something new about myself” (Challenge subscale), and “If I am working on a difficult task, I know when to seek help” (Control subscale). Response options ranged from 1-4 (not at all true, a little true, quite true, and completely true). A 20% missing data rule was applied to incomplete responses on the measure. Cronbach’s alpha in Year 1 was .86 for the midlife sample and .82 for the later-life sample.

2.4 Analytic Approach

Three-level, multi-level models were used in order to assess daily intraindividual variability (Level 1; micro-time), yearly intraindividual variability (Level 2; meso-time),
intraindividual change (Level 2; meso-time), and interindividual differences (Level 3). In order to effectively parse each effect from the others, we used person-mean centering (Curran & Bauer, 2011; Hoffman & Stawski, 2009; Wang & Maxwell, 2015), which allowed us to understand the unique effects of within-person fluctuations as well as between-person differences. Daily NA and daily stress were assessed at Level 1 for all aims and models. Including day at Level 1 controlled for systematic changes in daily stress over the course of the 56 days (Wang & Maxwell, 2015). Level 1 centering involved subtracting person \((k)\) averages for each wave \((j)\) from each person’s daily scores \((i)\) on each wave of data \((x_{ijk} - \bar{x}_{jk})\). At Level 2, we included wave stress scores to assess the effect of intraindividual variability in yearly fluctuations of average daily stress on daily NA. Centering stress at Level 2 involved subtracting each person’s total average across all waves of data from each person’s wave average \((\bar{x}_{jk} - \bar{x}_{..k})\). Finally, all models for all aims included the between-person effect of stress at Level 3. The models for all aims were built sequentially, by first exploring the main effects, then the two-way interactions, then the three-way interactions, and, for Aim 3, the four-way interaction. All main effects were specified as random. In order to allow the models to converge the interactions were specified as fixed effects (Singer & Willett, 2003). The data were analyzed using the SAS Proc Mixed procedure with Maximum Likelihood estimation, so missing data was assumed to be missing at random or missing completely at random (Fitzmaurice, Laird, & Ware, 2004). Although the models overlap with each other, each answers a unique question.
2.4.1 Aim 1

The first set of models involved understanding how cross-sectional differences in age as well as the aging process relate to differences in the daily stress-NA relationship as well as how these age differences and age changes impact the effect of global stress perceptions on the daily stress-NA relationship. At Level 2, we included wave to assess the effect of aging on NA. At Level 3, we included age at Time 1 to assess the effects of cross-sectional age differences on daily NA. The first set of analyses explored the within-person daily main effects of stress ($\delta_{200}$), the within-person main effects of wave ($\delta_{010}$), the within-person wave main effects of stress ($\delta_{020}$), and the between-person effects of stress ($\delta_{001}$) and age ($\delta_{002}$) on daily NA. All the main effects were specified as random.

Level 1:

$$NA_{ijk} = \beta_{0ijk} + \beta_{1jk}(\text{day}_{ijk} - 1) + \beta_{2jk}(\text{Stress}_{ijk} - \text{Stress}_j) + e_{ijk}$$

Level 2:

$$\beta_{0jk} = \gamma_{00k} + \gamma_{01k}(\text{wave}_{jk}) + \gamma_{02k}(\text{Stress}_j - \text{Stress}_{..k}) + u_{0jk}$$

$$\beta_{1jk} = \gamma_{10k} + u_{1jk}$$

$$\beta_{2jk} = \gamma_{20k} + u_{2jk}$$

Level 3:

$$\gamma_{00k} = \delta_{000} + \delta_{001}(\text{Stress}_{..k}) + \delta_{002}(\text{Age}_k) + v_{00k}$$

$$\gamma_{10k} = \delta_{100} + v_{10k}$$

$$\gamma_{20k} = \delta_{200} + v_{20k}$$

$$\gamma_{01k} = \delta_{010} + v_{01k}$$

$$\gamma_{02k} = \delta_{020} + v_{02k}$$

(1A)
Next, we added in the two-way interactions. The Level 2 wave by Level 1 daily stress interaction tested whether the daily stress-NA relationship changes with the aging process ($\delta_{210}$) whereas the Level 3 age by Level 1 daily stress interaction tested whether cross-sectional differences in age relate to differences in the daily stress-NA relationship ($\delta_{201}$). We expected that the aging process itself as well as older adults would relate to a more buffered relationship between daily stress and daily NA. Finally, the Level 3 global stress by Level 1 daily stress interaction examined whether the daily stress-NA relationship was stronger for those with greater overall global stress perceptions ($\delta_{202}$), as indicated by previous research. The interactions were specified as fixed effects in order for the model to converge.

**Level 1:**

$$NA_{ijk} = \beta_{0jk} + \beta_{1jk}(\text{day}_{ijk} - 1) + \beta_{2jk}(\text{Stress}_{ijk} - \text{Stress} \cdot_{jk}) + e_{ijk}$$

**Level 2:**

$$\beta_{0jk} = \gamma_{00k} + \gamma_{01k}(\text{wave}_{jk}) + \gamma_{02k}(\text{Stress}_{jk} - \text{Stress} \cdot_{k}) + u_{0jk}$$

$$\beta_{1jk} = \gamma_{10k} + u_{1jk}$$

$$\beta_{2jk} = \gamma_{20k} + \gamma_{21k}(\text{wave}_{jk}) + u_{2jk}$$

**Level 3:**

$$\gamma_{00k} = \delta_{000} + \delta_{001}(\text{Stress} \cdot_{k}) + \delta_{002}(\text{Age} \cdot_{k}) + \nu_{00k}$$

$$\gamma_{10k} = \delta_{100} + \nu_{10k}$$

$$\gamma_{20k} = \delta_{200} + \delta_{201}(\text{Age} \cdot_{k}) + \delta_{202}(\text{Stress} \cdot_{k}) + \nu_{20k}$$

$$\gamma_{01k} = \delta_{010} + \nu_{01k}$$

$$\gamma_{02k} = \delta_{020} + \nu_{02k}$$
\[ \gamma_{21k} = \delta_{210} \]  

(1B)

The three-way interaction between Level 3 age, Level 2 wave, and Level 1 daily stress tested whether individuals of different starting ages experience the effects of aging on the daily stress-NA relationship differently \((\delta_{211})\). The three-way interaction between Level 3 age, Level 3 global stress, and Level 1 daily stress indicated whether the hypothesized exacerbating effect of global stress perceptions on the daily stress-NA relationship differed according to age differences \((\delta_{203})\). Based on previous research, we expected that the effect of global stress on the daily stress-NA relationship would be mitigated by older age at Wave 1. On the other hand, the Level 3 global stress, Level 2 wave, and Level 1 daily stress interaction indicated whether the exacerbating effect of global stress perceptions on the daily stress-NA relationship differs as individuals age \((\delta_{212})\).

Level 1:

\[
NA_{ijk} = \beta_{0jk} + \beta_{1jk}(\text{day}_{ijk} - 1) + \beta_{2jk}(\text{Stress}_{ijk} - \text{Stress}_{jk}) + e_{ijk}
\]

Level 2:

\[
\beta_{0jk} = \gamma_{00k} + \gamma_{01k}(w\text{ave}_{jk}) + \gamma_{02k}(\text{Stress}_{jk} - \text{Stress}_{.k}) + u_{0jk}
\]

\[
\beta_{1jk} = \gamma_{10k} + u_{1jk}
\]

\[
\beta_{2jk} = \gamma_{20k} + \gamma_{21k}(w\text{ave}_{jk}) + u_{2jk}
\]

Level 3:

\[
\gamma_{00k} = \delta_{000} + \delta_{001}(\text{Stress}_{.k}) + \delta_{002}(\text{Age}_{k}) + v_{00k}
\]

\[
\gamma_{10k} = \delta_{100} + v_{10k}
\]

\[
\gamma_{20k} = \delta_{200} + \delta_{201}(\text{Age}_{k}) + \delta_{202}(\text{Stress}_{.k}) + \delta_{203}(\text{Age}_{k} * \text{Stress}_{.k}) + v_{20k}
\]
\( \gamma_{01k} = \delta_{010} + \nu_{01k} \)

\( \gamma_{02k} = \delta_{020} + \nu_{02k} \)

\( \gamma_{21k} = \delta_{210} + \delta_{211}(\text{Age}_k) + \delta_{212}(\text{Stress}_k) \)  

(1C)

2.4.2 Aim 2

The purpose of Aim 2 was to explore how dispositional resilience impacts the daily stress-NA relationship and whether cross-sectional age differences moderate these relationships. Therefore, dispositional resilience, a Level 2 variable, was centered by subtracting each person’s overall mean across all waves from their dispositional resilience score at each wave of data (\( \bar{x}_{jk} - \bar{x}_k \)). Age at Wave 1 was entered at Level 3.

Similar to Aim 1, we first explored the main effects. Unlike the main effects model from Aim 1, this main effects model uniquely tested the within-person wave main effects of dispositional resilience (\( \delta_{020} \)) and the between-person effects of dispositional resilience (\( \delta_{002} \)) on daily NA. All the main effects were again specified as random.

Level 1:

\( \text{NA}_{ijk} = \beta_{0ijk} + \beta_{1ijk}(\text{day}_{ijk} - 1) + \beta_{2ijk}(\text{Stress}_{ijk} - \text{Stress}_j) + e_{ijk} \)

Level 2:

\( \beta_{0ijk} = \gamma_{00k} + \gamma_{01k}(\text{Stress}_j - \text{Stress}_k) + \gamma_{02k}(\text{Resilience}_j - \text{Resilience}_k) + u_{0ijk} \)

\( \beta_{1jk} = \gamma_{10k} + u_{1jk} \)

\( \beta_{2jk} = \gamma_{20k} + u_{2jk} \)

Level 3:

\( \gamma_{00k} = \delta_{000} + \delta_{001}(\text{Stress}_k) + \delta_{002}(\text{Resilience}_k) + \delta_{003}(\text{Age}_k) + \nu_{00k} \)
\[ \gamma_{10k} = \delta_{100} + \nu_{10k} \]
\[ \gamma_{20k} = \delta_{200} + \nu_{20k} \]
\[ \gamma_{01k} = \delta_{010} + \nu_{01k} \]
\[ \gamma_{02k} = \delta_{020} + \nu_{02k} \]

Next, we added in the two-way interactions. Unique to this model is the Level 2 by Level 1 interaction between wave dispositional resilience and daily stress, which tested whether within-person wave dispositional resilience impacts the daily stress-NA relationship (\(\delta_{210}\)). The Level 3 dispositional resilience by Level 1 daily stress interaction tested whether between-person differences in dispositional resilience impact the daily stress-NA relationship (\(\delta_{202}\)). We expected within-person increases and greater global dispositional resilience levels to moderate the daily stress-NA relationship. In order to permit convergence, the interactions were specified as fixed effects.

Level 1:
\[ \text{NA}_{ijk} = \beta_{0jk} + \beta_{1jk}(\text{day}_{ijk} - 1) + \beta_{2jk}(\text{Stress}_{ijk} - \text{Stress}_{jk}) + e_{ijk} \]

Level 2:
\[ \beta_{0jk} = \gamma_{00k} + \gamma_{01k}(\text{Stress}_{jk} - \text{Stress}_{k}) + \gamma_{02k}(\text{Resilience}_{jk} - \text{Resilience}_{k}) + u_{0jk} \]
\[ \beta_{1jk} = \gamma_{10k} + u_{1jk} \]
\[ \beta_{2jk} = \gamma_{20k} + \gamma_{21k}(\text{Resilience}_{jk} - \text{Resilience}_{k}) + u_{2jk} \]

Level 3:
\[ \gamma_{00k} = \delta_{000} + \delta_{001}(\text{Stress}_{-k}) + \delta_{002}(\text{Resilience}_{k}) + \delta_{003}(\text{Age}_{k}) + \nu_{00k} \]
\[ \gamma_{10k} = \delta_{100} + \nu_{10k} \]
\[ \gamma_{20k} = \delta_{200} + \delta_{201}(\text{Age}_{k}) + \delta_{202}(\text{Resilience}_{k}) + \nu_{20k} \]
Finally, the three-way interaction between Level 3 age, Level 3 dispositional resilience, and Level 1 daily stress tested whether cross-sectional differences in age relate to differences in how between-person differences in dispositional resilience impact the daily stress-NA relationship ($\delta_{203}$). A significant effect here might indicate that global dispositional resilience among older adults does a better job at buffering the daily stress-NA relationship. The Level 3 age by Level 2 dispositional resilience by Level 1 daily stress interaction indicated whether within-person fluctuations in dispositional resilience differentially impact the daily stress-NA relationship according to cross-sectional age ($\delta_{211}$). This interaction might indicate that when older adults experience greater than usual dispositional resilience, they experience an even more buffered relationship between daily stress and NA.

Level 1:

\[ \text{NA}_{ijk} = \beta_{0jk} + \beta_{1jk}(\text{day}_{ijk} - 1) + \beta_{2jk}(\text{Stress}_{ijk} - \text{Stress}_{jk}) + e_{ijk} \]

Level 2:

\[ \beta_{0jk} = \gamma_{00k} + \gamma_{01k}(\text{Stress}_{jk} - \text{Stress}_{.k}) + \gamma_{02k}(\text{Resilience}_{jk} - \text{Resilience}_{.k}) + u_{0jk} \]
\[ \beta_{1jk} = \gamma_{10k} + u_{1jk} \]
\[ \beta_{2jk} = \gamma_{20k} + \gamma_{21k}(\text{Resilience}_{jk} - \text{Resilience}_{.k}) + u_{2jk} \]

Level 3:

\[ \gamma_{00k} = \delta_{000} + \delta_{001}(\text{Stress}_{.k}) + \delta_{002}(\text{Resilience}_{.k}) + \delta_{003}(\text{Age}_{k}) + v_{00k} \]
\[ \gamma_{10k} = \delta_{100} + \nu_{10k} \]
\[ \gamma_{20k} = \delta_{200} + \delta_{201}(\text{Age}_k) + \delta_{202}(\text{Resilience}_k) + \delta_{203}(\text{Age}_k \times \text{Resilience}_k) + \nu_{20k} \]
\[ \gamma_{01k} = \delta_{010} + \nu_{01k} \]
\[ \gamma_{02k} = \delta_{020} + \nu_{02k} \]
\[ \gamma_{21k} = \delta_{210} + \delta_{211}(\text{Age}_k) \quad \text{(2C)} \]

2.4.3 Aim 3

By including age, wave, and dispositional resilience into the next set of models, this aim tested whether age and dispositional resilience uniquely relate to variations in the daily stress-NA relationship. Moreover, we also examined how the relationships among dispositional resilience, stress, and cross-sectional age differences change as individuals age across time. In order to explore these higher order interactions, the main effects model included effects already tested in the previous models.

Level 1:
\[ \text{NA}_{ijk} = \beta_{0jk} + \beta_{1jk}(\text{day}_{ijk} - 1) + \beta_{2jk}(\text{Stress}_{ijk} - \text{Stress}_{jk}) + e_{ijk} \]

Level 2:
\[ \beta_{0jk} = \gamma_{00k} + \gamma_{01k}(\text{wave}_{jk}) + \gamma_{02k}(\text{Stress}_{jk} - \text{Stress}_k) + \gamma_{03k}(\text{Resilience}_{jk} - \text{Resilience}_k) + u_{0jk} \]
\[ \beta_{1jk} = \gamma_{10k} + u_{1jk} \]
\[ \beta_{2jk} = \gamma_{20k} + u_{2jk} \]

Level 3:
\[ \gamma_{00k} = \delta_{000} + \delta_{001}(\text{Stress}_k) + \delta_{002}(\text{Resilience}_k) + \delta_{003}(\text{Age}_k) + \nu_{00k} \]
\[ \gamma_{10k} = \delta_{100} + \nu_{10k} \]
\[ \gamma_{20k} = \delta_{200} + \nu_{20k} \]
\[ \gamma_{01k} = \delta_{010} + \nu_{01k} \]
\[ \gamma_{02k} = \delta_{020} + \nu_{02k} \]
\[ \gamma_{03k} = \delta_{030} + \nu_{03k} \]

\[ \gamma_{04k} = \delta_{040} \]

(3A)

The two way-interaction model uniquely tested whether the effects of dispositional resilience on NA change over time (\(\delta_{040}\)).

Level 1:
\[ NA_{ijk} = \beta_0 + \beta_1 (\text{day}_{ijk} - 1) + \beta_2 (\text{Stress}_{ijk} - \text{Stress}_{jk}) + e_{ijk} \]

Level 2:
\[ \beta_{0jk} = \gamma_{00k} + \gamma_{01k}(\text{wave}_{jk}) + \gamma_{02k}(\text{Stress}_{jk} - \text{Stress}_{.k}) + \gamma_{03k}(\text{Resilience}_{jk} - \text{Resilience}_{.k}) + \gamma_{04k}([\text{wave}_{jk} * (\text{Resilience}_{jk} - \text{Resilience}_{.k})] + u_{0jk} \]

\[ \beta_{1jk} = \gamma_{10k} + u_{1jk} \]

\[ \beta_{2jk} = \gamma_{20k} + \gamma_{21k}(\text{wave}_{jk}) + \gamma_{22k}(\text{Resilience}_{jk} - \text{Resilience}_{.k}) + u_{2jk} \]

Level 3:
\[ \gamma_{00k} = \delta_{000} + \delta_{001}(\text{Stress}_{.k}) + \delta_{002}(\text{Resilience}_{.k}) + \delta_{003}(\text{Age}_k) + \nu_{00k} \]
\[ \gamma_{10k} = \delta_{100} + \nu_{10k} \]
\[ \gamma_{20k} = \delta_{200} + \delta_{201}(\text{Age}_k) + \nu_{20k} \]
\[ \gamma_{01k} = \delta_{010} + \nu_{01k} \]
\[ \gamma_{02k} = \delta_{020} + \nu_{02k} \]
\[ \gamma_{03k} = \delta_{030} + \nu_{03k} \]
\[ \gamma_{04k} = \delta_{040} \]
\[ \gamma_{21k} = \delta_{210} \]
\[ \gamma_{22k} = \delta_{220} \]  

(38b)

Not tested in the previous models, the Level 2 by Level 2 by Level 1 three-way interaction between wave, wave resilience, and daily stress indicated whether the impact of resilience on the daily stress-NA relationship changes over time (\( \delta_{230} \)). A significant interaction here would indicate that as individuals age their dispositional resilience does a better job of buffering the relationship between daily stress and NA, for example.

Level 1:
\[ \text{NA}_{ijk} = \beta_{0jk} + \beta_{1jk}(\text{day}_{ijk} - 1) + \beta_{2jk}(\text{Stress}_{ijk} - \text{Stress}_{jk}) + e_{ijk} \]

Level 2:
\[ \beta_{0jk} = \gamma_{00k} + \gamma_{01k}(\text{wave}_{jk}) + \gamma_{02k}(\text{Stress}_{jk} - \text{Stress}_{..k}) + \gamma_{03k}(\text{Resilience}_{jk} - \text{Resilience}_{k}) + \gamma_{04k}[\text{wave}_{jk} * (\text{Resilience}_{jk} - \text{Resilience}_{k})] + u_{0jk} \]
\[ \beta_{1jk} = \gamma_{10k} + u_{1jk} \]
\[ \beta_{2jk} = \gamma_{20k} + \gamma_{21k}(\text{wave}_{jk}) + \gamma_{22k}(\text{Resilience}_{jk} - \text{Resilience}_{k}) + \gamma_{23k}[\text{wave}_{jk} * (\text{Resilience}_{jk} - \text{Resilience}_{k})] + u_{2jk} \]

Level 3:
\[ \gamma_{00k} = \delta_{000} + \delta_{001}(\text{Stress}_{..k}) + \delta_{002}(\text{Resilience}_{k}) + \delta_{003}(\text{Age}_{k}) + \nu_{00k} \]
\[ \gamma_{10k} = \delta_{100} + \nu_{10k} \]
\[ \gamma_{20k} = \delta_{200} + \delta_{201}(\text{Age}_{k}) + \nu_{20k} \]
\[ \gamma_{01k} = \delta_{010} + \nu_{01k} \]
\[ \gamma_{02k} = \delta_{020} + \nu_{02k} \]
\[ \gamma_{03k} = \delta_{030} + \nu_{03k} \]
\[ \gamma_{04k} = \delta_{040} \]
\[ \gamma_{21k} = \delta_{210} + \delta_{211}(\text{Age}_k) \]
\[ \gamma_{22k} = \delta_{220} + \delta_{221}(\text{Age}_k) \]
\[ \gamma_{23k} = \delta_{230} \]

Adding in the four-way interaction between Level 3 age, Level 2 wave, Level 2 wave resilience, and Level 1 stress indicated whether the effect of wave dispositional resilience on the stress-NA relationship changes differently for participants of different ages at Wave 1 (\(\delta_{231}\)). A significant interaction might indicate that dispositional resilience does a better job of buffering the daily stress-NA relationship as older adults age compared to midlife adults, for example.

**Level 1:**

\[ \text{NA}_{ijk} = \beta_{0ijk} + \beta_{1ijk}(\text{day}_{ijk} - 1) + \beta_{2ijk}(\text{Stress}_{ijk} - \text{Stress}_{jk}) + e_{ijk} \]

**Level 2:**

\[ \beta_{0ijk} = \gamma_{00k} + \gamma_{01k}(\text{wave}_{jk}) + \gamma_{02k}(\text{Stress}_{jk} - \text{Stress}_{..k}) + \gamma_{03k}(\text{Resilience}_{jk} - \text{Resilience}_{..k}) + \gamma_{04k}(\text{wave}_{jk} \ast (\text{Resilience}_{jk} - \text{Resilience}_{..k})) + u_{0ijk} \]
\[ \beta_{1jk} = \gamma_{10k} + u_{1jk} \]
\[ \beta_{2jk} = \gamma_{20k} + \gamma_{21k}(\text{wave}_{jk}) + \gamma_{22k}(\text{Resilience}_{jk} - \text{Resilience}_{..k}) + \gamma_{23k}(\text{wave}_{jk} \ast (\text{Resilience}_{jk} - \text{Resilience}_{..k})) + u_{2jk} \]

**Level 3:**

\[ \gamma_{00k} = \delta_{000} + \delta_{001}(\text{Stress}_{..k}) + \delta_{002}(\text{Resilience}_{..k}) + \delta_{003}(\text{Age}_k) + \nu_{00k} \]
\[ \gamma_{10k} = \delta_{100} + \nu_{10k} \]
\[\gamma_{20k} = \delta_{200} + \delta_{201}(\text{Age}_k) + \nu_{20k}\]
\[\gamma_{01k} = \delta_{010} + \nu_{01k}\]
\[\gamma_{02k} = \delta_{020} + \nu_{02k}\]
\[\gamma_{03k} = \delta_{030} + \nu_{03k}\]
\[\gamma_{04k} = \delta_{040}\]
\[\gamma_{21k} = \delta_{210} + \delta_{211}(\text{Age}_k)\]
\[\gamma_{22k} = \delta_{220} + \delta_{221}(\text{Age}_k)\]
\[\gamma_{23k} = \delta_{230} + \delta_{231}(\text{Age}_k)\] (3D)
3.1 Descriptive Statistics

Descriptive statistics for the person means of stress, NA, and dispositional resilience are presented in Table B.2. The number of waves participants completed, gender, and race were not related to the average levels of the variables of interest. Participants reported differences in average levels of NA associated with income ($F_{6, 941} = 7.58, p < .001$). Participants reported significant differences on global stress according to education ($F_{7, 948} = 3.93, p < .001$) and income ($F_{6, 941} = 7.64, p < .001$). Finally, participants differed in their reports of dispositional resilience by levels of education ($F_{7, 941} = 12.14, p < .001$). Compared to those with higher incomes, those with lower incomes reported greater average NA ($F = 29.25, p < .001$), greater global stress ($F = 7.64, p < .001$), and lower global dispositional resilience ($F = 81.44, p < .001$). Compared to those with lower levels of education, those with higher levels of education reported less global stress ($F = 8.24, p < .01$) and higher average levels of dispositional resilience ($F = 17.93, p < .001$). We explored whether the results would change when controlling for income because it was the only demographic variable to affect both the dependent
and independent variables. The significance of the effects did not change, therefore, we did not control for income in the final models.

The intraindividual and interindividually correlations (Zhang & Wang, 2014) between daily stress and daily NA across the waves are presented in Table B.3. The intraindividual (within-person) correlations at each wave revealed that individuals’ days of high stress related to days of high NA whereas the interindividual (between-person) correlations at each wave showed that people with greater daily stress tended to experience greater NA. A linear growth model on the transformed Fisher’s z scores for the correlations illustrated that both the intraindividual ($\beta = -0.03, p < .001$) and interindividual ($\beta = -0.03, p < .001$) correlations decreased across the waves. These results indicate that as individuals get older, they experience a less pronounced relationship between daily stress and daily NA (intraindividual correlation), and people who are highly stressed are less likely to also experience high levels of NA (interindivdual correlation) as they get older.

3.2 Aim 1

The results of the final model including all interactions for Aim 1 (Equation 1C) are presented in Table B.4. The main effects model (Equation 1A) revealed that greater levels of within-person daily stress positively relate to NA ($\delta_{000} = 0.43, p < .001$), later wave (getting older) negatively relates to NA ($\delta_{010} = -0.05, p = 0.028$), and greater within-person wave stress positively relates to NA ($\delta_{020} = 0.47, p < .001$). The between-person effects of stress and age were not significant.
All of the two-way interactions from Equation 1B were significant, supporting our hypotheses. The Level 2 wave by Level 1 daily stress interaction revealed that, although days of lower than typical stress for one individual relate to less NA and longitudinal age change enhances this relationship, the buffering effect of longitudinal age change is greater when individuals experience days of high stress ($\delta_{210} = -0.02, p < .001$; See Figure A.1). Similarly, the Level 3 age by Level 1 daily stress interaction revealed that the buffering effect of older age is also greater on days of high stress ($\delta_{201} = -0.004, p < .001$; See Figure A.2). Finally, the Level 3 global stress by Level 1 daily stress interaction revealed that individuals with high global stress experienced less NA on days of lower than usual stress, but more NA on days of higher than usual stress compared to individuals with low global stress ($\delta_{202} = 0.03, p < .001$; See Figure A.3).

The final model (Equation 1C) that included the three-way interactions revealed that only the Level 3 global stress, Level 2 wave, and Level 1 daily stress interaction was significant ($\delta_{212} = -0.001, p = .02$), indicating most noticeably that longitudinal age change buffers the effect of high daily stress on daily NA, but, a subtle crossover effect revealed that this buffering effect differs for individuals with different global stress levels on low daily stress days. Specifically, for individuals with high global stress levels, longitudinal age change relates to higher NA on low stress days whereas for individuals with low global stress, longitudinal age change relates to lower NA on low stress days (See Figure A.4).
3.3. Aim 2

The results of the final model including all interaction terms (Equation 2C) are presented in Table B.5. This model uniquely tested the effects of dispositional resilience on daily NA. Results from the main effects model (Equation 2A) revealed that within-person wave dispositional resilience did not relate to NA, but greater between-person dispositional resilience related to lower daily NA ($\delta_{002} = -0.02, p = .033$).

The two-way interactions from Equation 2B that were unique to Aim 2 were both significant, supporting our hypotheses and revealing that when individuals reported higher wave dispositional resilience compared to their typical levels, they experienced a buffered relationship between high daily stress and daily NA, but this was not the case on days of low stress ($\delta_{210} = -0.001, p = .005$; See Figure A.5). On the other hand, as expected, individuals with higher than average global dispositional resilience compared to others reported lower NA on days of both high and low stress ($\delta_{202} = -0.003, p < .001$; See Figure A.6).

The three-way interactions from Equation 2C unique to Aim 2 revealed that within-person fluctuations in dispositional resilience differentially impact the daily stress-NA relationship according to cross-sectional age differences. Specifically, when younger adults experience waves of higher than their own typical levels of dispositional resilience, they experience a buffered relationship between daily stress and NA on days of high stress whereas when older adults experience waves of higher than their own typical levels of dispositional resilience, they experience a buffered relationship between daily stress and NA on days of low stress ($\delta_{211} = 0.0002, p < .001$; See Figure
A.7). The three-way interaction between Level 3 age, Level 3 dispositional resilience, and Level 1 daily stress was not significant.

3.4 Aim 3

The results of the final model (Equation 3D) are presented in Table B.6. The two-way interaction unique to Aim 3 from Equation 3B revealed that as individuals age, they become less differentiated on the relationship between wave resilience and NA (δ₀₄₀ = 0.01, p < .01; See Figure A.8). The three-way interaction from Equation 3C between Level 1 daily stress, Level 2 wave, and Level 2 dispositional resilience was not significant. In addition, the four-way interaction from Equation 3D between Level 1 daily stress, Level 2 wave, Level 2 dispositional resilience, and Level 3 age was also not significant. Consequently, we do not have evidence that the effect of dispositional resilience on the daily stress-NA relationship changes as individuals get older.
CHAPTER 4:

DISCUSSION

The unique design and methodology of the current study allows us to uniquely contribute to the literature by examining resilience from a process-oriented perspective. We illustrate the idiographic nature of the resilience process in three ways. First, we effectively parse the effects of age differences from age changes on the daily stress-NA relationship by capturing the relationship at multiple times over the years. Second, we depict resilience as a contextualized process that depends on multiple person-related and environmental factors, such as dispositional resilience and global stress. Third, we demonstrate how the use of multiple timescales provides a complete picture of the resilience process - illustrating how the relationships among daily fluctuations, yearly changes, and individual differences inform this process.

4.1 Idiographic Nature of Resilience

The current project explores daily stress reactivity (intraindividual variability in the daily stress-NA relationship) within a context of multiple timescales to understand how the resilience process changes over time and how various factors relate to change and variability in this process. By assessing daily stress reactivity, a fundamental driving component of the resilience process, as well as other person-related and environmental
contextual variables over multiple years, the current study captures the idiographic nature of the resilience process. Specifically, we assess how intraindividual variability in yearly dispositional resilience, intraindividual change in age, and between-person differences in age, dispositional resilience, and global stress relate to daily stress reactivity. This study ultimately allows us to parse longitudinal age change from between person cross-sectional age differences, depict how other dynamic components relate to daily stress reactivity to inform a resilience process, and highlight the importance of using multiple timescales to provide a thorough illustration of the resilience process.

4.1.1 Age Differences and Age Changes

The findings from Aim 1 effectively tease apart the effects of aging within individuals and cross-sectional age differences between individuals on resilience by examining both wave (as an indicator of longitudinal age change) and age at Time 1 (as an indicator of cross-sectional age differences). The findings indicate that both longitudinal age change as well as cross-sectional age differences, specifically older age, buffer the daily stress-NA relationship. These findings support previous research indicating age differences in stress reactivity (Brose et al., 2011; Scott et al., 2013; Stawski et al., 2008), but they also add to the literature by indicating that adults tend to become less reactive to stress as they get older. Consequently, although we do not rule out the influence of cohort effects in previous research, the current study suggests that longitudinal age change is a potential mechanism for research findings depicting a
buffering effect of cross-sectional age differences on daily stress reactivity. In other words, by assessing daily stress reactivity within individuals multiple times over the years, we concretely show that adults tend to become less reactive to stress as they get older.

4.1.2 Situating Resilience in a Person and Environmental Dependent Context.

The findings from Aim 1 further indicate that although individuals with high global stress perceptions experience greater NA on days of high stress, they actually experience lower NA on days of low stress. Previous research emphasizes that high global stress makes the effect of daily stress on NA worse (Almedia, 2005; Bolger et al., 1989; Hay & Diehl, 2011; Scott et al., 2013; Sliwinski et al., 2009), and while the results of the current study support this past research, they also add to it by indicating that people with typically stressful lives experience less NA on low stress days. This finding suggests that higher global stress may result in greater savoring of low stress days. That is, it is possible that individuals with high global stress levels appreciate days of low stress more than those with low global stress levels and thus experience lower NA. This finding reveals that people’s general perceptions of stress are differentiated at the daily level. Specifically, individuals with higher stress compared to others may be able to recognize low stress days and reflect that recognition in their emotional well-being.

The unique effects of longitudinal age change and between-person global stress on the daily stress-NA relationship raise the question of whether longitudinal age change impacts the daily stress-NA relationship differently for individuals with different
levels of global stress perceptions. Although the effects of wave on the daily stress-NA relationship are similar to the effects of cross-sectional age differences – with both buffering the detrimental effects of high daily stress on NA – the results of the three-way interaction model reveal that longitudinal age change relates to higher NA for individuals with high levels of global stress on low stress days. Therefore, although getting older tends to help individuals be more resilient on high stress days, it does not benefit those with high levels of global stress on low stress days.

The findings from Aim 2 further situate daily stress reactivity in a broader context that depends on person-related and environmental contextual factors to illustrate the resilience process. These findings specifically support previous literature indicating that individuals with higher dispositional resilience experience a buffered relationship between daily stress and NA (Bergeman & Deboeck, 2014; Montpetit et al., 2010; Ong et al., 2006). Because between-person findings do not necessarily apply to the within-person level (Brose et al., 2010; Molenaar, 2004; Molenaar & Campbell, 2009), the within-person results add to the literature by uniquely showing that intraindividual increases in dispositional resilience also buffer the daily stress-NA relationship. In other words, people experience better stress reactivity if they have higher dispositional resilience levels compared to others and when they score higher on the dispositional resilience scale relative to themselves. These findings are particularly encouraging for the development of intervention and preventative care strategies because they indicate that both between-person level differences and within-person changes in dispositional resilience can promote better daily resilience. Interventions
and preventative care strategies can therefore work to help people capitalize on their own strengths. Because the within-person results compare people to themselves, we know that individuals have the resources at their disposal to raise their own levels of dispositional resilience, but intervention strategies need to be directed toward encouraging them to use those resources. For example these intervention strategies could encourage individuals to view their stressors as opportunities for growth rather than threats to their well-being, help them see the influence they have over their day-to-day lives, and encourage them to reflect upon how they make a meaningful difference in the world in order to raise scores on the respective challenge, control, and commitment subcomponents of the dispositional resilience scale. These findings suggest that individuals with higher greater dispositional resilience compared to others as well as the process of raising one’s own dispositional resilience score can promote healthier emotional well-being on a day-to-day basis.

These results not only highlight the importance of examining the stress-NA relationship as a fluctuating process – changing both within individuals and differing between them, but also the importance of taking these differences into consideration when developing intervention/preventative care strategies. Although we did not include positive emotions as a variable in our study, research suggests that positive and negative emotions are more independent of each other during times of low stress but can become inversely related during times of high stress (Zautra, Reich, Davis, Potter, & Nicolson, 2000). In addition, individuals who savor positive emotions tend to have greater trait dispositional resilience (Ong et al., 2006; Ong et al., 2009). The Broaden and
Build Theory suggests that positive emotions promote broader cognitive awareness, which allows individuals to view stressful situations from different perspectives, or see the bigger picture, and to engage in behaviors that allow them to build a reserve of resources, such as social support, on which they can rely during stressful situations (Fredrikson, 2005). This previous research along with our findings indicating that individuals with greater global stress have lower NA on low stress days, individuals with higher dispositional resilience have better stress reactivity, and within-person increases in individual dispositional resilience relate to better stress reactivity suggest that intervention strategies could target these highly stressed individuals on those low stress days to encourage them to take time to appreciate their lower levels of negative emotions and develop greater positive emotions. These strategies may help individuals develop greater dispositional resilience, which in turn may help them be less reactive to increases in daily stress, and ultimately benefit their emotional and physical well-being. At the same time, the cross-level 3-way interaction from Aim 2 indicates that midlife adults experience the benefits of increases in wave resilience on days of high stress whereas older adults did not. This suggests that intervention/prevention strategies aimed at increasing wave resilience might be more effective for midlife rather than older adults. Older adults might already engage other resilience resources; this can be explored in future research.
4.1.3 The Importance of Multiple Timescales.

Developmental processes consist of multiple structures, captured at different levels of the individual, which unfold and change to comprise a system (Bergeman et al., under review, Hollenstein et al., 2013). These systems not only fluctuate and change themselves, but they also relate to each other to comprise broader level systems, and these systems also fluctuate and change (Bergeman et al., under review). Researchers emphasize the importance of using research designs and methodologies that can capture these different systems (Bergeman et al., under review; Gerstorf et al., 2014; Hollenstein et al., 2013). Because these systems operate at different rates, researchers must use multiple timescales to capture the relationship between different systems to understand broader level systems.

The current project assesses the different structures and systems of the resilience process in this way. Specifically, the resilience process consists of multiple structures, such as stress, NA, dispositional resilience, and age. The dynamic aspect of daily stress or NA, for example, each constitutes a micro-level system, whereas the dynamic relationship between daily stress and NA comprises the meso-level system of stress reactivity. We not only capture this meso-level system and idiographic component of the resilience process (stress reactivity), but also depict how this system relates to other structures to inform relationships with broader level systems and how these systems change over time. In other words, to provide an illustration of resilience as a developmental process dependent on multiple time-scaled components, we assess stress reactivity as a daily component of the resilience process, longitudinal age change
and fluctuations in dispositional resilience as dynamic longer-term components of the resilience process, and global stress and age differences as dispositional, static contributors of the resilience process.

Bergeman et al. (under review) explain that researchers tend to examine the meso-level system of stress reactivity at micro-time, begging the questions: How does this system change over time? How do global changes in more macro-level systems contribute to changes in this meso-level system? How do individual differences impact changes in this system? The current study answers these questions by examining different components of the resilience process through the lens of multiple timescales. Thus, we establish how intraindividual variability in the daily stress-NA meso-level system relates to a resilience macro-level system, which can ultimately inform interventions and prevention strategies aimed at promoting positive macro-level outcomes. Because previous research indicates that the daily stress-NA relationship predicts long-term mental and physical well-being (Charles et al., 2013; Piazza et al., 2012), exploring how this meso-level system of stress reactivity relates to other characteristics of the individual, such as dispositional resilience, global stress, and aging, can illustrate where, how, and toward whom intervention and preventative care resources should be targeted.

4.2 Limitations and Future Directions

The current study explores the process of resilience by illustrating daily fluctuations, yearly changes, and cross-sectional differences in the daily relationship
between stress and negative affect (NA). Therefore, although we examined stress reactivity, or the fluctuating intraindividual relationship between daily stress and NA, as a micro-level component of the resilience process, other micro-level components may also inform this process. For example, some research examines the dynamic relationship between positive and negative emotions as an indicator of stress resistance, which likely also plays a role in the resilience process (Ong et al., 2009; Zautra et al., 2000). Although we did not include positive emotions as a variable in the current study, future research could explore how the relationship between positive and negative emotions changes as individuals age and how it relates to dispositional resilience differences and possible changes.

Although assessing participants across different waves can illustrate an aging process, we cannot be certain that it illustrates the typical aging process for all individuals. That is, participants entered the study at Wave 1 at different ages, which informs cross-sectional differences, but it is important to note that age changes reflect different within-person behaviors across waves irrespective of age when they entered the study. Thus, it is possible that the effects of wave are only illustrative of the aging process for individuals who are willing to participate, and continue to participate, in daily diary studies and not illustrative of a lifespan developmental process. At the same time, however, the results do effectively elucidate the impact of longitudinal age change and cross-sectional age differences on the daily stress-NA relationship as well as the effect of fluctuations and differences in dispositional resilience and global stress for the participants in the study.
Because both stress perceptions and NA were assessed at the end of each day, we cannot determine whether stress triggers greater NA or greater NA causes individuals to perceive greater stress. Regardless, because our approach focuses on stress reactivity as an underlying component of the resilience process, we were interested in how the cyclical, ebbs and flows of the relationship between daily stress and NA contributes to other resilience factors. Therefore, the significance of the implications from the study does not depend on the directionality of the relationships.

More importantly, because the relationship between daily stress and NA has been linked to long-term mental and physical health (Charles et al., 2013; Piazza et al., 2012), the findings can inform preventative and intervention care, as stated above.

Finally, future research can continue to situate the resilience process in an even broader context. Nesselroade (1991) emphasizes that intraindividual variability must be understood in the context of intraindividual change and interindividual differences to fully understand developmental processes. Moreover, Gerstorf et al. (2014) explain that shorter term developmental processes at one level impact longer term developmental processes at broader levels and vice versa. By situating the micro-time, idiographic relationship between stress and NA (stress reactivity), in the context of changing and differing people, environments, and longer time, the current project illustrates the resilience process as a dynamic, developmental one. Specifically, we illustrate how changes over time and how fluctuations and differences in global characteristics, such as dispositional resilience, overall stress levels, and cross-sectional age differences, relate to fluctuations in the stress-NA relationship, but we do not explore how these
relationships predict long-term mental and physical well-being. In other words, we link resilience processes operating at micro-time to resilience processes operating at meso-time. Previous research shows that daily stress reactivity, a resilience process operating at micro-time, relates to mental and physical well-being as much as ten years later, resilience outcomes captured at macro-time (Charles et al., 2013; Piazza et al., 2012). Therefore, an important next step is to link both micro-time (daily) and meso-time (change across waves) processes to macro outcomes to better understand the course by which daily processes impact long-term health. Ram and Gerstorf (2009) explain that researchers can link these processes together by examining time-structured intraindividual variability, which allows researchers to observe fluctuations on short-term dynamic processes as well as net intraindividual variability unrelated to time, which reveals the individual’s dynamic characteristics, or their capacity for change. Consequently, future research can use the beta estimates created here, which captured a short-term dynamic process related to resilience, as indicators of dynamic characteristics to predict various aspects of long-term physical and mental health.

4.3 Concluding Remarks

The current project depicts resilience from an idiographic perspective, capturing intraindividual variability, intraindividual change, and interindividual differences in the daily stress-NA relationship. Consequently, we not only illustrate how differences between individuals impact the daily stress-NA relationship, but also how these processes unfold over time and how this development differs according to changes and
differences in the variables of interest. The results therefore inform our understanding of the resilience process by illustrating how dynamic daily level components of resilience relate to contextual person-related and environmental factors and how these relationships change over time. Consequently, we illustrate that global stress perceptions differentially impact daily stress reactivity - relating to worse resilience on days of high stress but not days of low stress. Further, we not only illustrate that older individuals experience better daily stress reactivity, but also that stress reactivity improves as individuals get older. Finally, we show that differences and fluctuations in dispositional resilience enhance daily stress reactivity, but do so differently according to cross-sectional age. Therefore, the study illustrates that intervention and prevention care strategies aimed at the daily level can promote resilience, such as encouraging the savoring of days of low stress and helping individuals develop better dispositional resilience (particularly among midlife adults). Perhaps the most encouraging finding is that daily stress reactivity improves as adults age, regardless of dispositional resilience fluctuations and differences, suggesting that adults tend to experience better emotional well-being as they get older. In sum, by exploring different time-scaled components related to resilience both at the daily level and yearly level as well as individual differences, the current study provides a developmental process-oriented illustration of resilience.
APPENDIX A

FIGURES
Figure A.1: The interaction between daily stress and wave.
Figure A.2: The interaction between daily stress and cross-sectional age.
Figure A.3: The interaction between daily stress and global stress.
Figure A.4: The interaction between daily stress, wave, and global stress.
Figure A.5: The interaction between daily stress and wave dispositional resilience.
Figure A.6: The interaction between daily stress and global dispositional resilience.
Figure A.7: The interaction between daily stress and wave dispositional resilience.
Figure A.8: The interaction between wave and wave dispositional resilience.
APPENDIX B

TABLES
TABLE B.1

DESCRIPTIVE FREQUENCIES FOR PARTICIPANTS

<table>
<thead>
<tr>
<th></th>
<th>N (%)</th>
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<tbody>
<tr>
<td><strong>Gender</strong></td>
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<tr>
<td>Females</td>
<td>571 (60%)</td>
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<tr>
<td>Males</td>
<td>386 (40%)</td>
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<td><strong>Race</strong></td>
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<tr>
<td>White</td>
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<td>Divorced</td>
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<td>$75,000 - $99,999</td>
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<td>Over $100,000</td>
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TABLE B.2

DESCRIPTIVE STATISTICS OF PERSON MEANS

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<th>Statistics for All Participants on Their First Wave</th>
<th>N</th>
<th>Mean</th>
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<th>Median</th>
<th>Kurtosis</th>
<th>Skewness</th>
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<td>958</td>
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<td>11.49</td>
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<td>958</td>
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<td>138.00</td>
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<td>Mean NA</td>
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<td>0.66</td>
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TABLE B.3
WITHIN- AND BETWEEN-PERSON CORRELATIONS

<table>
<thead>
<tr>
<th>Wave 1</th>
<th>Wave 3</th>
<th>Wave 5</th>
<th>Wave 7</th>
</tr>
</thead>
<tbody>
<tr>
<td>(N)</td>
<td>(M)</td>
<td>(Std)</td>
<td>(N)</td>
</tr>
<tr>
<td>684</td>
<td>.52</td>
<td>.28</td>
<td>571</td>
</tr>
<tr>
<td>491</td>
<td>.43</td>
<td>.27</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Wave 1</th>
<th>Wave 3</th>
<th>Wave 5</th>
<th>Wave 7</th>
</tr>
</thead>
<tbody>
<tr>
<td>(N)</td>
<td>(M)</td>
<td>(Std)</td>
<td>(N)</td>
</tr>
<tr>
<td>56</td>
<td>.67</td>
<td>.03</td>
<td>56</td>
</tr>
<tr>
<td>56</td>
<td>.57</td>
<td>.03</td>
<td></td>
</tr>
</tbody>
</table>

Table 3 shows the aggregated within-person correlations (correlations between daily stress and daily NA at each time point for each individual across their 56 days) averaged across the participants over time and aggregated between-person correlations (correlations between daily stress and daily NA scores at each time point) averaged across the 56 days over time.
## Table B.4

### Final Model for Aim 1

<table>
<thead>
<tr>
<th></th>
<th>Estimate</th>
<th>SE</th>
<th>t Value</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Fixed Within Level 1 Effects Estimates</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>$\delta_{000}$ (intercept)</td>
<td>2.62***</td>
<td>0.65</td>
<td>4.00</td>
</tr>
<tr>
<td>$\delta_{100}$ (Time)</td>
<td>-0.01***</td>
<td>0.00</td>
<td>-11.65</td>
</tr>
<tr>
<td>$\delta_{200}$ (Daily stress)</td>
<td>-0.11**</td>
<td>0.04</td>
<td>-2.47</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Fixed Within Level 2 Effects Estimates</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>$\delta_{010}$ (Wave)</td>
<td>-0.05*</td>
<td>0.02</td>
<td>-2.25</td>
</tr>
<tr>
<td>$\delta_{020}$ (Wave stress)</td>
<td>0.47***</td>
<td>0.03</td>
<td>16.99</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Level 1*Level 2 Interaction</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>$\delta_{210}$ (Daily stress*Wave)</td>
<td>-0.00</td>
<td>0.00</td>
<td>-0.47</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Fixed Between Effect Estimates</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>$\delta_{001}$ (Global stress)</td>
<td>0.06</td>
<td>0.03</td>
<td>1.92</td>
</tr>
<tr>
<td>$\delta_{002}$ (Age)</td>
<td>-0.03*</td>
<td>0.01</td>
<td>-2.29</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Level 1*Level 3 Interactions</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>$\delta_{201}$ (Daily stress*Age)</td>
<td>0.00</td>
<td>0.00</td>
<td>0.10</td>
</tr>
<tr>
<td>$\delta_{202}$ (Daily stress*Global stress)</td>
<td>0.03***</td>
<td>0.00</td>
<td>13.68</td>
</tr>
<tr>
<td>$\delta_{203}$ (Daily stress<em>Age</em>Global stress)</td>
<td>-0.00</td>
<td>0.00</td>
<td>-1.06</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Level 1<em>Level 2</em>Level 3 Interactions</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>$\delta_{211}$ (Daily stress<em>Wave</em>Age)</td>
<td>-0.00</td>
<td>0.00</td>
<td>-0.64</td>
</tr>
<tr>
<td>$\delta_{212}$ (Daily stress<em>Wave</em>Global stress)</td>
<td>-0.00*</td>
<td>0.00</td>
<td>-2.34</td>
</tr>
</tbody>
</table>

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

Table 4 illustrates the final model for Aim 1 of all interactive effects among stress, wave, and cross-sectional age on NA.
**TABLE B.5**

**FINAL MODEL FOR AIM 2**

<table>
<thead>
<tr>
<th></th>
<th>Estimate</th>
<th>SE</th>
<th>t Value</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Fixed Within Level 1 Effects Estimates</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>$\delta_{000}$ (intercept)</td>
<td>9.24***</td>
<td>1.61</td>
<td>5.75</td>
</tr>
<tr>
<td>$\delta_{100}$ (Time)</td>
<td>-0.01***</td>
<td>0.00</td>
<td>-11.45</td>
</tr>
<tr>
<td>$\delta_{200}$ (Daily stress)</td>
<td>0.91***</td>
<td>0.12</td>
<td>7.92</td>
</tr>
<tr>
<td><strong>Fixed Within Level 2 Effects Estimates</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>$\delta_{010}$ (Wave Stress)</td>
<td>0.48***</td>
<td>0.03</td>
<td>18.28</td>
</tr>
<tr>
<td>$\delta_{020}$ (Wave Resilience)</td>
<td>-0.00</td>
<td>0.01</td>
<td>-0.11</td>
</tr>
<tr>
<td><strong>Level 1*Level 2 Interaction</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>$\delta_{210}$ (Daily stress*Wave resilience)</td>
<td>-0.00</td>
<td>0.00</td>
<td>-0.94</td>
</tr>
<tr>
<td><strong>Fixed Between Effect Estimates</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>$\delta_{001}$ (Global stress)</td>
<td>-0.11***</td>
<td>0.03</td>
<td>-3.52</td>
</tr>
<tr>
<td>$\delta_{002}$ (Global resilience)</td>
<td>-0.03**</td>
<td>0.01</td>
<td>-3.04</td>
</tr>
<tr>
<td>$\delta_{003}$ (Age)</td>
<td>-0.02*</td>
<td>0.01</td>
<td>-2.08</td>
</tr>
<tr>
<td><strong>Level 1*Level 3 Interactions</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>$\delta_{201}$ (Daily stress*Age)</td>
<td>0.01</td>
<td>0.01</td>
<td>0.55</td>
</tr>
<tr>
<td>$\delta_{202}$ (Daily stress*Global resilience)</td>
<td>-0.00***</td>
<td>0.00</td>
<td>-4.18</td>
</tr>
<tr>
<td>$\delta_{203}$ (Daily stress<em>Global resilience</em>Age)</td>
<td>-0.00</td>
<td>0.00</td>
<td>-1.05</td>
</tr>
<tr>
<td><strong>Level 1<em>Level 2</em>Level 3 Interaction</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>$\delta_{211}$ (Daily stress<em>Wave resilience</em>Age)</td>
<td>0.00***</td>
<td>0.00</td>
<td>4.38</td>
</tr>
</tbody>
</table>

*p < .05, **p < .01, ***p < .001

Table 5 illustrates the final model for Aim 2 of all interactive effects among stress, dispositional resilience, and cross-sectional age on NA.
Table 6 illustrates the final model for Aim 3 of all interactive effects among stress, wave, and cross-sectional age on NA.


