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Stressor Diversity: Introduction and Empirical Integration Into the Daily Stress Model

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The present study examined whether and how stressor diversity, the extent to which stressor events are spread across multiple types of stressors, contributes to daily affective well-being through the adult life span. Stressor diversity was examined as a unique predictor of daily affect and as a moderator of stressor exposure and stressor reactivity effects. Analyses span 2 independent studies of daily stress: the National Study of Daily Experiences with $N = 2{,}022$ adults, aged 33 to 85 years, assessed over $T = 8$ days, and the Intraindividual Study of Affect, Health, and Interpersonal Behavior with $N = 150$ adults, aged 18 to 89 years, assessed over $T = 63$ days. Across both studies, older age was associated with less stressor diversity. Additionally, multivariate multilevel models indicated higher stressor diversity was linked with better affective well-being. Age, however, was not a consistent moderator of such associations. The combination of low stressor diversity and high stressor exposure is discussed as an operationalization of chronic stressors, and this combination was associated with particularly high negative affect and low positive affect. We believe further work will benefit from including both the frequency and diversity of stressor experiences in analyses in order to better characterize individuals' stressor experiences.

Keywords: daily stress, entropy, longitudinal analysis, negative affect, positive affect

Daily stressors—the "hassles" people experience in daily life, such as work deadlines, arguments, or caring for an ill child—influence both proximal and long-term affective well-being (Almeida, 2005; Charles, Piazza, Mogle, Sliwinski, & Almeida, 2013; Lazarus & Folkman, 1984). Generally, individuals with greater *stressor exposure*—that is, those who experience more daily stressors—tend to report higher levels of negative affect (NA) than individuals with lower stressor exposure (Birditt, Cichy, & Almeida, 2011; Bolger, DeLongis, Kessler, & Schilling, 1989; Bolger & Schilling, 1991; Zautra, Affleck, Tennen, Reich, & Davis, 2005). However, stressor exposure on its own provides an incomplete picture of individuals' stressor experiences. Additionally useful information may be provided by *stressor diversity*—the dispersion of "hassles" across multiple domains. High stressor diversity involves, for instance, exposure to many types of stressors (e.g., health stressors, financial stressors, home chore overloads, work stressors, and interpersonal tensions), while low stressor diversity involves exposure to only a few types of stressors (e.g., only work stressors and arguments). Using intensive longitudinal data, Brose and colleagues (2013) laid a foundation for studying the relations between diversity of stressor contexts and affective variability and reactivity, and how these associations differ between young and old adults. Taking an interactional (Person × Context) approach, they found that aspects of life context, including individuals' stressor profiles, accounted for substantial between-person differences in emotional stability, including those often attributed to age. The purpose of the present study is to introduce stressor diversity as an important theoretical aspect of individuals' stressor ecosystem and describe how stressor diversity relates to daily affective well-being across the adult life span.

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Examining Diversity in the Stressor Ecosystem

In ecology, an ecosystem consists of an interactive system of organisms and their abiotic contexts, which exist in relatively stable dynamic equilibrium (Tansley, 1935). The health of an ecosystem is often characterized by both the abundance and diversity of inhabitant species (Magurran, 1988). Total abundance—the total number of individuals (from all species) in an ecosystem—is often a function of the total amount of resources in the environment. Resource-rich environments tend to support larger populations than resource-poor environments. In complement, the relative abundance or evenness of species is related to the variety and distribution of resources. Diverse environments support many types of species, whereas environments with few types of resources support only a few highly adapted species.

The flexibility of the ecosystem concept provides a robust framework of concepts that may be applied to the study (and future expansions) of the stressor system. Analogous to the biological ecosystem, individuals' 'stressor ecosystems' can also be characterized in terms of abundance and diversity. The total number of stressors an individual experiences, *stressor exposure* or abundance, may be related to the total amount of available resources. Portending theoretical arguments presented below, individuals with more resources may be able to tolerate more exposure. In complement, the relative abundance or evenness of stressor types (e.g., interpersonal stressors, financial stressors), *stressor diversity*, may indicate the availability or depletion of specific types of resources. The ecosystem analogy is also flexible enough to encompass self-generated elements (e.g., stressors that an individual causes). Self-generated elements are acknowledged and incorporated within the "dynamism" of all ecosystems, though the scientific study of them often simplifies analysis by separating biotic and abiotic elements (e.g., in the same way that psychologists separate person and context).

Abundance is straightforwardly measured by counting the number of organisms in a specific geographic area. Simultaneously, *diversity* within an ecosystem can be quantified using entropy measures (e.g., Shannon, 1948). Adapted for use in social sciences, entropy measures have been used by economists, sociologists, psychologists, and developmentalists to assess a variety of constructs, including income/social inequality (see Bourguignon, 1979), market equilibrium and product diversity (see Pla, Casanoves, & Di Rienzo, 2012; Foley, 1994; Hu, Tian, Wang, & Zhang, 2012), noise in molar neural networks (Allen, Kaufman, Smith, & Propper, 1998), racial/ethnic diversity (Budescu & Budescu, 2012), emodiversity (Quoidbach et al., 2014), and behavioral flexibility (Ram, Conroy, Pincus, Hyde, & Molloy, 2012). Specific to the study of daily stressors, Brose and colleagues (2013) used entropy (Blau's index) to quantify stressor heterogeneity. Following these lines, we shall describe individuals' stressor ecosystems in terms of abundance and diversity. Specifically, total stressor exposure is measured by either counting the total number of stressors experienced within a specific observation period or the proportion of periods (e.g., days) on which stressors occur (Almeida, 2005; Bolger & Schilling, 1991). In complement, stressor diversity is measured as the entropy of the stressor types an individual experienced during a specified observation period (e.g., during 1 week).

For conceptual clarity, consider the two 'stressor ecosystems' shown in Figure 1. Both individuals were exposed to the same number of stressors over a 60-day period (i.e., $M = 1.2$ stressors per day). That is, these two individuals' lives are characterized by identical *stressor exposure*. However, the individuals differ dramatically with respect to *stressor diversity*. Individual A's (left panel) stressors are relatively homogeneous in that they are concentrated in a few categories (i.e., 'chronic' experience of primarily network stressors—stressful events that happen to close others).

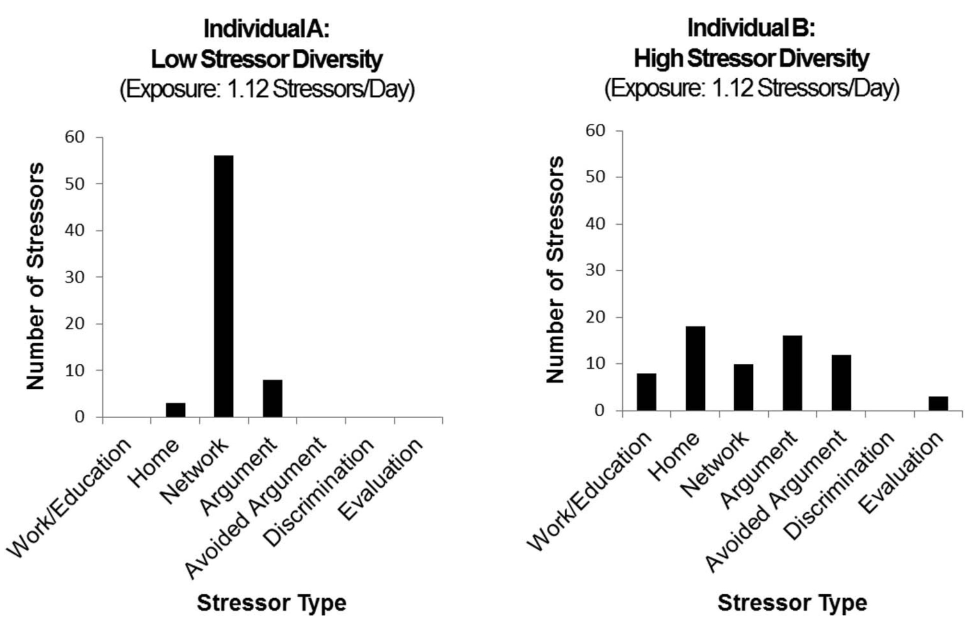

Figure 1. Participants with equal stressor exposure and either low stressor diversity (Individual A entropy = .13) or high stressor diversity (Individual B entropy = .95).

In contrast, Individual B's (right panel) stressor experiences are relatively diverse in that they are distributed much more evenly across all seven stressor types. It follows, then, to investigate how these differences are related to daily well-being.

Associations of Stressor Diversity and Stressor Exposure With Daily Well-being

Hobfoll's (1989, 2001) Conservation of Resources (COR) model provides a framework for interpreting stressor diversity and formulating hypotheses about how stressor exposure and diversity may be related to individuals' well-being. In brief, the model posits that humans are motivated by the desire to attain, protect, and maintain resources. Hobfoll (1989) defines resources as objects (physical items that serve a function for the individual), conditions (specific social roles that are pursued), personal characteristics, and energies (resources such as time and money that are used to obtain other resources). As they go about their daily lives, individuals continually appraise situations with respect to their resources, engaging or spending those resources in a conservative way. By definition, stressors demand and/or deplete resources (Halbesleben, Neveu, Paustian-Underdahl, Westman, 2014; Hobfoll, 1989). As stressors are encountered, the loss of resources that must be engaged to cope leads to poorer affective well-being.

Consideration of stressor exposure in the COR framework is straightforward in that facing stressors requires resources. Following the corollaries of the theory: (a) individuals with many resources are less vulnerable than individuals with few resources; (b) resource loss begets further resource loss through loss spirals wherein resources cannot be replaced as fast as they are spent; (c) resource gains beget further resource gains through gain spirals wherein proactive coping efforts both reduce total resource expenditures and facilitate resource replacement; and (d) conservation rules promote or hamper proactive coping such that individuals with many resources are free to invest in proactive coping for probable events while individuals with few resources are limited to engagement in "reactive" defensive coping with actual events. These predictions all suggest that greater stressor exposure will deplete resources and result in lower well-being. The hypothesized simple relation between stressor exposure and well-being is strongly supported in the literature (e.g., Birditt et al., 2011; Bolger et al., 1989; Bolger & Schilling, 1991; Zautra et al., 2005). We incorporate this relation in our conceptualization of the stressor ecosystem in Figure 2, as the arrow between total exposure (the sum of stressor counts) and daily affective well-being. Reactivity is then displayed as the arrow between a daily stressor and daily well-being.

Expanding beyond the simple relation between stressor exposure and well-being, we additionally consider the implications of stressor diversity. Two possibilities emerge—which we label here as the *Uncertainty of Stressor* and *Chronicity of Stressor* perspectives—depending on whether stressor diversity indicates greater or lesser resource demand.

Uncertainty of Stressor Perspective

One of the original ideations of diversity (Shannon, 1948), and the basis for the most commonly used diversity index (Shannon's entropy; details in method section), was to quantify uncertainty. Higher diversity indicates greater uncertainty, and lower diversity indicates greater certainty. In the stressor ecosystem, this would translate to an individuals' level of uncertainty about what stressor type will be faced next. For example, in Figure 1, Individual A can be quite certain that the next stressor will also be of the network stressor type. In contrast, Individual B has much greater uncertainty about the next stressor. The level of uncertainty has implications for engagement of resources in proactive coping. With high probability of network stressor occurrence, Individual A can proactively cope with greater utility and more easily maintain well-being. In contrast, Individual B's uncertainty about what stressor will occur next inhibits proactive coping, and leads to "reactive" defensive coping, potentially greater resource loss, and lower well-being. That is, *the uncertainty of stressor perspective suggests that higher stressor diversity will be related to lower well-being*. This hypothesis integrates well with COR formulations wherein there are multiple types of resources (Hobfoll, 2001). When stressor diversity is high, many types of resources are threatened or drawn down. The inconsistency of deployment leaves no chance to develop "expertise" in coping with a particular stressor type (Brose et al., 2013). However, when stressor diversity is low, potentially fewer types of resources are threatened, and other resources are available for reinvestment. Note, this hypothesis can also be aligned with Lazarus and Folkman's (1984) Theory of Stress, Appraisal, and Coping, in which the goodness-of-fit between stressors and coping resources is more important than simply the existence of general coping resources. From this viewpoint, high stressor diversity may then be indicative of poorer fit between available resources and the stressors encountered. In sum, the consistency provided by a low diversity stressor ecosystem may facilitate proactive coping, development of domain-specific efficiency, maintenance of resource reserves, and thus support higher levels of well-being.

Chronicity of Stressor Perspective

Alternatively, the consistency present in a low diversity stressor ecosystem may be particularly threatening for well-being, indicating a comparatively chronic stressor. By definition, low stressor diversity means that the same stressors appear over and over again. For example, Aldwin (1994) illustrated a scenario where a military veteran experienced the constant threat of attack while deployed for 18 months, but only engaged in combat about five times. Similarly, Mclean and Link (1994) consider community strains such as technological and natural disasters as chronic stress. Even if the duration of the exposure is relatively short *the persistence of the threat* and *duration of stress and coping responses* are extended (see also Gottlieb, 1997; and chronic stress categorization in Baum, O'Keefe, & Davidson, 1990) Thus, low stressor diversity may indicate the presence of a continuing problematic stressor or source of stress.

Hobfoll (2001) suggests that chronic stressors lead to support deterioration from others, resource depletion, and entry into a loss spiral because there is no opportunity for resource replacement. For example, Individual A (low stressor diversity) in Figure 1 consistently faces recurring network stressors, a chronicity that will deplete resources and lower well-being. In contrast, diversity of stressors provides opportunities to invest and replace a greater variety of resources. For example, Individual B (high stressor diver-

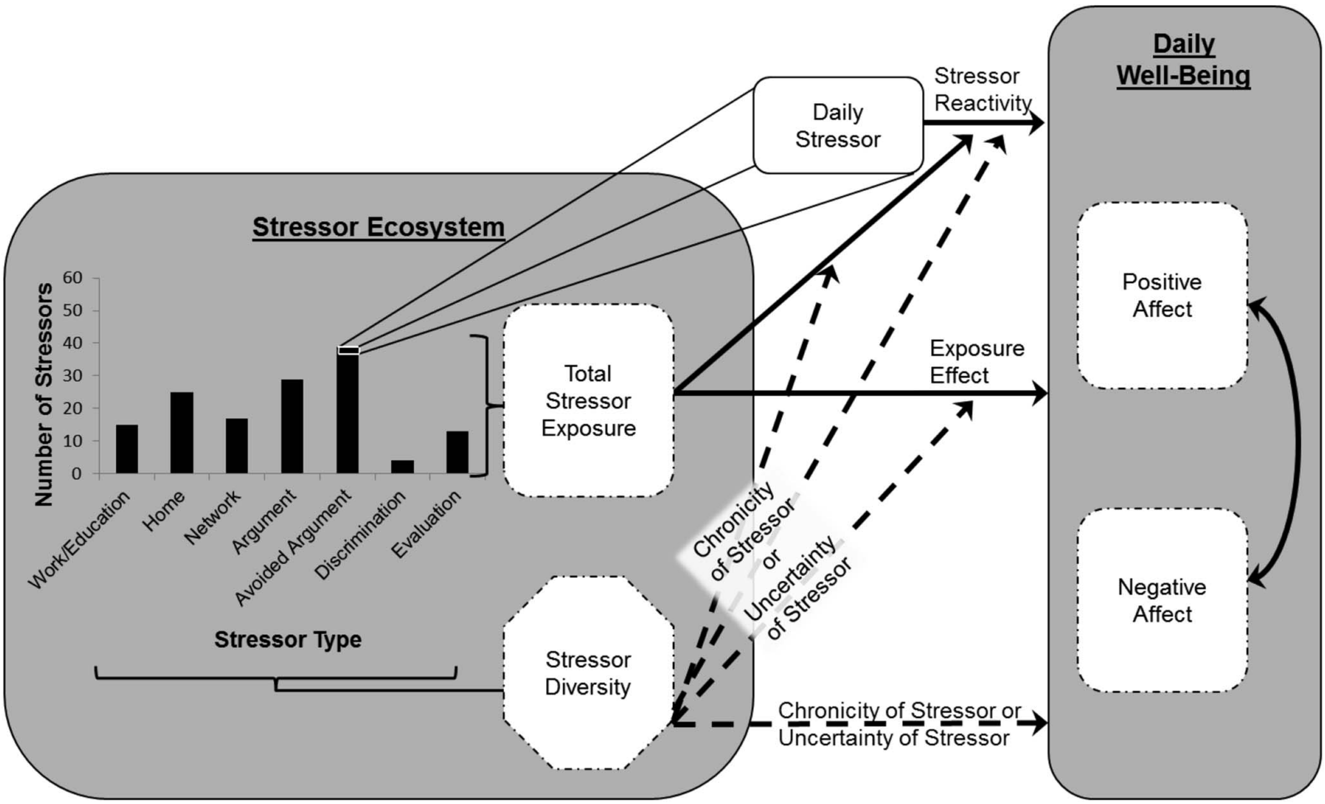

Figure 2. Conceptual diagram relating the stressor ecosystem to daily well-being. The stressor ecosystem consists of stressor exposure (the sum of stressor counts or total percentage of stressor days) and stressor diversity (the dispersion of stressor experiences across stressor types). The exposure effect is the association between total stressor exposure and daily well-being. Stressor diversity is expected to relate to daily well-being via either the *Chronicity of Stressor* or *Uncertainty of Stressor* hypotheses. These opposing hypotheses also dictate stressor diversity's moderation of the relations among exposure, and stressor reactivity, and daily affect. Stressor reactivity, or the change in affect associated with a stressor experience, is displayed as the arrow between a daily stressor and daily well-being.

sity) has opportunities to replace resources lost from a work stressor, while experiencing a home stressor, and subsequently replace resources lost from the home stressor when experiencing a network stressor. These replacement opportunities help maintain resources and support higher levels of well-being. This hypothesis can also be integrated with the Theory of Stress, Appraisal, and Coping (Lazarus & Folkman, 1984), where *low* stressor diversity may be indicative of poorer fit between available resources and the stressors encountered. In sum, *the chronicity of stressor perspective suggests that higher stressor diversity will be related to higher well-being.*

Uncertainty or Chronicity of Stressors Moderates Exposure Effects

In general, higher stressor exposure should be associated with poorer well-being as a result of greater threat to resources; but following the two perspectives outlined above, stressor diversity may either exacerbate or ameliorate the association between stressor exposure and daily well-being. From the *Uncertainty of Stressor* perspective, high stressor diversity in combination with high exposure would result in exacerbated resource loss spirals, making it even more difficult to proactively or reactively cope. As such, stressor diversity will moderate the association between stressor exposure and daily well-being, such that individuals with stressor ecosystems characterized by *high* stressor exposure and *high* stressor diversity will have particularly low well-being. Alternatively, from the *Chronicity of Stressor* perspective, the adverse effects of chronic stressors are particularly pertinent when stressor exposure is high and stressor diversity is low, as this indicates presence of a *frequently* recurring stressor. As such, stressor diversity will moderate the association between stressor exposure and daily well-being, such that individuals whose stressor ecosystem is characterized by *high* stressor exposure and *low* stressor diversity will have particularly low well-being. These alternative hypotheses are included in Figure 2 as the arrows between stressor diversity and daily affective well-being, as well as the arrows between stressor diversity and the stressor exposure and reactivity effects.

Stressor Diversity and Age

Life span developmental theories of socioemotional functioning provide a strong foundation for examining age-related changes/

differences in stressor diversity. For example, the Selection, Optimization, and Compensation (SOC) theory of life span development (Baltes, 1997) suggests that as adults age, their ability to adapt to multiple demands degenerates. Such decline should lead older adults to select out of potentially stressful situations, as well as to focus (optimize) their resources toward the stressors they cannot avoid. Such selection occurs in the context of age-related changes in stressor exposure. For example, a number of studies find that, compared with younger adults, older adults have more exposure to network and health stressors and less exposure to work and home overload, financial, and interpersonal stressors (Almeida & Horn, 2004; Lazarus, 1996; Birditt, Fingerman, & Almeida, 2005). In line with these studies, SOC theory suggests that selection (e.g., avoiding stressors), optimization (e.g., applying resources to unavoidable stressors), and compensation (e.g., changing coping strategies) would align with role changes across the life span, particularly the shifts away from caretaking of children and parents, away from work, and toward retirement, to contribute to age-related decreases in stressor diversity. Similarly, Socioemotional Selectivity Theory (SST) (Carstensen, Isaacowitz, & Charles, 1999) suggests that motivational changes prompted by shifts in perception of time left in life as limited (vs. expansive) increase focus on emotionally meaningful goals. As individual's age, they will prioritize engagement with close friends and family over new acquaintances. This paring down of social networks and avoidance of potentially negative relationships suggests that older individuals will have less diverse experiences, and thus less diverse stressors than younger individuals. The Strength and Vulnerability Integration (SAVI) theory of emotional well-being across adulthood (Charles, 2010) additionally suggests that older adults avoid emotionally distressing situations because of emotion-regulation gains accumulated through life experience. Again, SAVI theory suggests older adults reduce avoidable stressful situations and are left only with unavoidable stressors. In sum, selective engagement, consistent across theories of emotions and aging, suggests that stressor diversity decreases with age.

When faced with unpredictable, unavoidable stressors, older adults experience age-related vulnerabilities in down-regulating emotional responses (Charles, 2010), thus SAVI suggests age would moderate the relation between stressor diversity and affect. SOC and SAVI theories also predict that when older individuals are not able to adequately optimize allocation of their scarce emotion-regulation resources, the older individual may not be able to best apply compensatory strategies, such as shifting attention or avoiding a situation (Baltes, 1997; Charles, 2010). Following the *uncertainty of stressor* perspective, *high* stressor diversity indicates unpredictability. Thus, stressors would be difficult to avoid or proactively cope with, leading older adults to experience particularly high NA and low PA in the presence of *high* stressor diversity. However, the *chronicity of stressor* perspective suggests that *low* stressor diversity indicates chronic stressors (i.e., frequent and repeated stressors may be considered predictable but unavoidable). Chronic stressors, by definition, are difficult to avoid and/or continually proactively cope with, leading older adults to experience particularly high NA and low PA in the presence of *low* stressor diversity. Thus, age should moderate the association between stressor diversity and affect in the direction of one of the opposing hypotheses.

Brose and colleagues (2013) provide some empirical evidence of relations among stressor diversity, age, and affect. They found that, controlling for stressor exposure, older adults experienced less heterogeneous stressors (i.e., less stressor diversity), and this age difference was associated with lower NA reactivity and NA affective variability in older adults. Although age and stressor context uniquely explained variance in affective variability, they also had a substantial shared variance. For affective reactivity, age and stressor context each uniquely explained more variance than they explained jointly. In older and younger samples matched by stressor context, affect variability was significantly reduced, but affect reactivity was not significantly reduced. Expanding upon Brose et al.'s (2013) findings, the present study examines how stressor diversity uniquely predicts both daily NA and PA, how stressor diversity moderates the association between stressor exposure and daily affect, and how age moderates such associations.

The Present Study

Using two independent studies of daily stress, the present study integrates stressor diversity into the daily stress process model. First, we examine age differences in stressor diversity. Changes in socioemotional goals and competencies through adulthood suggest a negative association between stressor diversity and age (Carstensen et al., 1999). Second, using multivariate multilevel models, we examine how stressor diversity is uniquely linked to daily NA and PA and moderates the link between stressor exposure and daily affect. Two opposing hypotheses for the associations between stressor diversity and affect emerge from Hobfoll's (1989) Conservation of Resources Theory. From the *Uncertainty of Stressor* perspective, *high* stressor diversity indicates greater uncertainty and inability to proactively cope. This perspective suggests that individuals with high stressor diversity would report high NA and low PA, and as literature has long supported the negative association between stressor exposure and daily well-being, individuals with high stressor diversity and high exposure would report particularly high NA and low PA. From the *Chronicity of Stressor* perspective, *low* stressor diversity indicates chronic stressors and restricted coping options. This perspective suggests that individuals with *low* stressor diversity would report high NA and low PA, and individuals with *low* stressor diversity and high exposure would report particularly high NA and low PA. Third, we examine the relations among stressor diversity, age, and daily affect. Following SAVI (Charles, 2010), older adults may be more vulnerable to the affective implications of stressor diversity, with the direction of effects following either the *Uncertainty* or *Chronicity of Stressor* perspectives.

Method

To examine whether and how stressor diversity contributes to daily NA and PA throughout the adult life span, we make use of data from two independent daily diary studies. Comprehensive descriptions of the National Survey of Daily Experiences (NSDE; Almeida, McGonagle, & King, 2009), and the Intraindividual Study of Affect, Health, and Interpersonal Behavior (iSAHIB; Ram et al., 2014) can be found in the noted references, while specific details relevant to the present study are given below.

Our intent in utilizing data from two independent studies that used different measures and sampling schemes was to obtain a set of replicable findings that provide more robust conclusions, inferences, and identification of potentially fruitful avenues for further inquiry. Both studies include daily repeated measures of both NA and PA, and of multiple stressor types. As well, both studies allow for examination of stress processes across wide swaths of the adult life span (ages 33 to 84 years in NSDE, and 18 to 89 years in iSAHIB). The studies also differ in important ways. Most importantly, NSDE consists of a large ($N = 2{,}022$), national sample that provided up to eight days of data per person, and iSAHIB consists of a small ($N = 150$), select sample, that provided more than 60 days of data per person. Consequently, placed side-by-side the two datasets provide for more robust generalizability with respect to both *interindividual* differences and *intraindividual* variability of daily experiences than either study can on its own.

NSDE Participants

The second wave of the National Study of Daily Experiences (NSDE) consisted of $N = 2{,}022$ adults recruited from the national sample of the Midlife in the United States (MIDUS) study (Almeida et al., 2009). These participants (57.22% female) ranged in age from 33 to 84 years ($M_{\text{Age}} = 56.24$, $SD_{\text{Age}} = 12.20$), generally reported their physical health as "very good" ($M = 2.39$, $SD = 0.99$, on a 5-point scale) and were largely Caucasian (92.07%), with 3.20% African American, and 4.39% of other ethnicities. The sample was mostly middle-class, with average annual household income $M_{\text{Income}} = \$70{,}603.61$ ($Median_{\text{Income}} = \$57{,}500$, $SD_{\text{Income}} = \$57{,}971$) and education past high school ($n = 1{,}728$; 85.46%). When generalizing to the U.S. population, one must consider that American adults have not received quite as much education, have lower median household income, and are more racially heterogeneous than the national NSDE sample (U.S. Census Bureau, 2014).

NSDE Procedure

Upon recruitment into NSDE, participants were contacted each evening for 8 consecutive days for an ~15-min telephone interview during which they were asked to report on the experiences they had that day, including stressor events and affect (Almeida et al., 2009). Separate from the phone interviews, participants were mailed and asked to complete a survey about physical and mental health as well as lifestyle and sociodemographic information (part of the larger MIDUS procedures, see Brim, Ryff, & Kessler, 2004). Participants were compensated $25 in advance for completing the entire NSDE protocol. In total, participants provided between 1 and 8 days of data ($M = 7.37$, $SD = 1.29$), with 92.72% providing 6 or more daily reports and 68.64% providing all 8 daily reports.

NSDE Measures

Daily Affect. As part of each evening's interview, participants indicated "How much of the time today did you feel _________?" on a 0–4 scale, where 0 = *none of the time*, 1 = *a little of the time*, 2 = *some of the time*, 3 = *most of the time*, and 4 = *all of the time*. Daily *negative affect* (NA) was calculated as the average of responses to 14 items (adapted from the Non-Specific Psychological Distress Scale, Kessler et al., 2002): feeling restless or fidgety, nervous, worthless, so sad that nothing could cheer you up, that everything takes effort, hopeless, lonely, afraid, jittery, irritable, ashamed, upset, angry, and frustrated (Cronbach's alpha = .85 across all persons and occasions; range across days = [.83, .86]). Similarly, *positive affect* (PA) was calculated as the average of 14 items (adapted from Mroczek & Kolarz, 1998): feeling in good spirits, cheerful, extremely happy, calm and peaceful, satisfied, full of life, close to others, like you belong, enthusiastic, attentive, proud, active, and confident (Cronbach's alpha = .94; range = [.92, .95]).

Daily Stressors. Individuals' daily stressor events were measured each evening via semistructured interview using the Daily Inventory of Stressor Events (DISE; Almeida, Wethington, & Kessler, 2002). From a theoretical standpoint, the DISE was developed to capture the full range of daily stressor event types, without capturing mood-related or resource risk outcomes as stressor events (Almeida, Wethington, & Kessler, 2002). Admittedly, the measure does not provide as much in-depth stressor type information as some comprehensive checklists (e.g., The Daily Life Experiences Checklist, Stone & Neale, 1982; the Inventory of Small Life Events, Zautra, Guarnaccia, & Dohrenwend, 1986). However, evidence for comprehensiveness might be in part garnered from NSDE, where only .06% of reports fell into the catch-all "other stressor" category. Participants were asked whether they had experienced each of 7 stressor types: *arguments*, *avoided arguments*, *discrimination*, *work/education stressors*, *home stressors*, *network stressors*, and *other stressors*. The interview questions for *arguments*, *avoided arguments*, and *network stressors* asked about the experience of such occurrences as judged by the individual: "Did you have an argument or disagreement with anyone since (this time/we spoke) yesterday?"; "Since (this time/we spoke) yesterday, did anything happen that you could have argued about but you decided to let pass in order to avoid a disagreement?"; and "Since (this time/we spoke) yesterday, did anything happen to a close friend or relative (other than you've already mentioned) that turned out to be stressful for you?" Assessments of *work/education stressors, home stressors*, and *other stressors* framed the question by asking for events that most people would consider stressful: "Since (this time/we spoke) yesterday, did anything happen at [question domain] (other than what you already have mentioned) that most people would consider stressful?" The interview question for *discrimination stressors* was prefaced with: "Many people experience discrimination on the basis of such things as race, sex, or age. Did anything like this happen to you since (this time/we spoke) yesterday?" Each day participants indicated whether they had (= 1) or had not (= 0) experienced each of the seven types of events.

From these 7 binary item responses, we created three variables. Specifically, $stressorday_{id}$ is a time-varying binary variable indicating whether one or more stressors (of any type) had occurred on each study day (= 0 if no items were endorsed, = 1 if any of the 7 items were endorsed); $stressorcount_{id}$ is a time-varying variable indicating the total number of stressors (across all 7 types) reported on a particular day (calculated as the sum of the 7 binary items; participants can only report one event per stressor type); and $stressortype_{id}$ is a 7-category nominal variable indicating the type(s) of stressor that occurred each day. On average, participants reported experiencing one or more stressors on 38.82% of study days, with $M = 0.51$ ($SD = 0.74$) number of stressors per day. The most common stressor type was avoided arguments (28.53% of stressor days), followed by arguments (17.76%), home (16.16%), work/education (15.80%), "other" (10.61%), network (9.96%), and discrimination stressors (1.18%).

iSAHIB Participants

The Intraindividual Study of Affect, Health, and Interpersonal Behavior (iSAHIB; Ram et al., 2014) consisted of $N = 150$ adults recruited from the Pennsylvania State University and surrounding community. The sample was stratified by gender (51% women) and across the adult life span (five 14 year age-bins), ranging in age from 19 to 89 years ($M_{\text{Age}} = 47.64$, $SD_{\text{Age}} = 18.85$). Participants had obtained between 2 and 24 years of formal education ($M_{\text{Edu}} = 16.36$, $SD_{\text{Edu}} = 3.90$), had median annual household income of '$50,000 – $74,999' ($Range_{\text{Income}}$: 'under $20,000' to '$200,000 and over'; $Mode_{\text{Income}}$ = '$20,000 – $49,999'), and average general health scores of $M = 22.79$ ($SD = 4.19$; range = 9.83 to 29.50; SF-36 General, Ware & Sherbourne, 1992). Similar in composition to the NSDE sample, participants self-identified as Caucasian (91%), African American (4%), Asian American (1%), and Mixed or Other (4%) ethnicity. As a select sample from central Pennsylvania, cautions about generalizing to the broader U.S. population are warranted. The national population is, on average, less educated, has lower median household income, and has greater racial heterogeneity (U.S. Census Bureau, 2014).

iSAHIB Procedure

Participants recruited into iSAHIB completed three, 21-day "measurement bursts" spaced at approximately 4.5-month intervals ($M = 5.25$ months between Bursts 1 and 2; $M = 4.25$ months between Bursts 2 and 3). During each measurement burst, individuals provided (in addition to within-day reports about their social interactions) end-of-day reports about their feelings, thoughts, and behaviors using a customized 'iSAHIB Surveys' application on a study-provided smartphone. Before and after each measurement burst, participants visited the laboratory to receive training and debriefings, and complete Web-based questionnaires on their demographics, health, and personality. Participants received $500 compensation for completing the entire protocol. In total, participants provided between 13 and 76 days of data ($M = 57.05$ $SD = 12.68$), with 95% providing over 20 daily reports and 82% providing over 50 daily reports.

iSAHIB Measures

Daily Affect. As part of each end-of-day questionnaire, participants indicated to what degree they felt various affective states that day, answering "Today I felt _________," on a 'touch-point continuum' (slider-type interface) scaled from 0 (*not at all*) to 100 (*strongly*; numbers not visible to participants). Participants' daily *negative affect* (NA) was calculated as the average of responses to 9 items: nervous, embarrassed, upset, tense, sluggish, sad, bored, disappointed, and depressed (Cronbach's alpha = .87). Similarly, daily *positive affect* (PA) was calculated as the average of 10 items: enthusiastic, happy, alert, proud, excited, calm, peaceful, satisfied, relaxed, and content (Cronbach's alpha = .93).

Daily Stressors. Individuals' level of daily stress was assessed as response to "Today I felt stressed" on the same 0 (*not at all*) to 100 (*strongly*) touch-point continuum scale, immediately after which they were prompted with, "Based on the stress you just indicated, what were the sources of your stress?" and asked to check as many of the following 9 boxes as appropriate: *being evaluated, work/education, health/accident, events that happened to others, interpersonal tensions, finances, home, other, or none* (adapted from the DISE, Almeida et al., 2002). The same three variables created for the NSDE data, $stressorday_{id}$, $stressorcount_{id}$, and $stressortype_{id}$, were also created for the iSAHIB stressor data. On average, participants reported experiencing one or more stressors on 72.15% of study days, with $M = 1.28$ ($SD = 1.22$) number of stressors per day. The most common stressor type was financial stressors (19.36% of stressors), followed by interpersonal tensions (17.29%), home (13.12%), work/education (12.27%), "other" (10.88%), network (10.63%), health/accident (10.18%), and evaluation stressors (6.27%).

Data Analysis

Our main interests were to (a) describe age differences in stressor diversity (and stressor exposure), (b) assess how stressor diversity is uniquely linked to daily affect and/or moderates the link between stressor exposure and daily affect, and (c3) examine whether any of the associations between stressor diversity and daily affect are moderated by age. Thus, our first tasks were to calculate the stressor exposure and stressor diversity indices from the repeated measures of daily stressors.

Stressor exposure. *Stressor exposure*, the abundance of stressors to which an individual was exposed, was quantified as the average number of stressors an individual i reported across his or her total number of completed study days, $d = 1$ to T_i. Note that stressor exposure is often operationalized as the proportion of days on which a stressor occurs (Almeida, 2005). However, to reduce multicollinearity between exposure and diversity (particularly in data where the number of occasions is small, as in NSDE) we use the average stressor count. This operation is still highly similar to the more common proportion-based operationalization (NSDE: $r = .89$; iSAHIB: $r = .78$). Specifically,

$$Stressor\ Exposure_i = \frac{1}{T_i}\sum_{d=1}^{T_i} stressorcount_{di} \tag{1}$$

Note that in NSDE, $T_i \leq 8$ ($M = 7.37$, $SD = 1.29$) and in iSAHIB, $T_i \leq 76$ ($M = 57.05$ $SD = 12.68$).

Stressor diversity. Paralleling other investigations of diversity in psycho-social domains (Allen et al., 1998; Budescu & Budescu, 2012; Ram et al., 2012; Quoidbach et al., 2014), the diversity of each individual's (i) stressor types (j) across all study days was quantified using Shannon's (1948) entropy index. Specifically,

$$Stressor\ Diversity_i = -\left(\frac{1}{\ln(m)}\right)\sum_{j=1}^{m} p_{ij}\ \ln p_{ij} \tag{2}$$

where m is the number of available stressor categories (in NSDE, $m = 7$; in iSAHIB, $m = 8$), and p_{ij} is the proportion of individual i's stressors that were in each category, $j = 1$ to m.

Following this formulation, entropy scores can range from 0 (no diversity), where all of an individual's daily stressor experiences are of a single type (e.g., all no-stress days) to 1 (maximum diversity), where all 7 or 8 stressor types are evenly represented (e.g., a different stressor type on each day or all stressor types on all days). For example, in Figure 1, Individual A's stressors are concentrated mainly in one stressor type ($stressordiversity_i = .13$), and Individual B's stressors are spread across stressor types fairly evenly ($stressordiversity_i = .95$).

Age differences in stressor diversity (and stressor exposure). Age differences in stressor diversity and stressor exposure were described using standard regression models of the form,

$$Stressor\ Diversity_i = \alpha_0 + \alpha_1 Age_i + \alpha_2 Age_i^2 + r_i \quad (3)$$

where linear and quadratic age-gradients are indicated by α_1 and α_2, respectively. Analyses were conducted separately for NSDE and iSAHIB with Age_i centered at each study's sample mean ($M_{Age} = 56.24$ and 47.10, respectively).

Associations of stressor diversity and stressor exposure With daily affect. To examine how stressor diversity, stressor exposure, and age were related to both daily NA and PA, we applied multivariate multilevel models (Snijders & Bosker, 1999) to data where the repeated measures of NA and PA are stacked into a single variable, $Affect_{di}$, alongside two dummy variables (Neg_{di} and Pos_{di}), which were coded 0 or 1 depending on whether the specific observation (i.e., row of data for $Affect_{di}$) was a measure of daily NA or PA (see Bolger & Laurenceau, 2013, Chapter 8). In principle, the Neg_{di} and Pos_{di} dummy variables are used to "turn on or off" specific coefficients. The model (Model 1) was specified as

Model 1, Level 1:

$$Affect_{di} = \beta_{0iNA} Neg_{di} + \beta_{0iPA} Pos_{di} + \beta_{1iNA}(Neg_{di} * Stressor_{di}) + \beta_{1iPA}(Pos_{di} * Stressor_{di}) + e_{NAdi} + e_{PAdi} \quad (4)$$

where $Affect_{di}$ is modeled as a function of person-specific intercepts, β_{0iNA} for NA and β_{0iPA} for PA, person-specific stressor reactivity coefficients, β_{1iNA} and β_{1iPA}, which indicate the extent to which an individual's NA or PA changes in response to a stressor, and residual errors, e_{NAdi} and e_{PAdi}, which are assumed to be normally distributed and may be correlated with each other. The four person-specific intercepts and stress-reactivity coefficients are, in turn, modeled as a function of the stressor exposure and stressor diversity variables derived above. That is,

Model 1, Level 2:

$$\beta_{0iNA} = \gamma_{00NA} + \gamma_{01NA}(Stressor\ Exposure_i) + \gamma_{02NA}(Stressor\ Diversity_i) + \gamma_{03NA}(Stressor\ Exposure_i * Stressor\ Diversity_i) + u_{0iNA} \quad (5)$$

$$\beta_{0iPA} = \gamma_{00PA} + \gamma_{01PA}(Stressor\ Exposure_i) + \gamma_{02PA}(Stressor\ Diversity_i) + \gamma_{03PA}(Stressor\ Exposure_i * Stressor\ Diversity_i) + u_{0iPA} \quad (6)$$

$$\beta_{1iNA} = \gamma_{10NA} + \gamma_{11NA}(Stressor\ Exposure_i) + \gamma_{12NA}(Stressor\ Diversity_i) + \gamma_{13NA}(Stressor\ Exposure_i * Stressor\ Diversity_i) + u_{1iNA} \quad (7)$$

$$\beta_{1iPA} = \gamma_{10PA} + \gamma_{11PA}(Stressor\ Exposure_i) + \gamma_{12PA}(Stressor\ Diversity_i) + \gamma_{13PA}(Stressor\ Exposure_i * Stressor\ Diversity_i) + u_{1iPA} \quad (8)$$

where u_{0iNA}, u_{0iPA} and u_{1iNA}, u_{1iPA} are residual between-person differences that are assumed multivariate normally distributed (i.e., with variances and covariances) and uncorrelated with e_{NAdi} and e_{PAdi}. Model 1, was used to assess whether stressor diversity was uniquely related to daily NA and PA (parameters γ_{02NA} and γ_{02PA}) and/or moderated the relation between stressor exposure and daily NA and PA (γ_{03NA} and γ_{03PA}), controlling for the proximal effects of daily stressor reactivity (Equations 7 and 8).

Age as a moderator of relation between stressor diversity and daily affect. The model was then expanded to examine whether and how those relations were moderated by age. Specifically in Model 2, Age_i was added as a person-level predictor such that Equations 5 to 8 were of the form,

$$\beta_{0iNA} = \gamma_{00NA} + \gamma_{01NA}(Stressor\ Exposure_i) + \gamma_{02NA}(Stressor\ Diversity_i) + \gamma_{03NA}(Stressor\ Exposure_i * Stressor\ Diversity_i) + \gamma_{04NA}(Age_i) + \gamma_{05NA}(Stressor\ Exposure_i * Age_i) + \gamma_{06NA}(Stressor\ Diversity_i * Age_i) + \gamma_{07NA}(Stressor\ Exposure_i * Stressor\ Diversity_i * Age_i) + u_{0iNA} \quad (9)$$

with specific interest in how age moderated the relation between stressor diversity and NA and PA (γ_{06NA} and γ_{06PA}) and, if present, the extent to which stressor diversity moderated how stressor exposure was related to NA and PA (γ_{07NA} and γ_{07PA}).

All models were fit separately to the two data sets using SAS 9.3 (proc reg for linear regression; proc mixed with REML estimation for the multilevel regression, Littell, Milliken, Stroup, & Wolfinger, 1996), with incomplete data treated as missing at random (Little & Rubin, 1987), and all coefficients evaluated for statistical significance at $\alpha = .05$ (with the multivariate model providing for more appropriate standard errors by accounting for correlation between NA and PA). All person-level predictors were grand mean centered so the parameter estimates depict effects for the average person in each study (as described in the participants sections above) on a no-stressor day.

Results

Descriptive statistics for the main variables of study are shown in Table 1 (NSDE below the diagonal, iSAHIB above the diagonal). The overall patterns of results are very similar across both studies. In NSDE, stressor diversity ranged from 0 to 0.95 (M = 0.41, SD = 0.27). These diversity scores were positively correlated with stressor exposure (r = .67) and NA (r = .26), and negatively correlated with PA (r = −0.22) and age (r = −0.18). In iSAHIB, stressor diversity ranged from 0 to 0.95 (M = 0.71, SD = 0.18). Here again, diversity scores were positively correlated with stressor exposure (r = .48) and NA (r = .23), and negatively correlated with PA (r = −0.25) and age (r = −0.23). Consistent with

Table 1
Means, Standard Deviations, and Correlations of Daily Affect, Stressor Exposure, Stressor Diversity, and Age in NSDE (Below Diagonal) and ISAHIB (Above Diagonal)

Variable	Mean (*SD*)	Positive Affect (PA)	Negative Affect (NA)	Stressor Exposure	Stressor Diversity	Age
		57.47 (14.56)	19.85 (10.31)	1.31 (.85)	.72 (.18)	47.10 (18.76)
PA	2.72 (.71)	—	−.45*	−.44*	−.25*	.10
NA	.21 (.28)	−.50*	—	.58*	.23*	−.06
Stressor Exposure	.53 (.48)	−.30*	.48*	—	.48*	−.27*
Stressor Diversity	.41 (.27)	−.22*	.26*	.67*	—	−.23*
Age	56.24 (12.20)	.20*	−.16*	−.23*	−.18*	—

Note. Sample-level descriptive statistics for NSDE are shown below the diagonal, for iSAHIB above the diagonal; *SD* = standard deviation; N_{NSDE} = 2,022 (n = 1,814 for Stressor Diversity); N_{iSAHIB} = 150 (n = 149 for Stressor Diversity). Missing cases for Stressor Diversity variable are individuals who reported no stressors across the entire reporting period. NA and PA scores calculated as person-specific means on a 0 to 4 scale for $T \approx 8$ days (NSDE) or on a 0 to 100 scale for $T \approx 63$ days (iSAHIB).
* $p < .01$.

expectations and prior studies, stressor exposure was negatively correlated with age (NSDE $r = -0.23$, iSAHIB $r = -0.27$) and PA was negatively correlated with NA in both studies (NSDE $r = -0.50$, iSAHIB $r = -0.45$). The differences in sample-level averages are likely in part due to study differences in both the sampling of persons and in the number of repeated measures (and the scales used). Of particular note, sample-level differences in average stressor exposure (NSDE $M = 0.53$, iSAHIB $M = 1.31$) are likely driven by the differences between NSDE's event-based assessment and iSAHIB's sources of stress assessment. Sample-level differences in average stressor diversity (NSDE $M = 0.41$, iSAHIB $M = 0.72$) are likely driven by the greater number of daily assessments for iSAHIB.

Age Differences in Stressor Diversity (and Stressor Exposure)

Results from examination of age differences in stressor diversity (and stressor exposure) are shown in Table 2. In NSDE, age differences in stressor diversity were described by a decreasing linear gradient ($\alpha_1 = -0.004$, $p < .0001$) with very slight downward curvature ($-0.001 < \alpha_2 < 0.00$, $p = .048$). Similar findings were obtained with iSAHIB, where age differences in stressor diversity were described by a decreasing linear gradient ($\alpha_1 = -0.002$, $p = .006$), without significant curvature ($-0.001 < \alpha_2 < 0.00$, $p = .19$). Plots of these statistically significant, but slight overall decreases in stressor diversity across age (NSDE: $R^2 = .03$; iSAHIB: $R^2 = .08$) are shown in Figure 3a for NSDE and Figure 3c for iSAHIB. Alongside these differences, age differences in stressor exposure were described by decreasing linear gradients in both studies (NSDE: $\alpha_1 = -0.01$, $p < .0001$, $R^2 = .05$; iSAHIB: $\alpha_1 = -0.01$, $p = .002$, $R^2 = .07$) as shown in Figures 3b and 3d. In sum, findings from both studies show a consistent pattern where older age is associated with slightly lower stressor diversity and stressor exposure.

Associations of Stressor Diversity and Stressor Exposure With Daily Affect

Results from the multivariate multilevel models of daily affect are shown in Table 3.

NSDE. First, we examine results from Model 1 for NSDE, which regressed NA and PA on stressor diversity, stressor exposure, stressor reactivity, and their interactions. The prototypical NSDE participant's NA on a nonstress day was estimated as $\gamma_{00\text{NA}} = 0.14$ ($p < .0001$) on the 0 to 4 scale. As expected, individual differences in this stressor-free level of NA were related to stressor exposure, $\gamma_{01\text{NA}} = 0.20$ ($p < .0001$); greater stressor exposure was related to higher NA. As hypothesized, stressor diversity was uniquely associated with the stressor-free level of NA, $\gamma_{02\text{NA}} = -0.10$ ($p = .001$), and moderated the effect of stressor exposure on NA, $\gamma_{03\text{NA}} = -0.16$ ($p = .006$). The result-

Table 2
Results From Regression Analyses Examining Age Differences in Stressor Diversity and Stressor Exposure

	NSDE		iSAHIB	
Variable	Stressor Diversity estimate (*SE*)	Stressor Exposure estimate (*SE*)	Stressor Diversity estimate (*SE*)	Stressor Exposure estimate (*SE*)
Intercept (α_0)	.42* (.01)	.53* (.01)	.73* (.02)	1.35* (.09)
Age (α_1)	−.004* (.001)	−.01* (.001)	−.002* (.001)	−.01* (.004)
Age^2 (α_2)	−.0001* (<.001)	<.0001 (<.001)	<.0000 (<.001)	−.0001 (.00)
R^2	.03	.05	.08	.07

Note. *SE* = standard error; N_{NSDE} = 2,022 (n = 1,814 for Stressor Diversity); N_{iSAHIB} = 150 (n = 149 for Stressor Diversity). Missing cases for Stressor Diversity variable are individuals who reported no stressors across the entire reporting period. Stressor exposure scores calculated as person-specific means of stressors experienced over $T \approx 8$ days (NSDE) or $T \approx 63$ days (iSAHIB).
* $p < .05$.

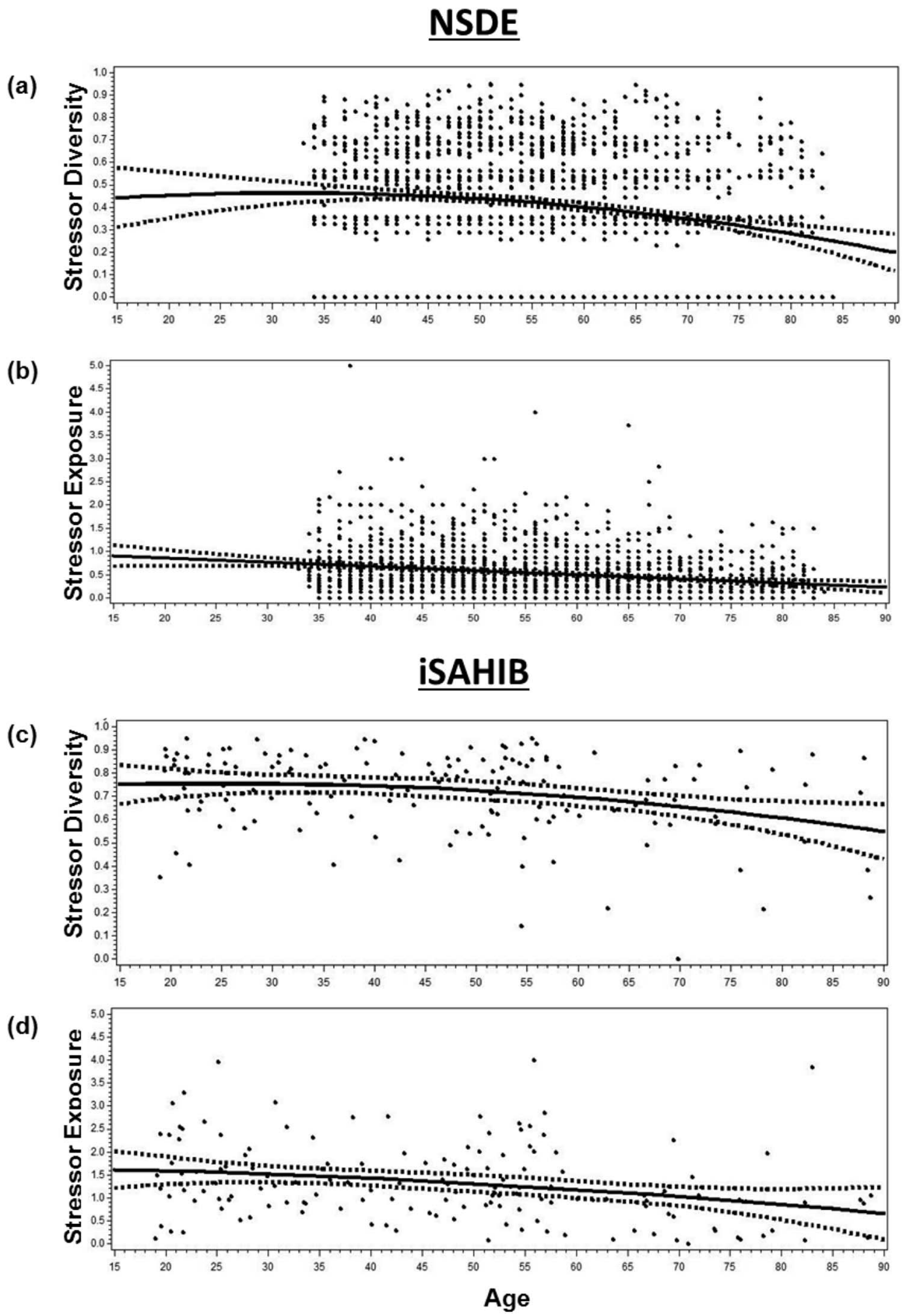

Figure 3. Age differences in stressor diversity [in NSDE (a) and iSAHIB (c)] and Stressor exposure [in NSDE (b) and iSAHIB (d)]. *Stressor exposure* quantified as average number of stressors experienced across study period, T (NSDE: T ≈ 8 days and iSAHIB: T ≈ 63 days; $N_{\mathrm{NSDE}} = 2{,}022$ (n = 1,814 for stressor diversity) $N_{\mathrm{iSAHIB}} = 150$ (n = 149 for stressor diversity). Missing cases for stressor diversity variable are individuals who reported no stressors across the entire reporting period.

ing pattern of differences in baseline levels of NA is shown in Figure 4a. As can be seen, *low* stressor diversity exacerbates the association between stressor exposure and NA, a pattern that supports the chronicity of stressor perspective. For the prototypical NSDE participant, NA increased on stressor days (i.e., stressor reactivity) by $\gamma_{10\mathrm{NA}} = 0.17$ ($p < .0001$) units on the 0 to 4 scale. As expected, individual differences in reactivity were related to stressor exposure, $\gamma_{11\mathrm{NA}} = 0.14$ ($p < .0001$), such that individuals

Table 3
Results From Multivariate Multilevel Models Assessing Associations of Stressor Diversity and Stressor Exposure With Daily Affect (Model 1) and Age as a Moderator of Those Associations (Model 2)

	NSDE				iSAHIB			
	Model 1: Associations of Stressor Diversity and Stressor Exposure with Daily Affect		Model 2: Age as a moderator of the relation between Stressor Diversity and Daily Affect		Model 1		Model 2	
Variable	Est.	(*SE*)	Est.	(*SE*)	Est.	(*SE*)	Est.	(*SE*)
Fixed effects for Negative Affect (NA)								
Intercept(γ_{00NA})	.14*	(.01)	.14*	(.01)	16.83*	(.87)	16.91*	(.88)
Exposure (γ_{01NA})	.20*	(.02)	.20*	(.02)	6.01*	(1.17)	5.95*	(1.21)
Diversity (γ_{02NA})	−.10*	(.03)	−.10*	(.03)	−14.76*	(5.67)	−13.50*	(5.76)
Exposure × Diversity (γ_{03NA})	−.16*	(.06)	−.18*	(.06)	−18.40*	(5.90)	−16.70*	(6.37)
Stressor Day (γ_{10NA} = Reactivity)	.17*	(.01)	.17*	(.01)	5.11*	(.59)	5.33*	(.60)
Reactivity × Exposure (γ_{11NA})	.14*	(.03)	.12*	(.03)	.78	(.88)	1.00	(.90)
Reactivity × Diversity (γ_{12NA})	−.06	(.03)	−.07*	(.04)	8.02*	(3.92)	8.45*	(3.91)
Reactivity × Exposure × Diversity (γ_{13NA})	−.11	(.06)	−.12	(.07)	9.12*	(4.51)	8.52	(4.68)
Age (γ_{04NA})	—	—	>−.01	(<.01)	—	—	.09	(.05)
Stressor Exposure × Age (γ_{05NA})	—	—	>−.01	(<.01)	—	—	.12	(.06)
Stressor Diversity × Age (γ_{06NA})	—	—	>−.01	(<.01)	—	—	−.84*	(.35)
Stressor Exposure × Stressor Diversity × Age (γ_{07NA})	—	—	<.01	(.01)	—	—	−.74*	(.33)
Stressor Reactivity × Age (γ_{14NA})	—	—	>−.01*	(<.01)	—	—	−.01	(.04)
Stressor Reactivity × Stressor Exposure × Age(γ_{15NA})	—	—	<.01	(<.01)	—	—	.02	(.05)
Stressor Reactivity × Stressor Diversity × Age(γ_{16NA})	—	—	>−.01	(<.01)	—	—	.51*	(.27)
Stressor Reactivity × Stressor Exposure × Stressor Diversity × Age (γ_{17NA})	—	—	−.01	(.01)	—	—	.61*	(.26)
Fixed effects for Positive Affect (PA)								
Intercept(γ_{00PA})	2.74*	(.02)	2.75*	(.02)	59.30*	(1.35)	59.06*	(1.36)
Exposure (γ_{01PA})	−.48*	(.07)	−.44*	(.07)	−6.60*	(1.80)	−6.92*	(1.85)
Diversity (γ_{02PA})	.04	(.10)	.05	(.11)	10.81	(8.76)	7.07	(8.85)
Exposure × Diversity (γ_{03PA})	.54*	(.18)	.57*	(.19)	23.83*	(9.20)	−3.54*	(.70)
Stressor (γ_{10PA} = Reactivity)	−.14*	(.01)	−.14*	(.01)	−3.61*	(.68)	28.20*	(9.86)
Reactivity × Exposure (γ_{11PA})	.02	(.05)	.02	(.05)	−1.01	(1.02)	−.89	(1.06)
Reactivity × Diversity (γ_{12PA})	.01	(.05)	.03	(.06)	−8.96*	(4.52)	−9.03*	(4.58)
Reactivity × Exposure × Diversity (γ_{13PA})	−.12	(.11)	−.13	(.12)	−11.60*	(5.16)	−11.91*	(5.48)
Age (γ_{04PA})	—	—	.01*	(<.01)	—	—	−.04	(.08)
Stressor Exposure × Age (γ_{05PA})	—	—	.01	(.01)	—	—	−.17	(.10)
Stressor Diversity × Age (γ_{06PA})	—	—	.01	(.01)	—	—	.98	(.51)
Stressor Exposure × Stressor Diversity × Age (γ_{07PA})	—	—	−.01	(.02)	—	—	.01	(.49)
Stressor Reactivity × Age (γ_{14PA})	—	—	<.01	(<.01)	—	—	.03	(.04)
Stressor Reactivity × Stressor Exposure × Age(γ_{15PA})	—	—	−.01*	(<.01)	—	—	.02	(.06)
Stressor Reactivity × Stressor Diversity × Age(γ_{16PA})	—	—	.01	(<.01)	—	—	−.17	(.31)
Stressor Reactivity × Stressor Exposure × Stressor Diversity × Age (γ_{17PA})	—	—	.02	(.01)	—	—	−.16	(.30)
Random effects								
Variance in NA intercept	.03*	(<.01)	.03*	(<.01)	56.77*	(8.71)	57.34*	(8.83)
Covariance of NA and PA intercepts	−.05*	(<.01)	−.05*	(<.01)	−23.42*	(9.89)	−20.41*	(9.86)
Variance in PA intercept	.44*	(.02)	.43*	(.02)	171.08*	(21.89)	168.14*	(21.84)
Covariance of NA intercept and NA reactivity slope	.02*	(<.01)	.02*	(<.01)	1.29	(3.54)	−.65	(3.60)
Covariance of PA intercept and NA reactivity slope	−.03*	(<.01)	−.03*	(<.01)	−5.72	(5.58)	−5.19	(5.51)
Variance in NA reactivity slope	.02*	(<.01)	.02	(<.01)	8.32*	(2.57)	7.65*	(2.45)
Covariance of NA intercept and PA reactivity slope	>−.01	(<.01)	>−.01*	(<.01)	6.11	(4.34)	6.61	(4.42)
Covariance of PA intercept and PA reactivity slope	−.02*	(.01)	−.02*	(.01)	−8.10	(6.69)	−9.28	(6.81)
Covariance of NA reactivity and PA reactivity	−.01*	(<.01)	−.01*	(<.01)	−4.15	(2.32)	−4.28	(2.34)
Variance in PA reactivity slope	.02*	(<.01)	.02*	(<.01)	12.14*	(3.42)	12.83*	(3.59)
Residual variance of NA intercept	.05*	(<.01)	.05*	(<.01)	97.05*	(1.51)	97.01*	(1.51)
Covariance of NA and PA residuals	−.03*	(<.01)	−.03*	(<.01)	−53.77*	(1.28)	−53.77*	(1.28)
Residual variance of PA intercept	.15*	(<.01)	.15*	(<.01)	109.88*	(1.71)	109.87*	(1.71)
Fit indices								
AIC	16997.7		17107.9		125417.3		125434.8	
BIC	17069.2		17179.4		125456.3		125473.8	

Note. NSDE: N = 2,022, $T \approx 8$; iSAHIB: N = 150, $T \approx 63$; Est. = estimate; *SE* = standard error; AIC = Akaike information criterion; BIC = Bayesian information criterion.
* $p < .05$.

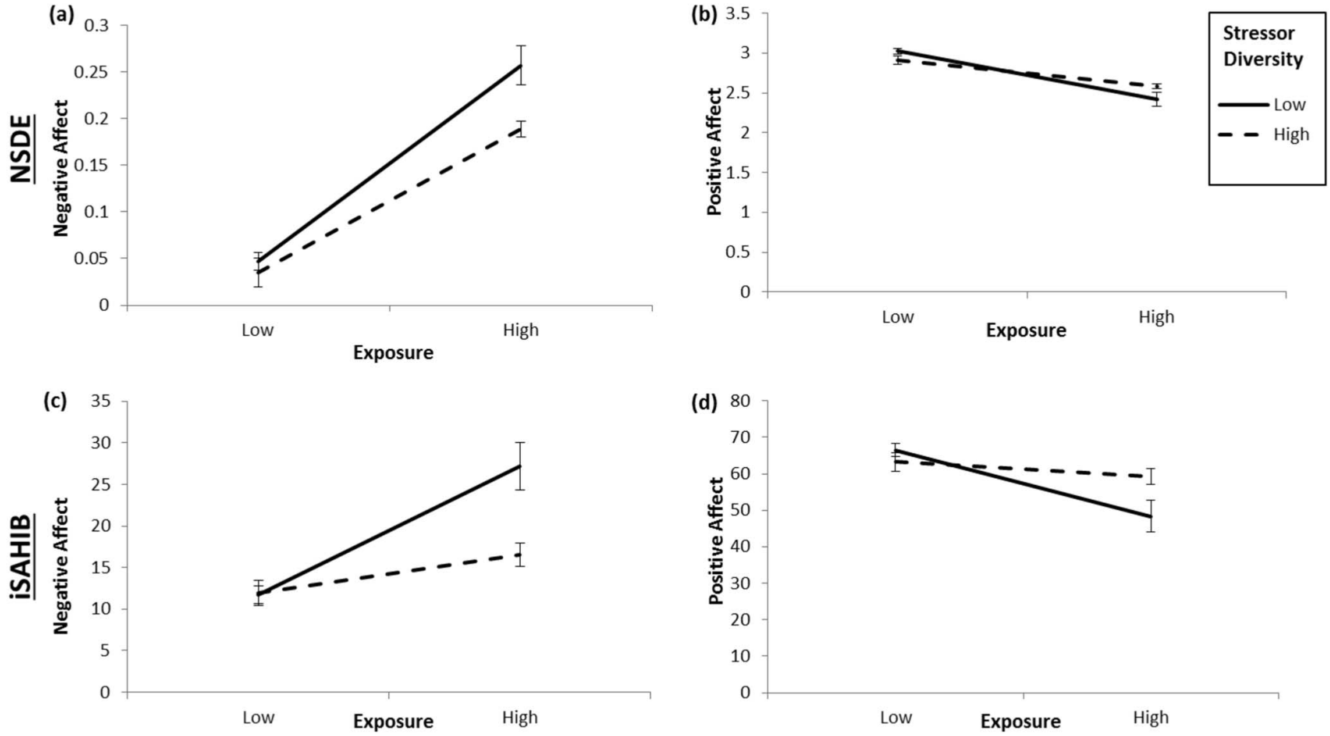

Figure 4. Stressor diversity moderates the association between stressor exposure and affect.

with greater stressor exposure also tended to have greater stressor reactivity. Stressor diversity was marginally associated with extent of stressor reactivity in NA, $\gamma_{12NA} = -0.06$ ($p = .05$), but did not moderate the effect of stressor exposure on stressor reactivity, $\gamma_{13NA} = -0.11$ ($p = .07$). Of note, a follow up analysis found the same pattern of results when using stressor severity in place of stressor day as a predictor. Broadly summarized, the pattern of findings for NA in NSDE indicates that stressor exposure is linked with poorer affective well-being, whereas stressor diversity is linked with better affective well-being—greater diversity is associated with lower baseline NA, slightly lower reactivity to stress, and mitigation of the relation between stressor exposure and baseline NA (although no mitigation of stressor reactivity).

A complementary pattern of findings was found in PA. The prototypical NSDE participant's PA on a nonstress day was estimated as $\gamma_{00PA} = 2.74$ ($p < .0001$) on the 0 to 4 scale. As expected, individual differences in this baseline level of PA were related to stressor exposure, $\gamma_{01PA} = -0.48$ ($p < .0001$), such that individuals with greater stressor exposure tended to have lower PA. Contrary to expectations, stressor diversity was not uniquely associated with baseline level of PA, $\gamma_{02PA} = 0.04$ ($p = .66$). As hypothesized, however, stressor diversity moderated the effect of stressor exposure, $\gamma_{03PA} = 0.54$ ($p = .002$). The resulting pattern of differences in no-stressor day levels of PA is shown in Figure 4b. As can be seen, *low* stressor diversity exacerbates the association between stressor exposure and PA, a pattern that again supports the chronicity of stressor perspective. For the prototypical NSDE participant, PA decreased on stressor days (i.e., stressor reactivity) by $\gamma_{10PA} = -0.14$ ($p < .0001$) units on the 0 to 4 scale. Individual differences in PA reactivity were *not* related to stressor exposure, $\gamma_{11PA} = 0.02$ ($p = .66$) or stressor diversity, $\gamma_{12PA} = 0.01$ ($p = .83$). Further, stressor diversity *did not* systematically moderate the effect of stressor exposure on stressor reactivity, $\gamma_{13PA} = -0.12$ ($p = .30$). Broadly summarized, the pattern of findings for PA in NSDE indicates that stressor exposure is linked with poorer affective well-being, whereas stressor diversity is linked with better affective well-being—greater diversity is associated with no difference in overall PA or PA reactivity to stressors, but mitigates the relation between stressor exposure and overall PA (although it does not mitigate reactivity).

After accounting for differences in stressor diversity and stressor exposure, residual between-person variance remains in both baseline levels (intercepts) of NA (Variance in NA intercept = 0.03, $p < .0001$) and PA (Variance in PA intercept = 0.44, $p < .0001$) and stressor reactivity (Variance in NA Reactivity Slope = 0.02, $p < .0001$; Variance in PA Reactivity Slope = 0.02, $p < .0001$). Overall levels of NA and PA negatively covary (Covariance of NA and PA intercepts = -0.05, $p < .0001$), as do NA and PA reactivity (Covariance of NA Reactivity and PA Reactivity = -0.01, $p < .0001$). Within-person residuals in NA and PA also exist (within-person residual variance of NA = 0.05, $p < .0001$; within-person residual variance of PA = 0.15, $p < .0001$) and are negatively correlated (covariance of within-person NA and PA residuals = -0.03, $p < .0001$; in correlation units $r = -.35$).

iSAHIB. Second, we examine concordance with results from Model 1 for iSAHIB. The prototypical iSAHIB participant's NA on a nonstress day was estimated as $\gamma_{00NA} = 16.83$ ($p < .0001$) on the 0 to 100 scale. As expected, individual differences in this overall level of NA were related to stressor exposure, $\gamma_{01NA} = 6.01$ ($p < .0001$); individuals with greater stressor exposure also tended to have higher baseline NA. As hypothesized, stressor diversity was uniquely associated with overall level of NA, $\gamma_{02NA} = -14.76$ ($p = .01$), and moderated the relation between stressor exposure and NA, $\gamma_{03NA} = -18.40$ ($p = .002$). The resulting pattern of differences in baseline levels of NA is shown in Figure 4c. As can be seen, *low* stressor diversity exacerbates the association between stressor exposure and NA, a pattern that replicates in the NSDE results and supports the chronicity of stressor perspective. For the prototypical iSAHIB participant, NA increased on stressor days (i.e., stressor reactivity) by $\gamma_{10NA} = 5.11$ ($p < .0001$) units on the 0 to 100 scale. Individual differences in NA stressor reactivity were *not* related to stressor exposure, $\gamma_{11NA} = 0.78$ ($p = .37$). However, stressor diversity was uniquely associated with extent of stressor reactivity in NA, $\gamma_{12NA} = 8.02$ ($p = .04$), and moderated the effect of stressor exposure on stressor reactivity, $\gamma_{13NA} = 9.12$ ($p = .04$). The pattern of differences in NA stressor reactivity by stressor exposure and stressor diversity is shown in Figure 5. Particularly large NA stressor reactivity is associated with high levels of stressor exposure in the presence of high stressor diversity. Of note, a follow up analysis found the same pattern of stressor diversity moderation when using stressor severity in place of stressor day as a predictor. Broadly summarized, the pattern of findings for NA in iSAHIB indicates that stressor exposure is linked with poorer affective well-being, while stressor diversity is linked with mixed affective well-being—greater diversity is associated with lower overall NA, mitigation of the relation between stressor exposure and overall NA, but also with greater reactivity to stressors and exacerbation of the relation between stressor exposure and stressor reactivity.

A complementary pattern of findings was found in PA. The prototypical iSAHIB participant's PA on a nonstress day was estimated as $\gamma_{00PA} = 59.30$ ($p < .0001$) on the 0 to 100 scale. As expected, individual differences in this overall level of PA were related to stressor exposure, $\gamma_{01PA} = -6.60$ ($p = .0002$), such that greater stressor exposure was related to lower PA. Stressor diversity was not uniquely associated with overall level of PA, $\gamma_{02PA} = 10.81$ ($p = .22$) directly, but did moderate the effect of stressor exposure, $\gamma_{03PA} = 23.83$ ($p = .01$). The resulting pattern of differences in baseline levels of PA is shown in Figure 4d. As can be seen, *low* stressor diversity exacerbates the association between stressor exposure and PA, a pattern that again matches the NSDE findings and supports the chronicity of stress perspective. For the prototypical iSAHIB participant, PA decreased on stressor days (i.e., stressor reactivity) by $\gamma_{10PA} = -3.61$ ($p < .0001$) units on the 0 to 100 scale. Contrary to expectations, individual differences in reactivity were not related to stressor exposure, $\gamma_{11PA} = -1.01$ ($p = .32$). However, like with NA, stressor diversity was uniquely related to extent of stressor reactivity, $\gamma_{12PA} = -8.96$ ($p = .05$), such that greater stressor diversity exacerbated the reactivity, and moderated the effect of stressor exposure on stressor reactivity, $\gamma_{13PA} = -11.60$ ($p < .03$). The pattern of differences in PA stressor reactivity by stressor exposure and stressor diversity is shown in Figure 5. PA stressor reactivity is associated with high levels of stressor exposure in the presence of high stressor diversity. Broadly summarized, the pattern of findings for PA in iSAHIB indicates that stressor exposure is linked with poorer overall affective well-being but not reactivity, whereas stressor diversity is linked with mixed affective well-being—greater diversity is associated with no difference in overall PA, greater PA reactivity to stressors, mitigation of the relation between stressor exposure and overall PA, and exacerbation of the relation between stressor exposure and reactivity.

After accounting for differences in stressor diversity and stressor exposure, residual variance remains at the between-person level in both overall levels (intercepts) of NA (Variance in NA intercept = 56.77, $p < .0001$) and PA (Variance in PA intercept = 171.08, $p < .0001$) and reactivity (Variance in NA Reactivity Slope = 8.32, $p = .0006$; Variance in PA Reactivity Slope = 12.14, $p = .0002$). Overall levels of NA and PA negatively covary (Covariance of NA and PA intercepts = −23.42, $p = .02$), but NA and PA reactivity only marginally covary (Covariance of NA Reactivity and PA Reactivity = −4.15, $p = .07$). Within-person residuals in NA and PA also exist (Residual within-person variance of NA = 97.05, $p < .0001$; Residual within-person variance of PA = 109.88, $p < .0001$) and are negatively correlated (Covariance of within-person NA and PA residuals = −53.77, $p < .0001$; in correlation units $r = -.52$).

Age as a Moderator of the Relation between Stressor Diversity and Daily Affect

With rather good replication across studies, we then examined whether and how the relations noted above differed with age. Results from Model 2, where age was included as an additional predictor, are also shown in Table 3.

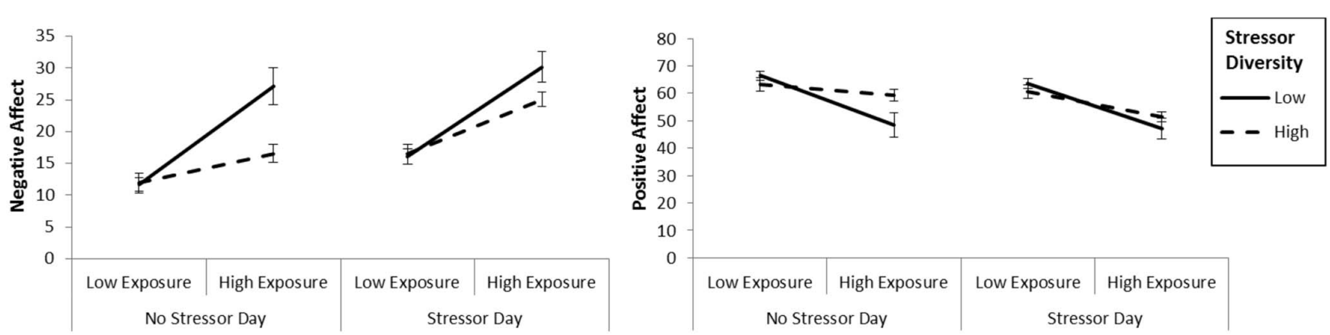

Figure 5. The extent that stressor diversity moderates the relation between stressor exposure and negative affect (left) and positive affect (right) differs by stressor day (results from iSAHIB).

NSDE. Results from NSDE, seen in the Model 2 column, indicate that age was not uniquely associated with NA, γ_{04NA} <0.001 (p = .36). Age was, however, associated with stressor reactivity in NA, γ_{14NA} = 0.001 (p = .02). For every decade of age, NA is 0.01 greater on stressor days than no-stressor days. There was no evidence that age moderated any of the higher order interactions of stressor diversity with stressor exposure ($\gamma_{sNA} < 0.01$, $ps > .05$). Age was uniquely associated with PA, γ_{04PA} = 0.01 ($p < .0001$), but was not associated with stressor reactivity in PA, γ_{14PA} <0.01 (p = .78). Here again, there was no evidence that age moderated any of higher order interactions ($\gamma_{sPA} \leq 0.01$, $ps > .05$). In sum, the roles stressor diversity (and stressor exposure) play in affective well-being do not differ across age in NSDE. Also of note, an additional analysis finds the same directional patterns of age moderation in the presence of self-reported physical health, income, and education.

iSAHIB. Results from Model 2 in iSAHIB, seen in the right most column of Table 3, were more complicated. Evidence that age moderated the relation between stressor diversity and NA (γ_{06NA} = −0.84, p = .02), the extent to which stressor diversity moderated the relation between stressor exposure and NA (γ_{07NA} = −0.74, p = .03), and the extent to which stressor diversity moderated stressor reactivity of NA (γ_{16NA} = 0.51, p = .05), was all superseded by a 4-way interaction, Stressor reactivity × Stressor exposure × Stressor diversity × Age (γ_{17NA} = 0.61, p = .02). The pattern of differences (model derived means) is shown in Figure 6. In attempting to interpret the pattern of effects, first consider mean NA for younger adults compared to older adults. On no-stressor days, younger adults do not display affective difference between low and high stressor diversity, whereas older adults with low stressor diversity show significantly greater NA than those with high stressor diversity. The interaction between stressor exposure and stressor diversity is much stronger for older adults, such that low stressor diversity and high stressor exposure are associated with particularly high NA. For older adults, low stressor diversity is associated with greater NA stressor reactivity, whereas younger adults do not experience this effect. Luckily, perhaps, the complementary pattern was not found on the PA side. Age was not uniquely associated with PA, γ_{04PA} = −0.04 (p = .62), stressor reactivity, γ_{14PA} = 0.03 (p = .42), and did not enter with any higher order interactions ($\gamma_{sPA} < 0.20$, $ps > .05$). Again, an additional analysis finds the same directional patterns of age moderation in the presence of self-reported physical health, income, and education.

In sum, in NSDE there was no evidence of age differences in how stressor diversity and exposure were related to NA or PA (although there were slight differences in stressor reactivity). Likewise, in iSAHIB there was no evidence of age differences in how stressor diversity and exposure were related to PA. There was, however, evidence of a complicated pattern of age differences in how stressor diversity and exposure were related to NA. On no-stressor days, older adults with low stressor diversity show significantly greater NA than those with high stressor diversity, whereas younger adults do not show any difference. For older adults, low stressor diversity is associated with exacerbated stressor exposure effects and high stressor diversity is associated with exacerbated reactivity effects.

Discussion

Using two independent studies of daily stress with samples covering a broad range of adulthood, our primary aims were to (a) describe age differences in stressor diversity and stressor exposure, (b) evaluate how stressor diversity is uniquely linked to daily affect and/or moderates the link between stressor exposure and daily affect, and (c) examine whether the associations between stressor diversity and affect are moderated by age. First, results indicate that age differences in stressor diversity followed a slight downward trend. Second, higher stressor exposure was associated with poorer baseline affect (higher NA, lower PA), and higher stressor diversity was both associated with better baseline affect (lower NA, no difference in PA) and mitigated stressor exposure effects on both NA and PA—a pattern of findings that replicated across both studies. In contrast, the studies provided mixed evidence regarding whether stressor diversity moderated individuals' stressor reactivity. Third, age did not moderate the associations between stressor diversity and PA, and while age showed some moderation of stressor diversity's effects on NA in iSAHIB, this isolated result in only one of the two studies is interpreted cautiously.

Age Differences in Stressor Diversity (and Stressor Exposure)

Results from both iSAHIB and NSDE indicate that older age is associated with lower stressor diversity: .04 and .02 difference in

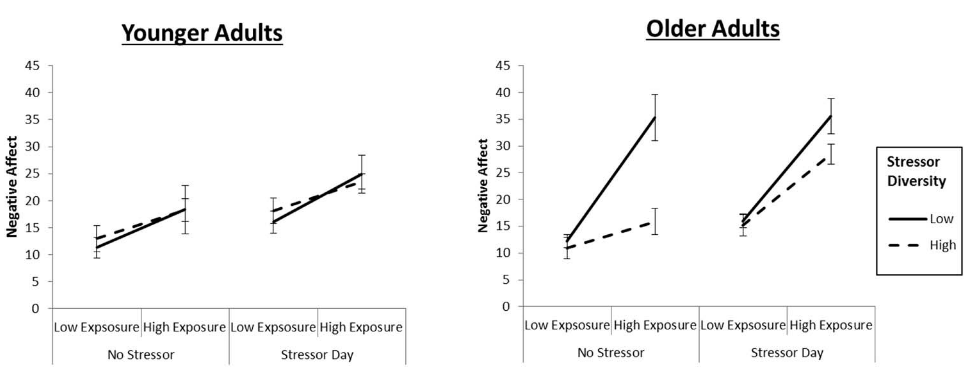

Figure 6. Age moderates the association among stressor diversity, stressor exposure, stressor reactivity, and negative affect in iSAHIB.

diversity (along the 0 to 1 scale) with each decade of age in NSDE and iSAHIB, respectively. These small but significant effects provide some additional support for life span theories of socioemotional functioning (e.g., Carstensen et al., 1999; Charles, 2010) and the notion that older adults select out of stressful situations by narrowing both the volume and scope of stressor experiences (Baltes, 1997). Though the distinctions among stressor types and their associations with well-being have been well-documented (Bolger et al., 1989; Bolger & Schilling, 1991), the literature typically examines the relation between stress and affect either via aggregate stressor exposure (which treats all stressor types equally) or via isolation of specific stressor types (Hay & Diehl, 2010; Neupert, Almeida, & Charles, 2007; Stawski, Cichy, Piazza, & Almeida, 2013). The introduction of a *stressor diversity* construct that quantifies evenness across the total array of stressor types may help unify these two approaches. For example, age-related trends in the specific stressor types experienced through adulthood suggest increases in network stressors and health stressors, but decreases in work, home, overload, financial, and interpersonal stressors (Almeida & Horn, 2004; Birditt et al., 2005)—a pattern of changes consistent with the downward trending age gradient in stressor diversity seen here. Decreases in stressor diversity across age may thus tie together the more granular investigation of specific stressor types with more global representations of individuals' overall stressor ecosystem.

Important to note is that we did not directly assess or examine the mechanisms that may be driving the age differences. Rather, age serves as a proxy for a variety of possible mechanisms, including the changes in motivation and/or use of proactive coping and appraisal strategies from which we developed the hypotheses, but also changes in social roles that occur throughout adulthood (Elder, 1995). Future research that additionally tracks individual-level changes in motivation, socioemotional, and social role priorities will provide further understanding of how the volume and scope of stressors influence daily well-being.

Associations of Stressor Diversity and Stressor Exposure With Daily Affect

Consistent with prior studies (e.g., Birditt et al., 2011; Bolger et al., 1989; Bolger & Schilling, 1991; Zautra et al., 2005), we found that greater *stressor exposure* was associated with poorer affective well-being—both higher NA and lower PA. Extending the inquiry of individuals' stressor ecosystems, we found that greater *stressor diversity* was both uniquely associated with better affective well-being—lower NA, no differences in PA—and mitigated the effects of exposure on affective well-being—both NA and PA. Interpreted with respect to the COR model (Hobfoll, 1989), these results align with a *chronicity of stressor* perspective. Thus, with results replicating across both NSDE and iSAHIB, stressor diversity appears to be a marker of chronicity rather than of uncertainty. That is, the associations between diversity and daily well-being appear to be driven by presence (or not) of consistent, repeated exposure to a limited number of stressor types. As outlined in the introduction, the constant, concentrated demand for a select set of resources and the entry into loss-spirals and reactive coping that accompany that constancy would result in lower well-being (Hobfoll, 2001). Although stressor exposure is known to deplete coping resources (Halbesleben et al., 2014), our findings suggest that the diversity (or lack thereof) of those stressors also plays an important role in individuals' vulnerability and potential for deteriorated affective well-being. As such, these findings offer a new operationalization of a "chronic stressor" as a stressor ecosystem that is specifically characterized by the combination of high stressor exposure and low stressor diversity. Further work can use the quantifications provided by the abundance and diversity metrics outlined here (or similar metrics such as Simpson's/Blau's index, see Brose et al., 2013) to examine the relations between chronic stressors and health outcomes with additional precision.

In contrast to the consistent association between stressor diversity and baseline NA and PA that emerged in both NSDE and iSAHIB, the two studies provided a rather mixed set of results regarding whether and how stressor diversity moderated individuals' stressor reactivity. Stressor diversity was related to decreased NA reactivity in NSDE, but to increased NA reactivity in iSAHIB. Stressor diversity was not related to PA reactivity in NSDE, but was related to increased PA reactivity in iSAHIB. Similarly mixed findings emerged regarding whether stressor diversity moderated the relation between stressor exposure and stressor reactivity. Stressor diversity did not moderate the relation between stressor exposure and NA reactivity in NSDE, but did moderate the relation in iSAHIB. Confusingly, stressor diversity was related to a weaker association between stressor exposure and PA reactivity in NSDE, but a stronger association in iSAHIB.

These mixed and inconsistent findings surrounding stressor diversity's role as a moderator of between-person and within-person associations promote consideration of two important issues. First, the mechanisms linking stressor diversity to affect at the between-person level and the within-person level may differ. The *chronicity of stressor* perspective appears consistently at the sample level (i.e., between-person differences in stressor diversity are associated with between-person differences in affect). However, it is likely that within-person change (i.e., change in affect from a stressor-free day to a stressor day) is driven by different processes than sample-level change processes (see Molenaar & Campbell, 2009). For instance, high stressor diversity and high stressor exposure in the between-person space may indicate chronicity, whereas high stressor diversity and high stressor exposure may indicate uncertainty at the individual-level, when a person is evaluating stressors in comparison to their specific normative situation. These differences in between and within-person mechanisms may also be considered alongside the differences in stressor type measurement. For example, it is possible that a particular stressor type, such as health/accident stressors (assessed in iSAHIB but not NSDE), may have stronger impacts on the association between stressor diversity and exacerbated stressor reactivity. Such stressor type differences could impact stressor diversity's moderation of within-person reactivity effects while failing to impact the moderation of stressor exposure in cases such as health/accident stressors that are relatively less common in proportion to total stressor exposure, compared with other stressor types. Second, we may need to be particularly careful when comparing the two data sets regarding within-person change. The number of occasions on which the within-person associations are based differs greatly: 8 days of data in NSDE, and 60+ days of data in iSAHIB. In the only other study we know of that has examined stressor diversity using intensive longitudinal data, Brose and colleagues' (2013) analysis of 100-day data found that stressor diversity exacerbated

NA reactivity, as was found with iSAHIB's 60-day data. Given that the study designs through which data are obtained differentially prioritize examination of between-person and within-person associations, there is continued need to specify the multilevel processes linking between-person differences in stressor diversity to within-person changes and use of designs that allow precise examination of those links.

The similarities and differences in NA and PA results further support a push toward including both of these affective well-being indicators in models of stressor processes (e.g., Folkman, 2008; Schilling & Diehl, 2014). Although the subjective well-being literature suggests that the affective components of well-being consist of both NA and PA (Diener, Scollon, & Lucas, 2009), most of the stress literature examines only NA (Folkman, 2008). This may be a result of the claim that daily negative events, such as stressors, have a greater association with NA, whereas daily positive events have a greater association with PA (van Eck, Nicolson, & Berkhof, 1998). Although some studies support this claim (Smith & Christensen, 1996; David, Green, Martin, & Suls, 1997), the present analyses add to a growing body of evidence that negative events, such as stressors, also influence PA (Mroczek et al., 2015; Repetti, 1993; Smyth et al., 1998; Stawski, Sliwinski, Almeida, & Smyth, 2008; van Eck et al., 1998; Zautra et al., 2005). Given that NA and PA are independently related to health and well-being outcomes, including cardiac problems, depression, and longevity of life (Diener & Chan, 2011; Diener, Scollon, & Lucas, 2009; Mroczek et al., 2015), it appears useful to further parse the specific processes through which stressors influence NA and PA, both jointly and distinctly. Future studies might consider further how analytical tools, such as the multivariate multilevel modeling approach used here, as well as multivariate time-series models might facilitate identification and eventual modification of those processes (e.g., Ram, Brose, & Molenaar, 2011).

Age as a Moderator of the Relation Between Stressor Diversity and Daily Affect

Findings from both NSDE and iSAHIB indicate that the role stressor diversity plays in PA does not differ by age. In iSAHIB, a significant 4-way interaction hints that older adults' NA may be more vulnerable to the chronicity of stressors that manifests when stressor exposure is high and stressor diversity is low. This one instance of age moderation is consistent with expectations derived from the propositions in the SAVI model (Charles, 2010). In particular, in situations of unavoidable stressors (e.g., chronic stressors), older adults are more vulnerable physiologically and psychologically. That this vulnerability only emerges in NA and not in PA may be because loss of resources (a negative) is more salient than gain of resources (a positive). That is, NA may be more sensitive than PA to the change in resources that are thought to accompany chronicity of stressors (Hobfoll, 1989). However, we are highly cautious when making these inferences because this result did not replicate across the two studies or outcomes.

Limitations and Outlook: Design and Measurement Issues

In developing a robust set of replicable findings, our analyses made use of two complementary studies of daily stress and affect. Still, some limitations must be kept in mind. Participants in both NSDE and iSAHIB were more racially homogenous, more educated, and had higher household incomes than the general U.S. population. Although the similarities of the two samples allows comparison across the two studies, future research should examine whether and how the results generalize to more socioeconomically and racially diverse samples, especially because aspects of the stressor ecosystem are known to differ by SES and race (e.g., Birditt et al., 2011; Caspi, Bolger, & Eckenrode, 1987; Cichy, Stawski, & Almeida, 2014; Kessler, Mickelson, & Williams, 1999; Pearlin, Schieman, Fazio, & Meersman, 2005; Williams & Mohammed, 2009).

Differences in the number of occasions sampled (NSDE: $T \sim 8$ days, iSAHIB: $T \sim 63$ days) also impact interpretation of intraindividual findings and constructs. iSAHIB results suggest stressor diversity negatively impacts within-person reactivity, and NSDE results show improved or null effects. Although NSDE sampling was designed to assess a participant's typical week, the variety of stressor types that can be assessed in that time is necessarily smaller than can be assessed over longer time periods. When more occasions are sampled, the precision of averages and differences among days and stressors improves. The time scale at which stressors are measured (e.g., within day, end of day, monthly), as well as the number of stressor occasions sampled, may also alter the meaning of the stressor diversity construct. The broad consistency of stressor diversity effects at the person-level, however, lends strength to our findings across these different time scales. The time scales at which stressor diversity manifests (months, weeks, days, etc.) must be addressed in future work.

The present analyses should also be considered with respect to some additional assumptions and advances related to the quantification of the stressor ecosystem and well-being. In analyses of affective reactivity, we must consider that affect measured at the end of a stressor day may not be the best proxy for changes in affect that occur at the actual time the stressor was encountered. Daily reactivity differences may indeed reflect short-term stressor residue or within-person variability in emotional experience. However, stressor reactivity as measured at the end of the day has been related to long-term health and well-being outcomes, and warranted examination in relation to stressor diversity (Charles et al., 2013; Mroczek et al., 2015; Piazza, Charles, Sliwinski, Mogle, & Almeida, 2013).

The quantification of stressor diversity also comes with assumptions, which our work and future work must carefully consider. Perhaps most importantly, calculation of Shannon's entropy assumes that the daily measurements of stressor type are independent, identically distributed (iid), and show no time-related trends (see Ram & Gerstorf, 2009, for in-depth discussion of this issue). Several measurement issues embedded in the study design have implications for conceptual interpretation of the iid assumption. NSDE assesses stressor events (discrete time episodes of finite length) which are required to be less than 24 hours, and though the same type of event may occur on successive days—and may indicate carryover of a causal mechanism (e.g., poverty persists)—any single event may not be reported on multiple days. The iSAHIB study, however, assesses the sources of stress, which are more akin to "threats" with fuzzy temporal beginnings and endings (i.e., no clarity on the temporal location of the challenge). Statistical rejection of the iid assumption is impractical, both in NSDE and in iSAHIB, as simulations examining the power of the Ljung-Box test for detecting auto-correlations suggest upward of 100 equally spaced observations are needed in the univariate continuous data case. However, with the iSAHIB data, we can empirically test the assumption by formally treating the iSAHIB data as multivariate categorical sequences, identifying the "bouts"—consecutive reports of the same stress source—and calculating the average duration of those bouts, in days. We then borrow the "parallel analysis" procedure used in factor analysis for determining the number of factors (Horn, 1965): we shuffle the data—randomly reordering of each person's time-series—and recalculate the bout durations. The average correlation between bout-length in the true data and bout-length in the randomly shuffled data was .84, and thus suggests that shuffling the data does not strongly influence rank-order of the contiguity in these time-series. With the pure measure of contiguity relatively unaffected by random shuffling, we concluded that the iid assumption is tenable in these data. With these short time-series, contiguity manifests in the exposure variable, so if stressors occur 10 days in a row, rank-order of contiguity will be high in all possible reshufflings of the data; this highlights why there is interplay of exposure and diversity in the theoretical propositions and analytical results.

However, the lack of direct contiguity assessment presents a divergence between our conceptualization of chronic stressors as high stressor exposure and low stressor diversity and conceptualization of "chronic" as uninterrupted, continuous phenomena. For example, Wheaton (1994) notes chronicity as ". . . problems and issues that are either so regular in the enactment of daily roles and activities, or so defined by the nature of daily role enactments or activities, they behave as if they are continuous for the individual" (p. 82). Our operationalization of stressor diversity purposefully ignores the contiguity of the daily measurement, treating all days as independent, but still seems to capture the notions of regularity in the daily role enhancements and activities. So, although our use of chronicity gets very close to Wheaton's (1994) definition, it does miss something about the continuous nature of chronic stressors. In our reading of the literature, the existing theoretical and conceptual discussions do not provide the level of precision needed to formulate a mathematical definition of chronic stress—so there is room for multiple operationalizations. Our paper proposes one way to capture the notions summarized by Wheaton (1994) and Gottlieb (1997) using daily dairy data from two studies. We suggest that the *threat* of stressor events that are experienced with greater frequency than other stressors and occur with high frequency throughout a time period, even if not contiguously, can be considered constant. We also note that different number and spacing of assessment occasions can lead stressors to appear more or less contiguous. Thus, the specific operationalizations need to be interpreted in the context of the data at hand—but also underscores the benefits of our two-study replication effort.

A related point can be made about stressor types. In the existing literature, the specific stressor types assessed differ across studies. Thus, the specifics of the calculation of diversity (Equation 2) carry forward some initial measurement decisions. In the present analyses, the two studies both assessed work overloads, home overloads, interpersonal tensions (arguments and avoided arguments), and network stressors. NSDE, however, also included discrimination stressors, while iSAHIB included evaluation stressors, health/accident stressors, and financial stressors. For this reason, stressor diversity must be considered within the context of the specific ways in which stressors were assessed, particularly when, as in the present studies, stressor types assessed may be relevant to age-related trends. For example, in NSDE, avoided arguments are considered a type of stressor event (one that is associated with age as older adults employ stressor avoidance strategies to a greater extent than younger adults; Birditt et al., 2005). We conducted a sensitivity check, removing "avoided argument" from the stressor day variable, stressor exposure computation, and stressor diversity computation. Although, we found the same pattern of associations here, replication of age-related differences in stressor diversity and its associations with affect may depend on the specifics of the measurement paradigm.

Pulling all these measurement issues together, alternative or amended measures of diversity should be considered, particularly as we attempt to articulate stressor residue and chronicity of stressor constructs more precisely. For example, it may be possible to incorporate notions of "stressor decay" processes through inclusion of exponential functions within the entropy statistic, itself. However, the sampling rate may need to be changed to a cadence that allows for better capture of change. Relatedly, we purposively kept the analysis in a categorical space (assessing relative abundance using a categorical typology of stressor types) to maintain operational consistency with ecological diversity measures (e.g., species diversity, operationalized as relative abundance of the categorical typology of species). However, follow-up analyses with a continuous "stressor severity" variable in place of the stressor day predictor provided a very similar pattern of results. As the construct of stressor diversity gets elaborated, we can explore how to simultaneously incorporate qualitative (type) and quantitative (severity/intensity) aspects of stressors in a single metric (i.e., assessing relative abundance using a continuous stressor severity by stressor type operationalization). The addition of stressor severity to the presented framework would need to consider how both inter- and intrastressor type differences in severity may affect the interpretation of stressor diversity and its associations with affect (Hobfoll, 1989; Brose et al., 2013).

Notably, even in the categorical space, there are a plethora of alternative diversity indices, each with their own assumptions (Magurran, 1988). For example, turbulence (Elzinga, 2006; see also Elzinga & Liefbroer, 2007) is a measure that merges notions of diversity and occasion-to-occasion contiguity. Turbulence is higher when there is a lot of switching between states, and low when there is contiguity in one state. The correlation between the time-dependent turbulence measure and the iid-based entropy measure in the iSAHIB data is .56. This suggested that entropy measure being used to operationalize diversity is not missing too much of what might be embedded in measures that accommodate the contiguity-based perspective on chronicity. However, additional analyses suggest that turbulence does not capture the aspects of stressor diversity that influence negative affect. This may indicate that contiguity of sources across daily assessments is not the most relevant feature of individuals' psychological experience of stressors. Ultimately, we chose to work with the Shannon's entropy measure, so as to remain consistent with the ecological literature (Magurran, 1988) and previous examinations of categorical diversity measures in the social sciences without compromising compatibility with Brose et al.'s (2013) work using Blau's diversity index (correlations between Shannon's and Blau's indices in NSDE: $r = .98$; in iSAHIB: $r = .96$).

Our objective in this paper was to investigate the importance of stressor diversity for affective well-being. The next step is to parse apart the mechanisms through which stressor diversity influences well-being. We based our theoretical predictions about how stressor diversity would be related to well-being on Hobfoll's (1989) implication that stressors vary in avoidability and predictability. However, we were not able to explicitly test the core theoretical assumptions. We only tested the implied downstream relations, albeit using an entropy index that was developed and is interpreted, across fields, as a measure of predictability (e.g., Shannon's original work was in information theory). In the absence of data on the avoidability of stressors (perceived or actual), or individual coping and appraisal strategies (including proactive stressor avoidance), we must remain a bit cautious in interpretation of mechanisms. Although we interpreted the "chronicity" of low stressor diversity and high stressor exposure as a contextual threat to affective well-being, it may instead reflect individuals' ineffective coping strategies. Looking toward future analyses, we did a bit of preliminary searching for potential pathways. Stressor diversity is weakly correlated with education and income (as proxies for SES-related mechanisms) in both NSDE ($r_{income} = -0.03$, $r_{education} = 0.17$) and iSAHIB ($r_{income} = -0.22$, $r_{education} = 0.04$). Stressor diversity does not appear to be related to a measure of general social integration (NSDE: $r = -0.04$). Further inquiries might look at pathways related to coping resources (Lazarus & Folkman, 1984), health (both physical and mental), or personality, a known marker of exposure to controllable/avoidable and uncontrollable/unavoidable stressors (e.g., Kendler, Gardner, & Prescott, 2003; Magnus, Diener, Fujita, & Pavot, 1993). In sum, although the identification and testing of specific mechanisms was outside the scope of this paper, we look forward to such future research. Particularly important in this search may be the design of longitudinal studies that allow for testing causal relations.

Synopsis

The purpose of the present study was to introduce stressor diversity as an important aspect of individuals' stressor ecosystems and describe how stressor diversity relates to daily affective well-being across the adult life span. Indeed, evidence from two complementary studies suggests that low stressor diversity is linked with poor affective well-being, and that older adults experience less stressor diversity than younger adults. The combination of high exposure and low stressor diversity leads to particularly high NA and low PA, a pattern that may indicate and more precisely operationalize chronic stressors. We recommend further use of the stressor diversity construct to better understand and optimize individuals' stressor ecosystem, development, and well-being.

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