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Advancing the Study of Resilience to Daily Stressors

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Abstract

Historically, studies of childhood and adult resilience have typically focused on adaptation to chronic life adversities, such as poverty and maltreatment, or isolated and potentially traumatic events, such as bereavement and serious illness. Here, we present a complementary view and suggest that stressors experienced in daily life may also forecast individual health and well-being. We argue that daily process approaches that incorporate intensive sampling of individuals in natural settings can provide powerful insights into unfolding adaptational processes. In making this argument, we review studies that link intraindividual dynamics with diverse health-related phenomena. Findings from this research provide support for a multiple-levels-analysis perspective that embraces greater unity in pivotal resilience constructs invoked across childhood and adult literatures. Drawing on insights and principles derived from life-span theory, we conclude by outlining promising directions for future work and considering their broader implications for the field of resilience.

Keywords

daily stress; resilience; dampened reactivity; accelerated recovery; toughening; richness

Resilience has numerous meanings in prior research but generally refers to the capacity of a dynamic system to adaptively respond to environmental adversity. Inherent in the construct of resilience are two distinct dimensions: exposure to significant risks and evidence of positive adjustment (Luthar & Cicchetti, 2000; Luthar et al., 2000; Zautra et al., 2008). A key implication is that resilience is best understood as an active dynamic adaptation to stressors rather than as an inert trait or predisposition. Although indicators of adaptational processes vary across developmental and ecological contexts, predominant conceptualizations of resilience emphasize three key elements: sustainability, recovery, and steeling. *Sustainability* refers to the maintenance of health and well-being in the face of major life stressors (Bonanno, 2004; Masten et al., 1990). *Recovery* refers to how quickly and effectively people bounce back or regain equilibrium following challenge and adversity (Curtis & Cicchetti, 2003; Davidson, 2000). *Steeling* refers to the propensity for

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prior stressor exposure to increase coping capacity in the face of future stressors (Rutter, 2012; Seery, 2011). Evidence of these core elements of resilience in the context of toxic environmental circumstances (Luthar, 2006) and potentially traumatic events (Bonanno et al., 2011; Seery, 2011) have been well documented, but the capacity for resilience in the face of naturally occurring day-to-day stressors is not well understood.

In this article, we review current research that demonstrates the phenomenon of resilience is not limited to major life adversities but applies to relatively minor events encountered in daily life. This research illustrates how dynamic daily processes can be conceived as resilient factors that describe individuals' inherent capacity for change (Kalisch et al., 2015; Ram & Gerstorf, 2009) and, in turn, are linked to physical health and psychological functioning. Drawing on principles from life-span theory (Baltes, 1987; Staudinger et al., 1993), we present a multiple-levels-analysis perspective that takes into account resilience processes that operate across different timescales (Fig. 1), including both short-term, *intraindividual variability* and long-term, *intraindividual change* (for definitions of terms in italicized type, see Table 1). We highlight the benefits of *measurement-burst designs* (Nesselroade, 1991b; Sliwinski, 2008) and point to the unfulfilled potential of existing time-series tools (Brose et al., 2022; Hamaker et al., 2018) for investigating and modeling *interindividual differences* in intraindividual variability (Wang et al., 2012). We conclude with a discussion of remaining questions and future directions, including how daily process inquiries hold great promise for elucidating resilience processes that can inform new targets for intervention research and practice.

Resilience as Dynamic Daily Process

The idea that resilience reflects a dynamic process is not new. Developmental researchers and theorists have long noted that the temporal unfolding nature of resilience implies that it is not a trait or personality characteristic (Luthar, 2006; Luthar et al., 2000; Rutter, 2006). Commenting on this issue, Luthar and colleagues (2000) maintained that a core distinction between resilience and traits that purport to capture resilience is that only the former presupposes a dynamic process and exposure to adversity. Similar concerns have been raised about the use of single-administration trait questionnaires in studies of adult resilience (Bonanno et al., 2011; Kalisch et al., 2017). The overarching message that emanates from these influential programs of research is clear: To better understand the adaptational processes that underpin resilience, researchers need to examine them as they unfold.

The conception of resilience as an unfolding dynamic process necessitates research designs that combine *idiographic* (patterns of variability and change within individuals) and *nomothetic* (patterns of differences across individuals) methods. This hybrid approach is exemplified in the daily process paradigm (Bolger & Zuckerman, 1995; Tennen & Affleck, 2002), which uses *intensive longitudinal methods* (e.g., experience sampling, daily diary assessments) to examine individual differences in the patterning of temporal events and behavior. These methods enhance ecological validity, strengthen causal inference, and minimize recall error. Note that process-oriented designs permit the assessment of resilience processes closer to their real-time moments of change.

Applications of Daily Process Formulations of Resilience to Health

Although the theoretical significance of daily process designs for resilience research has been recognized (Almeida, 2005; Ong et al., 2009), empirical studies to date have primarily explored how individual differences in personal vulnerabilities and resources predict exposure and responses to daily stressful events (Bolger & Zuckerman, 1995; Zautra et al., 2005). More recently, researchers have turned to daily process designs to probe the dynamic processes that give rise to interindividual differences (Charles et al., 2013; Leger et al., 2018; Smyth et al., 2018). In this section, we review research that demonstrated the value of conceptualizing specific daily *resilience processes* as interindividual difference characteristics (Ram & Gerstorf, 2009). Working at the interface between substantive theory and methodological implementation, we delineate four dynamic processes that underlie individual differences in resilience to everyday stressors: *dampened reactivity, accelerated recovery, toughening* and *inoculation*, and *richness* and *balance.* Each resilience process is described along with illustrative examples of how it is operationalized and measured in daily life. Studies that explore how these dynamic processes are associated with psychological functioning and physical health are then reviewed (for details of each study, see Table 2), followed by recommendations for future research. Findings from this work demonstrate how the use of intraindividual, process-oriented methods can serve as powerful tools to illuminate context-specific protective processes (Luthar et al., 2000) and thereby help to identify individuals who are most at risk for maladaptive adjustment and poor health.

Dampened reactivity

Leading models of stress and health posit that heightened stress reactivity plays a prominent role in the development of psychiatric disorders and disease risk (Epel et al., 2018). Although individual differences in physiological responses to standardized laboratory stressors have been widely reported, growing research suggests that individuals may also differ in their reactivity and recovery from naturally occurring stressors. Here we focus on studies of affective responses to daily stressors, which constitute the bulk of existing intensive longitudinal studies of stress. Operationally, affective reactivity has been conceptualized as interindividual differences in the degree of intraindividual coupling of daily stress and affect (Sin et al., 2015). From a resilience perspective, these intraindividual parameters measure a continuum of interindividual differences in affective reactivity to daily stressors, which range from resilience (i.e., dampened reactivity) on one end to vulnerability on the other (i.e., heightened reactivity).

Measurement.—Affective reactivity is typically estimated as the regression coefficient (β_{1j}) in a within-persons regression model,

$$\text{Affect}_{ij} = \beta_{0j} + \beta_{1j}\left(\text{stressor}_{ij}\right) + r_{ij},$$

where the stressor_{ij}

variable is a binary indicator that distinguishes event and nonevent occasions. The regression coefficient β_{1j} captures the expected change in affect for person j in response to a same-day stressor event (Ong et al., 2013; Sin et al., 2015).

Associations with mental and physical health.—Growing evidence indicates that dampened negative affect (NA) reactivity to daily stressors may be protective against subsequent mental-health problems (Bai et al., 2020; Charles et al., 2013; Cohen et al., 2005), chronic health conditions (Piazza et al., 2013), marital risk (Ong et al., 2020), allostatic load (Piazza et al., 2019), and even mortality (Chiang et al., 2018; Stanton et al., 2019). Likewise, the maintenance of positive affect (PA) in the face of daily stressors is associated with more favorable profiles of sleep (Ong et al., 2013), health-related biomarkers (Sin et al., 2015), mental health (Ong & Burrow, 2018; Zhaoyang et al., 2020), and longevity (Mroczek et al., 2015).

Recommendations.—Assessing dynamic resilience processes as stable individual differences requires measures that are reliable and sensitive to intraindividual change. A challenge in assessing the reliability of person-specific estimates (random slopes) that reflect daily stress reactivity is that it is unknown how many measurement occasions are needed for the individual slope estimates to be accurate and valid measures of interindividual differences. These problems can be addressed by applying a dynamic structural equation model approach in which the random effects are treated as latent variables in a general latent variable model framework (Asparouhov et al., 2018; Hamaker et al., 2018). Using simulated data on daily stress reactivity and change in affective distress, Brose et al. (2022) demonstrated that parameter estimates became closer to the true parameter estimates when a one-step multilevel structural equation model (MSEM) approach was used compared with a two-step approach.

In addition to linking dampened reactivity to changes in well-being, MSEM approaches that incorporate measurement-burst designs (Nesselroade, 1991b; Sliwinski, 2008) can be used to establish the temporal stability of interindividual differences in daily resilience processes. Life-span developmentalists have long recognized the importance of longitudinal designs for understanding temporal aspects of development, including intraindividual variability and intraindividual change (Baltes & Nesselroade, 1979; Nesselroade, 1991a; Wohlwill, 1973). Figure 1 illustrates a design that consists of intensive “bursts” of measurements obtained over micro timescales (e.g., hours, days, weeks) from a single individual and that are repeated over macro timescales (e.g., years, decades).

Employing two-wave measurement burst data from the National Study of Daily Experiences, Rush et al. (2019) reported a significant average intraindividual association in stress reactivity across bursts, albeit with considerable variability in the strength of the association within each burst. Using an MSEM approach, future work could benefit from assessing the timing of effects or temporal specificity of associations between dampened reactivity and

well-being and the extent to which they exert reciprocal effects on each other (Brose et al., 2022; Rush et al., 2019).

Accelerated recovery

Beyond reactivity, recent theory and research suggest that interindividual differences in the rate of affective recovery from daily stressors may also have implications for long-term health. Whereas dampened reactivity reflects the magnitude of responses to stress, accelerated recovery reflects the speed with which stress responses return to baseline (Epel et al., 2018).

Measurement.—Affective recovery can be estimated as the regression coefficient (β_{1j}) in a within-persons regression model,

$$\text{Affect}_{ij} = \beta_{0j} + \beta_{1j}\left(\text{stressor}_{ij-1}\right) + r_{ij},$$

where the stressor_{ij} variable is a binary indicator that distinguishes event and nonevent occasions. The regression coefficient β_{1j} captures the expected change in affect for person *j* in response to a stressor event experienced on the previous day (Leger et al., 2018).

Associations with mental and physical health.—Like differences in stressor reactivity, individuals differ in the rate or speed with which they recover from daily stressors. Using a daily burst design (i.e., 8-day diary study nested within a 10-year longitudinal study design), Leger et al. (2018) demonstrated that temporary or short-lived NA in response to daily stressors was associated with fewer numbers of chronic conditions and lower functional impairment 10 years later. Likewise, Bergeman and Deboeck (2014) found the interindividual differences in the rate of stress reduction or dissipation was inversely associated with depressive symptoms over a 5-year period. These findings demonstrate the unique contribution of daily process studies to elucidating dynamic resilience processes (e.g., dampened reactivity and accelerated recovery). Collectively, these studies show how daily study designs can be incorporated into longitudinal studies to make inferences about intraindividual dynamics, which thereby generates more highly predictive models of stress and health (Epel et al., 2018). Critically, the scope of these investigations offers insights into daily processes that simply could not have been ascertained from traditional trait reports of resilience assessed at a single point in time (Kalisch et al., 2017).

Recommendations.—Dynamic operationalizations of stress recovery depend crucially on the length of time between measurements. Linking retrospective reports of daily stress and affect over an entire day may thus obscure recovery processes that manifest across relatively faster timescales (e.g., minutes, hours). More frequent measurement bursts

assessed at shorter intervals would therefore permit a better understanding of stress-recovery processes as they naturally occur in daily life (Hamaker et al., 2015). More generally, daily process studies of stress reactivity and recovery should be broadened to include measures of health that go beyond self-report (Gordon & Mendes, 2021; Leger et al., 2018). Experimental studies have assessed physiological recovery from laboratory-based stressors and their links to physical health (e.g., Panaite et al., 2015; Steptoe & Marmot, 2005). Future studies that combine experimental manipulations, intensive longitudinal designs, and objective indices of physical health may yield new insights into the dynamic mechanisms involved in accelerated recovery from daily stressors. Finally, from the perspective of psychological traits, consistency in idiographic structure (i.e., intraindividual variability patterns defined across time and situations) is fundamental to understanding individual differences in personality (Beck & Jackson, 2020; Shoda et al., 1994). Yet evidence for temporal stability and cross-situational consistency in stressor reactivity and recovery have not been established and therefore constitute an important future research direction. Furthermore, the potential contaminating influence of personality traits, such as neuroticism, on the relation between affective reactivity/recovery and health has received scant attention (but see Sin et al., 2015; Stanton et al., 2019). Hence, an important methodological issue for future studies of interindividual differences in resilience processes and health is whether associations are independent of neuroticism and allied personality traits.

Toughening and inoculation

Although much work has focused on resilience as the capacity to absorb and recover from stressful events, there is growing evidence that stressful experiences themselves may also contribute to the capacity for resilience (Seery et al., 2010). This conceptualization of resilience holds that stressors that are challenging but manageable can play an adaptive role in preparing individuals for coping with later stressors, a protective phenomenon referred to as *toughening* or *inoculation* (Dienstbier, 1989; Meichenbaum, 1993). Note that toughening and inoculation effects are not limited to major life adversities but may also influence adaptation to minor daily stressors. DiCorcia and Tronick (2011) reviewed developmental research that showed successful regulation of everyday stressors scaffolded by caregiver reparatory sensitivity prepares infants for coping with subsequent stressors. Seery and Quinton (2016) reviewed social-psychological evidence demonstrating U-shaped relationships between daily stressor exposure and wellbeing. Although this research did not directly employ intensive longitudinal designs, it underscores the potential of daily process studies to advance understanding of the protective benefits or toughening qualities of daily stressor exposure that until now have been ascribed to cumulative lifetime adversities (Seery et al., 2010).

Measurement.—One component of everyday stressor exposure that may be of particular importance for health is the effect of stressor pile-up in daily life (Schilling & Diehl, 2014; Smyth et al., 2018). Researchers interested in stressor pileup have used various indices to quantify patterns of stressor accumulation (e.g., frequency counts of daily stressors, number of stressor reactivity-recover cycles). According to Schilling and Diehl (2014), stressor pileup can be expressed with the following equation:

$$A_{(k)ti} = \frac{\sum_{j=1}^{k}(k-j+1)S_{(t-j)i}}{\sum_{j=1}^{k} j},$$

where

$A_{(k)ti}$

is an index of stressor pileup across

k

days for individual

i

and

k

specifies the number of days that precede day

t

(Schilling & Diehl, 2014).

Associations with mental and physical health.—Research suggests that stressor pileup is a common daily phenomenon (Almeida et al., 2002; Bolger et al., 1989) that can have adverse consequences for mental health and well-being, especially in the short term (Bolger & Schilling, 1991; Grzywacz & Almeida, 2008; Serido et al., 2004). Using data from a 30-day diary study, Schilling and Diehl (2014) found that stressor pileup over the course of a week had an independent effect on daily NA, above and beyond the effect of concurrent daily stress. In a coordinated analysis of data from two ecological-momentary-assessment (EMA) studies, Almeida and colleagues (2020) reported that greater stressor pileup was more strongly associated with physical activity compared with reactivity and recovery. Extending this research to a clinical sample, Smith et al. (2021) found that the cumulative buildup of stressors over recent hours predicted greater subsequent binge-eating symptoms among adults with binge-eating disorder.

Recommendations.—Although exposure to mild everyday stressors has been theorized to foster resilience (Seery & Quinton, 2016), this has yet to be tested empirically using intensive longitudinal data. To the extent that exposure to daily stressors builds resilience through toughness and inoculation, individual differences in daily stressor accumulation and pileup should demonstrate U-shape relationships with well-being such that moderate levels of stressor pileup (relative to no or high levels) contribute to improved health over time. Charles et al. (2021) provided some evidence consistent with this premise; they found, in a sample of adults, that leading a stress-free life, although associated with higher emotion well-being, may be linked to lower cognitive functioning. A potential fruitful direction for future work would be to explicitly test curvilinear relationships between daily stressor pileup and subsequent health.

To date, almost all investigations of daily stress processes have created aggregate measures of individual differences and then drawn inferences about more dynamic processes that underlie psychological adjustment. In contrast, the study by Almeida et al. (2020) used a intraindividual approach to capture everyday stress processes and demonstrated substantial

variation in the temporal patterning of stressor pileup both within and across days. This approach represents a significant advance in the assessment of stressor pileup because it allows researchers to begin to explicitly test resilience processes (e.g., toughening and inoculation) across different timescales as they unfold in real time and in individuals' natural environments. Do low to moderate levels of stressor pileup reflect adaptive flexibility such that exposure to some stress in daily life is more likely to provide opportunities to develop toughness than exposure to either no stress or high stress? Do toughening mechanisms (e.g., mastery, perceived control, and belief in the ability to cope) that have been theorized to account for resilience in the face of major life adversities (Seery et al., 2010) also explain how and why exposure to minor daily hassles may be beneficial to overall mental health and well-being? To date, no studies have systematically examined these questions.

Richness and balance

Distinguished from cumulative stressor counts are indices that capture stressor diversity, or the richness and balance of "hassles" (e.g., home chores, work deadlines, interpersonal tensions) across multiple domains of daily life. Consistent with a conservation model of stress (Hobfoll, 1989), high stressor diversity theoretically functions as a resource that confers differential wellbeing (Koffer et al., 2016). Following techniques used in the natural sciences to assess the biodiversity of ecosystems (Magurran, 2004; Morin, 1999), researchers have used measures of diversity to assess a variety of social and psychological phenomena, including racial and ethnic diversity (Budescu & Budescu, 2012), behavioral flexibility (Ram et al., 2012), population genetics (Sherwin, 2010), community social networks (Li et al., 2015), emotional diversity (Ong et al., 2018; Quoidbach et al., 2014; Urban-Wojcik et al., 2022), and activity diversity (Lee et al., 2018, 2022).

Measurement.—Stressor diversity can be estimated using Shannon's (1948) entropy:

$$SD_i = -\left(\frac{1}{\ln(m)}\right)\sum_{j=1}^{m} p_{ij}\ln p_{ij},$$

where
SD_i
is an index that quantifies the relative variety or
richness and evenness or balance in stressor experiences
(j)
across all study days for individual
i
(Koffer et al., 2016).

Associations with mental and physical health.—Employing data from two independent diary studies, Koffer and colleagues (Koffer et al., 2016, 2018) used an entropy index to quantify the dispersion of daily stressors across multiple domains (e.g., health, financial, work, interpersonal) and found that higher daily stressor diversity was associated with lower NA and weaker links between daily stressor exposure and NA. Using EMA data, Koffer et al. (2020) reported that lower stressor diversity (i.e., higher number of stressors

concentrated in one domain) coupled with higher stressor exposure was associated with higher diastolic blood pressure in a sample of middle-aged adults.

Recommendations.—The number of stressor events sampled may affect the interpretation of stressor diversity and its association with health and well-being. Coarse assessments of individuals' overall stressor ecosystems could restrict the degree to which richness and balance of stressful experiences are adequately captured (see Brown & Coyne, 2017). Thus, future research should examine whether the number of stressors assessed influences the rank order of stressor-diversity scores (see Benson et al., 2018). Furthermore, whereas extant work has focused on the immediate consequences of stressor richness and balance, it is plausible that exposure to many types of daily stressors that are appraised as manageable rather than overwhelming may also contribute to the propensity for resilience to future stressors, be they major life adversities or minor daily hassles (Seery & Quinton, 2016). Finally, methods used to operationalize stressor diversity, such as Shannon's entropy, assume that stressor events are independent and identically distributed across time (Ram & Gerstorf, 2009). This assumption is untenable, however, when stressors are conceptualized as continuous phenomena. One such class of stressors are chronic strains that represent unresolved, recurrent demands that people face in their daily lives (Pearlin & Skaff, 1996). Here, alternative diversity indices that incorporate heterogeneity in time-series data, such as measures of turbulence (Koffer et al., 2016), may be used to quantify the amount and distribution of individuals' daily stressor exposure.

Examples of turbulent variation abound in nature. Unchecked by natural controls, invasive species, for example, can spread quickly and displace native plants, animals, and other organisms, which causes dramatic biodiversity loss and ecosystem degradation. In a similar vein, differential exposure to turbulent (stochastic) daily stressors may disrupt the continuity of everyday life and, over time, threaten the health and functioning of the emotional ecosystem (Quoidbach et al., 2014). By contrast, low turbulent stressor ecologies may be characterized by greater homogeneity (predictability) in patterns of daily stressor exposure (Ram et al., 2017).

Integrating Life-Span Principles in the Study of Resilience

As the preceding discussions suggest, resilience is a heterogeneous construct that encompasses an array of dynamic processes, including dampened reactivity, rapid recovery, moderate stressor exposure, and high stressor diversity. We have argued that a daily process conceptualization of resilience may reveal the adaptive ways in which individuals respond to stressors in everyday life and thereby complement traditional formulations of resilience that primarily focus on major life adversities (Luthar et al., 2000; Zautra et al., 2008). In this final section, we summarize key principles and concepts from life-span theory and their implications for advancing the study of resilience in daily life. Although some of these concepts are inherent in previous models of resilience, a life-span perspective provides an interpretive framework for understanding variation in resilient functioning (Infurna, 2021; Staudinger et al., 1993).

Multidirectionality and multidimensionality

A key insight from life-span theory is that the development of adaptive capacities throughout life is characterized by the simultaneous unfolding of increases, decreases, and maintenance in functioning. Furthermore, development is a process that spans multiple domains such that decrements in one domain may coexist with stability or even increments in other domains. Taken together, these multidirectionality and multidimensionality perspectives may help to explain the heterogeneity in functioning across domains observed among people labeled as resilient (Luthar, 2006). Indeed, evidence of discordance between behavior and physiological functioning has led some scholars to question whether resilience is a veridical construct or one that is only "skin deep" (Brody et al., 2013). Yet as developmentalists have pointed out, resilience is not an "across-the-board phenomenon" (Infurna & Luthar, 2017; Luthar, 2006), and adaptation across diverse spheres of functioning is never uniform but manifest in co-occurring profiles of successive gains and losses (Staudinger et al., 1993).

Translating multidirectional and multidimensional conceptions of adaptation to empirically tractable questions is critical for advancing the study of resilience in daily life. To what extent do daily manifestations of dampened reactivity, accelerated recovery, toughening, and stressor richness and balance change across the life span? How does the timing, direction, and rate of change in these resilience processes differ before and after adversity? Do affective and nonaffective domains of resilience in daily life constitute related, but distinct, processes (Nezlek, 2005)? Although there is growing recognition of the multidirectional and multidimensional nature of resilience to major life stressors (Infurna & Luthar, 2017), little is known about how resilience processes cohere across multiple domains (e.g., affective, cognitive, physiological) in daily life. Furthermore, to date, the resilience literature has largely focused on single outcomes, which prevents a comparison of trajectories of adaptation within and across different domains of functioning (Infurna & Luthar, 2017). How to relate resilience processes that manifest on micro timescales (e.g., hours, days) to "varieties" in resilient outcomes (Ryff et al., 2012) that unfold over macro timescales (e.g., years, decades)? The answers to these questions await further investigation.

Plasticity and reserve capacity

From a life-span perspective, whether individuals can sustain, recover, or benefit from adversity depends critically on the degree of adaptive potential, or *plasticity* (Staudinger et al., 1993). Furthermore, the extent to which such adaptive plasticity protects against future stressors is reflected in the level and accumulation of latent capabilities, or *reserve capacity* (Cullati et al., 2018). Although the concepts of plasticity and reserve capacity have been recognized in life-course models of resilience (Gallo et al., 2009; Ryff & Singer, 2008), their explicit connections to resilience in daily life have not been addressed.

Incorporating life-span principles more systematically into daily process research can enhance understanding of resilience to everyday stressors. Is plasticity or intraindividual variability in short-term resilience processes (e.g., dampened reactivity, toughening) modifiable through intervention (Baltes, 1987; Staudinger et al., 1993)? When one considers the timing of potential interventions, is midlife a critical, more malleable period in the life course for examining resilience in the face of challenge or the potential for change and

plasticity (Infurna, 2021)? If so, what effect will preventive interventions in midlife have on catalyzing future benefits in the form of greater reserve capacity in later life? Pursuit of these questions may lead to important insights into how intensive longitudinal designs can be incorporated into randomized controlled studies of resilience to determine causal intraindividual mechanisms (Hamaker & Wichers, 2017).

Conclusion

The study of resilience in everyday life offers critically needed complements to existing research on potential trauma and extreme adversity. In this review, we have discussed the utility of four idiographic indices (i.e., dampened reactivity, accelerated recovery, toughness/inoculation, and richness/balance) and key principles of life-span development (i.e., multidirectionality, multidimensionality, plasticity, and reserve capacity) that warrant greater attention in daily process studies of resilience. Continued research in this area will deepen understanding of the mechanisms by which individuals' inherent capacity for change, conceived as dynamic daily processes, exert their health-promoting effects. Beyond dynamic models that depict life as it is lived, daily process research holds great promise for unifying diverse formulations of resilience across the child and adult literatures (e.g., sustainability, recovery, steeling), thereby affording greater insight into what it means to be well in the face of adversity.

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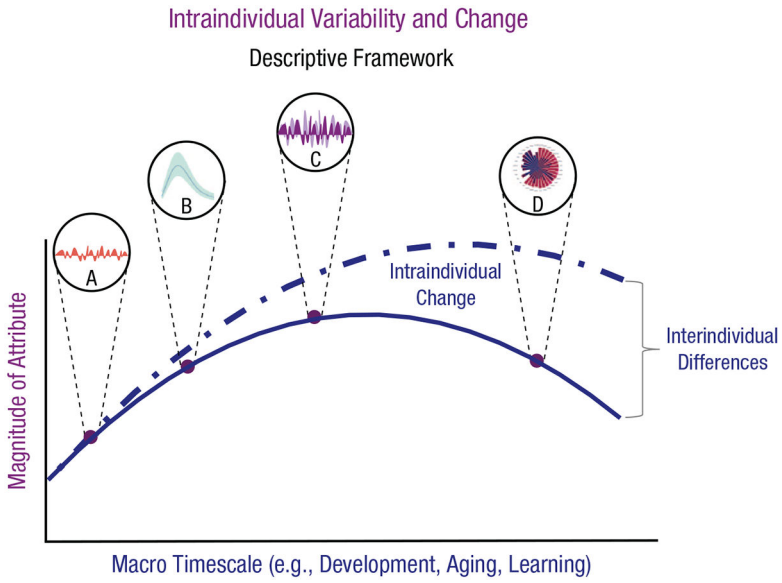

Fig. 1.

A visual representation of resilience operating across different timescales, including both short-term dynamics (intraindividual variability) and long-term changes (intraindividual change). Dynamic resilience processes are characterized as intensive “bursts” of measurements and depicted in magnified circles A (dampened reactivity), B (accelerated recovery), C (toughness/inoculation), and D (richness/balance). The solid line connecting the bursts represents long-term intraindividual-change processes (e.g., development) that accrue with advancing age. The dashed line indicates each person’s mean level of the attribute. Figure based on figures in Nesselroade (1991b), Ram and Gerstorf (2009), and Benson and Ram (2018).

Table 1.

Glossary of Terms

Construct	Definition
Inoculation/toughening	Psychological and physiological changes that promote effective coping, including appraising stressors as more manageable (rather than overwhelming)
Intensive longitudinal methods	Methods that employ repeated assessments of individuals (e.g., experience sampling, daily diary) that allow researchers to study people's thoughts, emotions, and behavior
Interindividual differences	Between-persons characteristics that are relatively stable over time
Intraindividual change	Enduring, long-term change over macro timescale (e.g., years, decades) because of developmental or aging effects
Intraindividual variability	Short-term fluctuations over micro timescales (e.g., days, weeks) because of individual adaptation or contextual influences
Measurement-burst designs	A design that incorporates bursts of intensive repeated assessment within a relatively short period of time and are repeated longitudinally over more widely spaced intervals
Multidimensionality	The complex interplay of factors that influence development across the life span, including biological, cognitive, and socioemotional changes
Multidirectionality	Adaptive capacities throughout life that are characterized by the simultaneous unfolding of increases, decreases, and maintenance in functioning
Plasticity	The capacity to change in response to experience or environmental stimulation throughout the life span
Reactivity	Changes in affect, cognition, or physiology in response to daily stressors
Recovery	Reduced activation levels in affect, cognition, and physiology following a stressor
Reserve capacity	Level and accumulation of latent capabilities or individual resources for responding effectively to challenging conditions
Resilience processes	Adaptive responses to daily stressors (i.e., dampened reactivity, accelerated recovery, toughness/inoculation, richness/balance) that increase the likelihood of subsequent health and well-being
Resiliency	The capacity of a dynamic system to adaptively respond to environmental adversity
Richness and balance, or diversity	The spread of stressors across multiple domains of daily life
Steeling	The propensity for prior stressor exposure to increase coping capacity in the face of future stressors
Stressor pileup	Cumulative stressors that build up over a period of time
Sustainability	The maintenance of health and well-being in the face of stressors
Turbulence	A type of diversity index that incorporates contiguity in time-series data

Table 2.

Overview of Studies Examining Links Between Resilience Processes and Health Outcomes

Study	Predictor	Outcome	Summary of findings
Almeida et al. (2020)	Reactivity, recovery, and pileup	Physical activity	Greater stressor pileup, but not NA reactivity or recovery, predicted lower subsequent levels of physical activity.
Anderson et al. (2021)	NA reactivity	Depressive and anxiety symptoms	Dampened NA reactivity in Latinx high school students predicted decreased depressive symptoms, but not anxiety symptoms, during the first year of college.
Bai et al. (2020)	PA and NA reactivity	Internalizing problems	Dampened NA and PA reactivity in response to school stressors predicted fewer internalizing problems across 3 years in children ages 8 to 13.
Bergeman & Deboeck (2014)	Rate of stress dissipation	Depressive symptoms	Higher rates of stress dissipation predicted lower depressive symptoms, particularly in individuals low in trait resistance.
Booij et al. (2018)	PA and NA reactivity	Psychotic and depressive symptoms	Attenuated PA and NA reactivity predicted lower depressive symptoms, but not psychotic symptoms, in a general population.
Charles et al. (2013)	NA reactivity	General affective distress/an affective disorder	Dampened NA reactivity predicted lower general affective distress and decreased likelihood of an affective disorder.
Charles et al. (2021)	Stressor exposure	Affective well-being, chronic conditions, and cognitive functioning	Experiencing no daily stressors was related to better physical and emotional well-being and lower levels of cognitive functioning.
Chiang et al. (2018)	NA reactivity	Mortality	Dampened NA reactivity predicted lower mortality in adults with chronic illness.
Cohen et al. (2005)	NA reactivity	Depression reduction and depressive symptoms	Attenuated NA reactivity predicted lower depressive symptoms.
Drake et al. (2021)	NA reactivity	Flourishing	Dampened NA reactivity was associated with higher levels of flourishing.
Koffer et al. (2020)	Stressor diversity	Blood pressure	Lower stressor diversity was related to higher diastolic blood pressure in older adulthood.
Koffer et al. (2016)	Stressor diversity	Affective well-being	Higher stressor diversity was linked with better affective well-being.
Leger et al. (2018)	NA the day after a stressor	Chronic conditions and functional limitations	Lower NA the day following a stressful event predicted fewer chronic conditions and functional limitations over a period of 10 years.
Mroczek et al. (2015)	NA and PA reactivity	Mortality	Dampened PA reactivity predicted lower mortality risk, but NA reactivity did not.
Ong et al. (2013)	PA reactivity	Sleep outcomes—rest and quality	Attenuated PA reactivity was associated with impaired sleep, especially in people high in trait PA.
Ong et al. (2018)	PA and NA reactivity	Depressive symptoms	Dampened NA and PA reactivity to daily discrimination predicted lower depressive symptoms among African Americans.
Ong et al. (2020)	NA reactivity	Marital quality	Dampened NA reactivity predicted better marital quality 10 years later. This was moderated by HRV.
Piazza et al. (2013)	NA reactivity	Chronic conditions	Dampened NA reactivity predicted decreased risk of chronic health conditions.
Piazza et al. (2019)	NA reactivity	Allostatic load	Dampened NA reactivity predicted lower allostatic load but only among older adults with high levels of stressor exposure.
Rook et al. (2016)	NA reactivity	Blood glucose levels	Decreased NA reactivity predicted lower fasting glucose levels in patients with diabetes.
Rush et al. (2019)	NA reactivity	Life satisfaction, PWB	Decreased NA reactivity over time predicted higher levels of life satisfaction and PWB.

Study	Predictor	Outcome	Summary of findings
Schilling & Diehl (2014)	Pileup	Affective well-being	Stressor pileup over the week was associated with increases in NA but not PA.
Selcuk et al. (2016)	NA reactivity	Changes in PWB	NA reactivity mediated the relationship between partner responsiveness and PWB; decreased NA reactivity predicted higher PWB.
Sin et al. (2015)	NA and PA reactivity	Inflammation (Il-6, CRP)	Attenuated NA reactivity predicted greater levels of subsequent PWB. Decreased PA reactivity was associated with lower Il-6; decreased NA reactivity was associated with higher CRP among women.
Sin et al. (2015)	NA reactivity	HRV (SDRR, HF-HRV, RMSSD)	Decreased NA reactivity was associated with higher heart rate variability.
Smith et al. (2021)	Reactivity, recovery, and pileup	Binge eating disorder	Stressor pileup, but not reactivity or recovery, was associated with more binge-eating symptoms in adults with binge-eating disorder.
Stanton et al. (2019)	NA and PA reactivity	Mortality	NA reactivity, but not PA reactivity, mediated the relationship between partner responsiveness and mortality; dampened NA reactivity predicted lower mortality risk.
Zhaoyang et al. (2020)	PA and NA reactivity	Depressive symptoms	Dampened PA reactivity predicted decreased depressive symptoms over 18 months—NA reactivity did not.

Note: For studies that used indices of reactivity and recovery, results are summarized on a continuum, ranging from resilience to vulnerability. NA = negative affect; PA = positive affect; HRV = heart rate variability; PWB = psychological well-being; Il-6 = Interleukin-6; CRP = C-reactive protein; SDRR = standard deviation of R-R intervals; HF-HRV = high frequency HRV, RMSSD = root mean square of successive differences.