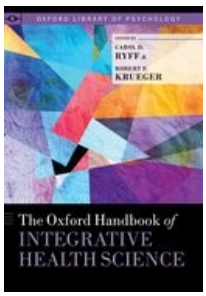

The Oxford Handbook of Integrative Health Science

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https://doi.org/10.1093/oxfordhb/9780190676384.001.0001

Published online: 09 October 2018 **Published in print:** 29 November 2018 **Online ISBN:** 9780190676407 **Print ISBN:** 9780190676384

CHAPTER

25 Distinguishing Between Enduring and Fragile Positive Affect: Implications for Health and Well-Being in Midlife

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https://doi.org/10.1093/oxfordhb/9780190676384.013.35 Pages 343–354

Published: 09 October 2018

Abstract

Considerable theory and research on positive affect (PA) reveals that high PA relates to adaptive outcomes. Increasingly, however, it has become clear that high PA also has a costly side, as it sometimes relates to adverse outcomes, such as intense psychological distress, risky health behaviors, and even early mortality. This chapter appraises the existing body of empirical evidence and discusses how frameworks that consider both stable and dynamic forms of PA can help reconcile conflicting evidence concerning the association between PA and diverse health outcomes. Drawing on survey, daily diary, and biological data from the Midlife in the United States (MIDUS) study, empirical findings and ongoing studies of middle-aged adults are summarized. The chapter concludes with a discussion of integrative research opportunities afforded by MIDUS.

Keywords: positive affect, health outcomes, Midlife in the United States Study, MIDUS, middle-aged adults, health

Subject: Health Psychology, Psychology

Series: Oxford Library of Psychology

Collection: Oxford Handbooks Online

Introduction

There is growing evidence that positive affect (PA) is associated with reduced risk of coronary heart disease and stroke, two of the leading causes of death in the United States (Boehm & Kubzansky, 2012; Diener & Chan 2011; Pressman & Cohen, 2005). Moreover, meta-analyses of longitudinal observational studies indicated that greater PA is associated with increased survival, independent of comorbidities (Chida & Steptoe, 2008; Howell, Kern, & Lyubomirsky, 2007). These findings are further supported by longitudinal studies linking hedonic well-being (i.e., feelings of happiness and enjoyment) to lower mortality (Davidson, Mostofsky, & Whang, 2010; Martín-María et al., 2017; Steptoe & Wardle, 2012; Xu & Roberts, 2010; Zaninotto, Wardle, & Steptoe, 2016).

Encompassing both interindividual differences (e.g., affective traits) as well as intraindividual variability (e.g., dynamic states), *positive affect* refers to the extent to which a person experiences pleasurable emotions, such as happiness, joy, excitement, enthusiasm, and contentment (Lyubomirsky, King, & Diener, 2005). Efforts to understand the mechanisms linking PA and health have focused on restorative *health behaviors*, such as sleep quality and quantity (e.g., Ong et al., 2013; Ong, Kim, Young, & Steptoe, 2017; Steptoe, O'Donnell, Marmot, & Wardle, 2008); *psychobiological processes*, including neuroendocrine, immune, and cardiovascular responses (e.g., Ong & Allaire, 2005; Ong, Fuller-Rowell, Bonanno, & Almeida, 2011; Steptoe, Gibson, Hamer, & Wardle, 2007; Steptoe & Wardle, 2011); and *stress-buffering* or protective effects (e.g., Cohen, Alper, Doyle, Treanor, & Turner, 2006; Fredrickson, Mancuso, Branigan, & Tugade, 2000; Ong, Bergeman, Bisconti, & Wallace, 2006).

Contrasting with the evidence of links between PA and adaptive functioning, there is increasing evidence
p. 344 that high PA also has a "dark side" ↳ (Gruber, Mauss, & Tamir, 2011) that is associated with intense psychological distress (Diener, Colvin, Pavot, & Allman, 1991); risky health behaviors (Martin et al., 2002); and early mortality (Friedman et al., 1993). Grant and Schwartz (2011) reviewed a broad range of evidence indicating that at very high levels, positive traits and experiences may undermine individuals' psychological and physical well-being. Oishi, Diener, and Lucas (2007), in an analysis of longitudinal data, found a nonmonotonic association between dispositional affect (defined as self-rated cheerfulness at college entry) and income, such that respondents who were moderately cheerful on entering college earned the most money 19 years later, while those who were extremely cheerful earned less. In some instances, for example, in mania and bipolar disorder, an excessive degree of PA is a core marker of psychopathology (for a review, see Gruber, 2011; Gruber et al., 2011).

Is There More to Positive Affect Than Whether It Is High or Low?

To date, most conceptualizations of PA have focused on the implications of possessing high versus low levels of "trait" PA. However, another aspect of PA might be important, namely, the degree of fluctuation or intraindividual variability in individuals' PA states over time. In this chapter, we report on our research in the Midlife in the United States (MIDUS) study as well as prior literature examining PA level and various forms of PA dynamics in relation to health. *PA level* refers to interindividual differences in the average level of positive feelings. In contrast, *PA dynamics* refers to short-term changes in PA that unfold over time. We discuss how a framework that considers both PA level and PA dynamics can help reconcile when high PA is conducive or detrimental to health. Drawing on our work in MIDUS, we highlight the utility of analytic methods that allow for the assessment of affective dynamics and suggest that examination of dynamic patterns may help reveal both risk-protective and risk-augmenting effects associated with high PA. Finally, we discuss the roles of both PA level and PA dynamics and their implications for models of emotional aging and theoretical perspectives on positive psychological well-being. We conclude with a discussion of several unresolved methodological challenges concerning PA, health, and aging that we believe deserve further attention, as well as opportunities in MIDUS for addressing these questions.

Overview of Positive Affect and Health in MIDUS

MIDUS is a longitudinal study designed to investigate the role of behavioral, psychological, and social factors in accounting for age-related variations in health and well-being in a national sample of Americans (Brim, Ryff, & Kessler, 2004). In the first wave of MIDUS (beginning 1995), over 7,000 adults ages 25–74 completed baseline assessments of demographics, psychosocial constructs, and self-reported health via telephone and self-administered questionnaires. Trait PA was assessed by asking participants to rate how much of the time in the past 30 days they had felt each of these six emotions: *cheerful, in good spirits, extremely happy, calm and peaceful, satisfied,* and *full of life* (Mroczek & Kolarz, 1998). Furthermore, a random subset of 1,499 participants were enrolled in a daily diary substudy, during which they reported on nightly telephone interviews for eight consecutive evenings how often they felt *in good spirits* each day (Almeida, 2005). These repeated assessments of daily PA enabled the examination of intraindividual dynamics in PA and its prospective associations with health and well-being. Data collection for the second wave of MIDUS (2004–2007) expanded on these assessments by including 13 daily PA items to the daily diary substudy, in addition to new cognitive, biological, and neurological measures. The study of PA and health in MIDUS is further bolstered by the expansion of the sample in the MIDUS Refresher study, as well as assessments of trait PA and biomarkers in the Midlife in Japan (MIDJA) study. The third wave of MIDUS data collection—currently under way for the daily diary, biomarker, gene expression, and neuroscience projects—will offer unparalleled opportunities for examining PA and its associations with biological markers of health and well-being across time scales spanning from days to decades.

What Does It Mean to Have Fragile Positive Affect?

In the wake of research suggesting there is perhaps a dark side to high PA, an alternative view of PA has emerged, one where high PA is viewed as a heterogeneous construct rather than a unidimensional label. In particular, in one formulation of the heterogeneity of PA, Ong and Ram (2017) characterized an individual's PA along a fragile-versus-enduring continuum. Whereas PA that is enduring reflects global feeling states
p. 345 that are ↳ relatively stable across time, PA that is fragile reflects feeling states that are fluctuating, variable, and subject to external influence. In this section, we focus on two markers of PA fragility that have been used in investigations of mental and physical health: affective variability and affective reactivity. Although other markers of affect dynamics have been studied (e.g., instability and inertia; Brans, Koval, Verduyn, Lim, & Kuppens, 2013; Hohn et al., 2013), we focus on these two markers because they capture the extent to which the ebb and flow of affect is influenced by various factors, both internal and external to the person. As a guide for understanding the investigation of enduring and fragile PA, we describe the fragile and enduring formulations of these constructs, how these constructs have been measured in prior work, and their associations with health and well-being.

Intraindividual Affective Variability

Conceptualization

Positive affect and negative affect (NA) fluctuate over time, with intraindividual *affective variability* indicating the extent to which affect fluctuates over a specific period of time (e.g., across 8 days in the MIDUS daily diary). Of theoretical interest is quantifying an individual's range of behavioral experience.

Measurement

Of the many indices and models available, the intraindividual standard deviation (*iSD*) is by far the most popular index of intraindividual variability (Ram & Gerstorf, 2009). Formally, affective variability is most often measured from $t = 1$ to T repeated measures of individual i's affect as

$$iSD_i = \sqrt{\frac{1}{T-1}\sum_{t=1}^{T}\left(affect_{it} - \overline{affect}_i\right)^2}$$

Of note, however, the *iSD* (and other related indices) quantifies the range of individuals' affective experience without concern about the time-ordered repeated-measures nature of intraindividual variability. As a consequence, the use of such indices implies that the ordering of occasions is immaterial and that the same summary information could be obtained even when the data are randomly ordered with respect to time. The assumption is that the repeated observations of the same individual are independent and identically distributed. Consequently, such indices do not indicate anything about the pattern of moment-to-moment changes in affect (e.g., cycles, oscillations, lagged effect), only the total amount of fluctuation of affect (Ebner-Priemer & Trull, 2011). Interpreted with respect to fragile-versus-enduring PA, greater affective variability (e.g., larger *iSD)* might be considered an indicator of fragile PA.

Associations With Mental and Physical Health

In an early investigation, Wessman and Ricks (1966) examined intraindividual variability in daily mood among a small group of Harvard (*N* = 18 men) and Radcliffe (*N* = 25 women) students over a 6-week period. In both men and women, affective variability (operationalized by the *iSD* of daily hedonic level = PA − NA) was independent of average hedonic level (*r* = -.17 in women and *r* = .03 in men). Wessman and Ricks (1966) also reported for their male sample several intriguing psychological correlates of affective variability, such as low denial and repression and high impulsivity and openness.

Since Wessman and Ricks' (1966) now classic work, studies have demonstrated that individual differences in intraindividual affective variability (daily) are stable across time (e.g., Eaton & Funder, 2001; Eid & Diener, 1999; Penner, Shiffman, Paty, & Fritzsche, 1994); significantly heritable (Zheng, Plomin, & von Stumm, 2016); and differentially related to personality traits such as neuroticism and extraversion (Moskowitz & Zuroff, 2004, 2005). Wichers, Wigman, and Myin-Germeys (2015) reviewed empirical data suggesting a link between increased affective variability—particularly variability in NA—and borderline personality disorder, depression, and future psychopathology.

There is also growing interest in the associations of intraindividual variability in PA with psychological and physical health. Gruber, Kogan, Quoidbach, and Mauss (2013) examined PA variability across two studies (using a combination of diary and day reconstruction methods) and found that greater variability in daily PA was associated with lower life satisfaction and higher depression and anxiety. In another investigation, Chan, Zhang, Fung, and Hagger (2016) investigated relations between affective variability and physical health in a large-scale, population-based survey in China. A total of 15,050 adults (ages 18 to 99 years old) reported their affective experiences during the previous day and their history of chronic health conditions
p. 346 (e.g., diabetes, hypertension, depression). Analyses revealed that PA variability was associated with greater
↳ risks of chronic health conditions like angina and depression.

Human et al. (2015) examined the association between within-day PA variability and daily cortisol profiles in samples of middle-aged and older adults. The authors proposed that low PA variability would indicate lack of flexibility to the external environment and that high PA variability would signal excessive reactivity, whereas moderate PA variability might reflect the ability to flexibly and effectively respond to contextual influences. Results indeed revealed a curvilinear relation, such that relative to very low or very high PA intraindividual variability, a moderate degree of PA variability was associated with more favorable hypothalamic–pituitary–adrenal (HPA) axis functioning (i.e., lower levels of cortisol and steeper diurnal cortisol slopes).

Finally, employing data from 793 adults in the first and second waves of the MIDUS daily diary study, Hardy and Segerstrom (2017) examined concurrent and prospective relations between affect variability and physical health, finding that greater daily PA variability was associated at both waves with higher concurrent psychological distress and worse physical health (i.e., self-rated health, chronic conditions, activities of daily living, and medication use), independent of PA level. However, NA variability, but not PA variability, predicted change in psychological and physical health across 10 years in MIDUS.

Importantly, almost all of the reviewed studies herein adjusted for mean PA level in estimating the association between PA variability and health outcomes, making it unlikely that the associations between PA variability and health are conflated with or driven exclusively by differences in individuals' PA level. Intraindividual affective variability is therefore a useful and interpretable indicator of fragility that has long-term consequences for health, as demonstrated by findings from MIDUS. Yet, although affective variability is thought to reflect flexibility (or inflexibility) and responsiveness to the environment (Hardy & Segerstrom, 2017; Human et al., 2015), it does not take into account concurrent contextual influences. We

turn next to the concept of *affective reactivity*, a bivariate construct that captures the within-person coupling between time-varying factors.

Affective Reactivity

Conceptualization

Another form of affective dynamics is *affective reactivity*, generally conceptualized as the magnitude of emotional reactions that are elicited in response to specific "external" events (Charles, Piazza, Mogle, Sliwinski, & Almeida, 2013). Unlike other indices of affective dynamics, measures of affective reactivity directly capture intraindividual *covariation*, specifically the relation between external events and affect. Typically defined as stressor-related changes in NA and PA, heightened affective reactivity theoretically reflects increases in NA (*exacerbation*) as well as decreases in PA (*dampening*) in response to stressor events (Mroczek et al., 2013).

Measurement

Affective reactivity is typically estimated as the regression coefficient, β_i, in a within-person regression model,

$$affect_{i(t)} = \mu_i + \beta_i stressor_{i(t)} + e_{i(t)}$$

where the $stressor_{i(t)}$ variable is an indicator that distinguishes stressor versus nonstressor (or high vs. low stress) occasions. The regression coefficient captures the extent of difference between a person's PA or NA on stressor days compared to nonstressor days. Differences in β_i (i.e., random effects) reflect individual differences in affective reactivity, with some people being more reactive to stressors than others (Ong et al., 2013; Sin, Graham-Engeland, Ong, & Almeida, 2015). In the current discussion, affective reactivity (more negative relation between stressors and PA) might be considered an indicator of fragile PA.

Associations With Mental and Physical Health

Most research to date on how individual differences in affective reactivity (particularly of NA) has been associated with health and well-being have come from MIDUS. This body of research has largely focused on NA reactivity due to the field's long-standing interest in understanding the role of negative emotions in stress and health processes. Evidence using prospective data in MIDUS suggests that NA reactivity to daily stressors is associated with increased risk of mental disorders (Charles et al., 2013) and chronic health conditions (Piazza, Charles, Sliwinski, Mogle, & Almeida, 2013), and diminished eudaimonic well-being (Selcuk, Gunaydin, Ong, & Almeida, 2016), up to a decade later. Furthermore, heightened NA reactivity to
p. 347 daily stressors has been cross-sectionally linked to lower levels of fluid cognitive ability (Stawski, Almeida,
↳ Lachman, Tun, & Rosnick, 2010); higher cortisol (Jacobs et al., 2007); smaller antibody responses to ingested antigens (Stone, Marco, Cruise, Cox, & Neale, 1996); lower resting heart rate variability (indicative of cardiovascular autonomic dysregulation; Sin, Sloan, McKinley, & Almeida, 2016); and elevated inflammation in women (Sin et al., 2015). Health behaviors, including physical inactivity and smoking, have been identified as potential pathways linking NA reactivity to poorer health (Sin et al., 2015).

Although much of the existing literature has focused on NA reactivity to daily stressors, research suggests that PA reactivity to everyday stressors may also account for important individual differences in distal health and well-being outcomes. MIDUS research utilizing within-person measures of affective reactivity

indicates that greater decreases in PA on stressor days—relative to one's PA on nonstressor days—was associated with diminished sleep efficiency, independent of NA reactivity; mean levels of daily affect; and stressor frequency (Ong et al., 2013). Importantly, dynamic PA interacted with trait PA, such that the associations of PA reactivity with poorer sleep efficiency, morning rest, and overall sleep quality were most evident among participants with higher trait PA (Ong et al., 2013). Heightened PA reactivity was also associated with elevated inflammation among 872 midlife adults in the MIDUS daily diary substudy, controlling for NA reactivity and a range of demographic, physical, psychological, and behavioral factors (Sin et al., 2015).

Among college students, O'Neill, Cohen, Tolpin, and Gunthert (2004) demonstrated that heightened PA reactivity to daily interpersonal stressors was a unique vulnerability factor in the development of later depressive symptoms. Likewise, Finan, Zautra, and Davis (2009) observed that failure to maintain PA in the face of daily pain (high affective reactivity) reflected a vulnerability for fibromyalgia patients. Finally, PA reactivity (but not NA reactivity) was associated with doubling of mortality risk across a decade among men in the VA Normative Aging Study (Mroczek et al., 2013). More recently, a MIDUS investigation of affective reactivity and mortality found that greater NA reactivity and PA reactivity in response to everyday stress predicted morality risk over a 20-year period, particularly for individuals with a history of chronic illness (Chiang, Turiano, Mroczek, & Miller, 2018).

New Directions for Integrative Health Research

As the studies reviewed demonstrate, the quantification and study of PA dynamics assessed across days has proven useful and informative in predicting distal psychological and physical health outcomes. Beyond showing that PA dynamics indicate aspects of individuals' function that are distinct from PA level, research on PA dynamics (i.e., variability, reactivity) may help to reveal the heterogeneity among individuals with high or low PA. We discuss the implications of the interplay between PA level and PA dynamics in the next sections.

Unpacking What Is Behind High and Low Positive Affect

Understanding the relations between measures of PA level and markers of PA dynamics may provide a potential explanation for why, at very high levels, PA sometimes confers detrimental outcomes (Gruber et al., 2011). For instance, Diener, Colvin, et al. (1991) reported that people who experienced intense PA were also more likely to experience intense NA. Likewise, Friedman and colleagues found that extremely cheerful people were more likely to engage in risky health behaviors (Martin et al., 2002) that increased their risk of early mortality (Friedman et al., 1993). One hypothesis is that among individuals with high PA, those who are also fragile may have more negative outcomes. Although data are sparse, the previously mentioned findings from MIDUS are congruent with this hypothesis, showing that among individuals high in trait PA, elevated PA reactivity (i.e., defined as the magnitude of change in daily PA in response to daily events) confers an additional vulnerability for poor sleep (Ong et al., 2013).

At the broader level, the studies reviewed here suggest that labeling high PA as either unequivocally "good" or "bad" is not sufficient for a full understanding of PA–health associations. As such, interindividual differences in PA dynamics may be particularly important in distinguishing among various forms of fragile and enduring high PA. That is, fragile PA may manifest in a number of ways. In one manifestation of fragile high PA (i.e., variable high PA), a person may report typically experiencing high PA, yet their day-to-day PA may exhibit considerable short-term fluctuations. In another manifestation of fragile high PA (contingent
p. 348
high PA), a person with generally high levels of PA shows heightened and maladaptive PA reactivity ↳ to everyday events (i.e., severely diminished PA in response to daily stressors). Taken together, these various

potential manifestations of fragile high PA point to the need for an alternative, more nuanced, perspective on positive psychological well-being.

As with fragile high PA, the combination of low PA level and markers of PA dynamics (e.g., variability) may represent a form of fragile low PA that constitutes vulnerability. This assertion is consistent with recent findings suggesting that variability in life satisfaction over time may be a meaningful predictor of health, especially in combination with mean levels. Specifically, in a study of nearly 4,500 middle-aged and older Australians, Boehm, Winning, Segerstrom, and Kubzansky (2015) found that individuals with low mean life satisfaction and high variability in life satisfaction had the greatest risk of mortality over a 9-year follow-up. Nevertheless, other studies suggest the opposite, namely, that fragile low PA may indicate a "mood-brightening" effect whereby individuals experiencing an overall deficit in PA level report improvements in affect (e.g., larger increases in PA) when responding to positive events (Bylsma, Taylor-Clift, & Rottenberg, 2011).

It remains unclear to what extent high or low PA level in combination with PA dynamics is a reliable indicator of vulnerability or resilience. This topic can be examined in MIDUS using trait-like measures of affect administered during the baseline psychosocial survey, the biomarker project, or the neuroscience project, in conjunction with day-to-day and past-week affect obtained from the daily diary substudies. Because PA was assessed in a variety of ways across projects in MIDUS and across three waves spanning 20 years, researchers can evaluate congruence versus incongruence among measures of PA, fluctuations in PA, and long-term stability or change in PA. Combinations of lower versus higher PA level and the different manifestations of PA dynamics can be compared as prognostic indicators for health and well-being outcomes, including development of affective disorders, chronic conditions, and mortality risk. This work would lead to a better understanding of affective dynamics as vulnerability or resilience factors for subsequent well-being, as well as identifying targets for future efforts to improve emotion regulation, stress management, and health.

Adaptive Aging and Positive Psychological Well-Being

A large body of empirical research documents age differences in emotional well-being (Charles, 2010). Cross-sectional and longitudinal studies revealed that negative emotions occur with less frequency with age, whereas positive emotions occur with greater frequency with age, though there is some evidence that these age associations may be moderated by functional health limitations (Kunzmann, Little, & Smith, 2000) and the onset of terminal decline processes (Gerstorf et al., 2010). Additionally, in contrast to younger adults, older adults experience more stable positive emotionality (Carstensen et al., 2011; Mroczek, 2004) and are more adept at maintaining and upregulating PA during unpleasant situations (Riediger, Schmiedek, Wagner, & Lindenberger, 2009; Voelkle, Ebner, Lindenberger, & Riediger, 2013).

Recent work in MIDUS suggests that age differences in NA might be attributable—at least in part—to reconstructive processes, such that older adults tend to appraise and remember emotional experiences less negatively than do younger adults (Charles et al., 2015). The psychosocial processes underlying age differences in PA, on the other hand, are not well understood. For example, do older adults rely more on goals and appraisals when reporting PA compared to younger adults? Are age differences in recall and experience of particular positive emotions (e.g., calm, satisfied, excited, grateful) associated with aging-relevant outcomes, such as health-related quality of life, disability, and disease incidence and progression? These questions can be answered using MIDUS data on affect, social contexts, and emotion-related goals to examine the different factors that contribute to affective dynamics across adulthood.

Although most life span developmental theories of motivation and emotion recognize individual differences in PA as an important outcome of healthy aging, investigations that address the predictive utility of PA

dynamics have been, with a few exceptions (i.e., Carstensen et al., 2011; Mroczek et al., 2013; Rocke & Brose, 2013; Sin et al., 2015), absent in contemporary aging research. This contrasts to inquiry into life span development in other domains where, for example, intraindividual variability in cognitive functioning have been shown to be predictive of subsequent declines in fluid abilities, mild cognitive impairment, and the onset of dementia (Diehl, Hooker, & Sliwinski, 2015). Future research on emotions and aging would benefit
p. 349 from lessons learned in other domains, by examining whether individual differences in PA level and PA dynamics might relate to adaptive aging and health outcomes. There are opportunities ↳ in MIDUS to pursue this line of work, for example, by evaluating PA dynamics as predictors of cognitive and physiological functioning, functional limitations, lifestyle behaviors, and longevity. To the extent that PA dynamics indicates an inability to adapt to the environment, fragility in PA may signal poor emotion regulation, particularly among older adults whose accrual of physiological deficits may accentuate vulnerability to disease and premature mortality (Charles, 2010).

Methodological Challenges

In closing, we discuss five methodological challenges that seem especially important for sharpening our understanding of the nature of fragile (vs. enduring) PA and its role in mental and physical health over the life course. Of primary concern is the limited number of long-term longitudinal studies. Indeed, studies to date have largely been cross-sectional, making it difficult to infer the causal significance of associations between PA dynamics and health. Overall, it is striking just how few studies have addressed the direction of influence. Prospective, multiwave studies such as MIDUS are critically important in advancing the science of PA dynamics and health because they (a) allow for tests of theoretical models of PA that assume stability in PA and in the relations between PA and health over time; (b) help address questions regarding the timescales (durations) on which sustained PA is associated with health outcomes; and (c) can provide evidence about the direction of causality. MIDUS has extensive measures of affect, stress, and health across varying timescales, ranging from days, weeks, and months, up to three decades. These rich data make MIDUS particularly well suited for investigating the pathways—including biological, behavioral, and stress-buffering mechanisms (Ong, 2010)—that underlie the associations of PA level and (daily) dynamics with prospective health outcomes.

The relation among different facets of PA dynamics that act on different timescales (moment to moment, day to day, or year to year— is unknown (Hollenstein, 2015). In a recent study utilizing MIDUS data, Charles and colleagues (2015) demonstrated that age differences in daily NA were more pronounced when people recalled emotions over increasingly longer periods of time (e.g., across a month, a week, or a day). Furthermore, drawing on two measurement bursts of daily diary assessments in MIDUS across 10 years, Sliwinski and colleagues (2009) found that NA reactivity to daily stressors increased longitudinally and was stable across midlife. Nevertheless, NA reactivity varied within persons, such that people were more reactive to daily stressors during times of higher global stress. As the processes underlying fluctuations and changes in individuals' PA states may be different than for NA, determining the timescale(s) on which PA actually operates and the contexts underlying within-person variation in PA dynamics may be crucial to resolving divergent findings in the literature (Houben, Van Den Noortgate, & Kuppens, 2015). Likewise, measures of health may reflect different processes when captured at different timescales. For example, transient increases in inflammatory activity are appropriate and adaptive in the face of immediate threat, whereas persistent inflammation is indicative of physiological dysregulation.

Given that the timescale that is appropriate for capturing affective and health processes will depend on the research question, a major challenge for future research on affect dynamics is to account for temporal complexity by examining affect dynamics and health at multiple timescales simultaneously (Ram & Diehl, 2015; Ram & Gerstorf, 2009). For example, findings from MIDUS and other middle-aged samples indicate

that daily PA tracks with across-day or day-to-day fluctuations in biological and behavioral health indicators, including diurnal cortisol and sleep (Sin, Almeida, et al., 2017; Sin et al., 2015; Sin, Ong, Stawski, & Almeida, 2017). Given that PA can fluctuate rather quickly, the cadence of assessment for moment-to-moment tracking of PA will be a fruitful avenue for future research (see Ram & Reeves, 2018).

Another methodological drawback concerns inadequate assessment of potential alternative explanations for why PA dynamics are related to health. Specifically, there is no consensus regarding which negative psychological states to measure and control for in studies linking PA to health (Boehm & Kubzansky, 2012). Past research has adjusted for various constructs, such as general NA, specific negative emotions, and depressive symptoms. Given that NA may covary with PA (Reich, Zautra, & Davis, 2003), attention to potential confounding by negative arousal states is critical. Researchers should aim to account for NA dynamics that correspond with the PA dynamics under investigation, for example, controlling for NA reactivity when examining PA reactivity (Mroczek et al., 2013; Ong et al., 2013; Sin et al., 2015). Similarly, it is possible that self-report measures of both trait and state PA contain adjectives (e.g., vigor, energetic, alert) that ↳ are confounded with physical health (Pressman & Cohen, 2005). Given the in-depth assessments of positive emotions across different MIDUS projects, this concern might be addressed in future work using MIDUS data by eliminating overlap between the putative measure of PA and the putative measure of health or by including objective measures of physical health.

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Other methodological challenges concern the measurement of PA. In particular, the vast majority of studies rely on self-report measures. Measuring PA using implicit measures that assess automatic processes operating outside of conscious awareness (Quirin, Kazén, & Kuhl, 2009; Quirin, Kazén, Rohrmann, & Kuhl, 2009) could add to our understanding of individual differences in fragile PA processes. Specifically, discrepancies between high explicit PA and low implicit or nonconscious PA may capture another potential form of fragile PA. The measurement of PA also raises questions concerning the role of affective arousal (Ong, 2010; Pressman & Cohen, 2005) and complexity (Ong, Benson, Zautra, & Ram, 2018; Ong, Zautra, & Finan, 2017). The use of diverse modes of PA assessments (e.g., informant reports, behavioral assessments, coding of facial expressions) may help address these concerns, as well as reduce reporting biases (Diener, Sandvik, Pavot, & Gallagher, 1991). These methodological challenges can be further examined and addressed using MIDUS data. For instance, the MIDUS Neuroscience Project has brain-based assessments of reactivity and recovery to positive and negative stimuli. These assessments might serve as an alternative to self-reported affect, in addition to enabling linkages to daily affective dynamics and longer-term retrospective reports of affect.

Beyond the measurement of PA, the measurement of health is also an issue for future work. Notably, most research to date has focused on how individual differences in PA dynamics are associated with vulnerability to ill-being and psychopathology. Less attention has been paid to whether interactions between PA level and PA dynamics account for unique variance in physical health, including physiological systems, onset and progression of disease, and restorative health behaviors. MIDUS affords unique opportunities to advance the science of PA dynamics due to its comprehensive measures of affect, well-being, and biomarkers of health. For example, fragile versus enduring forms of high PA can be linked to physiological functioning across multiple systems (e.g., cardiovascular, metabolic, immune, autonomic), neurobiological substrates, as well as responses to and recovery from laboratory-based stress tasks.

Conclusion

In sum, although there is growing evidence of an association between PA and mental and physical health, full understanding of the phenomenon is far from complete. PA is not only short term and in the moment, but also a more enduring, long-term part of the human experience. The overarching challenge is to integrate different approaches to consider both stable and dynamic aspects of PA. More research is needed to clarify the mechanisms underlying the association between PA dynamics and mental and physical health outcomes in different contexts. For example, in addition to examining PA dynamics among healthy participants, studying adults in MIDUS with health conditions, during life transitions (e.g., retirement, bereavement), and under chronic stress (e.g., caregiving) may enable better understanding of how the normative functions of PA can go awry (Gruber et al., 2011). This work will afford discovery of the specific timescales and contexts in which PA dynamics support or undermine health. Ultimately, comprehensive understanding of PA and how it changes from moment-to-moment and over the life course will require moving beyond the predictive value of PA level (whether it is high or low) to a systematic consideration of the interplay between PA level and various forms of PA dynamics (variability, reactivity) and their relation to health. The challenge for future researchers is to delineate these processes more precisely so that efforts to sustain health and well-being at older ages can be more fully realized. We hope this chapter will stimulate other researchers to assist in this endeavor.

Acknowledgments

Nancy Sin was supported by National Institute on Aging (NIA) grant F32AG048698. Nilam Ram's contributions were supported by the National Institutes of Health (R01 HD076994, P2C HD041025, UL TR000127) and the Penn State Social Science Research Institute. The National Study of Daily Experiences (NSDE) II and NSDE Refresher were supported by NIA grants R01-AG19239 and P01-AG020166. The original Midlife in the United States (MIDUS) study was supported by the John D. and Catherine T. MacArthur Foundation Research Network on Successful Midlife Development. The MIDUS Biomarker project was supported by the following ↳ grants: M01-RR023942 (Georgetown), M01-RR00865 (University of California at Los Angeles) from the General Clinical Research Centers Program, and 1UL1RR025011 (University of Wisconsin, Madison) from the Clinical and Translational Science Award (CTSA) program of the National Center for Research Resources, National Institutes of Health.

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