Social and Personality Psychology Compass 5/8 (2011): 538–551, 10.1111/j.1751-9004.2011.00370.x

The Health Significance of Positive Emotions in Adulthood and Later Life

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Abstract

A growing body of literature supports a link between positive emotions and health in older adults. In this article, we review evidence of the effects of positive emotions on downstream biological processes and meaningful clinical endpoints, such as adult morbidity and mortality. We then present relevant predictions from lifespan theories that suggest changes in cognition and motivation may play an important role in explaining how positive emotions are well maintained in old age, despite pervasive declines in cognitive processes. We conclude by discussing how the application of psychological theory can inform greater understanding of the adaptive significance of positive emotions in adulthood and later life.

The arc of emotion in the second half of life is marked by divergent trajectories. While negative emotions, particularly anger, decline with advancing age, positive emotions remain fairly stable (Carstensen, Pasupathi, Mayr, & Nesselroade, 2000; Charles, Reynolds, & Gatz, 2001). Much of the existing literature has focused on identifying the mechanisms underlying age differences in the regulation and experience of emotion (see Charles & Carstensen, 2009; Scheibe & Carstensen, 2010; Urry & Gross, 2010, for a review). In this article, we highlight studies that chart the health significance of emotional aging. We focus on positive emotions – defined as pleasant feeling states such as joy, contentment, and love that motivate adaptive approach behavior (Fredrickson, 2004).We review evidence of explanatory pathways linking positive emotions and health, giving emphasis to the major approaches, empirical findings, and methodological gaps that currently exist in the literature. We distinguish studies assessing more enduring, stable positive emotions or *traits* from those measuring or inducing short-term changes in positive emotions or *states*. We then summarize relevant predictions from lifespan theories that provide motivational and cognitive accounts of age differences in emotional well-being. We conclude by discussing how integrating existing empirical findings with current theories of emotional aging can offer a more complete understanding of the health significance of positive emotions in adulthood and later life.

Theoretical Mechanisms Linking Positive Emotion to Health

Accumulating evidence supports an association between positive emotion and enhanced physical health (see Chida & Steptoe, 2008; Pressman & Cohen, 2005, for a review). Across experimental and prospective epidemiological studies, significant aspects of adult health influenced by positive emotion include self-reported health, physical functioning, disease severity, and mortality. Although the literature is not without theoretical gaps and

methodological inconsistencies (see Pressman & Cohen, 2005, for a discussion), overall, the data suggest that positive emotions have measureable health benefits, the summative effect of which may be to delay the onset of frank disease and extend healthy functioning in later life.

How might positive emotions influence health in adulthood and later life? Ong (2010) outlined four potential pathways through which positive emotions contribute to adult health outcomes: health behaviors, physiological systems, stressor exposure, and stress undoing (these mirror some of the pathways by which stress and personality affect health; Hawkley & Cacioppo, 2004; Mroczek & Spiro, 2007). Overall, evidence supporting these pathways are apparent both at the level of stable traits and at the level of naturally occurring or induced positive emotional states.

Health behaviors

Considerable associational evidence implicates negative health practices and behaviors in the development of acute and chronic health conditions (Adler & Matthews, 1994). Moreover, because the effects of negative health behaviors (e.g., poor nutrition, a sedentary lifestyle) accumulate with age, older adults are at greater risk for chronic and acute health disorders. Importantly, individual differences in positive emotion may afford protection from health risks by affecting the initiation and maintenance of positive health practices over time. Integrative reviews indicate that trait positive emotion is prospectively associated with greater health-enhancing behaviors that support restorative processes (Pressman & Cohen, 2005; Steptoe, Dockray, & Wardle, 2009). One powerful source of restoration is *sleep*, which provides numerous recuperative benefits. Aging is associated with impairments in sleep quality, including poorer sleep efficiency and greater sleep disturbances (Bloom et al., 2009). While progressive loss of sleep quality can have adverse effects on the body, empirical evidence demonstrates that positive emotions may be conducive to adaptive sleep patterns, especially among older adults (Steptoe, O'Donnell, Marmot, & Wardle, 2008). These findings notwithstanding, a recent meta-analytic review of 54 prospective studies concluded that in healthy older adults (60 years and older), the beneficial effects of psychological well-being on mortality persist even after controlling for health behaviors (Chida & Steptoe, 2008), suggesting that there may be more than one pathway through which positive emotion may exert influence on adult health outcomes.

Physiological systems

Alongside the proliferation of research on behavioral mechanisms has been an increase in studies probing the physiological substrates of positive emotion, particularly in older adults (Ong, 2010; Steptoe, O'Donnell, Badrick, Kumari, & Marmot, 2008). Aging, of course, is associated with progressive decrements in multiple physiological systems (cardiovascular, immunologic, neuroendocrine). These physiological pathways, in turn, are implicated in diverse health outcomes associated with aging, such as diabetes, atherosclerosis, rheumatoid arthritis, and coronary heart disease (Kiecolt-Glaser, McGuire, Robles, & Glaser, 2002). While prolonged activation of neuroendocrine, immune, and cardiovascular systems can have adverse effects on the body, increasing evidence suggests that positive emotion may alter disease risk via dampening of these physiological systems. In an illustrative study, Steptoe, Wardle, and Marmot (2005) showed that after accounting for health status and psychosocial factors, trait positive emotion was

associated with lower salivary cortisol output both on working and nonworking days, lower ambulatory heart rate, and reduced fibrinogen responses (a marker of immune competence). More recent research has highlighted the importance of positive emotion following major life events. For example, using data from the Midlife in the United Sates (MIDUS) survey and the National Study of Daily Experiences (NSDE), Ong, Fuller-Rowell, Bonanno, and Almeida (2011) found that deficits in trait positive emotion following spousal loss fully accounted for the differences in observed diurnal cortisol slopes. Moreover, the associations were independent of trait negative emotion, suggesting that trait positive emotion may have a salutary health effect that is separate from that of psychological distress.

Growing experimental evidence suggests that positive emotion may also influence health by altering aspects of immune function known to affect disease susceptibility. Marsland, Pressman, and Cohen (2007) reviewed eight studies that assessed the effects of induced positive emotion on levels of salivary immunoglobulin A (sIgA), a component of the immune system that is found in saliva and is involved the body's defense against infection. All eight studies reviewed found clear evidence that state positive emotion was related to increases in sIgA levels. Although these studies focused on healthy young adults, these data provide promising evidence that alterations in physiological systems (e.g., via immune function) may represent an important intermediate pathway linking positive emotion with health in later adulthood. Indeed, such effects may be of particular importance for older adults, among whom the accrual of immunological deficits may accentuate susceptibility to disease and early mortality.

Stressor exposure

Linking positive emotion to health necessitates deeper understanding of the environmental mechanisms underlying patterns of age variation in disease states. Individual differences in stressor exposure have long been suspected as contributing to age-related differences in vulnerability to illness and disease. Cohen and Williamson (1991) proposed that stress may interact with age to precipitate the aging of the immune system. Subsequent reviews (e.g., Kiecolt-Glaser & Glaser, 2001) have supported the hypothesis that differential exposure to stressors hastens age-related declines in physical health. By contrast, increasing evidence suggests that positive emotion could directly impact health outcomes by lowering overall stressor exposure. Prospective studies of community-dwelling older adults, for example, indicate that positive emotion is associated with reduced exposure to acute health conditions including incident stroke, myocardial infarction, and rehospitalization for coronary problems (Pressman & Cohen, 2005).

There is also evidence that positive emotion may play a role in mitigating exposure to stressors associated with aging, including pain, inflammation, and disability. For example, using repeated-measures data from a sample of women with osteoarthritis and fibromyalgia, Zautra, Johnson, and Davis (2005) found that higher levels of overall positive emotion predicted a decrease in pain reports during subsequent weeks. Steptoe, O'Donnell, Badrick, et al. (2008) assessed associations between trait positive emotion and inflammatory markers (C-reactive protein and interleukin-6) in healthy men and women. The results indicated that trait positive emotion was associated with reduced levels of C-reactive protein and interleukin-6 concentration over the day in women (but not in men). Ostir, Ottenbacher, and Markides (2004) examined the relationship between trait positive emotion and subsequent risk of frailty in a sample of noninstitutionalized Mexican Americans. After adjusting for baseline medical conditions and demographic predictors, trait

positive emotion was associated with a 3% decreased risk of frailty. Overall, these studies provide preliminary evidence of the prospective association between positive emotion and diminished stressor exposure.

Stress reactivity and recovery

Whereas positive emotion is believed to directly affect health via behavioral, physiological, and stressor exposure pathways, accruing experimental research – and older adults' subjective reports of their own experience – suggests that positive emotion may also benefit health by ameliorating or buffering the adverse effects of stress. Age differences in stress reactivity and recovery are supported by experimental studies showing that older adults exhibit greater stress-induced immune and cardiovascular dysregulation compared to younger adults (Uchino, Birmingham, & Berg, 2010). Support for the stress-buffering effect of positive emotion can be drawn from experimental-challenge and naturalistic-diary studies (see Pressman & Cohen, 2005, for a review) demonstrating that positive emotion can alter the severity and duration of stress responses that foster disease vulnerability. For instance, Cohen, Alper, Doyle, and Treanor (2006) showed that following experimental exposure to a respiratory virus, adults who scored higher on a measure of trait positive emotion showed diminished risk of developing upper respiratory illness. Brummett, Boyle, Kuhn, Siegler, and Williams (2009) found that trait positive emotion was related to lower blood pressure reactivity during sadness recall (but not during anger recall), more epinephrine, and lower cortisol rise after waking. Other studies have utilized repeated measures of positive emotional states and examined their contemporaneous role in dampening statelike fluctuations in stress responses (e.g., Ong, Bergeman, & Bisconti, 2004; Ong, Bergeman, Bisconti, & Wallace, 2006). Zautra, Smith, Affleck, and Tennen (2001), for example, found that weekly positive emotions attenuated the relationship between pain and negative emotion in a sample of women with rheumatoid arthritis or osteoarthritis. Taken together, these findings suggest that both trait and state positive emotion are associated with lower stress reactivity.

In addition to attenuating stress reactivity, positive emotions may also contribute to faster recovery from stress-related physiological arousal. Strong empirical support for this pathway has been reported in a number of studies with younger adults, which demonstrate that induced positive emotion (via film) following laboratory stress results in a more rapid return to baseline levels of heart rate and blood pressure (e.g., Fredrickson, Mancuso, Branigan, & Tugade, 2000). There is also evidence that positive emotions facilitate adaptive stress recovery in older adults. For example, in naturalistic-diary studies, daily positive emotions have been found to mitigate the effects of negative emotion on blood pressure, even after adjusting for individual differences in trait affect and other potential confounds (Ong & Allaire, 2005). Overall, these findings further support the idea that positive emotions facilitate adaptive recovery from the effects of negative emotions.

In sum, the studies described above suggest that health-enhancing behaviors, reduced activation of physiological processes, diminished stressor exposure, and adaptive stress reactivity and recovery may be among the important pathways linking positive emotion to adult health outcomes. Increasing evidence also suggests the health effects of each of these pathways may be most apparent in later life, although more research on age differences in the associations between positive emotion and health-related processes is clearly needed. One provocative hypothesis is that the processes that foster greater emotional resilience emerge during the middle years (Labouvie-Vief, 2003; Mroczek, 2004). If so, midlife may prove to be an influential period on the pathway to adaptive emotional aging.

Explaining Age Differences in Emotional Well-Being

A large body of empirical research documents age differences in emotional well-being (see Charles, 2010; Charles & Carstensen, 2009, for a review). Cross-sectional (Carstensen et al., 2000; Mroczek & Kolarz, 1998; Stone, Schwartz, Broderick, & Deaton, 2010) and longitudinal studies (Charles et al., 2001; Costa et al., 1987; Griffin, Mroczek, & Spiro, 2006) reveal that negative emotions occur with less frequency, whereas positive emotions occur with similar if not greater frequency across age cohorts, 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). Although age may shape emotional experience, younger and older adults differ in a multitude of ways. In this section, we review predictions from two prominent lifespan theories – socioemotional selectivity theory (Carstensen, Isaacowitz, & Charles, 1999) and dynamic integration theory (Labouvie-Vief, 2003) – that suggest changes in cognition and motivation may play an important role in explaining how positive emotions are well maintained in old age, despite pervasive declines in resource-intensive processes. Overall, we find that the literature contains plausible accounts of mechanisms associated with age differences in emotional well-being, but contains few published studies that provide formal tests of mechanistic hypotheses.

Motivation and the positivity effect

Socioemotional selectivity theory provides a motivational account for the apparent improvements in emotional well-being with age (Carstensen & Charles, 1998). The theory postulates that when time is perceived as limited, goals emphasizing emotion and meaning are prioritized over those aimed at gaining knowledge and information. This age-associated shift in motivation, in turn, is predicted to have consequences for information processing, such that older adults are more likely to prioritize positive over negative material – a phenomenon termed the 'positivity effect' (Carstensen & Mikels, 2005). Socioemotional selectivity theory, however, predicts that the specific processing mechanisms involved in the positivity effect (e.g., attention and memory) may also contribute to age differences in emotional regulation. Direct evidence consistent with this later prediction is limited, however (for a discussion, see Scheibe & Carstensen, 2010).

Evidence supports a developmental pattern in which the ratio of positive to negative material remembered increases with age. This positivity effect in *memory* has been documented in studies of recall and recognition memory (Charles, Mather, & Carstensen, 2003), working memory (Mikels, Larkin, Reuter-Lorenz, & Carstensen, 2005), autobiographical memory (Kennedy, Mather, & Carstensen, 2004), and mutual reminiscing (Pasupathi & Carstensen, 2003). Importantly, and consistent with socioemotional selectivity theory, age differences in the positivity effect can be eliminated by making salient emotional goals (Mather & Johnson, 2003) or by controlling future time perspective (Löckenhoff & Carstensen, 2007). Finally, there is some evidence (e.g., Kennedy et al., 2004; Pasupathi & Carstensen, 2003) that the positivity effect in memory may operate in the service of emotional well-being by enhancing the experience of positive emotion.

The positivity effect is present not only in memory but also in *attention*. Studies examining visual attention, for example, have found that older adults show a looking preference toward positive and away from negative stimuli (Isaacowitz, Wadlinger, Goren, & Wilson, 2006a,b; Mather & Carstensen, 2003). Moreover, recent research suggests that this positivity effect in attention may serve a critical regulatory function (Isaacowitz,

Toner, Goren, & Wilson, 2008; Isaacowitz, Toner, & Neupert, 2009), making it easier for older adults to manage disruptions in emotional experience. For example, in a recent eye-tracking study, Isaacowitz et al. (2009) found that older adults with good executive functioning displayed a pattern of mood-incongruent positive gaze, looking toward positive and away from negative faces when in a bad mood. These findings extend related work (e.g., Knight et al., 2007; Mather & Carstensen, 2005) by demonstrating that a major function of motivated selective attention is to enhance positive emotion and promote emotion regulation.

Cognitive control and emotion regulation

Whereas socioemotional selectivity theory spotlights motivation as a key factor in age-related improvements in emotion regulation, dynamic integration theory (Labouvie-Vief, 2003) holds that changes in underlying executive processes (e.g., cognitive control) account for at least some of the observed age differences in emotional well-being. In particular, the theory predicts that diminishing cognitive control capacities associated with aging lead to a gradual shift from a more complex mode of emotion regulation to one emphasizing optimization of individual well-being. That an age-related decrease in affect complexity may paradoxically result in an increase in affect optimization is suggested by a number of findings in the literature. For example, in a cross-sectional study comparing the regulatory styles of younger, middle-aged, and older adults, Labouvie-Vief and Medler (2002) reported that older adults displayed a pattern of high optimization (high positive affect) along with low complexity (e.g., high denial and repression). This pattern was confirmed in a recent 6-year longitudinal study (Labouvie-Vief, Diehl, Jain, & Zhang, 2007). Consistent with dynamic integration theory, the findings suggested that older adults displayed a developmental trajectory of increasing optimization and decreasing complexity.

As noted, dynamic integration theory predicts that affect optimization reflects a compensatory response to losses in cognitive control with age rather than a motivated shift in resource allocation as suggested by socioemotional selectivity theory. One implication of this prediction is that age-related increases in well-being may be driven, in part, by emotion regulation strategies that are automatic and relatively effortless. To the extent that age-associated declines in cognitive resources result in greater difficulty inhibiting emotionally arousing stimuli, dynamic integration theory also predicts prolonged emotional arousal would lead to impairments in cognitive–affective complexity with age (Labouvie-Vief, 2003). In support of this prediction, Wurm, Labouvie-Vief, Aycock, Rebucal, and Koch (2004) found that older adults (but not younger adults) had difficulty processing high-arousing stimuli in a study using an emotional Stroop task. It is noteworthy that this finding is also consistent with a growing body of work suggesting that sustained exposure to highly arousing stimuli may result in the reduction (or even elimination) of age-associated improvements in emotional well-being (see Charles, 2010; Charles & Carstensen, 2009, for a discussion).

Integrating Theory and Research

Although most lifespan theories recognize positive emotion as an important outcome of emotional aging, studies that move beyond piecemeal approaches to testing integrative models remain few in number. Below we briefly highlight three directions for future research that illustrate how the application of psychological theory can inform greater understanding of the significance of positive emotion in adulthood and later life.

Aging and the health effects of positive emotion

Experimental and prospective investigations of positive emotion and health have examined older adults and, by and large, have not compared younger, middle-aged, and older adults in the same study. Based on existing evidence, several effects can be predicted. First, if emotional goals such as 'feeling good' assume greater primacy with age, then there should be age differences in the relative impact of positive emotion on meaningful clinical endpoints such as decreased mortality and increased longevity. Although direct evidence of age differences is limited, this prediction is supported by integrative reviews suggesting that positive emotion is more strongly associated with survival among community-dwelling older adults over the age of 60 (Chida & Steptoe, 2008; Pressman & Cohen, 2005).

Second, inasmuch as positive emotions contribute to delaying the onset of age-related morbidity, a reasonable hypothesis is that associations between positive emotion and pre-disease pathways should be stronger in populations at risk because of age. As discussed earlier, increasing evidence suggests that aging is associated with heightened cardiovascular reactivity to psychosocial stress (Uchino et al., 2010). Exaggerated stress responsivity, in turn, has been implicated as a risk factor for the development of a broad array of coronary conditions, including stroke, myocardial ischemia, and hypertension (Pickering & Gerin, 1990). Importantly, a recent study by Ong and Isen (2010) showed that that experimental manipulations of positive emotion (via film induction) prior to a stressful stimulus (i.e., Trier Social Stress Test) led to attenuated cardiovascular reactivity relative to a neutral condition, with stronger effects emerging for older adults compared with younger adults. Although the literature on age differences in underlying pathways connecting positive emotion with health is sparse, these findings provide additional experimental footing for the postulated *buffering effect* (Kok, Catalino, & Fredrickson, 2008) by setting positive emotion theory and research within a lifespan context.

Finally, age differences in the physiological manifestations of positive emotion should vary by level of activation or arousal, with activated or high arousal positive emotions (e.g., excitement, joy) triggering greater physiological responses than unactivated or low arousal positive emotions (e.g., calm, contentment). This prediction is supported by a recent meta-analysis and empirical review (Pinquart, 2001; Pressman & Cohen, 2005) that show (i) smaller age effects associated low arousal positive emotions than with high arousal positive emotions and (ii) stronger associations between high arousal positive emotions and heightened cardiovascular and immune responses, particularly in persons with chronic or terminal illness and among institutionalized older adults. While these findings are provocative, studies of activation/arousal as a potential link in the chain connecting positive emotion and adult health remain largely unintegrated (Pressman & Cohen, 2005). Observational studies that have focused on the health effects of activated and unactivated positive emotions have often failed to include adequate controls for negative emotion. Additionally, laboratory studies of induced positive emotions have not always included manipulation checks, thus complicating comparisons across studies; this is a limitation of the research to date. These important limitations notwithstanding, the suggestion that that low arousal or unactivated positive emotions may be associated with health benefits is in accord with experimental research (Isen, 2008) showing that mild positive affect can have a marked influence on cognitive processes and social behavior. In turn, these resources may promote psychological resilience and trigger increases in positive emotions over time (Ong, Bergeman, & Boker, 2009; Ong, Fuller-Rowell, & Bonanno, 2010).

Aging and the regulation of positive emotion

Although supportive evidence exists that emotion regulation processes are linked to well-being (Gross & John, 2003), there is growing recognition that the specific emotion regulatory acts that people engage in may vary with age. Building on earlier work, Urry and Gross (2010) recently proposed a process model of emotion regulation and aging that is consistent with the meta-theory of selection, optimization, and compensation suggested by Baltes and Baltes (1990). In particular, the selection, optimization, and compensation with emotion regulation (SOC-ER; Urry & Gross, 2010) framework posits that aging is associated with increased selectivity in the use of specific regulatory strategies (e.g., situation selection, situation modification, attentional deployment, cognitive change, response modulation) that can be further classified in terms of when they occur in the emotion-generative process (i.e., antecedent-focused regulation versus response-focused regulation). Moreover, as with socioemotional selectivity theory, motivation is a central component of the SOC-ER framework, with the implication being that age-related changes in motivation prompt the selective use of specific types of regulation strategies in the service of well-being.

Age differences have been demonstrated in both antecedent-focused (i.e., situation selection, attentional deployment, cognitive change) and response-focused (i.e., response modulation) processes. For instance, age differences in the selection of social goals (e.g., close social partners) appear to have a positive impact on emotional well-being: Compared with younger adults, older adults report being in a more positive and less negative mood when they interact with family members and avoid arguments with others (Charles & Piazza, 2007; Charles, Piazza, Luong, & Almeida, 2009). In addition, older adults have been found to use attentional deployment and positive reappraisal (antecedent-focused strategies) more frequently, and with greater efficacy, than younger adults (Isaacowitz et al., 2009; Shiota & Levenson, 2009). Finally, there is also some evidence that older adults are less likely than younger adults to use unhealthy response-focused regulation strategies, such as expressive suppression, as a means of inhibiting ongoing emotion response tendencies (John & Gross, 2004).

Although the study of age differences in emotion regulation processes appears promising, several unanswered questions remain. First, are there regulatory processes that have the specific function of sustaining or increasing positive emotional experience? While additional research on this question is clearly needed, theory and findings suggest that there are individual differences in positive emotion regulation (Tugade & Fredrickson, 2007). For example, evidence from a number of investigations supports the conclusion that *savoring*, a regulatory strategy aimed at maintaining and enhancing positive emotion (Bryant, 1989), can have salutary effects on health and well-being (Bryant, 2003; Wood, Heimpel, & Michela, 2003). Additionally, recent research (conducted primarily with younger adults) suggests that beliefs about the malleability of emotions (i.e., implicit theories) can exert a powerful influence on social and emotional functioning (Tamir, John, Srivastava, & Gross, 2007). Do implicit theories of emotion vary with age, and if so, what effect do these associations have on the experience and regulation of positive emotion? Finally, if older adults tend to be in a more positive emotional state compared to younger adults (Mroczek, 2001), then the question arises as to whether the experience of positive emotion itself can enhance older adults' emotion regulation capacity (Wadlinger & Isaacowitz, 2011). Robust evidence consistent with this expectation comes from decades of research that demonstrate positive emotions have a facilitative effect on attention, motivation, and decision-making (see Ashby, Isen, & Turken, 1999; Isen, 2008, for a review). Moreover, the *broaden-and-build theory* (Fredrickson, 2004) suggests that positive emotions may widen the scope of

visual attention and social cognition, which over time, may enhance and increase one's reserve capacity. Thus, momentary experiences of positive emotion should account for some of the known age-related positivity effects in attention. In turn, the accrued experience of positive emotion should build assets (e.g., psychological resilience) that afford certain individuals the ability to automatically activate positive emotions, with minimal effort. Such experiences may be of particular relevance for older adults, among whom declining cognitive resources may result in increased reliance on implicit affective processes (Carstensen, Mikels, & Mather, 2006). This possibility remains to be tested.

Aging and the ratio of positive to negative emotion

Although most theories view affect balance as a hallmark of subjective well-being, few specify how much positivity is actually needed to produce a state of optimal well-being or flourishing (Keyes, 2002). Recent empirical work, however, has begun to examine the limited research on positive emotions and flourishing. For example, Fredrickson and Losada (2005) found that optimal mental health was associated with a ratio of positive to negative emotion at or above 2.9 to 1. Similar results were obtained by Waugh and Fredrickson (2006) in a prospective study of social relationships and by Ong and Burrow (2010) in a recent experimental investigation of social broadening.

Evidence for the health benefits of positivity in older adults comes from a study by Carstensen et al. (2011), who found that positive emotional experience (assessed by subtracting the average of negative emotion from the average of positive emotion) was predictive of survival. Although these findings are consistent with the general expectation that affect balance is predictive of health, a recent prospective study provided a more direct test of Fredrickson and Losada's (2005) theory of positivity. Specifically, using data from the MIDUS, Ong and Mroczek (2010) examined the degree to which positivity ratios predicted survival over a 10 period. Following Waugh and Fredrickson (2006), a positive emotion was counted as being felt if it was ≥2, and a negative emotion as being ≥1. The number of positive emotions was then divided by the number of negative emotions to create a positivity ratio for each participant. Results support the theory (Fredrickson & Losada, 2005) and showed that participants high in positivity had a lower mortality risk compared with those low in positivity. Cox regression analyses indicated that ratio of positive to negative emotion was significantly associated with the hazard of mortality, with a hazard ratio of 0.95, 95% confidence interval = 0.90–1.00; $p < 0.05$. Individuals who experienced high positivity ratios survived longer than those who experienced low positivity ratios. Figure 1 shows the survival curves for three groups separated by median split. Interestingly, the median positivity ratio in this sample was 3.0, with those low in positivity (1 SD below the median) experiencing an odds of death that was 1.34 times greater than those high in positivity.

Finally, although there is evidence linking positivity ratios to mental flourishing and longevity, there is also reason to think that this association may be driven by a healthy aging effect. That is, although positive emotions may affect health, health status itself may also affect how individuals experience positive emotions in later life. A bidirectional account of positive emotions and health is consistent with broaden-and-build theory which suggests that positive emotions and health serially influence each other, producing an 'upward spiral' toward enhanced well-being (Fredrickson & Joiner, 2002). Other indirect evidence consistent with this expectation can be seen in studies of individuals with advanced diseases, in which high levels of positive emotion have been observed to be detrimental to health (Brown, Butow, Culjak, Coates, & Dunn, 2000; Devins et al.,

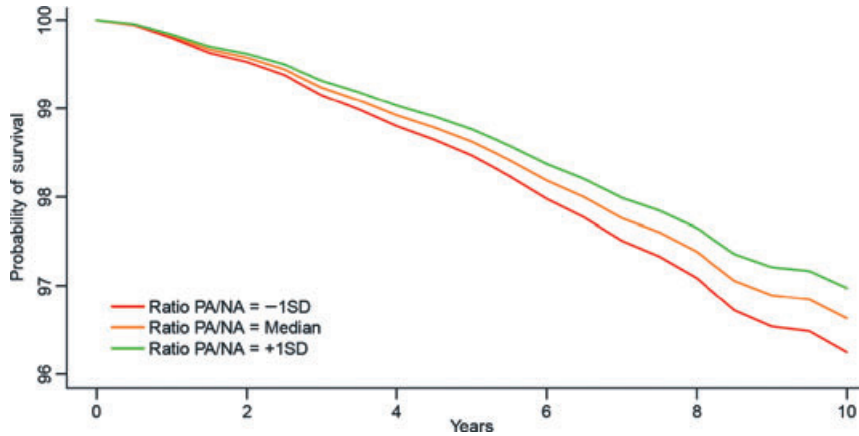

Figure 1 Survival curves for three groups of positivity defined by median split (adjusted for age, gender, race, education, and depression).

1990). Perhaps in these circumstances (e.g., life-threatening illness), positive emotional resources are of limited utility to enhancing health, because it is unclear how such resources should be directed. Although not well studied, this reasoning suggests an empirically testable hypothesis. Inasmuch as positivity is a resource that can influence multiple health outcomes, the association between positivity and mortality should be weaker for low-preventable versus high-preventable causes of death. In addition, because advancing age itself my represents a condition in which little can be done to delay death, it is reasonable to assume nonlinear positivity effects with age, with positivity differences in mortality being substantially reduced at the very end of life.

Conclusion

A substantial body of research suggests that despite declines in cognitive resources, emotional well-being is well preserved in old age. Although there is growing support for the importance of positive emotions in later life, full understanding of the phenomenon is far from complete. Questions remain concerning age differences in the regulation, physiological manifestation, and optimal level of positive emotion. More research is also needed to clarify the role of personality traits in the emotion–health association, as emotion-laden traits such as neuroticism have emerged as important predictors of health outcomes, especially mortality (Mroczek & Spiro, 2007; Mroczek, Spiro, & Turiano, 2009). To the extent that progress can be made on these issues, research on emotional aging may begin to create theoretically informed links to other literatures currently attempting to probe the health significance of positive emotions.

Acknowledgement

Preparation of this article was supported by grants from the National Institute on Aging (R01AG023571, R21AG026365). We extend thanks to Derek Isaacowitz, Corinna Löckenhoff, and Gary Evans for helpful comments on a previous version of this article.

Short Biographies

Anthony Ong received his Ph.D. in developmental psychology from the University of Southern California in 2002. From 2002 to 2006, he was a post-doctoral fellow in the psychology department at the University of Notre Dame. He is currently Associate Professor of Human Development at Cornell University. His research includes studies of resilience and lifespan development with specific interest in developmental plasticity or the capacity of individuals to flexibly adapt to changing environmental demands with age. A major focus of his recent work involves understanding the biobehavioral and sociocultural pathways through which positive emotions contribute to health and well-being.

Daniel Mroczek's major interests are in adult development and aging, especially lifespan personality development and the relationship between personality and health in the adult years. He is also interested in the general association between personality and physical health. In this line of research, he has found that change in personality predicts mortality (Mroczek & Spiro, 2007), and that smoking mediates the association between personality and mortality (Mroczek, Spiro & Turiano, 2009). Additionally, he has a number of statistical and methodological interests such as longitudinal design, daily diary and experience sampling techniques, multilevel modeling (including growth-curve models), and proportional hazards models. Most of his research is funded by the National Institutes of Health (NIH), in particular the National Institute on Aging (NIA). He received his B.S. from Loyola University Chicago and his Ph.D. (in developmental psychology) from Boston University. He was a post-doctoral fellow at the University of Michigan's Institute for Social Research from 1992 to 1995. From 1995 to 2005, he was on the developmental psychology faculty of Fordham University in New York City. Since 2005 he has been at Purdue University, where is a full professor and a faculty affiliate of Purdue's Center on Aging and the Life Course.

Catherine Riffin received her BA in Psychology and Philosophy from Mount Holyoke College and is currently pursuing her doctorate in Developmental Psychology at Cornell University. Her research interests include emotion, health, and aging.

Endnote

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