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Pathways Linking Positive Emotion and Health in Later Life

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Abstract

Numerous changes in physiological functioning accompany the aging process. Gradual declines in fundamental aspects of the neuroendocrine, cardiovascular, and immune systems contribute to increased risks for morbidity and mortality. Importantly, alterations in physiological processes are not invariant with age but are influenced by individual differences in vulnerability and resilience that accrue across the life span. In this review, I focus on what is known about positive emotion as a contributing factor in lowering morbidity and mortality in older adults. I describe plausible pathways that may underlie the association between positive emotion and health and review illustrative studies examining these pathways. The findings point to new research questions that pose important research opportunities.

Keywords

aging, health, positive emotion, resilience, stress

There is growing empirical evidence that positive emotion protects against poor health outcomes in later life. Two recent reviews have documented a robust association between positive emotion and improved health (Chida & Steptoe, 2008; Pressman & Cohen, 2005). Across experimental and large-scale prospective studies, significant aspects of adult health predicted by positive emotion include self-reported health, physiological responses, physical functioning, disease severity, and mortality. In this article, I review the biobehavioral and psychosocial pathways that may account for the relationship between positive emotion and health in later adulthood. 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 demonstrable health benefits in later life, the net effect of which may be to slow or delay the rate of functional decline in resilience.

Underlying Pathways

Associations between positive emotion and adult health outcomes raise the question of mechanisms underlying these effects. A number of candidate pathways linking positive emotion with adult health have been identified (Marsland, Pressman, & Cohen, 2007; Pressman & Cohen, 2005; see also Hawkley & Cacioppo, 2004), but with few exceptions, the evidence base to date includes few formal tests of mechanistic hypotheses. In this article, I examine four intermediate pathways by which positive emotion may influence adult morbidity and mortality: health behaviors, physiological systems, stressor exposure, and stress undoing.

Health behaviors

Health habits are heavily implicated in the development of acute and chronic health conditions. Moreover, because the effects of negative health behaviors, such as poor nutrition, a sedentary lifestyle, and reduced sleep accumulate with age, older adults are at greater risk for chronic and acute health disorders (Adler & Matthews, 1994). Importantly, individual differences in positive emotion may directly impact health by affecting the initiation and maintenance of restorative health practices over time. Integrative reviews indicate that enduring, or *trait*, positive emotion is prospectively associated with greater health-enhancing behaviors, such as better diet, regular exercise, and improved sleep (Pressman & Cohen, 2005; Steptoe, Dockray, & Wardle, 2009). In an illustrative study, Steptoe, O'Donnell, Marmot, and Wardle (2008) used data from an ecological momentary assessment study of 736 adults

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(58–72 years) and reported an inverse association between trait positive emotion (measured by aggregating momentary assessment ratings over the day) and sleep disturbance that was independent of age, sex, employment status, and psychological distress. While these findings raise the possibility that stable trait-like feelings of positive emotion may serve to delay the effects of aging by fortifying health-enhancing behaviors, 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 like smoking and exercise (Chida & Steptoe, 2008), suggesting that there may be more than one explanatory pathway through which positive emotion may exert influence on adult health outcomes.

Physiological systems

Aging is associated with progressive decrements in neuroendocrine, immune, and cardiovascular responses. These interrelated 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, empirical evidence demonstrates that positive emotion may alter disease vulnerability via dampening of these physiological systems. In a study of 116 men and 100 women (45–59 years), Steptoe, Wardle, and Marmot (2005) showed that independent of age, sex, socioeconomic status, smoking, body mass index, and psychological distress, trait positive emotion (aggregated across a working day and evening) 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). Similar findings were replicated at 3-year follow-up (Steptoe & Wardle, 2005). Although the literature on adults is limited and includes relatively few prospective cohort studies, these data provide promising evidence that alterations in physiological systems represent a mediational pathway linking positive emotion with health in later adulthood. Moreover, the associations were independent of negative affect, suggesting that positive emotion may have a salutary health effect that is separate from that of psychological distress. Indeed, such effects may be of particular importance for older adults, among whom the accrual of physiological deficits may accentuate vulnerability to disease and premature mortality.

Stressor exposure

Individual differences in stressor exposure have long been suspected as contributing to age-related differences in vulnerability to illness and disease. In an influential review, 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 contributes to, and hastens, age-related declines in physical health. Empirical evidence from studies of community-dwelling older adults indicates that positive emotion is prospectively 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 acute stressors associated with aging, including pain (Zautra, Johnson, & Davis, 2005), inflammation (Steptoe, O'Donnell, Badrick, Kumari, & Marmot, 2008), and disability (Ostir, Ottenbacher, & Markides, 2004). For example, Steptoe, O'Donnell, Badrick, et al. (2008) assessed associations between trait positive emotion (measured by averaging momentary ratings over the day) and inflammatory markers (C-reactive protein and interleukin-6) in 2,873 healthy men and women (50–74 years). 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 et al. (2004) examined the relationship between trait positive emotion (measured by the positive emotion subscale items from the Center for Epidemiological Studies—Depression scale) and subsequent risk of frailty in a sample of noninstitutionalized Mexican American participants (65–94 years). After adjusting for baseline medical conditions, years of schooling, marital status, age, and sex, trait positive emotion was associated with a 3% decreased risk of frailty. Although these studies provide a demonstration of the prospective association between positive emotion and diminished stressor exposure, the pathways underlying this association have not been established. Specifically, the intervening steps (i.e., trait positive emotion leading to lower cumulative vulnerability, which over time has positive health consequences such as increased longevity) remain largely unconfirmed.

Stress undoing

Whereas trait positive emotion is believed to directly affect health via behavioral, physiological, and stressor exposure pathways (Cohen & Pressman, 2006), accruing experimental research—and older adults' reports of their own experience—suggest that transitory, or *state*, positive emotion might also benefit health by ameliorating and even undoing the adverse effects of acute stress. Research on differential stress reactivity and recovery has figured prominently in studies of aging and health. 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 (cf. Cohen & Williamson, 1991; Uchino, Birmingham, & Berg, 2010). Support for the undoing 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.

Cohen, Alper, Doyle, and Treanor (2006) showed that following experimental exposure to a respiratory virus, adults

(21–55 years) who scored higher on a measure of trait positive emotion (assessed by averaging daily emotion ratings over a 2-week period) showed diminished risk of developing upper respiratory illness. Moreover, effects were independent of negative affect as well as other cognitive and social traits, such as optimism, extraversion, mastery, self-esteem, and self-reported health, thus suggesting a specific relationship between trait positive emotion and resistance to illness. Other studies have utilized daily diary measures of positive emotional states and examined their contemporaneous role in dampening cardiovascular responses following from negative emotional arousal (e.g., Ong, Bergeman, Bisconti, & Wallace, 2006). Ong and Allaire (2005), for example, reported a relationship between daily positive and negative emotion and blood pressure in a sample of nonhypertensive adults (60–87 years). Notably, daily positive emotion was found to mitigate the effects of negative emotion on blood pressure, even after controlling for trait affect and other potential confounds, such as age, sex, and marital status.

In addition to attenuating stress reactivity, state positive emotion may also facilitate faster recovery from stress-related physiological arousal. Strong support for this pathway has been reported in a number of studies with younger adults showing 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). Supportive evidence for positive emotion's influence on stress recovery in older adults is found in naturalistic diary studies revealing that the duration of minor stressors is shorter following a period of elevated daily positive emotion (e.g., Ong & Allaire, 2005). More recent experimental evidence suggests that induced positive emotion may also reduce age differences in cardiovascular stress responses (e.g., Ong & Isen, 2010). By holding acute stress exposure constant, this latter approach provides a mechanistic explanation for how age-related decrements in stress reactivity arise. Using a social-evaluative threat paradigm, Ong and Isen (2010) found that experimental manipulations of positive emotion (via film induction) prior to a stressful stimulus (i.e., Trier Social Stress Test) resulted in attenuated cardiovascular reactivity relative to a neutral condition, with stronger effects emerging for older adults (65–80 years) compared with younger adults (18–30 years). These findings provide additional experimental footing for the postulated stress-undoing effects of positive emotions (Fredrickson et al., 2000) by suggesting a buffering effect of positive emotion on cardiovascular responses to laboratory stress.

Compelling Unanswered Questions

Data reviewed above demonstrate that trait and state positive emotion have wide-ranging benefits on downstream behavioral, psychosocial, and biological processes, as well as on meaningful disease endpoints in later life such as morbidity and mortality. Research on positive emotion and aging is still in its early phases, however, and several important questions remain.

Are there alternative explanations for the association between positive emotion and adult health?

Future research will have to determine the extent to which positive emotion is confounded with unmeasured variables. Several recent reviews (e.g., Marsland et al., 2007; Pressman & Cohen, 2005) have advocated testing the association between positive emotion and health through careful statistical control of potential emotional confounds (e.g., negative affect), as well as closely related psychological constructs (e.g., neuroticism, extraversion, optimism, social support). Although statistical controls are invaluable in nonexperimental research, such adjustments may obscure the identification of potential mechanisms of change. Thus, observational studies that attempt to substantiate a causal link between positive emotion and health should apply statistical controls in a theory-driven manner.

Is the association between positive emotion and health moderated by emotional arousal?

Several studies suggest that level of emotional arousal may moderate the association between state positive emotion and health. Overall, the data from experimental and correlational studies support an association between high-arousal, or activated, positive emotions (e.g., excitement, joy) and heightened cardiovascular and immune responses, particularly in persons with chronic or terminal illness and among institutionalized older adults (Pressman & Cohen, 2005). Although these findings are provocative, there have been few studies of arousal as a potential link in the chain connecting positive emotion and adult health. Additionally, observational studies that have focused on the health effects of activated (e.g., enthusiasm, excitement) and nonactivated (calm, content) positive emotions have often failed to include adequate controls for negative emotion. In comparison, laboratory studies, in which positive emotional arousal is experimentally manipulated, have not always included manipulation checks, thus complicating comparisons across studies (Pressman & Cohen, 2005). Despite these caveats, the suggestion that moderate levels of positive emotion may be associated with health benefits is in accord with decades of experimental research (e.g., Isen, 2008) showing that mild positive affect can have a marked influence on cognitive processes (e.g., cognitive flexibility, problem solving) and social behavior (e.g., sociability, altruism).

Can studies of age differences inform studies of age changes?

From a developmental perspective, perhaps the most pressing question that future research needs to address is the extent to which changes in positive emotion are linked to changes in health across the adult life span. Few studies have directly

compared cross-sectional age differences and longitudinal age changes in positive emotion and health. Models of emotional aging must explain, for example, why a multitude of physiological processes decline with age whereas emotional well-being (i.e., positive emotion) is well maintained in old age. Although there is quite likely not a single answer to these questions, conducting life-course investigations containing a broad cross section of overlapping age groups (i.e., accelerated longitudinal designs) may help separate developmental effects from cohort influences. Such studies can inform understanding of the mechanisms that both subserve age-related differences in positive emotion and mitigate age-related declines in physiological resilience.

Concluding Remarks

Three decades ago, Lazarus, Kanner, and Folkman (1980) suggested that under intensely stressful conditions, positive emotions may provide an important psychological time-out, help to sustain continued coping efforts, and replenish vital resources that have been depleted by stress. Until recently, there has been little empirical support for these ideas. Foundational evidence for the adaptive function of positive emotion is now beginning to accrue, however. Taken together, the available data indicate that there is no single answer to the question of how positive emotion influences health outcomes in later adulthood. Instead, findings suggest that health behaviors, physiological systems, stressor exposure, and stress undoing may be among the key pathways underlying disparities in physical health, psychological well-being, and even longevity in later life. Future work building on these findings will require greater attention to the interaction between increasing positive emotion and the presence of decreasing resilience with aging. Targeted prevention and intervention strategies that enhance positive emotions, particularly among the most vulnerable, are likely to play an important role in preventing serious physical illness, minimizing the burden of stress, and improving overall functioning in older adults.

Recommended Reading

Charles, S.T., & Carstensen, L.L. (2009). Social and emotional aging. *Annual Review of Psychology*, *61*, 383–409. A comprehensive, highly accessible overview of what is known about socioemotional development.

Fredrickson, B.L. (2003). The value of positive emotions. *American Scientist*, *91*, 330–335. A clearly written review for readers who wish to expand their knowledge on positive emotions.

Ong, A.D., Bergeman, C.S., & Chow, S.M. (2009). Positive emotions as a basic building block of resilience in adulthood. In J. Reich, A. Zautra, & J. Hall (Eds.), *Handbook of adult resilience: Concepts, methods, and applications* (pp. 81–93). New York, NY: Guilford. A highly accessible overview of what is known about positive emotions and resilience in later life.

Zautra, A.J. (2003). *Emotions, stress, and health*. New York, NY: Oxford University Press. A thorough, far-reaching theoretical analysis of the relationships between stress, emotions, and health.

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References

Adler, N., & Matthews, N. (1994). Health psychology: Why do some people get sick and some stay well? *Annual Review of Psychology*, *45*, 229–259.

Chida, Y., & Steptoe, A. (2008). Positive psychological well-being and mortality: A quantitative review of prospective observational studies. *Psychosomatic Medicine*, *70*, 741–756.

Cohen, S., Alper, C.M., Doyle, W.J., & Treanor, J.J. (2006). Positive emotional style predicts resistance to illness after experimental exposure to rhinovirus or influenza A virus. *Psychosomatic Medicine*, *68*, 809–815.

Cohen, S., & Pressman, S. (2006). Positive affect and health. *Current Directions in Psychological Science*, *15*, 122–125.

Cohen, S., & Williamson, G.M. (1991). Stress and infectious disease in humans. *Psychological Bulletin*, *109*, 5–24.

Fredrickson, B.L., Mancuso, R.A., Branigan, C., & Tugade, M.M. (2000). The undoing effect of positive emotions. *Motivation and Emotion*, *24*, 237–258.

Hawkley, L.C., & Cacioppo, J.T. (2004). Stress and the aging immune system. *Brain, Behavior, and Immunity*, *18*, 114–119.

Isen, A.M. (2008). Some ways in which positive affect influences decision making and problem-solving. In M. Lewis, J. Haviland-Jones & L.F. Barrett (Eds.), *Handbook of Emotions* (3rd ed., pp. 548–573). New York, NY: Guilford.

Kiecolt-Glaser, J.K., & Glaser, R. (2001). Stress and immunity: Age enhances the risks. *Current Directions in Psychological Science*, *10*, 18–21.

Kiecolt-Glaser, J.K., McGuire, L., Robles, T.F., & Glaser, R. (2002). Emotions, morbidity, and mortality: New perspectives from psychoneuroimmunology. *Annual Review of Psychology*, *53*, 83–107.

Lazarus, R.S., Kanner, A.D., & Folkman, S. (1980). Emotions: A cognitive-phenomenological analysis. In R. Plutchik & H. Kellerman (Eds.), *Theories of emotion.* (pp. 189–217). New York, NY: Academic Press.

Marsland, A.L., Pressman, S., & Cohen, S. (2007). Positive affect and immune function. In R. Ader (Ed.), *Psychoneuroimmunology* (4th ed., Vol. 2, pp. 761–779). San Diego, CA: Elsevier.

Ong, A.D., & Allaire, J. (2005). Cardiovascular intraindividual variability in later life: The influence of social connectedness and positive emotions. *Psychology and Aging*, *20*, 476–485.

Ong, A.D., Bergeman, C.S., Bisconti, T.L., & Wallace, K. (2006). Psychological resilience, positive emotions, and successful adaptation to stress in later life. *Journal of Personality and Social Psychology*, *91*, 730–749.

Ong, A.D., & Isen, A.M. (2010). *Positive emotions attenuate age differences in cardiovascular responses following laboratory stress*. Unpublished manuscript, Cornell University.

Ostir, G.V., Ottenbacher, K.J., & Markides, K.S. (2004). Onset of frailty in older adults and the protective role of positive affect. *Psychology and Aging*, *19*, 402–408.

Pressman, S., & Cohen, S. (2005). Does positive affect influence health? *Psychological Bulletin*, *131*, 925–971.

Steptoe, A., Dockray, S., & Wardle, J. (2009). Positive affect and psychobiological processes relevant to health. *Journal of Personality*, *77*, 1747–1775.

Steptoe, A., O'Donnell, K., Marmot, M., & Wardle, J. (2008). Positive affect, psychological well-being, and good sleep. *Journal of Psychosomatic Research*, *64*, 409–415.

Steptoe, A., O'Donnell, K., Badrick, E., Kumari, M., & Marmot, M.G. (2008). Neuroendocrine and inflammatory factors associated with positive affect in healthy men and women: Whitehall II study. *American Journal of Epidemiology*, *167*, 96–102.

Steptoe, A., & Wardle, J. (2005). Positive affect and biological function in everyday life. *Neurobiology of Aging*, *26*, 108–112.

Steptoe, A., Wardle, J., & Marmot, M. (2005). Positive affect and health-related neuroendocrine, cardivascular, and inflamatory processes. *Proceedings of the National Academy of Sciences*, *102*, 6508–6512.

Uchino, B.N., Birmingham, W., & Berg, C. (2010). Are older adults less or more physiologically reactive? A meta-analysis of age-related differences in cardiovascular reactivity to laboratory tasks. *Journal of Gerontology: Psychological Sciences*, *65B*, 154–162.

Zautra, A.J., Johnson, L.M., & Davis, M.C. (2005). Positive affect as a source of resilience for women in chronic pain. *Journal of Consulting and Clinical Psychology*, *73*, 212–220.