

Review Article

# Learning from Normal Aging: Preserved Emotional Functioning Facilitates Adaptation among Early Alzheimer's Disease Patients

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**ABSTRACT:** Alzheimer's disease (AD) has been largely characterized by severe deterioration of cognitive functioning. Only recently has more attention been shifted to identifying the preserved capacity and functioning of AD patients. By reviewing the AD literature, we observe that despite the various cognitive impairment and deficits, early Alzheimer's patients perform certain types of automatic emotion regulation and display a positivity effect in emotion recognition and emotional memory. Moreover, we argue that, like their healthy aged peers, the optimization of such preserved emotion-based capacities helps early AD patients increase positive emotions, which may counteract the negative effects of the disease, thus maintaining their socio-emotional functioning. Finally, we discuss the emotion-based capacities strategies that AD patients may use to facilitate their adjustment to a life with Alzheimer's.

**Key words:** Alzheimer's disease, emotional functioning, resilient aging

Over the last two decades, the focus of aging theories and research has shifted from understanding the losses and deficits to exploring the gains and benefits of growing old. As a result, there has been increased interest in studying the psychological processes of successful aging, which emphasizes three important components: freedom from disability/ disease, high cognitive and physical functioning, and social engagement [1, 2]. However, little attention has been paid to examining whether such criteria are also valid for those with chronic physical or mental illnesses, such as Alzheimer's disease. Past studies on Alzheimer's patients have generally focused on the cognitive declines and ignored the preserved functions of those patients. However, Harris found that [3], early or even moderate AD patients actually displayed characteristics of resilient aging, such as adopting a positive outlook about life, optimizing remained resources to compensate for functional declines, and maintaining active social participation. In this paper, by reviewing the literature on the emotional functioning of early AD patients, we argued that the optimization of

preserved emotional capacities might help AD patients to compensate for, and resiliently adapt to the impairment of cognitive functions caused by the disease.

## The concept of resilient aging

Different from the traditional concept of resilience that emphasizes sustainability and recovery from trauma, the concept of resilient aging attaches the key importance to the maintenance of well-being and positive affect per se. It is undeniable that old age is limited by deteriorating health and shrinking temporal horizon, and all these reduce the adaptive reserves of older adults. Indeed, Hildon and his colleagues [4] found that over 71.3% of those aged between 68 and 82 years had at least one significant negative life event in the past five years. Despite the challenges of old age, numerous studies have consistently shown that older adults actually adapt more resiliently than do younger adults [5, 6, 7 and 8].

The key process that contributes to resilient aging is that older adults maintain high emotional functioning. Several

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studies found compared with younger adults, older adults selectively attended to and recall positive information more and negative information less [9, 10]. Moreover, older adults experienced less negative emotions [11, 12, 13] but more low arousal positive emotions than did their younger counterparts [14, 15, 16]. Positive emotions are building blocks for resilience [17, 18]. Firstly, both physiological evidence and experience sampling studies (for a review, see [19]) found that the level of positive mood was associated with multiple aspects of physical health, and predicted better cardiovascular recoveries and immune system [17, 18, 20]. Secondly, positive emotions can dampen the automatic arousal generated by negative emotions, thus reducing the risk of depression [21, 22]. To interpret the beneficial effects of positive emotions mentioned above, Fredrickson and her colleagues formulated the broaden and build theory [23, 24], which suggested that positive emotions, including joy, interest, content, love would expand and capitalize our mental resources [25]. While negative emotions tend to narrow one's attention to a specific action tendency (i.e., fight or flight), positive emotions, in contrast, tend to broaden an individual's momentary thought-action repertoires, which allow the individual to conceptualize the issue from different perspectives and attain a more adaptive solution [26]. Thirdly, positive emotion can facilitate resilience after loss or trauma. By reviewing the qualitative studies on resilience in facing bereavement, Bonanno stated that positive emotion and laughter could be important pathways to resilience [27]. In addition, even a brief exposure to positive emotion, such as getting a surprising gift or watching a hilarious movie, can counteract the effect of ego-depletion and restore individuals' psychological resources [25].

Older adults focus more on positive emotions than do younger adults. According to the socioemotional selectivity theory, the shrinkage of perceived future time causes age-related changes in prioritization and pursuit of social goals [28]; thus, compared with younger adults, older adults are more likely to place importance on emotionally meaningful goals, which maximize positive experiences in daily life. With a higher level of positive emotion, older people can better cope with various declines and losses associated with aging. Age-related enhancement on maintaining emotional well-being also assists older adults to be more efficient in finding positive meaning and accept negative affect in the face of daily stressors and adversities [29]. In fact, greater emotional well-being and optimism would predict higher level of resilience among older adults, thus leading to successful aging [30].

As abovementioned, numerous studies have consistently shown that older adults displayed a higher level of resilience than did younger adults [5, 6, 7, 8], in terms of better emotion regulation [31], more mature coping strategy [32], and richer prior experience of trauma and stress [33]. Instead of focusing on the dispositional factors that characterize resilience, resilience in later life emphasizes the dynamic process which individuals respond to environment, incorporate

“frailty” and balance well-being [34]; for example, research on palliative care patients showed that, even in the last stage of life, individuals can balance the dialectical tension of surrender and resistance [35].

### *Adaptation to challenges associated with Alzheimer's disease*

The abovementioned evidence suggested that resilient aging should not be limited within healthy population, but may also be applicable among those with chronic disorders, which has been barely investigated in the previous research. This is the case despite the fact that chronic disorders including dementia, heart disease, hypertension, diabetes, cancers and mobility impairment are highly prevalent among older people. Among them, dementia such as Alzheimer's disease is among the most common and handicapping. According to the World Health Organization, 35.6 million people were diagnosed with dementia in 2012. The number is expected to increase to 65.7 million by 2030 and to 115.4 million by 2050 [36]. In particular, in the Asia-Pacific region, Takeda [37] reported that there were 13.7 million demented patients in 2005 and this number would increase to 64.6 million by the year 2050. Moreover, among the cases diagnosed as dementia, Alzheimer's disease accounts for over 50% [38, 39]. Although dementia research has grown over the past decades, no curative treatment has been found for the disease. Aging researchers should reflect on the concept of resilient aging for older adults with Alzheimer's disease.

In recent years, a few studies have started to understand the psychological adjustment among patients with mild cognitive impairment (MCI) or early Alzheimer's [40, 41]. Cohen and Eisdorfer were the first to suggest that older people in the early stage of AD could learn to cope with the stressors and live with the disease. After the stages of recognition and concern, denial, sadness and anger, they will adjust themselves and adopt more mature coping strategies [40]. In addition, based on interviews with 22 AD patients on early or middle stage, Harris and Durkin reported that AD patients actually used several internal and external strategies to cope adaptively with the chronic stress [41]. These strategies include acceptance, disclosure about their illness, innovative techniques (such as marking important appointments on an electronic calendar), maintenance of a positive self or attitude, connection with past activities, altruism, spirituality and proactive skills.

Although the aforementioned studies suggested that early AD patients could use some strategies to adjust to the illness, there is a lack of research to understand the specific strategies they can potentially use. Past studies in resilient aging among healthy older adults can shed light on this question. As reviewed above, older adults face increasing declines and losses associated with aging. However, the capabilities in emotion regulation, emotion recognition, and emotional memory are

relatively intact. We argue that the preserved emotional capacities and the strategies to maximize them will not only be beneficial to healthy older adults, but also to patients with Alzheimer's disease, at least those in the early stage.

### ***Emotion regulation and resilience of early AD patients***

For a number of years, AD patients are believed to have greater difficulties to regulate and control their emotional responses than the healthy older adults do. Emotion regulation involves a goal-directed process in which individuals modify the dynamic features of emotion, including magnitude and duration of behavioral, experiential, and physiological responses [42]; therefore, it relies much on executive control, which is the ability to monitor and modify on-going behaviors [43]. Previous studies showed that verbal fluency and working memory were associated with up- and down- regulatory abilities among younger adults, healthy older adults as well as dementia patients [44, 45]. Thus, the prominent neuro-cognitive impairments in AD might limit patients' emotion regulation capacities. In fact, early AD patients were found to have more difficulties in amplifying their emotional expressions when looking towards positive stimuli and diminishing their emotional expressions when looking towards negative stimuli [46]. Moreover, AD patients tended to have poorer performance in facial recognition tasks, particularly when sad faces were presented [47]. In addition, compared with healthy older adults, the emotion enhancement on memory is weaker among AD patients [48].

However, other studies comparing the emotional functioning between healthy older adults and those with early Alzheimer's have found that some aspects of emotional functioning, especially emotion regulation and affective experience, might be preserved in the early stage [49, 50]. No significant difference was found on self-reported emotion regulation and emotional experience between early AD patients and healthy controls [49, 50, and 51]. This lack of difference could not be simply attributed to the deficit of self-awareness on that of AD patients, since they did report reduced cognitive empathy [52]. In addition, past study [51] found that despite the deficiency in inhibition, AD patients maintained automatic suppression in emotion regulation as well as the control group. More specifically, spontaneous suppression, but not controlled suppression of behavioral emotional expression, was found to be preserved among patients in the early or even middle stage of Alzheimer's disease. Different from the well-documented impairment in cognitive inhibition, automatic suppression is a reflective inhibitory mechanism. For example, when a startle noise happened with warning, early AD patients could spontaneously down-regulate somatic activation as

well as normal elders. However, when an explicit instruction was provided ("you should suppress any expression after the signal"), patients showed a similar level of impairment as fronto-temporal lobar degeneration patients (FTLD) [38]. In other words, although deterioration of cognitive functions caused by AD hampers controlled emotional suppression, AD patients' automatic emotional functioning remains relatively intact.

Furthermore, according to the model of socioemotional function of AD patients [46], even though the behavioral amplification of expressed emotion is disrupted, the ability of AD patients to inhibit ongoing emotion expressive behaviors and their subjective experience of emotion are relatively well preserved. Recently, neuroimaging evidence also showed that when recalling a stressful event, the activation of amygdala and OFC (orbitofrontal cortex) responses predicted individuals' dispositional resilience [53]. Given that amygdala and OFC have been spared during the early stage of Alzheimer's disease, it is not surprising that AD patients maintain some key aspects of emotional functioning.

### ***Preserved emotional experience of early AD patients***

Moreover, positive emotion could be another important resource for AD patients to achieve resilient aging. As mentioned above, positive emotion can promote physical and emotional recovery in the face of negative events, build psychological resources [25] and broaden thought-action repertoires in coping [23, 24, 54]. Previous studies showed that, although AD patients might not be able to remember the source of their emotional experience due to the cognitive impairment, their self-reported daily emotion was valid and reliable [41]. It should be noted that most studies did not directly assess AD patients' emotional experience, but used "Dementia Quality of Life," which includes many items about positive affect (PA) and negative affect (NA), to measure emotional experience. Findings from these studies suggested that AD patients tended to report higher levels of PA and NA than did their caregivers [55]. Later studies revealed that the negative affect AD patients experienced was mainly confusion. After adopting a specially designed affect scale, the "Visual Analogue Mood Scale for cognitive impaired population," Ready and her colleagues found that AD patients reported a higher level of negative emotions, particularly "confusion," than MCI patients and controls did [56]. Given that AD patients are more likely to experience blankness and difficulties in recalling daily events, it is plausible that they feel confused more often. Meanwhile, despite common beliefs that AD patients are depressed, empirical evidence showed that only 11 to 50% of the AD patients display depression symptoms [57],

such as feeling “a sense of being trapped,” or the feeling that “the future seems hopeless.” The majority of AD patients do not display such symptoms. Moreover, early AD patients are capable of regulating and relieving negative emotions [58], for example, by engaging in the leisure activities and obtaining social support through interpersonal interactions.

Given the above, interventions to optimize emotional experience may bring significant improvement on AD patients. According to the study of Ready et al., the negative association between positive emotions and negative emotions was stronger for AD patients than MCI patients or control group [56]. This finding, though correlational, suggests that for AD patients, interventions boosting positive emotions are likely to reduce negative emotions at the same time. Simple interventions such as exposure to familiar music, family visit, or walking in a garden, may lead to an optimal balance between PA and NA among AD patients. Moreover, studies on amnesic patients showed that once their mood (sadness and happiness) had been induced, it could be sustained over time [59]. Therefore, for AD patients who also show amnesic symptoms, the salutary effect of interventions that reduce negative emotions or increase positive emotions, e.g., helping others (increasing gratitude), mindfulness or positive reminiscence [60], may still maintain even when the activities have ended.

In fact, a few studies in Alzheimer’s under the framework of resilience have identified positive emotions as one of the most significant emotional resource for both AD patients and their families. Positive emotions, together with laughter, may assist AD patients to better cope with chronic stresses, improve immune functions, decrease negative responses, and increase social interactions [37]. Moreover, positive emotions can help caregivers and their families relieve tension and stress, preventing caregivers’ fatigue and burnout [61]. Compared with standard care, involving both family caregivers and dementia patients in enjoyable activities together can reduce their negative feelings and create positive feelings more effectively [58].

### ***Positivity bias on early AD’s emotional perception***

Positive emotional expression also has well-recognized salutary effects on health outcomes. For example, it is found that laughter could improve immunological [62] and endocrinological responses [63], as well as increase pain tolerance [64]. In terms of emotional expression, there are three types of laughter and smile: (1) laughter and smile during social communication and humor appreciation, (2) those accompanied by pleasant feelings and (3) those evoked by a release of tension. Only the first type of laughter and smile is impaired among AD patients,

while the other two are generally well preserved [37]. Even for patients in the late stage of Alzheimer’s, they are able to smile when they release their physical or mental strains. Therefore, according to Takeda and his colleagues [37], providing more encouragement and positive responses to AD patients may serve as complementary and alternative medicine for them, and helps them to build up resilient adaptation.

Apart from displaying positive emotional expressions, perceiving positive emotional expression may also be preserved among AD patients. Studies on healthy older adults’ emotion recognition found they displayed a salient positivity bias on the attention and memory of emotional faces [10], which enables them to better encode and store positive information, thus pursuing emotional goals and enhancing subjective well-being [65]. The findings on AD patients suggested that they maintain their abilities to decode and recognize positive emotions but not negative emotions (for a review, see [47]). Compared with mood disorders patients and healthy older adults, AD patients tend to select happy but not negative labels in emotion recognition tasks [66]. Consistently, Wiecheteck and his colleagues [67] also found that AD patients preserved the recognitions of happy but not fear or disgust faces. By adopting a sophisticated matching task, a recent study [68] showed that only the abilities to recognize happy but not sad or angry faces were relatively preserved among early AD patients. Given the association between the ability to recognize happy faces and positive emotions, the researchers posited that early AD patients might use this as an emotion regulatory strategy to increase positive emotions. Like their healthy counterparts, early AD patients display a positivity bias to favor and optimize positive information during daily social interactions. Moreover, the AD related impairment on emotion recognition could be alleviated by higher intensity of emotional expression [66]: When the intensity of emotional expression is 100%, no AD effect was found on emotion labeling of happy and angry faces.

As a prerequisite of communication, emotion perception is important for quality of life. Greater ability in decoding facial emotions correlates with better relationship well-being as well as lower depression [69]. Studies on psychosis have found that emotion perception could improve the cognitive and social functioning of patients [70]. Generalizing these findings to AD patients, interventions to improve emotional perception may significantly improve AD patients’ social competence and their caregivers’ well-being [71]. With appropriate communicative strategies, such as different verbal tone, displaying magnified facial expression or body languages, it is possible to help AD patients improve their accuracy



in recognizing emotional responses, and thus, facilitate their social interactions.

### ***Positivity bias on early AD's emotional memory***

Other than perception, early AD patients also displayed a positivity bias that showed stronger preferences to remembering positive faces than did their normal counterparts [72]. Werheid and colleagues proposed that this might be due to a reliance on gist-based memory strategy that help AD patients compensate for their losses in memory. In daily life, people are more likely to smile at known rather than unknown faces. When we perceive a smiling face looking at us, we tend to show a positivity-related recognition bias and believe that we “have seen” that person. Among healthy older adults, gist-based processing would enable them to encode and store critical information as compact event records, thereby preserving the memory of the essence of the events despite the age-related declines in developmental flexibility and cognitive ability [73, 74]. For early AD patients, they can also adopt gist-based memory with environmental support (e.g., writing down the gist of the event) [75, 76]. This may suggest possible solutions to amend AD patients' memory impairment. Moreover, like their healthy aged peers, AD patients are more likely to remember emotional rather than neutral events (for a review, see [77]). Such an emotion enhancement effect on memory could be a useful paradigm to help AD patients enhance their performance in episodic memory tasks. For example, factual information that AD patients need to remember can be framed in emotional contexts. Another way that may improve their memory is through collaboration between them and their caregivers by having them complete the memory task in pairs. For instance, Dixon and Gould [78] found that the presence of collaborators could enhance episodic memory performance of both younger and older adults, particularly when the collaboration was within long-term married couples. By looking into the metacognition of collaboration, these researchers suggested that with extensive experiences as a collaborative group, older married couple showed relatively higher memory confidence or self-efficacy, which led to greater and more efficient memory processing. When it comes to AD patients, it is promising that interventions involving caregivers in AD patients' memory processing could help them memorize.

In addition, AD patients might retain the emotion-based complex learning capability [79]. It is noteworthy that AD patients consistently experience positive and negative emotions towards people they do not consciously remember [79], which should be more than a simple implicit emotion-based learning process. Due to the

complexity of interpersonal interactions in our daily life, an individual can be perceived as good or bad or both at different periods of time. Emotion-based learning systems built on a wide range of emotional experiences associated with that particular person might help us form an overall aggregate assessment, to decide whether an individual was generally “good” or “bad”. These emotion-based learning systems are preserved in AD patients. For example, using the Iowa Gambling Task (IGT), Evan-Roberts and Tunbull [79] found that, despite severe deterioration of recent memories, an Alzheimer's patient at moderate stage preserved complex emotion-based learning capacity and showed a similar level of IGT performance as healthy older adults across several sessions. The findings not only demonstrated that AD patients might be capable of acquiring and retaining new emotion-based knowledge, but also shed light on cognitive trainings for them: adding emotional tags to important events may optimize the complex emotion-based learning capacity of AD patients and improve their memory.

Taken together, like healthy older adults, AD patients at the early stage show a positivity bias in emotional experience, expression recognition and emotional memory. Given that positive emotions play a significant role in resilient aging, early AD patients may retain the abilities to achieve subjective well-being despite the cognitive declines. Thus, rehabilitation and training programs for AD patients may capitalize on their preserved emotional capacities to reduce or compensate for the cognitive deterioration. For example, Isaacowitz and Choi [80] have successfully trained healthy older adults to fixate on positive stimuli by a constrained dot-probe paradigm, i.e. by repeatedly showing a probe after positive stimuli but no other types of stimuli [81]. This suggests that attention is malleable among older adults. Similar gaze training on positive information or significant features may help early AD patients to further allocate their attention on these stimuli, amplify their positive emotions and compensate for their loss of executive control. In addition, coaching them to gaze at the eye regions of facial expressions may also help them to better perceive emotional expressions [82].

### **Conclusion**

After decades of investigation on the impairments and losses caused by the AD pathology, it may be timely for us to shift our focus to developing strategies that encourage AD patients to maximize the use of their preserved emotional capacity. By reviewing the literature on the emotion research in AD patients, we have shown that some emotional regulation abilities, facial expression

recognition and emotional memories are relatively preserved among early AD patients, despite the salient declines of their cognitive functioning. This preserved emotional functioning could be an important asset for them to build and strengthen their resilience in the later life.

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### References

- [1] Depp C, Vahia, IV, Jeste DV (2010). Successful Aging: Focus on Cognitive and Emotional Health. *Annu Rev Clin Psychol*, 6: 527-550.
- [2] Rowe JW, Kahn RL (1997). Successful aging. *Gerontologist*, 37:433-440.
- [3] Harris PB (2008). Another wrinkle in the debate about successful aging: the undervalued concept of resilience and the lived experience of dementia. *Int J Aging Hum Dev*, 67: 43-61.
- [4] Hildon Z, Montgomery S M, Blane D, Wiggins RD, Netuveli G (2010). Examining resilience of quality of life in the face of health-related and psychosocial adversity at older ages: What is "right" about the way we age? *Gerontologist*, 50: 36-47.
- [5] Ong AD, Bergeman CS, Bisconti, TL (2006). Psychological resilience, positive emotions, and successful adaptation to stress in later life. *J Pers Soc Psychol*, 91: 730-749.
- [6] Ong, AD (2010). Pathways linking positive emotion and health in later life. *Curr Dir Psychol Sci*, 19: 358-362.
- [7] Ong AD, Bergeman, CS, Boker SM (2009). Resilience comes of Age: Defining features in later adulthood. *J Pers*, 77: 1777-1804.
- [8] Uchino BN, Berg CA, Smith TW, Pearce G, Skinner M (2006). Age-related differences in ambulatory blood pressure during daily stress: Evidence for greater blood pressure reactivity with age. *Psychol Aging*, 21: 231-239.
- [9] Isaacowitz DM, Wadlinger HA, Goren D, Wilson HR. (2006). Is there an age-related positivity effect in visual attention? A comparison of two methodologies. *Emotion* 6:511-516.
- [10] Mather M, Carstensen LL. (2003). Aging and attentional biases for emotional faces. *Psychol. Sci*, 14:409-415.
- [11] Carstensen LL, Pasupathi M, Mayr U, Nesselroade JR. 2000. Emotional experience in everyday life across the adult life span. *J. Personal. Soc. Psychol*, 79:644-655.
- [12] Diener, E., Suh, ME. (1997). Subjective well-being and age: an international analysis. In: Schaie, KW, Lawton MP, editors. *Annual Review of Gerontology and Geriatrics*. New York: Springer, Vol.17, 304-323
- [13] Mroczek DK, Kolarz CM. 1998. The effect of age on positive and negative affect: a developmental perspective on happiness. *J. Pers. Soc. Psychol*, 75:1333-1349.
- [14] Hay EL, Diehl M (2012). Emotion complexity and emotion regulation across adulthood. *Eur J Ageing*, 8:157-168.
- [15] Diener E, Sandvik E, Larsen RJ. 1985. Age and sex effects for emotional intensity. *Dev Psychol*, 21:542-546
- [16] Lawton MP, Kleban MH, Rajagopal D, Dean J. 1992. Dimensions of affective experience in three age groups. *Psychol. Aging* 7:171-184.
- [17] Carver CS, Scheier MF (1993). Vigilant and avoidant coping in two patient samples. In: Krohne, HW, editor. *Attention and avoidance: Strategies in coping with aversiveness*. Kirkland, WA: Hogrefe & Huber Publishers, 295-319.
- [18] Kubzansky LD, Sparrow D, Vokonas P, Kawachi I (2001). Is the glass half empty or half full? A prospective study of optimism and coronary heart disease in the normative aging study. *Psychosom Med*, 63: 910-916.
- [19] Lefcourt, HM (2001). The humor solution. In: Snyder CR, editor. *Coping with stress: Effective people and processes*. London: Oxford University Press, 8-92.
- [20] Fredrickson BL, Mancuso RA, Branigan C, Tugade M M (2000). The Undoing Effect of Positive Emotion. *Motiv Emot*, 24: 237-258.
- [21] Wichers M, Jacobs N, Derom C, Thiery E, Os JV (2007). Depression: Too Much Negative Affect or Too Little Positive Affect? *Twin Res Hum Genet*, 10(S): 19-20.
- [22] Southwick SM, Charney, DS (2012). The Science of Resilience: Implications for the Prevention and Treatment of Depression. *Science*, 338: 79-82.
- [23] Fredrickson BL, Tugade MM, Waugh CE, Larkin GR (2003). What good are positive emotions in crisis? A prospective study of resilience and emotions following the terrorist attacks on the United States on September 11th, 2001. *J Pers Soc Psychol*, 84: 365-376.
- [24] Fredrickson, BL (2001). The Role of Positive Emotions in Positive Psychology: The Broaden-and-Build Theory of Positive Emotions. *Am Psychol*, 56: 218-226.
- [25] Tice DM, Baumeister RF, Shmueli D, Muraven, M (2007). Restoring the self: Positive affect helps improve self-regulation following ego depletion. *J Exp Soc Psychol*, 43: 379-384.
- [26] Tugade MM (2011). Positive emotion and coping: Examining dual-process models of resilience. In: Folkman S, editor. *Oxford Handbook of stress, health, and coping*. New York: Oxford University Press, 186-199.
- [27] Bonanno GA (2004). Loss, trauma, and human resilience: Have we underestimated the human capacity to thrive after extremely aversive events? *Am Psychol*, 59: 20-28.
- [28] Carstensen LL (2006). The influence of a sense of time on human development. *Science*, 312:1913-1915.
- [29] Shallcross AJ, Ford BQ, Floerke VA, Mauss IB (2012). Getting better with age: the relationship between age,

- acceptance, and negative affect. *J Pers Soc Psychol*, 104: 734-749
- [30] Lamond AJ, Depp CA, Allison M, Langer R, Reichstadt J, Moore DJ, et al (2009). Measurement and predictors of resilience among community-dwelling older women. *J of Psychiatr Res*, 43: 148-154.
- [31] Kessler EM, Staudinger UM (2009). Affective Experience in Adulthood and Old Age: The Role of Affective Arousal and Perceived Affect Regulation. *Psychol Aging*, 24: 349-362.
- [32] Windle G (2011). What is Resilience? A Review and Concept Analysis. *Rev Clin Gerontol*, 21: 152 – 169.
- [33] Davis MC, Zautra AJ, Johnson LM, Murray KE, Okvat HA (2007). Psychosocial stress, emotion regulation, and resilience among older adults. In: Aldwin C, Park C, Spiro A, Abeles R, editors. *Handbook of health psychology and aging*. New York: Guilford, 250-266.
- [34] Wiles JL, Wild K, Kerse N, Allen RE (2012). Resilience from the point of view of older people: 'There's still life beyond a funny knee' *Soc Sci Med*, 74: 416-424.
- [35] Nakashima M, Canda, ER. (2005). Positive dying and resiliency in later life: a qualitative study. *J Aging Stud*, 19: 109-125.
- [36] World Health Organization. Dementia [Internet]. [Place Unknown]; 2012 April [cited 2013 Nov10] Available from: [www.who.int/mediacentre/factsheets/fs362/en/](http://www.who.int/mediacentre/factsheets/fs362/en/).
- [37] Takeda M, Hashimoto R, Kudo T, Okochi M, Tagami S, Morihara T (2010). Laughter and humor as complementary and alternative medicines for dementia patients. *BMC Complement Altern Med*, 10: 28.
- [38] Goodkind MS, Gyurak A, McCathy M, Miller BL, Levenson RW (2010). Emotion Regulation Deficits in Frontotemporal Lobar Degeneration and Alzheimer's Disease. *Psychol Aging*, 25: 30-37.
- [39] Rosen HJ, Hartikainen, KM, Jagust W, Kramer JH, Reed, BR, Cummings JL et al (2002). Utility of clinical criteria in differentiating frontotemporal lobar degeneration (FTLD) from AD. *Neurology*, 58: 1608-1615.
- [40] Cohen D, Eisdorfer C. *The Loss of self: A family resource for the care of Alzheimer's disease and related disorders*. New York: Norton; 1986.
- [41] Harris PB, Durkin D (2002). Building resilience through coping and adapting. In: Harris PB, editor. *The person with Alzheimer's Disease*, Baltimore: The Johns Hopkins University Press, 165-184.
- [42] Thompson R, Gross JJ (2007). Emotion regulation. In: Gross JJ, editor. *Handbook of Emotion Regulation*, New York: Guilford Press; 3-24.
- [43] Royall DR, Lauterbach EC, Cummings JL, Reeve A, Rummans TA, Kaufer DI, et al (2002). Executive control function: a review of its promise and challenges for clinical research. A report from the Committee on Research of the American Neuropsychiatric Association. *J Neuropsychiatry Clin Neurosci*, 14: 377-405.
- [44] Gyurak A, Goodkind MS, Kramer JH, Miller B L, Levenson RW (2012). Executive functions and the down-regulation and up-regulation of emotion. *Cogn Emot*, 26: 103-118.
- [45] Schmeichel BJ, Volokhov RN, Demaree HA (2008). Working-memory capacity and the self-regulation of emotional expression and experience. *J Pers Soc Psychol*, 95: 1526-1540.
- [46] Henry J D, Rendell PG, Scicluna A, Jackson MM, Phillips LH (2009). Emotion Experience, Expression, and Regulation in Alzheimer's Disease. *Psychol Aging*, 24: 252-257.
- [47] McLellan T, Johnston L, Dalrymple-Alford J, Porter R (2008). The recognition of facial expressions of emotion in Alzheimer's disease: A review of findings. *Acta Neuropsychiatr*, 20: 236-250.
- [48] Kensinger EA, Anderson A, Growdon JH, Corkin S (2004). Effects of Alzheimer disease on memory for verbal emotional information. *Neuropsychologia*, 42: 791-800.
- [49] Burton KW, Kaszniak AW (2006). Emotional experience and facial expression in Alzheimer's disease. *Neuropsychol Dev Cogn B Aging Neuropsychol Cogn*, 13: 636-651.
- [50] Nash S, Henry JD, McDonald S, Martin I, Brodaty H, Peek-O'Leary MA (2007). Cognitive disinhibition and socioemotional functioning in Alzheimer's Disease. *J Int Neuropsychol Soc*, 13: 1060-1064.
- [51] Amieva H, Phillips LH, Della Sala S, Henry JD (2004). Inhibitory functioning in Alzheimer's disease. *Brain*, 127: 949-964.
- [52] Rankin KP, Gorno-Tempini ML, Allison SC, Stanley CM, Glenn S, Weiner MW, et al (2006). Structural anatomy of empathy in neurodegenerative disease. *Brain*, 129: 2945-2956.
- [53] Reynaud E, Guedj E, Souville M, Trousselard M, Zendjidian X, Khoury-Malham ME, et al. (2013). Relationship between emotional experience and resilience: An fMRI study in fire-fighters. *Neuropsychologia*, 51: 845-849.
- [54] Tugade MM, Fredrickson BL (2007). Regulation of Positive Emotions: Emotion Regulation Strategies that Promote Resilience. *J Happiness Stud*, 8: 311-333.
- [55] Sands LP, Ferreira P, Stewart AL, Brod M, Yaffe K (2004). What explains differences between dementia patients' and their caregivers' ratings of patient's quality of life? *Am J Geriatr Psychiatry*, 12: 272-280.
- [56] Ready RE, Carvalho JO, Green RC, Gavett BE, Stern RA (2011). The structure and validity of self-reported affect in mild cognitive impairment and mild Alzheimer's disease. *Int Psychogeriatr*, 23: 887-898.
- [57] Forsell Y, Wingblad B (1998). Major Depression in a Population of Demented and Nondemented Older People: Prevalence and Correlates. *J Am Geriatr Soc*, 46: 27- 30.
- [58] Manthorpe J, Iliffe S. *Depression in later life*. London and Philadelphia: Jessica Kingsley Publisher; 2005.
- [59] Feinstein JS, Duff MC, Tranel, D (2010). Sustained experience of emotion after loss of memory in patients with amnesia. *Proc Natl Acad Sci (USA)*, 107: 7674-7679.

- [60] Sin NL, Lyubomirsky S (2009). Enhancing well-being and alleviating depressive symptoms with positive psychology interventions: A practice-friendly meta-analysis. *J Clin Psychol*, 65: 467-487.
- [61] Bakker AB, Schaufeli WB, Sixma HJ, Bosveld W, van Dierendonck D (2000). Patient demands lack of reciprocity, and burnout: A five-year longitudinal study among general practitioners. *J Organ Behav*, 21: 425-441.
- [62] Takahashi K, Iwase M, Yamashita K, Tatsumoto Y, Ue H, Kuratsune H, et al. (2001). The elevation of natural killer cell activity induced by laughter in a crossover designed study. *Int J Mol Med*, 8:645-50.
- [63] Hayashi K, Hayashi T, Iwanaga S, Kawai K, Ishii H, Shoji S, et al (2003). Laughter lowered the increase in postprandial blood glucose. *Diabetes Care*. 26:1651-1652.
- [64] Stuber M, Hilber SD, Mintzer LL, Castaneda M, Glover D, Zeltzer L (2009). Laughter, humor and pain perception in children: A pilot study. *Evid-Based Compl Alt*, 6:271-276.
- [65] Mather M, Carstensen LL (2005). Aging and motivated cognition: the positivity effect in attention and memory. *Trends Cogn Sci*, 9: 496-502.
- [66] Phillips LH, Scott C, Henry JD, Mowat D, Bell, JS (2010). Emotion perception in Alzheimer's disease and mood disorder in old age. *Psychol Aging*, 25: 38-47.
- [67] Wiecheteck OM, Schenk F, Baenziger T, von Gunten A. (2011). An exploratory study on facial emotion recognition capacity in beginning Alzheimer's disease. *Eur Neurol* 65: 361-367.
- [68] Maki Y, Yoshida H, Yamaguchi T, Yamaguchi H (2013). Relative preservation of the recognition of positive facial expression "happiness" in Alzheimer's disease. *Int Psychogeriatr*. 25: 105-110.
- [69] Carton JS, Kessler EA, Pape CL (1999). Nonverbal decoding skills and relationship well-being in adults. *J Nonverbal Behav*, 23:91-100.
- [70] Addington J, Saeedi H, Addington D (2006). Facial affect recognition: Amediator between cognitive and social functioning in psychosis? *Schizophr Res*, 85: 142-150.
- [71] Bornhofen C, McDonald S (2008). Emotion perception deficits following traumatic brain injury: A review of the evidence and rationale for intervention. *J Int Neuropsychol Soc*, 14: 511-525.
- [72] Werheid K, McDonald RS, Simmons-Stern N, Ally BA, Budson AE (2011). Familiar smiling faces in Alzheimer's disease: Understanding the positivity-related recognition bias. *Neuropsychologia*. 49: 2935-2940.
- [73] Schacter DL, Addis DR (2007). Constructive memory: The ghosts of past and future. *Nature*, 455: 27.
- [74] Schacter DL, Addis DR, Buckner RL (2007). Remembering the past to imagine the future: the prospective brain. *Nat Rev Neurosci*, 8: 657-661.
- [75] Budson AE, Desikan R, Daffner KR, Schacter DL (2000). When false recognition is unopposed by true recognition: Gist-based memory distortion in Alzheimer's disease. *Neuropsychology*, 14: 277-287
- [76] Zhang F, Geng HY (2010). What can false memory tell us about memory impairments in Alzheimer's disease? *Chin Sci Bull*, 55: 3989-3997.
- [77] Klein-Koerkamp Y, Baciú M, Hot P (2012). Preserved and impaired emotional memory in Alzheimer's disease. *Front Psychology*, 3: 331.
- [78] Dixon RA, Gould ON (1998). Younger and Older Adults Collaborating on Retelling Everyday Stories, *Appl Dev Sci*, 2: 160-171.
- [79] Evans-Roberts CEY, Turnbull OH (2011). Remembering Relationship: Preserved Emotion-based Learning in Alzheimer's Disease. *Exp Aging Res*, 37: 1-16.
- [80] Isaacowitz DM, Choi Y (2011). The Malleability of Age-Related Positive Gaze Preferences: Training To Change Gaze and Mood. *Emotion*, 11: 90-100.
- [81] Wadlinger HA, Isaacowitz DM (2010). Fixing Our Focus: Training attention to regulate emotion. *Pers Soc Psychol Rev*, 15: 75-102.
- [82] Hot P, Klein-Koerkamp Y, Borg C, Richard-Mornas A, Adeline AP, Zsoldos I, et al (2013). Fear recognition impairment in early-stage Alzheimer's disease: When focusing on the eyes region improves performance. *Brain Cognition*, 82: 25-34.