

The mediator role of positive emotion interventions and cognitive health in community-dwelling older adults: A longitudinal cohort study

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Abstract

Background: As adults age, there is a greater risk of cognitive health decline, and thus protecting cognitive health is a public health priority. Negative mood is a risk factor for losing cognitive abilities among aging adults. The Broaden and Build Theory of Positive Emotion suggests that activities that build positive emotion may mediate the negative effects of negative mood. This theory guided an examination of the relationship between mood and activities that promote positive emotions and their effects on cognitive decline among aging adults.

Methods: The sample included 492 community-dwelling adults 60 years and older who completed a Community Health Assessment (CHA) and a COLLAGE Wellness Assessment (WEL) twice between the years 2007 and 2013. Cognition was measured using items from the CHA that formed the Cognitive Performance Scale (CPS) and activities that promote positive emotions was measured using items from the WEL. Negative mood was measured using items from the CHA. Logistic regression was used to associate CPS, mood, and positive emotion activities at baseline and after at least one year.

Results: All three of the negative mood variables were statistically significant predictors of a poor CPS score. The presence of negative statements ($p=0.036$), anger ($p=0.017$), and withdrawal ($p=0.009$) were statistically significant.

Conclusions: None of the activities that cultivate positive emotions were significantly associated with changes in CPS score. Future research should examine interventions to reduce negative mood and determine if they mediate the risk of cognitive decline among aging adults.

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Introduction

Cognitive health protection is a public health priority that impacts care providers, economics, and quality of life for aging adults [1]. Cognitive health is not just the absence of dementia or other cognitive diseases, but a complex structure that allows older adults to participate in fulfilling social relationships, maintain

an ongoing sense of purpose in life, and function independently [2]. Cognitive ability ranges from intact to severe impairment and is affected by pathologies such as Alzheimer's disease and other forms of dementia; cognition represents several domains such as executive functioning, episodic memory, processing speed, attention, language, and working memory [1,3]. When cognition is impaired, daily

activities become more difficult [1]. Age is the best-known risk factor for cognitive decline, although decline is not a direct consequence of aging [1,4]. Older adults fear losing cognitive abilities over any other medical condition, including cancer [5,6], and nearly two thirds of adults fear memory loss from aging [7].

Multiple wellness behaviors may protect older adults from the risk of cognitive health decline as they age [8]. Older adults who participate in regular physical activity, consume healthy diets, engage in a rich social network, participate in spiritual and intellectually stimulating activities, and embrace a positive outlook on life are less likely to experience cognitive health decline [8, 9]. Strout and Howard developed a method to precisely measure multiple wellness variables among community-dwelling older adults by conducting a Rasch analysis, which accounts for the level an older adult's wellness and the level of wellness associated with a behavior [10]. This model provided an opportunity to combine multiple wellness behaviors that represent one wellness domain, and to examine and compare their collective influence on cognition. Five domains of wellness (physical, social, spiritual, intellectual, and emotional) that each represent a collection of wellness behaviors were entered into a model to determine which domain is most strongly associated with cognitive health among aging adults [9]. Among 5,605 community-dwelling older adults, emotional wellness demonstrated the strongest association with cognitive health. The emotional wellness domain included four variables: life satisfaction, feeling valued, looking forward to new challenges and opportunities, and impact of stress on daily life [9].

Emotional wellness is the ability to acknowledge personal responsibility for life decisions with emotional stability and positivity [11]. A body of evidence suggests poor emotional wellness as exhibited by low mood and depression is related to cognitive decline among older adults [12-16]. Neuroticism is a personality trait that reflects emotional instability, negative emotions, depressive symptoms, and anxiety. Neuroticism also has been found to impair cognitive health in older adults [12-14]. In a 12-year longitudinal analysis by Wilson *et al.* [12], individuals with high neuroticism scores were 42% more likely to develop cognitive impairment

than individuals with low neuroticism. Additionally, the risk of mild cognitive impairment increased 6% for each depressive symptom a person demonstrated. In a cross-sectional analysis of 1,415 older adults, those with higher neurotic personality traits demonstrated poorer cognitive performance compared to those with lower neurotic personality traits [13]. In another longitudinal analysis of 506 older adults by Wang *et al.* [4], those with low neurotic personality traits and high extraversion personality traits demonstrated lowest risk for developing dementia at a six-year follow-up.

Depressive symptoms may independently increase the risk of cognitive decline as adults age [15]. In a cohort of 479 adults over age 60, those who demonstrated high depressive symptoms at baseline were at a significantly greater risk of developing cognitive health decline after a six-year follow-up when compared to those with no or fewer depressive symptoms.

Yates, Clare, and Woods [16] examined the relationship between Mild Cognitive Impairment (MCI) and depression with a meta-analysis of 60 studies of community-dwelling older adults aged 55-86. Older adults diagnosed with MCI were three times more likely to demonstrate depressive symptoms and two and a half times more likely to demonstrate symptoms of anxiety compared to those without cognitive impairment (OR)= 3.23, 95%: 2.00-5.22), (OR)=2.50; 95%, CI: 1.69-3.71). Those without cognitive impairment at baseline but displayed depressive symptoms were two and a half times more likely to progress to MCI over time (OR)=2.4; 95%, CI 1.91-3.02. There was a modest increased risk of MCI progression to dementia when depression symptoms were present at baseline (OR)=1.14; 95% CI 0.77-1.68).

Symptoms associated with poor mood are associated with an increased risk of cognitive decline over time [12-16]. Whether activities that promote positive emotions mediate the effects of negative emotion on cognitive decline over time remains unknown. The purpose of this research was to examine the relationship between mood and activities that promote positive emotions, and determine if these activities can ultimately mediate cognitive decline in aging adults.

The Broaden and Build Theory of Cultivating Positive Emotions guided this study [17,18]. Negative emotions decrease attention and cognition whereas positive emotions promote psychological growth and well-being over time [18]. Broadening positive emotions expands one’s attention, cognition, and action and builds their physical, intellectual, and social resources [18], which then allows one to manage threats more effectively. Positive emotion may help compensate or mediate the negative health effects of negative emotion through the “undoing effect” [17,18]. According to Frederickson [18], relaxation activities can broaden positive emotions by combating anxiety, promoting mindfulness, and demonstrating a physiologic positive effect on blood pressure, heart rate, breathing, and physiological arousal. These positive effects promote resiliency that a person can utilize later in life when they face psychological or physiological threats.

The objectives of the present study were to determine i) if among community-dwelling adults over age 60, those who report more negative moods are at higher risk for developing cognitive decline over time; and ii) if among community-dwelling adults over age 60, those who engage in activities that cultivate positive emotions will experience fewer negative moods and will demonstrate less risk for developing cognitive decline over time.

Methods

Study participants

The analysis included older adults from the COLLAGE consortium who completed a Wellness Assessment Tool (WEL) and a Community Health Assessment (CHA) between the years 2007 and 2013. COLLAGE is a national consortium of continuing care retirement communities (CCRC). COLLAGE aims to achieve two goals: 1) improve the quality of life for older adults and 2) establish COLLAGE as the leading model for keeping older adults of all socio-economic backgrounds active and independent [19]. Participants who live in a CCRC completed three annual assessments that provided the data for this research: The Community Health Assessment (CHA), the Wellness Assessment Tool (WEL), and the Functional Supplement (FS). These evaluations are

part of the interRAI assessment suite, and therefore ensure international consistency of internal testing, re-testing, and assessment, as well as consistent presentation, content, criterion, and proven validity [20, 21]. The assessment data are collected annually in a face-to-face conversation with a health professional trained in conducting interRAI assessments. Evaluations of adults younger than age 60 or not living in the community at the time of the assessment were excluded from the study.

Measurements

Cognition was measured using the Cognitive Performance Scale (CPS). The Cognitive Performance Scale (CPS) is generated from items on the CHA, the WEL, and the FS. Items that create the CPS and their corresponding instrument are listed in Table 1.

Table 1. Items from CHA and WEL that measure mood and positive emotion activities

Instrument	Variable	Item
CHA	Mood	Made negative statements
		Persistent anger with self or others
		Withdrawal from activities of interest
WEL	Activity to Promote Positive Emotion	Acupuncture
		Aromatherapy
		Massage
		Meditation
		Therapeutic Touch

CHA: Community Health Assessment; WEL: Wellness Assessment Tool

CHA is a core COLLAGE tool that measures various aspects of health and wellness, including: cognition, communication, vision, mood, psychosocial well-being, functional status, continence, disease diagnosis, health conditions, oral and nutrition status, medications, treatments and procedures, social relationships, and environment assessment. Select CHA responses determine the FS questions, which

aim to collect additional information regarding cognition, mood and behavior, functional status, continence, disease diagnoses, health conditions, oral and nutritional status, skin condition, medications, treatments and procedures, responsibility, social supports, environmental assessment, and discharge potential and overall status. CPS scores range from 0-6, with 0 being “cognitive health,” or no impairment, and 6 being “severe cognitive impairment.” The CPS is a valid and reliable measure of cognition that highly correlates with the Mini Mental Status Examination score [22]. Mood was measured using three items from the CHA (listed in Table 1). The responses to the mood items refer to the previous three days, regardless of cause. Activities that promote positive emotions were measured using WEL, which is a person-centered instrument that allows older adults to express interest in participating in wellness activities. The tool contains items that cover nine core areas: exercise and physical fitness, nutrition, social relationships, emotional health, spirituality, practices affecting health and well-being, recreation, sleep, and goals for wellness service planning. The WEL items that reflect activities to promote positive emotion are listed in Table 1.

Statistical analysis

Logistic regression was used to associate a set of predictors with the CPS score calculated one year following the initial assessment. The CPS score was dichotomized into those reporting a 0 (intact) and those reporting any number from 1 (borderline intact) to 6 (severely impaired). This binary score related to the set of items from the CHA and WEL instruments listed in Table 1. Each of the negative mood variables was also dichotomized into groups consisting of (1) those reporting no presence of the mood, and (2) those reporting the mood, whether it was exhibited or not. Activities promoting positive emotion were dichotomized into groups consisting of (1) those who did not participate in the activity, and (2) those who expressed preference for the activity whether or not they participated. These dichotomizations were chosen because of the small numbers of responses in the higher-level categories. In addition to these predictors of primary interest, we also controlled for age, gender, presence or absence of diabetes, presence

or absence of coronary heart disease, and education level. The dichotomized CPS value at intake was also controlled for in the analysis. All analyses were performed in SAS 9.3 [23].

Results

The final sample used for analysis consisted of 2,436 subjects aged 60 or older, with 492 having complete data for all of the variables of interest. The subjects were primarily female (70.3%) and had high levels of education (40.9% had graduate or professional degrees). Diabetes (11.8%) and coronary heart disease (17.7%) were present, but none had congestive heart failure. Demographics are tabulated in Table 2.

Table 2. Demographic characteristics of subsample used in analysis

	Mean	SD
Age	84.3	6.4 (60-101)
	N (%)	
Gender		
Female	346 (70.3)	
Male	146 (29.7)	
Education		
Did not complete high school	8 (1.63)	
High school graduate	64 (13.0)	
Technical school or some college	75 (15.2)	
Bachelors degree	144 (29.3)	
Graduate or professional degree	201 (40.9)	
Coronary heart disease	87 (17.1)	

Among community-dwelling adults over age 60, those who exhibited more negative mood symptoms at baseline had a greater risk of developing cognitive health decline over one year compared to those who demonstrated fewer negative mood symptoms. All three of the negative mood variables were statistically significant predictors of a CPS score. The presence of negative statements ($p=0.036$), anger ($p=0.017$), and

withdrawal ($p=0.009$) were statistically significant. The full results are listed in Table 3.

Table 3. Negative emotion association with CPS score controlling for age, gender, education, and chronic disease

Emotion	OR (95% CI)	p
Negative statements	0.131 (0.020-0.872)	0.036
Anger	3.064 (1.218-7.704)	0.017
Withdrawal	3.740 (1.388-10.079)	0.009

Odds Ratio (OR) represents the increase in odds of a poor CPS score with the presence of the condition

Secondly, we examined whether those who engage in activities that cultivate positive emotions experience fewer negative mood symptoms and demonstrate less risk for developing cognitive decline over three years compared to those who engage in fewer activities that cultivate positive emotions. The results indicated that none of the positively cultivating activities were significantly associated with changes in CPS score. The full results are in Table 4.

Table 4. Activity participation association with CPS score controlling for age, gender, education, and chronic disease

Activity	OR (95% CI)	p
Acupuncture	0.932 (0.335-2.595)	0.893
Aromatherapy	1.179 (0.269-5.172)	0.827
Massage	0.784 (0.382-1.607)	0.506
Meditation	0.990 (0.431-2.277)	0.982
Music therapy	0.779 (0.303-2.005)	0.605
Therapeutic touch	1.910 (0.469-7.771)	0.366

Odds Ratio (OR) represents the increase in odds of a poor CPS scores with preference for the activity

Discussion

There was mixed support for Frederickson’s Broaden and Build Theory of Positive Emotion. The results of this study support the proposition that negative mood decrease cognition. Older adults who demonstrated more anger and withdrawal had significantly higher odds of developing cognitive decline over time

compared to adults who demonstrated fewer negative moods. These findings are consistent with previous research that indicates a higher risk of cognitive decline among older adults who demonstrate poor mood or depression [12-16]. However, activities that promote positive emotion, including acupuncture, aromatherapy, massage, meditation, music therapy, and therapeutic touch, did not demonstrate the “undoing effect” described by Frederickson [17,18]. We note that the OR for anger indicates that there is a decrease in the probability of a high CPS score with presence of this mood. We hypothesize that this may be due to the high degree of linearity of the three mood variables. In addition, older adults with advanced cognitive decline may be unable to recognize or express their anger.

There are several possible explanations for the absence of statistical significance of an “undoing effect” on negative moods for those who participated in activities that promote positive emotions. The items used to measure activities that promote positive emotions did not include a dose response; participants simply stated if they participated in the activities at one point in time. Correlation research shows that higher levels of positive emotions over time build personal reserves [23]. The amount of time participants spent engaging in specific activities that promote positive emotion may not have been consistent enough over time to undo the effect of negative emotion on cognition. Frederickson [24] proposes that to overcome the potency of negative emotions, the ratio of positive emotion to negative emotion should be at least three to one. The tool used in this study to measure wellness limited the ability to examine the ratio of positive emotion, or the dose, warranting future research.

Recent research suggests that broadening or expanding of positive emotions to enable the creation of a reserve for managing physical threats is also influenced by social connections [25,26]. The perception of positive social connectedness with others accounted for the association between positive emotion and physical health in research by Kok *et al.* [25]; the items used to measure activities that promote positive emotions in the current study were all activities performed independently.

One randomized control trial examined the causal effect of adults who self-generate positive emotions by practicing meditation one hour per week; adults who participated in meditation experienced an increase in positive emotions, mindfulness, social support, purpose in life and decreased physical illness symptoms [26]. Interestingly, the meditation practice in this study, termed “loving kindness,” enabled adults to self-generate feelings of love, compassion, and goodwill, not only toward themselves, but also for others. The effectiveness of a meditation practice that expands to social connection with others supports previous research on social networks as a protective factor to prevent cognitive decline among older adults. Rich and positive social networks are associated with maintaining cognitive abilities as adults age [27-31]. The variables used in this study to promote positive emotions were isolated, single activities that adults would more than likely participate in alone. Future research should examine the undoing effect of social activities that promote positive emotions to determine the relationship between social connectedness, positive emotion, and cognition.

Study limitations

Although the sample size in the current study is relatively large, the lack of variation in the sample resulted in decreased power. A more heterogeneous sample would improve external validity of the results. The strongest predictor in the logistic model was the intake CPS score (OR=19.3, $p < 0.001$), which likely explains such a large portion of the variance that rendered the other predictors ineffective. Given that the CPS score analyzed was only one year after baseline, this result is not unexpected; the amount of time from baseline may influence the level of decline. Given the nonrandom nature of the subjects’ risk factors and choice of activities; however, controlling for baseline CPS scores is critical. We note that education was also an important predictor. Those not completing high school were significantly more likely to have a poor CPS score as compared to those who had a graduate or professional degree (OR=7.364; 95% CI: 1.37, 38.71), suggesting that health status is positively influenced by higher education.

Conclusions

In the present study, negative moods were associated with a greater risk of cognitive decline as adult’s age. Assessments for negative moods that increase the risk factor of cognitive decline may facilitate a health care provider’s ability to develop patient-centered cognitive decline prevention plans. The intervention for increasing positive emotion and how it reduces the risk of cognitive decline, remains unknown and should be examined in future research.

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