

Cognition and What Influences It

The cognitive reserve (CR) model suggests that the brain actively attempts to cope with brain damage by using preexisting cognitive processing approaches or by enlisting compensatory approaches. (1) Stern suggests that at the neural level two things are necessary: neural reserve and neural compensation. Neural reserve refers to the brain networks or cognitive paradigms that are less susceptible to disruption, perhaps because they are more efficient or have greater capacity. (1) Neural compensation refers to the process by which individuals suffering from brain pathology use brain structures or networks not normally used by individuals with intact brains to compensate for brain damage. (1)

The main take home point with the cognitive reserve theory is that a person's cognitive reserve is not fixed. At any point in one's lifetime it results from a combination of exposures including genetics, the environmental influences on brain reserve and pathology, and the ability to actively compensate for the effects of pathology. (1)

When applying the cognitive reserve concept to clinical practice certain traits of our individual clients may be able to clue us into the amount of cognitive reserve they might have. The IQ and degree of literacy of the person were found to be good markers. Level of income and occupational attainment (socioeconomic factors) also could clue us into the amount of cognitive reserve a person may have. These traits along with a larger cognitive reserve might allow those individuals to deal with pathology better and for longer periods of time. (1)

We also know that exercise and physical activity can have a significant effect on cognition in both the young and old including an increase in gray matter volume in the frontal and superior temporal lobes of the brain in older adults. (2) The results of one study would even suggest that even relatively short exercise interventions can begin to restore some of the losses in brain volume associated with normal aging. (2)

Animal studies can provide us with information we might not be able to obtain when dealing with human subjects and most of the information in the animal studies has been focused on the hippocampus and the medial temporal lobe of the brain. (2) Exercise has been shown to affect the neuronal structure and responsiveness that underlies cognition and behavior in young and adult animal models. It is well established that brain derived neurotrophic factor (BDNF) is increased with exercise in the hippocampus region and that aged brains are also responsive to exercise induced BDNF expression in that region. (2) In fact, BDNF has been shown to regulate neurotransmitters, including dopaminergic and cholinergic systems and may be playing a role in the exercise induced effects on neurotransmitters, (2) If this is the case it may be plausible that exercise could be an important intervention to reduce onset or incidence of Parkinson's disease.

If I could tell older adults two things they could do right now to potentially protect their brain I would tell them to read a book or do a crossword puzzle and to exercise aerobically at least 30 minutes a day 5 days a week. The reason being is that literacy

has been linked to a greater cognitive reserve (1) and thus potentially a greater ability to cope with cognitive pathology. The aerobic exercise is good for cardiovascular conditioning and has also been shown to increase brain volume and therefore cognitive function. (2)

References:

1) Stern Y. Cognitive Reserve and Alzheimer Disease. *Alzheimer Dis Assoc Disord*. July-Sept. 2006; 20(2): S69-S74.

2) Kramer AF, Erickson KI, Colcombe SJ. Exercise, Cognition, and the Aging Brain. *J Appl Physiol*. 2006; 101: 1237-1242.