

FORMAL AND INFORMAL EDUCATION VS. ALZHEIMER'S

Hifa Gülru Çağlar

EDUCATION

- In the dictionary: the process of teaching or learning in a school, or the knowledge that you get from this.

Formal education

- is the process of going from elementary school ⇒ high school ⇒ bachelor degree program ⇒ and possibly a graduate degree.
- classroom-based, provided by trained teachers.

Informal education

- happens outside the classroom, in after-school programs, community-based organizations, museums, libraries, or at home.
- e.g. reading books

- Both processes of formal and informal education are based on learning and memory.

BDNF

- Brain-derived neurotrophic factor (BDNF) regulates both shortterm synaptic functions and activity-dependent synaptic plasticity such as long-term potentiation. It is related to neural plasticity, learning and memory.

Learning upregulates brain-derived neurotrophic factor messenger ribonucleic acid: a mechanism to facilitate encoding and circuit maintenance?

[Kesslak JP](#), [So V](#), [Choi J](#), [Cotman CW](#), [Gomez-Pinilla F](#).

- This study based on training rats on water maze showed that, learning can impact BDNF mRNA expression localized to the brain areas involved in the processing of spatial information . Furthermore, behaviors such as physical activity and learning may help maintain and protect neurons at risk in aging and neurodegenerative disease via increased BDNF expression.

BDNF

- Brain-derived neurotrophic factor (BDNF) is a member of the neurotrophin family, which plays important roles in the survival, maintenance, and growth of neurons (Barde et al., 1982; Leibrock et al., 1989).

Education modifies the relation of AD pathology to level of cognitive function in older persons

D. A. Bennett, R. S. Wilson, J. A. Schneider, et al. *Neurology* 2003;60;1909 DOI 10.1212/01.WNL.0000069923.64550.9F

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130 persons, 62 men and 68 women

Clinical evaluation

Medical history
Neurologic examination
Neuropsychological performance testing
Review of a brain scan when available

Years of formal education

Follow-up evaluations, identical in all essential details, were performed annually by examiners blinded to previously collected data. At the time of death, all available clinical data were reviewed by persons blinded to all postmortem data, and a summary diagnostic opinion was rendered regarding the most likely clinical diagnosis at the time of death.

Neuropsychological performance testing

Cognitive function tests were selected to assess a broad range of cognitive abilities commonly affected by aging and AD.

Nineteen cognitive function tests were used to create a global measure of cognition and separate summary measures of five different cognitive abilities.

- seven tests of episodic memory (Word List Memory, Recall, and Recognition²² and immediate and delayed recall of two brief stories^{23,24})
- four tests of semantic memory (Verbal Fluency²² and short forms of the Boston Naming Test,²⁵ National Adult Reading Test,²⁶ and Extended Range Vocabulary²⁷)
- four tests of working memory (Digit Span Forward and Backward,²⁴ Digit Ordering,²⁸ and Alpha Span²⁹)
- two tests of perceptual speed (Symbol Digit Modalities Test³⁰ and Number Comparison²⁷)
- two tests of visuospatial ability (short forms of Judgment of Line Orientation³¹ and Standard Progressive Matrices³²).

Measures of ***global cognition***, based on all 19 tests, and of :

- episodic memory
- semantic memory
- working memory
- perceptual speed
- visuospatial ability

Neuropathologic evaluation

Tissue from the midfrontal gyrus, the superior temporal gyrus, the inferior parietal gyrus were examined.

Neuritic plaques, diffuse plaques, and neurofibrillary tangles were counted

Four composite scores, including global AD pathology score, a neuritic plaque score, a diffuse plaque score, and neurofibrillary tangle score, were derived for each subject.

RESULTS

Findings suggest that the relation between senile plaques and level of cognitive function differs by level of education.

This suggests that education not only provides a cognitive advantage such that persons with more years of education have higher levels of cognitive function throughout adult life and therefore require more pathology to reach any given level of cognitive impairment, but that education also somehow modifies the effect of AD pathology on cognition.

These data provide strong evidence that formal education, or something related to education, provides some type of cognitive or neural reserve that reduces the deleterious effect of senile plaques on cognitive abilities.

Education and related cognitive experiences may lead to greater redundancy in neural circuits involved in cognition thereby rendering these systems less vulnerable to pathology.

Work with experimental animals suggests that neural circuits are not static but capable of ongoing plasticity in adult and aged animals, and that the neuroplastic responses from environmental enrichment are functional and can be sustained over time.

Because education appears to modify the relation of senile plaques to cognitive function rather than simply providing a fixed cognitive advantage, it is possible that education, or factors related to education, induce a similar neuroplastic response in humans.

<http://en.wikipedia.org/wiki/Learning>

<http://en.wikipedia.org/wiki/Education>

http://en.wikipedia.org/wiki/Brain-derived_neurotrophic_factor

<http://www.ncbi.nlm.nih.gov/pubmed/9733207>

<http://www.neurology.org/content/75/19/1726.full.pdf+html>

<http://www.neurology.org/content/60/12/1909.full.pdf+html>