Today's Research on Aging

Program and Policy Implications

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Cognitive Aging: Imaging, Emotion, and Memory

Older adults commonly worry about losing their memory and other mental faculties. However, while aging is inevitable, severe cognitive decline is not a given. Fewer than one in five people over age 65 experiences moderate to severe memory impairment (see figure). Among those 85 and older, the share is higher, but still less than half. About one-third suffer from moderate to severe memory impairment.

To promote healthy aging, the National Institute on Aging (NIA) supports research aimed at better understanding the aging mind and its impact on the health behaviors and well-being of older Americans. This newsletter highlights NIA-funded research that examines several aspects of cognitive function in older adults, particularly ways in which they think differently and what can be done to enhance cognition or strengthen thought processes.

The Aging Brain

As individuals age, their brains shrink. They gradually lose nerve cells that they had from birth and process information more slowly. As a consequence, learning new concepts and patterns becomes more difficult. Memory also begins to fail. The ability to store, process, and manipulate information drops. It also becomes harder to switch between tasks. With time, deleting irrelevant information or mental clutter from stored memory becomes more difficult.

What's puzzling is that while some older adults may show pronounced deficits in perception, attention, and memory, others perform at least as well as younger adults or experience less of a drop in cognitive function.

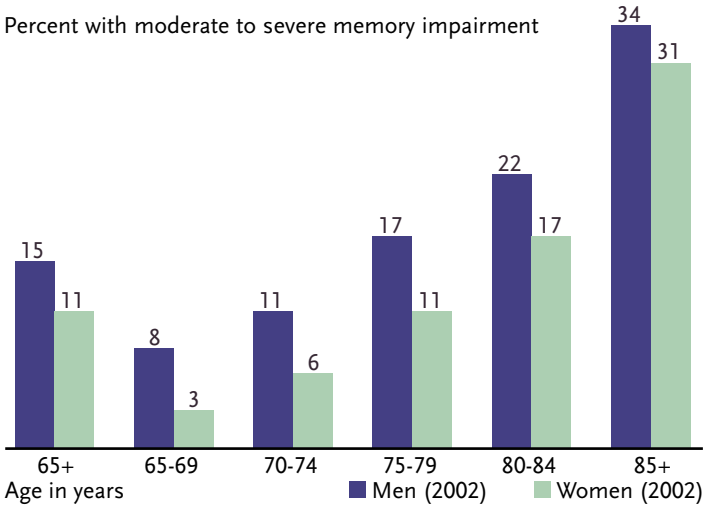
What explains the successful aging of some people compared with those who suffer far greater cognitive losses?

Researchers still don't have all the answers. But they now know that what happens in the maturing brain is far more nuanced than previously thought. The brain is flexible and adaptable. As people age, they continue to generate new nerve cells and also to use more parts of the brain than a young adult, so that the organization of the brain changes throughout an individual's life.

In This Issue

This review summarizes research related to the objectives of the National Institute on Aging, with emphasis on work conducted at the NIA demography centers. Our objective is to provide decisionmakers in government, business, and nongovernmental organizations with up-to-date scientific evidence relevant to policy debates and program design. These newsletters can be accessed at www.prb.org/TodaysResearch.aspx.

Fewer than 1 in 5 adults over age 65 experiences moderate to severe memory impairment.



Source: Federal Interagency Forum on Aging-Related Statistics, *Older Americans Update 2006: Key Indicators of Well-Being* (Washington, DC: Federal Interagency Forum on Aging-Related Statistics, 2006).

New Frontiers: The Brain Activates Different Areas in Older Adults

As researchers begin to narrow the gap between neuroscience and the study of cognitive aging, new findings about the aging brain have begun to emerge. A growing body of research offers evidence that older adults think differently from younger ones. When older adults were asked to perform the same cognitive tasks as young adults, brain scans showed that different or more parts of the brain lit up (Cabeza 2002; Park et al. 2001).

When adults performed cognitive tasks heavily dependent on the frontal cortex, such as matching faces and recalling words, neuroimaging showed distinct age differences in which area of the brain is accessed. Older adults sometimes used additional areas in the same region of the brain. For example, in one comparison of brain scans, whereas young adults performed a cognitive task by activating the left hemisphere of the prefrontal cortex, older adults activated both the right and left hemispheres. In other instances, older adults exhibited activity in the same area of the brain as did younger adults, plus additional activity in unrelated regions. Comparing brain scans for another task showed that older adults used the same area of the brain activated by younger adults plus other unrelated regions of the brain. Finally, older adults sometimes used an entirely different part of the brain than younger adults use for the same task.

These age-related differences in the pattern of brain activity suggest that how the brain works is not as clear-cut as previously thought. Evidence suggests that the brain does not just passively decline. The brain reorganizes itself, using different circuitry in older adults. It is a dynamic structure that reacts to experience, showing both gains and losses with age.

Just as research has shown what kinds of exercise and eating habits can build a healthy body, these brain studies that link behavior with physical structure are opening the door to new possibilities for people to optimize brain function. In the future, scientists may learn more ways to promote brain health and fitness through specific mental exercises.

However, some questions will need to be answered. While older adults draw more symmetrically on the two hemispheres in frontal areas of the brain than young adults, little is known about usage patterns in other parts of the brain. And although neural findings are changing the way we think about behavioral facets of cognitive aging, large studies with extensive behavioral testing and demographic and medical information are still needed to uncover answers about the relationships between the brain and behavior of older adults.

What is the role of experience and cognitive exercise in protecting the brain from the effects of age? Can using the mind protect it from cognitive loss or compensate for cognitive losses already sustained, just as exercise and diet can prevent high blood pressure or cardiovascular disease?

The discovery that the brain uses different circuitry as individuals age, and that older rats in enriched environments sprout neurons, suggests that the aging brain is more malleable than once thought. These findings also reinforce the possibility that certain environments and experiences can enhance brain function. Once researchers learn what those are, we may take action to make our minds as healthy as possible even as we age.

The Positivity Effect

Older adults think differently. At older ages, adults experience a "positivity effect," a shift from a disproportionate preference for negative information in young adulthood to a relatively stronger preference for positive information in old age (Carstenson, Isaacowitz, and Charles 1999).

In one study, when older adults were presented with pairs of advertisements that were identical except for the featured slogan, a majority preferred the ads featuring slogans that promised more emotional rewards over those that promised the expansion of horizons, exploration, and knowledge (Fung and Carstensen 2003). Yet when older adults were asked to imagine a longer time horizon before choosing which ad they preferred, they made choices like those made by younger participants. They did not show a significant preference for the emotion-related slogans.

In short, chronological age is associated with paying more attention to emotional gratification and the emotional aspects of life (Carstensen 2006; Mather and Carstensen 2005). As a consequence, attention to and memory for positive information is accentuated.

Shaping Goals Based on Perceived Time Left

Researchers have observed that people of different ages give priority to different types of goals. According to the "socioemotional selectivity theory," goals shift in importance depending on perceived time left. When time seems open-ended or abundant, people give priority to goals that focus on gathering information, experiencing something new, or expanding one's breadth of knowledge.

When time is perceived to be constrained or limited, individuals place priority on goals that emphasize feeling good and optimizing psychological well-being. When people perceive time as finite, they attach greater importance to finding emotional meaning and satisfaction from life and invest fewer resources into gathering information and expanding horizons.

Goals, preferences, and thought processes such as attention and memory change as time horizons shrink. The subjective sense of time left can change. Events such as the 9/11 attacks and the severe acute respiratory syndrome (SARS) epidemic in Hong Kong eliminated age differences on some motivation measures, reminding all people, regardless of age, of the fragility of life.

The positivity effect may influence how and when older adults make decisions. Greater attention to avoiding negative feelings may partially explain why older adults are more likely to avoid making a serious medical decision compared to younger adults. Instead of deciding whether to have a serious medical procedure, older people may avoid negative feelings by postponing the decision or avoiding it (Kennedy and Mather forthcoming). Should they decide to make a decision, they may deliberate for less time. For negatively laden decisions, they may seek out less information than younger adults do.

If older adults focus more on emotional content, they may encounter problems when it comes to informed decisionmaking in health care and finances. Choosing among treatment options could present formidable challenges. In addition, older adults' tendency to focus on positive information may make them vulnerable to scam artists and others who wish to take advantage of them.

The Benefit of Experience

Although changes in cognitive function that accompany aging would suggest that decisionmaking also deteriorates, older people do not necessarily make worse choices than younger people. If a decision matters a lot, older people may bring resources to bear in ways that compensate for lost capabilities (Peters et al. 2007; Kovalchik et al. 2005). Studies of risk and decisionmaking that include older adults report no age difference in attitudes or behavior for either financial or health decisions (Kennedy and Mather forthcoming). Both the young and old perceive risk similarly and are equally vulnerable to making choices based on wording that emphasizes the positive or negative implications of a potential decision.

Stephanie Kovalchik and her colleagues (2005) have found similar results in recent experiments on economic decisions. In fact, their results suggest that overconfidence in younger people affects decisionmaking more than it does in older people. The researchers suggest that older people have learned to use experience to temper overconfidence. This means these adults behave more like experts do and have more accurate beliefs about their knowledge and limitations.

Ways to Prevent Cognitive Decline

While research on what can be done to train the brain to maintain a high level of functioning is in its infancy, some recent findings offer hope. In a population-based study of elderly persons in Taiwan, researchers found that participating in social activities seems to help preserve cognitive function over a seven-year followup period (Glei et al. 2005). Respondents who engaged in one or two social activities had 13 percent

Improving Everyday Memory

Everyday memories are those that routinely occur in one's daily life. These include remembering names, plans for the day, what one needs to buy at the grocery store, when to take drugs, directions, or recent news. These memories are often difficult for older adults to recall. But that isn't always the case.

In one study that compared middle-age and older adults, the younger group forgot to take medications more often than the older adults did (Park and Meade forthcoming). Middle-age adults reported being busier and having more irregular schedules than older adults. Evidence indicates that this higher level of activity contributed to these adults forgetting everyday tasks such as taking medication. In fact, how busy individuals are turned out to be a better predictor of memory function than whether they remember to take medication.

In a later study, older adults learned to link remembering to monitor their blood glucose to a "naturally occurring" event in their daily lives, such as sitting down for breakfast. Imagining on Monday that they would monitor their glucose right after breakfast increased, by over 50 percent, the chance that individuals would actually remember to monitor blood glucose levels right after breakfast on Tuesday. This study suggests that by relying on imagining future events in a context and routine to support memory, older adults can improve their everyday memory.

fewer failures on cognitive tasks than those with no social activities. Respondents who engaged in three or more social activities failed one-third fewer tasks. The nine social activities measured included playing games; volunteering; and participating in a religious group, clan association, or organizations for the elderly.

Continuing to participate in social activities may help ward off cognitive decline as people age. The study also suggests that participation in social activities outside the family may be more important than (at least weekly) contact with family, friends, or neighbors.

In a more recent study, the first large-scale, randomized trial showed that mental exercises can improve memory, reasoning ability, and the information-processing speed for older adults (Willis et al. 2006). Participants who received training that targeted specific cognitive abilities—memory, reasoning, or speed of processing—reported less difficulty with daily living activities five years after the training, compared with those in the control group. Participants were tested on activities including everyday problemsolving; the ability to reason and identify information in medication labels; using the yellow pages; making change; and reacting quickly to a road sign.

As researchers begin to trace memory failure back to its sources, they will be better armed to fight age-related declines. In older adults, personal stressors have been linked to memory failure. In a daily diary study, when older adults experienced interpersonal stressors, such as arguments or potential arguments with friends, family, or acquaintances, they experienced more memory failures on the same day as well as an increase in memory failures from one day to the next (Neupert et al. 2006). The memory failures included poor recall of people's faces and inability to recall a word. Such findings may provide a foundation for future interventions that can mitigate age-related cognitive decline.

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The NIA Demography Centers

The National Institute on Aging supports 13 research centers on the demography and economics of aging, based at the University of California at Berkeley, the University of Chicago, Harvard University, the University of Michigan, the National Bureau of Economic Research, the University of North Carolina, the University of Pennsylvania, Pennsylvania State University, Princeton University, RAND Corporation, Stanford University, the University of Southern California/University of California at Los Angeles, and the University of Wisconsin.

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For More Information

The Aging, Demographics, and Memory Study
http://aging-memory.duhs.duke.edu/ADAMS.html

Documentation of Cognitive Functioning Measures in the Health and Retirement Study
http://hrsonline.isr.umich.edu/docs/userg/dr-006.pdf

***The Journals of Gerontology Series B: Psychological Sciences and Social Sciences*, Special Issue 1, June 2007, "Cognitive Interventions and Aging"**
http://psychsoc.gerontologyjournals.org/content/vol62/suppl_Special_Issue_1/

Life-Span Development Laboratory, Stanford University
http://psychology.stanford.edu/%7Elifespan/research.htm

Memory and Cognition Lab, University of California-Santa Cruz
http://psych.ucsc.edu/matherlab/index.html

Denise Park, "The Cognitive Neuroscience of Aging: Implications for Everyday Life," presentation delivered at the RAND 2004 Mini Medical School for Social Scientists, Santa Monica, Calif., July 8, 2004.
www.rand.org/labor/aging/rsi/minimed2004.html
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