Brain Aging and the Science of Decision-Making

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Can aging influence our ability to make important life decisions?

Goal:
Review what we know on how aging can affect decision-making; Practical advice on ways to help us make healthy choices as we age.
Why is it important to understand how aging influences our decision-making?

• With the growing older adult population, the ability to make sound decisions is increasingly important, including our day-to-day and long term financial, health care, and lifestyle choices.

• The decisions we make can impact our mood, quality life, health, financial security, and life satisfaction now and in the future.

• Understanding the science behind our decision-making has the potential to help us learn more about the effects of aging on cognitive and the brain, as well as to provide new approaches which support making good choices as we age for happier and healthier lives.
Cognitive decline in healthy and pathological aging

- Changes in cognitive abilities occur as we age
- But the changes in healthy aging are much more subtle than in pathological aging
- Do the cognitive effects of healthy aging influence our ability to make judgments and life decisions?

Sperling et al., Alzheimer’s & Dementia, 2011
So what goes in to making a decision?

- Decision-making typically includes the selection of an option that we think is likely to meet our goals.

- When faced with a decision, we often think through multiple options and weigh the pros and cons, drawing from past experience.

- Together the decision-making process can require a good deal of cognitive effort, especially when time is limited and the decisions are important ones.
Effects of healthy aging on cognition

- Performance declines with increasing age for Speed of Processing, Working Memory, and Long-Term Memory.
- Performance is preserved over age for World Knowledge.

Park and Reuter-Lorenz, 2009
Aging alters brain volume, function, and connectivity

- Brain aging is associated with alterations in volume, function, and connectivity

- Such brain changes are much less than what is observed in pathological aging

- Frontal and temporal brain regions are often preferentially affected in healthy aging, but other brain areas are also altered

Alexander et al., *NeuroReport*, 2006; Bergfield et al., *Neuroimage*, 2010
Aging alters brain chemicals that support decision-related networks

- During the course of healthy aging, neurochemical brain systems, involving dopamine, decline at a rate of 5-10% per decade.

- Modulation of neurochemical systems with aging, like dopamine, have also been implicated in decision making related to evaluating risks and rewards.

- Risk-taking behavior reduces with age and this may be, in part, related to the changes in the brain’s neurochemical systems.

Mohr et al., Neurosci Biobehav Rev, 2010
How might cognitive and brain aging influence our decision-making?

A little background

• Decisions draw on our ability to be self-aware, use self-control, regulate our emotions, keep long-term goals in mind, and place relevant value on the choices we make for the future

• These complex decision-making abilities can be influenced by our cognitive, emotional, interpersonal, and motivational styles

• Small day-to-day choices can constrain future options and the decisions you make, affecting your experience of aging, including cognitive and physical health, financial resources, and life satisfaction

• Research from neuroscience, psychology, and economics can help address important questions on the cognitive, emotional, and motivational capacities that we use in making decisions

• Studies have used complex tasks and games to test decision making styles, like risk-taking, and how it’s altered in aging

What do we know about how aging affects decision making?

Research findings and recommendations
The MetLife Study of Decision Making

- A sample of 72 healthy older adults, 50 to 79 years of age, screened to exclude pathological aging

- Participants completed a decision making task to assess their ability to make logically consistent decisions in which the same result is framed as either a loss or a gain

- Performance was related to measures of strategic learning or the ability to use a strategy to help identify important from less important information; conscientiousness or the trait of being careful and organized; and degree of vigilance or the tendency to consider many options, weigh outcomes and taking time to make sound decisions
The MetLife Study of Decision Making

- The three age groups performed similarly on the Decision-Making Task with equally low levels of bias suggesting an ability to make logical decisions.

- In contrast, high strategic learners showed less bias and more conservative decision-making than those who were low strategic learners.

- A relatively high degree of conscientiousness was seen in all three age groups with some small increases with increasing age.
How emotional and motivational brain circuits affect decision-making in aging?

- Three brain systems have been suggested that work together to support how we make choices during decisions.

- These systems function to support emotional anticipation of gain and loss, integration of value, and motivational processes that support motor responses.

- It is thought that healthy aging may diminish the projections of neurochemical circuits to the brain’s frontal lobe in ways that alter the ability to make optimal choices.

How age-related changes in cognition can influence our decisions

- Slowing of our ability to process information and use working memory in healthy aging can make cognitively demanding decisions harder.
- But healthy older adults can draw on greater prior experience and knowledge to make similar decisions in the future.
- Older adults tend to have more practice at making decisions than young adults.
- On balance, the limitations of cognitive aging can be offset by the greater experience and wisdom that comes with age.

Papp et al., *Aging Neuropsychol Cogn*, 2014; Li et al., *PNAS*, 2015
How age-related changes in emotion regulation can influence our decisions

• It has been suggested that the ability for emotion regulation is important for decision-making and improves with age.

• Research has shown that decision-makers that can avoid dwelling on bad past events, are likely to make better decisions about when it’s best to walk away from a loss (e.g., cancel projects that are not working out).

• When faced with adversity, older adults tend to focus on the positive, whereas younger adults tend to worry about negative possibilities.

• It may be that having better ability to regulate your emotions may also help offset the effects of age-related changes in cognition during decision-making.

• Older adults that tend to worry less about finding the optimal choice and focus more on the a “good enough” choice may be happier in making decisions.

Torges et al., *Psychol Aging*, 2008; Bruine de Bruin et al., *Psychol Aging*, 2016
We need more research on aging and decision-making

- More research is needed to link the novel tasks and games used in studies to real world outcomes
- Improving the decision making assessments may help identify individuals at risk for making suboptimal healthcare choices, financial mistakes, or scams and fraud
- Research may also identify opportunities for intervention, when individuals decision making performance is less than optimal
- Although current and past research is encouraging, the field of decision neuroscience is only beginning to address the need for practical, real world solutions to enhance decision making across the lifespan

Summary

• Healthy aging can lead to declines in some cognitive abilities, while others can be preserved

• Brain volume, function, connectivity and neurochemical systems are altered as we age and these changes may contribute to changes in our decision making

• Research so far on decision-making has shown that older adults tend to take less risks and have a more positive outlook on decision outcomes

• Using learning strategies combined with greater life experience and a positive emotional outlook may help to offset the cognitive changes during aging and their influence on good decision-making

• More research is needed, as we have only begun to understand how we make decisions and how our decision-making changes as we age
Recommendations for making healthy choices when making new decisions

• Stay informed on how making decisions can be influenced by cognitive, emotional, and motivational factors as we age

• Do your research to get the information you need to make an informed choice

• Try using strategies to focus on important information, when sifting through all the details of a decision

• Stay engaged with family, friends, and advisors to obtain other opinions

• Take the time to seek advice in making important financial, health care and lifestyle decisions
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