Healthy Brain, Healthy Decisions

The MetLife Study of Decision-Making Potential

December 2012
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200 Park Avenue
New York, NY 10166
MatureMarketInstitute@MetLife.com

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The MetLife Mature Market Institute (the Institute) partnered with the Center for BrainHealth at The University of Texas at Dallas and the University of California, San Francisco to investigate the decision-making capabilities of adults 50 to 79 years of age. The Healthy Brain, Healthy Decisions project is one of the first studies to investigate the connection between cognitive health, aging and decision-making capacity. Making logically consistent decisions is an important decision-making competency as it signifies an individual’s ability to recognize both sides of financial decisions, whether presented with potential gains or losses, and their ability to make appropriate and reliable financial choices. The study’s main aim was to identify factors that may inhibit or increase the risk of poor decisions in the 50 to 79 age group.

The Institute’s collaboration with researchers at the Center for BrainHealth and the University of California, San Francisco addresses decision-making mechanisms and offer an alternative to the pervasive negative stereotyping of the financial decision-making capacity of middle age and older adults, 87% of whom are cognitively healthy, according to the National Institute of Aging.

The Healthy Brain, Healthy Decisions project contends that previous large sample studies documenting declines in the ability to think logically and solve problems, starting as early as age 40, fail to identify individual factors, such as early dementia or other medical causes, which contribute to declining decision-making capacity. Moreover, previous research ignores positive age-related aspects such as extensive life experiences, reasoning ability, and accumulated knowledge that may preserve or even enhance decision-making.

In this study, participants completed a decision-making task designed to test their ability to make logically consistent financial decisions. Each individual’s decision-making was compared with their performance on measures of strategic learning capacity as well as traditional cognitive measures such as IQ and self-reported decision-making styles.

The results found no decision-making decline comparing performance across age groups in 50- to 79-year-olds, indicating that age alone is not a key factor in predicting logical consistency in decision-making capacity. Participants who most reliably demonstrated smart decision-making also excelled at the study's strategic learning task, which tested their ability to determine and use a strategy to sift and learn more important information rather than overloading their brain and memory with less important information.
The results shed light on factors that do and do not contribute to poor decision-making, such as:

- Age alone is not a predictive factor of lower decision-making capacity.
- Impaired strategic learning (the ability to determine and use a strategy to sift information) is strongly related to worse decision-making.
- Together, gender and cognitive function level (ranging from average to superior), may influence decision-making consistency.

Researchers gauged participants’ financial **conscientiousness**, the trait of being careful and organized, using a series of questions regarding monthly budgeting practices and financial retirement plans. Additionally, researchers assessed **vigilance** (i.e., an approach to decision-making characterized by carefully assessing options and possible alternatives before making a decision) by measuring the participant’s thoroughness when considering many options. Contrary to expectation, increased vigilance was neither found in the group in their seventies as compared to the group in their fifties, nor in women as compared to men. Also, researchers expected to see an unhealthy **hypervigilance** resulting in impulsive decision making in the oldest age group, but this was not the case. These additional findings show study participants in their seventies were more conscientious, remained appropriately vigilant, and avoided being impulsive when compared to the group in their fifties.

*Healthy Brain, Healthy Decisions* found that men and women between the ages of 50 and 79 performed equally on measures of strategic learning on decision-making performance. One unexpected gender-related finding, however, was the role of classic measures of cognition, such as IQ. Regardless of cognitive function level, women’s decision-making consistency was relatively similar, while men’s decision-making consistency varied depending on their cognitive function level. These findings, while intriguing, are very preliminary and require validation in further independent study.

**Conscientiousness:** The personal trait of being careful and organized. This study assessed care and organization towards financial decisions by asking participants about their retirement planning and their ability to stick with a monthly budget.

**Vigilance:** An approach to making decisions in which the individual considers as many options as possible, weighs various outcomes and takes the time to make a sound decision. Experts believe this is the best approach for making important decisions.

**Hypervigilance:** An impulsive and highly stressed approach to making decisions. Hypervigilant decision-makers focus on immediate solutions without considering other options or outcomes. Hypervigilance is seen as an unproductive decision-making style that is unlikely to produce good decisions or results.
Key Findings

Healthy Brain, Healthy Decisions findings challenge the common misconception that advancing age threatens decision-making performance. The project identified specific measures of brain function that influence decision-making capacity:

- **Strategic Learning** (the ability to determine and use a strategy to sift more important information from less important information)
- **Conscientiousness** (being careful and organized in regard to finances)
- **Gender**

Decision-making did not decline in healthy individuals with increased age as would be expected given popular belief.

The key findings are summarized below:

- **Healthy aging adults show no decline in decision-making.**
  Older decision-makers were as logically consistent as younger decision-makers. Increased age alone — from the early 50s through the late 70s — was not a key factor in predicting impaired decision-making capacity. For example, adults in the older age decade (70 to 79 years) were no more or no less logically consistent in their decision-making than adults in the younger age decades (50s or 60s). In sum, each age group demonstrated comparable decision-making patterns, indicating no decline with age.

- **Strategic learning capacity may actually increase with age.**
  All three age groups of older adults were comparable as strategic learners. Those in their 70s performed at least as well as the younger age group in their 50s on a cognitive measure of strategic learning. When use of a personal strategy to sift and learn incoming information was examined, all groups performed similarly on filtering the most relevant information from extraneous information presented.

- **Strategic learners are less likely to fall victim to bias toward riskier options.**
  A strong link was identified between decision-making and strategic learning. Performance on the strategic learning measure predicted adults’ ability to make logically consistent decisions regardless of age. Participants who performed well in sifting important information made more logically consistent decisions. In contrast, participants who performed poorly were less logically consistent and showed more bias toward riskier choices when presented with decision-making tasks that resulted in a potential financial gain or loss.
- **Conscientious decision-making intensifies with age.**
  Older decision-makers in the study reported themselves as more conscientious (i.e., careful and organized) than those in the younger age group reported themselves. On the study questionnaire addressing general attitudes toward personal finances, individuals in their 70s reported having a more conscientious style of decision-making as compared to individuals in their 50s who reported lower levels of conscientiousness in their decision-making. For example, individuals were asked to respond to statements such as “I feel competent to manage my own day-to-day personal finances” or “I worry about my personal finances.”

- **Risk tolerance can be linked to cognitive ability when coupled with gender.**
  Overall, men and women performed equally well at logically consistent decision-making and at strategic learning. In both men and women, strategic learning proficiency was associated with the ability to make logically consistent decisions.

- **There were differences between men and women in the relationship between decision-making and traditional measures of cognitive function.**
  Men who scored in the superior range of cognitive ability such as IQ, working memory (i.e., ability to hold information in mind for later use), verbal fluency (i.e., generating as many items in a particular category as possible in a short time period) and processing speed (i.e., how fast a cognitive task is performed), made more logically consistent decisions than men who scored in the average range. In contrast, there were no significant differences in logical consistency across the cognitive levels in women. In sum, men with average cognitive function demonstrated the highest risk seeking (lowest logical consistency) in decision-making of any group. Men in the superior cognitive range were the most conservative group followed by women in the average cognitive range. This was an unexpected finding in this study and requires further examination. Age was not a factor in this pattern.

Scientific discoveries now show that our brains retain immense capacity to be modified and strengthened as we age. To take advantage of the brain’s inherent ability to grow, rebuild, and rewire itself, individuals need to implement the necessary steps to maximize cognitive function sooner rather than later, and maintain the motivation to remain cognitively active, informed, and engaged in personal financial decisions. Combining the present findings with emerging evidence of retained cognitive brain health in aging suggests that policies aimed at protecting those most vulnerable to poor decision-making should focus on disease, rather than age itself, as a risk factor.
In sum, rather than attributing impaired decision-making to age alone, approaches that assess an individual’s strategic learning ability and cognitive function can improve our understanding of decision-making capacity at all ages and between genders. One potential consequence of this is that policies and practices that focus exclusively on age-related declines in decision-making will risk unnecessarily curtailing the autonomy of older adults with preserved cognitive function. Ultimately, finding ways to mitigate declining decision-making capacity if and when it is detected is an important goal.
Healthy Brain, Healthy Decisions was conducted by the Center for BrainHealth at the University of Texas at Dallas and the University of California, San Francisco in partnership with the MetLife Mature Market Institute from October 1, 2011 through June 30, 2012. A sample of 72 adults, comprised of 31 men and 41 women, was recruited from the Dallas-Fort Worth community. Ages were evenly divided between men and women in their fifties, sixties, and seventies.

The research focused on this age group for four major reasons:

1. The 50- to 79-year-old age group is the most rapidly growing segment of our population estimated at approximately 121,750,000 people or approximately 39% of the population.

2. A number of existing cognitive aging studies suggest continual worsening of cognitive function in the 50 to 79 years age span that may contribute to impaired decision-making.

3. Individuals within this age range face some of the most important financial, health, and work-related decisions such as, when to retire, how much to save, and whether to purchase financial products specific to their long-term needs. Decisions at this life stage have profound consequences for these adults themselves as well as their families and beneficiaries.

4. Other recent research focusing on interest rates and fee payments suggest that financial decision-making peaks in the early to mid-50s and declines afterwards.

Each participant was tested on a “framing” task to measure the logical consistency of their decision-making behavior. This framing task presented participants with multiple financial decisions to make, with decisions presented as financial gains or losses, in order to measure the influence of context on decision-making (see Key Terms on page 21 for further detail). All participants were also given cognitive assessments to determine their levels of cognitive performance. Following testing, participants completed a questionnaire reporting decision-making preferences. Participants were screened to rule out cognitive decline through phone screens, the Montreal Cognitive Assessment, and a depression inventory.

All participants were within or above the normal range of these cognitive assessments. Therefore, the results may be representative of individuals that are average, high-average, or superior functioning individuals in terms of cognitive function as well as decision-making style. The results show that with advancing age, individuals with intact cognition retain their ability to make logically consistent decisions. Our relatively homogeneous sample with carefully controlled cognitive screening yielded results that had sufficient statistical power, indicating that the results are likely to be reproducible in a similar population. These results are likely to generalize to cognitively healthy, educated, older individuals outside the sample tested.
Major Findings

The Healthy Brain, Healthy Decisions project represents one of the first studies to measure the contributions of age, cognitive function, decision-making style, and gender on decision-making performance in a group of healthy individuals between the age of 50 to 79 years. The results indicate that cognitively healthy adults in this age range possess the skills and capacities necessary to facilitate logically consistent decision-making.

Aging and Decision-Making

Whereas some research suggests declines in decision-making capacity occur with advancing age, in this well-controlled behavioral study we found no significant differences in the logical consistency of older and younger individuals age 50 to 79 (Figure 1).

Researchers used an established decision-making task to investigate the influence of framing, with choices presented as gains or losses, on logical decision-making involving money. Participants were repeatedly asked to choose between taking a small sure payoff and gambling for the possibility of a larger amount.

Framing Effects Task

Participants receive an initial endowment. Subjects cannot simply retain all of this endowment, but must choose between a sure option and a gamble option. In gain frames, the sure option is presented as money retained from the endowment (e.g., keep $20 of the initial $50), while in loss frames, the sure option is presented as money lost from the endowment (e.g., lose $30 of the initial $50). The gamble option is presented as a pie chart depicting the probability of winning (blue) or losing (green) all of the endowment.
In each case, the expected value of the sure choice and the gamble were balanced; for instance, participants could choose between a sure payoff of $20. In half the choices, outcomes were framed as sure gains, pushing individuals to choose the sure option. In the other half, outcomes were framed as sure losses, biasing decisions in favor of the risky gamble because people often seek to avoid losses.

Figure 1: Decision-Making Bias Across Three Decades

Figure 1 shows that all three age groups performed at a comparable level of the decision-making task and demonstrated only a very small amount of bias toward riskier choices (approximately 10% of total responses) on the decision-making measure. Lower percentages of bias are indicative of logical consistency across decisions; higher levels of bias are indicative of impaired decision-making. This evidence indicates that individuals in their 50s had the same small amount of bias in their decision-making as individuals in their 70s.

The key message here is that no decline was revealed on the decision-making task with increased age. In sum, all three groups showed comparable capacity to be logically consistent in decision-making.
Attitudes to Financial Risk (Risk-Aversion vs. Risk-Seeking)

There were no significant differences in risk-taking in that all three age groups showed a similar pattern of conservative choices. Consistent with previous studies, participants in all age groups tended to be risk-averse, preferring a conservative approach to financial decisions represented by choosing sure payoffs rather than gambling for a larger amount. Risk-aversion, indicated by choosing a sure gain instead of a gamble, was most pronounced when outcomes were framed in terms of gains rather than in terms of losses even though the financial outcomes were the same.

To illustrate this effect, consider a bettor at a racetrack who has previously lost $200 and has one more race to bet on for the day. If he frames his situation negatively, as being $200 poorer than at the start of the day, he will be more likely to gamble and make a risky bet on a long shot to try to win back the lost money. However, if he frames his situation more positively, as making one betting decision that is unrelated to his earlier losses, he will be more likely to bet more conservatively on a favorite (or not to bet at all).³

These findings are consistent with what other researchers have found in adult decision-making research. Specifically, the findings reveal the effect framing a result, either as a loss or as a gain, has on decision-making even though the outcome is the same. Secondly, the results confirm the trend for more conservative choices to be made when more money is at stake, as manifested by increased sure payoffs as the starting dollar amount went from $25 to $100.

Figure 2 shows that individuals made more conservative choices, i.e., more sure choices, when outcomes were framed positively (gain frames). In contrast, individuals made more risky choices when outcomes were framed negatively (loss frames), even though the outcomes were the same. As shown in Figure 2, individuals made fewer sure choices in the loss frame. For example, in choices with a starting dollar amount of $50, participants chose the sure payoff instead of the risky gamble roughly 60% of the time in gain frames, and roughly 45% of the time in loss frames. Individuals also made more conservative choices on the sure gain as the amount of money at stake increased. For example, in choices with a starting dollar amount of $100, participants overall were more likely to choose the more conservative sure payoff than in choices with a starting amount of $25.
Strategic Learning and Decision-Making

*Healthy Brain, Healthy Decisions* found that all three age groups performed equally well at strategic learning, the ability to spontaneously determine and employ strategies to sift and learn important information while ignoring less relevant information.

More importantly, the relationship between strategic learning (i.e., the ability to sift and learn the most important information from unimportant information) and logical consistency in decision-making was significant. As illustrated in Figure 3, better scores on the strategic learning measure (85th percentile and above) were associated with a higher logical consistency (manifested as lower bias or reduced susceptibility to framing), regardless of age or gender. In contrast, lower scores on the strategic learning measure (15th percentile or lower) were associated with impaired decision-making (manifested as increased bias or higher susceptibility to framing).
Strategic Learning Task

In the Strategic Learning Task, individuals are shown a series of 16 words; some words are lowercase and some are all caps. Participants are instructed that words in lowercase are worth 10 points and words in all caps are worth 1 point; the words are shown in one-second intervals and then are no longer accessible to the participant. The goal is for participants to garner as many points as possible. Each participant is shown three word lists and case point values are switched each trial. Participants are not instructed to try to remember all the 10-point words and block the 1-point words nor are they told how many words are presented. The scores look at how effectively individuals are able to spontaneously adopt and use a strategy to remember high point relative to low point while controlling for individual memory span. For example, compare a person who remembers 6 items with 3 being worth 10 points and 3 being worth 1 point to a person who remembers 6 items with 6 being worth 10 points and 0 of the low point words. It is clear that the second person is a more strategic learner than the first, despite the fact that they have the same memory span in regard to how much they can remember.

Figure 3: Strategic Learning Scores Predict Decision-Making Bias

![Bar chart showing the relationship between Strategic Learning Score and Decision-Making Bias.](chart.png)
Better strategic learners were more logically consistent decision-makers.

Participants who had low strategic learning scores showed more bias — that is, they were less conservative and made fewer number of logically consistent decisions. In contrast, individuals who were high performers on the strategic learning measure showed less bias and thus were more conservative. Of note, the low performers on strategic learning had roughly 15% bias on the decision-making task. Even this group performed well compared with earlier studies that reported 14-20% bias in healthy younger subjects. Thus, the cohort of cognitively healthy adults retained the capacity to make logically consistent decisions.

Decision-Making: Style and Performance

Participants demonstrated effective decision-making styles on the Melbourne Decision Making Style instrument, which assesses how people handle decision-making. Respondents were asked to gauge their level of financial conscientiousness. These questions concerned issues such as sticking to a budget and having a clear retirement plan. The results showed that the older participants felt more conscientious concerning personal financial matters than the younger Boomer age participants.

Figure 4: Care and Concern for Finances by Age

Individuals were asked to respond to statements such as “I feel competent to manage my own day-to-day personal finances” or “I worry about my personal finances.”
Major Findings

Figure 4 shows that individuals in their seventies gave themselves a higher rating of conscientiousness than the group in their fifties did. These findings suggest that an individual in their 70s would be more tuned in to issues and ask more questions related to their finances and financial activity than an individual in their 50s. As age increases, conscientiousness in the form of care and concern for their finances increases.

In addition to conscientiousness, one of the best means for handling decisions is called “vigilance” which refers to a careful assessment of options and possible alternatives before making a decision. Participants overall were more vigilant in their decision-making when compared to the average population scores for the Melbourne instrument. The instrument also assesses three negative ways to handle decisions which include familiar approaches such as procrastination and buck-passing (see Key Terms) and a less familiar strategy called “hypervigilance” which refers to impulsive and highly stressed decisions in which the individual fails to consider many options and choices. Participants were less likely as compared to the averages for this instrument to engage in procrastination, to pass the buck on a decision, or to engage in hypervigilant decision-making. These results suggest that participants were, as a group, healthy decision-makers who avoided the decision-making traps of procrastination, buck-passing, and hypervigilance.

Gender and Cognitive Performance Impact Decision-Making

Men with higher performance on standardized cognitive measures showed higher logical consistency in decision-making than did men with average performance on these measures. The men with average cognitive function were the highest risk seekers of all categories of gender by cognitive function levels. Meanwhile, women demonstrated no significant differences in logical consistency across levels of cognitive performance. (See Figure 5.)

This decision-making effect in men was influenced predominantly by more risky choices (i.e., more gamble choices) when outcomes were framed negatively (as losses); this increase in risk-seeking was not explained by age but instead by performance on classic cognitive measures. This behavior of choosing to gamble in loss frames is analogous to a racetrack bettor who makes riskier bets at the end of the day in an effort to recoup losses from earlier in the day. As this study was not initially designed to test for interactions between gender and cognitive performance in decision-making, the differences we observed between men and women require confirmation in subsequent studies designed specifically to evaluate the relationship between gender and cognitive ability in decision-making. No such gender distinct decision-making pattern was manifested on the cognitive measure of strategic learning.
There were significant differences between men and women in decision-making. Women were like-minded in assessing risk across cognitive function levels. However, men with higher cognitive performance made more logically consistent decisions than men with average cognitive performance. In women, there were no significant differences between average and higher cognitive functioning and logically consistent decision-making.
Summary

Decision-making capacity is retained in healthy aging adults.

The study results apply to adults who show overall cognitive health and indicate that retained decision-making capacity as we age should not be overlooked, short-changed, or discounted. Normal cognitive aging should be distinguished from medical causes of cognitive impairment. Whereas preclinical and clinical stages of dementia do contribute to impaired decision-making, adults who remain cognitively healthy may retain the cognitive capacity to support consistent and appropriate decision-making.

Older adult wisdom and conceptual thinking enhances decision-making.

As an aging society, we all have a vested interest not only in the weaknesses, but also the strengths of decision-making by mid-life and older adults. Recent empirical studies have largely highlighted potential shortcomings of decision-making with advancing age. However, a less-explored possibility is embodied by conceptual thinking and the concept of wisdom in aging. Wisdom is best characterized as the rich integration of knowledge and vast experiences that serve to guide sound judgment, choices, and actions.

For a large subset of older adults, advancing age seems to be associated with preserved and perhaps even enhanced decision-making.\textsuperscript{7,8} Retained decision-making capacity in cognitively healthy older adults should be embraced and encouraged rather than denigrated and disparaged. At any age, lowered expectations are linked to lowered performance despite preserved capacity.

This research explored individual factors associated with preserved and impaired decision-making in older adults. Factors beyond age should be targets for future cognitive and policy interventions to protect older adults from decision-making errors in the future.

Decision-making capacity does not decline in healthy aging adults.

Adults ages 50 to 79 can remain at peak decision-making capacity. The current findings indicate that older adults can retain the skills to support decision-making capacity if they remain cognitively healthy and free of dementia or other neurological causes of cognitive impairment. The cognitively healthy segment of older adults represents the largest group of seniors, approximately 87% of those age 65 years and older as reported by the National Institute of Aging (2012).\textsuperscript{9}
The present study results are in contrast to population-based findings, the latter of which indicate a decline in decision-making with advancing age. Advantages of the present study are that participants were carefully screened for dementia and other medical causes of cognitive decline, and that individual differences in cognitive ability, personality, and other demographic factors were examined that may account for variation in performance among individuals within a given age group. The results of this study are likely to generalize to cognitively healthy, educated, older individuals outside the sample tested.
Implications

A healthy brain supports healthy decision-making capacity.

The findings of *Healthy Brain, Healthy Decisions* indicate that age alone may not be a primary factor explaining impaired decision-making capacity. Instead, the ability to be a strategic learner i.e., the ability to spontaneously determine and employ strategies to sift and learn important information while ignoring less relevant information may be a better index of decision-making capacity than age. It is interesting to note that cognitive performance on traditional measures predicted decision-making outcomes differently between men and women. These classic measures were most informative in identifying men who may be more risk-seeking (those with average cognitive function) and those more conservative (those with superior cognitive function). Women were more like-minded across cognitive levels suggesting a similar approach regardless of cognitive level or even age. This finding in cognitively healthy adults emphasizes the high importance of classic cognitive measures as well as strategic learning tests in identifying adults with dementia-related cognitive decline.

Carefully controlled studies at the individual level can better distinguish between decline due to normal cognitive aging and impairments due to neurological illness. Such studies can also guide future efforts to mitigate the risk of impaired decision-making in older adults. For example, if impaired financial decision-making with advancing age reflects the increased incidence of illnesses such as Alzheimer's disease, this finding would support directing greater resources toward identifying individuals at risk and protecting them. However, if impaired financial decision-making is a general consequence of normal cognitive aging, even in those without dementia or medical causes of cognitive impairment, then this finding would support protective policies for the entire population of older adults independent of their health status.

Improved decision-making is possible at any age with a commitment to exercising the brain.

Strategic thinking and advanced reasoning should be continually exercised to maximize decision-making capacity at any age. The present research refutes the role of age alone as a negative factor in decision-making in cognitively healthy adults. Another major implication of this study is that a greater mastery of strategic learning, or the ability to spontaneously determine and employ strategies to sift and learn important information while ignoring less relevant information, is associated with higher levels of logical consistency in decision-making. The abilities to think conceptually, to identify and extract rules, and to apply these rules in logically consistent ways to new contexts are at the core of cognitive health whether young, middle, or older age. This viewpoint is
consistent with other research that reports that older adults manifest optimal performance on decision-making tasks that require extracting generalized principles.\(^1\) In contrast, a lower ability to think conceptually and to extract or sift information may be a risk factor reflecting a decline in logically consistent decision-making capacity in adults. This pattern of a strong link between decision-making rationality and ability to filter pertinent information from less relevant information held true for both men and women.

Combining the present findings on maintained decision-making capacity with prior evidence of retained abstract reasoning skills into late life, these results can motivate public efforts to discover and implement promising ways to promote independent decision-making into the seventies and beyond. Previous research has demonstrated that abstract learning and reasoning can be maintained across the lifespan. Moreover, prior research has also shown that short-term intensive brain training can strengthen and even restore abstract thinking and strategic learning capacity in cognitively healthy adults. Given the association of strategic learning and ability to make logically consistent decisions, it would be informative to study whether strategic learning could be a modifiable factor and a suitable target for future training seminars to enhance and perhaps improve decision-making in cognitively healthy middle-age and older adults.

**Age is not a disease: Look beyond age to find causes for poor decision-making.**

Impaired decision-making may signal disease rather than age-related issues. Whereas risks for dementia and other medical causes of cognitive impairment increase with advancing age, these data suggest that policies aimed at protecting those most vulnerable to poor decision-making should focus on disease, rather than age itself, as a risk factor. Policies that focus exclusively on age will risk unnecessarily curtailing the autonomy of older adults with preserved cognitive function.

This work suggests that impaired financial decision-making and poor strategic learning may be signals of early stages of dementia. Previous research indicates that impaired financial decision-making may be an early sign of cognitive impairment, in some cases preceding a clinical diagnosis of dementia by up to 10 years.\(^12\) Increasing age is the primary risk factor for dementia, and individuals at any age with any form of dementia are at risk for impaired decision-making. The present findings suggest that when impairments in decision-making emerge, they should not be attributed merely to the normal cognitive aging process. Instead these difficulties should prompt a medical evaluation for dementia as well as for potentially reversible causes of cognitive decline.
Intelligence and gender predict risk aversion more than age.

The finding that gender differences affect decision-making were particularly interesting. While the focus of this study was on aging and decision-making, these preliminary findings suggest that more research is needed to discern the scope and depth of decision-making differences between men and women as they age. It is important to understand which cognitively healthy adults are vulnerable to inappropriate risk taking and which groups appear to have heightened risk-seeking behaviors that are not financially detrimental. One key pattern that is important to emphasize is that even the least logically consistent groups of older adults in this study performed well when compared to younger adults in earlier studies, regardless of gender. Future studies are needed to verify if average cognitive functioning men and superior cognitive functioning women have higher risk tolerance. It is informative that no gender differences were identified on the strategic learning measures and the association to decision-making biases.

Decision-making and what impacts risk-aversion and risk-seeking are of particular interest since women become the lead decision-makers in late life due to loss of spouses and longer life spans. Current realities such as the delaying of marriage, an increase in single women as homeowners, and the continuing movement of women into once male-dominated professions demand that we know more about the differences between men and women as financial decision-makers. More immediate issues such as the increasing influence of women’s financial role, as women live longer than men, reinforce the need to extend our knowledge in an effort to better serve the needs of all adults.
Prospect Theory: Proposed by the Nobel Laureate economist Daniel Kahneman and his collaborator Amos Tversky, prospect theory is a well-established account of how people make decisions under conditions of uncertainty. Prospect theory accounts for irrational biases that influence our decisions, such as whether the same information is framed in a positive or negative light. Numerous studies based upon the framework of prospect theory have demonstrated that people often make economic decisions that are neither rational nor economically beneficial due to personal biases and susceptibility to external influences. 13

Logical Consistency: A logically consistent decision-maker is one who, when presented with the same choice described in two different ways (with the same chance of good or bad outcomes), makes the same choice each time.

Framing Effect: Unfortunately, decision-makers are not always logically consistent in their choices. As indicated above under Prospect Theory, the term “framing” refers to how different ways of presenting the same information can influence the decisions that we make using that information. For example, if you receive $100 dollars but may only keep $20, this reality can be framed in two ways — either as a loss or a gain. Framing this outcome as a loss, we might say you will lose $80 of the initial amount. To frame this outcome as a gain, we might say you will keep $20 of the initial amount. Both descriptions are accurate. A logically consistent decision-maker would use these two descriptions in the same way when making decisions.

Many studies have shown that, in reality, people are often influenced by the way that information is framed. 14,15 Individuals can often be manipulated to make riskier or otherwise less advantageous decisions depending upon how information is presented, rather than on the basis of the information itself. These effects are routinely exploited by con artists, and have implications for best practices in disclosures for legitimate financial products. In this study, we examined a well-documented effect, in which people tend to make more conservative decisions when outcomes are framed positively, and make riskier decisions when the same outcomes are framed negatively.

Strategic Learning: Strategic learning is manifested when a person faced with too much information to remember, develops a strategy to selectively learn the most important information while blocking out information that is distracting, irrelevant, or unimportant. To be a strategic learner, an individual must spontaneously adopt a strategy to remember select information while ignoring less relevant information.
Strategic learning measures the degree to which an individual utilizes a strategy that is distinct from trying to learn and absorb every piece of information presented. We measured strategic learning by evaluating an individual’s ability to selectively recall high-valued information while ignoring/blocking low-valued information in order to optimize the use of their individual memory span. We looked at the individual’s strategy while controlling for memory. For example, one person may be able to recall 9 items and another 6, but be equally strategic learners in what they remember.

We propose that the ability to recognize and spontaneously apply a strategy to learn information encompasses higher-level thinking that may be relevant to decision-making capacity. For example, the ability to determine which information is relevant from what is less relevant in making impending decisions is becoming increasingly more important. In this day of information overload, there is often a need to update decisions instead of adopting avoidance patterns (‘frozen’ decision-making) when faced with too much complex information.

**Buck-passing:** Avoiding the responsibility of a making a decision by preferring that or simply allowing another person to make the decision.

**Conscientiousness:** The personal trait of being careful and organized. This study assessed this care and organization by asking participants about their retirement planning and their ability to stick with a monthly budget.

**Vigilance:** An approach to making decisions, in which the individual considers as many options as possible, weighs various outcomes and takes the time to make a sound decision. Experts believe this is the best approach for making important decisions.

**Hypervigilance:** An impulsive and highly stressed approach to making decisions. Hypervigilant decision-makers focus on immediate solutions without considering other options or outcomes. Hypervigilance is seen as an unproductive decision-making style that is unlikely to produce good decisions or results.
### Figures and Tables

**Table 1: Measures utilized to document cognitive brain health**

<table>
<thead>
<tr>
<th>Cognitive domains</th>
<th>Measures</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Screening Measures</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Basic Cognitive Assessment</td>
<td>Telephone Interview for Cognitive Screen</td>
<td>Assessment measures used to screen for basic cognitive decline in all patients. Exclusion criteria included cognitive scores lower than standardized threshold as well as hearing or vision problems.</td>
</tr>
<tr>
<td></td>
<td>Montreal Cognitive Assessment</td>
<td></td>
</tr>
<tr>
<td>Beck Depression Inventory</td>
<td>Beck Depression Inventory Second Edition (BDI-II, Beck,</td>
<td>The BDI, also a screening measure, is a 21-item self-report instrument that assesses the presence of symptoms of depression as listed in the American Psychiatric Association’s Diagnostic and Statistical Manual of Mental Disorders Fourth Edition (DSM-IV; 1994).</td>
</tr>
<tr>
<td></td>
<td>Steer, and Brown 1996)</td>
<td></td>
</tr>
<tr>
<td><strong>Cognitive Measures</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Strategic Learning</td>
<td>Strategic Learning Task</td>
<td>Participants are asked to recall words from a list presented to them. Words are given high and low point values and participants are asked to try and get as many points as possible by remembering words.</td>
</tr>
<tr>
<td>Decision-Making</td>
<td>Framing Task</td>
<td>Participants are presented with an initial amount of virtual money. They are then asked to choose between a sure option of either keeping or losing a portion of the money or taking the gamble to win it all back.</td>
</tr>
<tr>
<td>Cognitive domains</td>
<td>Measures</td>
<td>Description</td>
</tr>
<tr>
<td>------------------------</td>
<td>--------------------------------------------------------------------------</td>
<td>-----------------------------------------------------------------------------</td>
</tr>
<tr>
<td>Working Memory</td>
<td>Digit backward (Wechsler 1999)</td>
<td>Orally recall number strings read aloud in backward order. Participant recalls the last word of sentences followed by answering questions related to the sentence.</td>
</tr>
<tr>
<td></td>
<td>Listening Span (Daneman and Carpenter 1980)</td>
<td></td>
</tr>
<tr>
<td>Switching</td>
<td>Trails B (Reitan and Wolfson 1995)</td>
<td>Alternately connect a set of numbers and alphabets in a certain sequence. Verbally produce as many names of fruits and furniture by alternating between the categories.</td>
</tr>
<tr>
<td></td>
<td>Category Switching (Delis 2001)</td>
<td></td>
</tr>
<tr>
<td>Intelligence</td>
<td>Wechsler Abbreviated Scale of Intelligence (WASI, Wechsler 1999)</td>
<td>Participants are asked to create meaningful similarities between pairs of words. Using Matrix reasoning as a measure of nonverbal reasoning.</td>
</tr>
<tr>
<td>Complex Abstraction</td>
<td>Test of Strategic Learning (TOSL, Chapman et al. 2010)</td>
<td>Construct as many abstracted meanings as you can from one lengthy text.</td>
</tr>
<tr>
<td>Processing Speed</td>
<td>Trails A (Reitan and Wolfson 1995)</td>
<td>Connect a set of numbers in ascending sequence as quickly as possible.</td>
</tr>
<tr>
<td>Verbal Fluency</td>
<td>COWA (Benton, Hamsher, &amp; Sivan, 1976)</td>
<td>Name as many words that begin with a given letter within one minute.</td>
</tr>
</tbody>
</table>
### Table 2: Participant Characteristics

<table>
<thead>
<tr>
<th>Variables</th>
<th>Group</th>
<th>Average</th>
<th>Range</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Education</strong> (average years)</td>
<td>50s</td>
<td>16.71</td>
<td>14–20</td>
</tr>
<tr>
<td></td>
<td>60s</td>
<td>16.39</td>
<td>12–20</td>
</tr>
<tr>
<td></td>
<td>70s</td>
<td>15.95</td>
<td>12–20</td>
</tr>
<tr>
<td><strong>BDI-II</strong> **  (Beck Depression Inventory) (average score)</td>
<td>50s</td>
<td>3.12</td>
<td>0–11</td>
</tr>
<tr>
<td></td>
<td>60s</td>
<td>2.57</td>
<td>0–11</td>
</tr>
<tr>
<td></td>
<td>70s</td>
<td>4.45</td>
<td>0–11</td>
</tr>
<tr>
<td><strong>MoCA</strong>  (Montreal Cognitive Assessment) (average score)</td>
<td>50s</td>
<td>29.08</td>
<td>27–30</td>
</tr>
<tr>
<td></td>
<td>60s</td>
<td>28.17</td>
<td>22–30</td>
</tr>
<tr>
<td></td>
<td>70s</td>
<td>28.23</td>
<td>23–30</td>
</tr>
</tbody>
</table>

All participants were comparable across education levels, depression scores, and basic cognition levels.

** 4 participants were excluded from the BDI-II measure in the table because although meeting criteria for inclusion, these participants endorsed higher levels of depressive symptoms as compared to the rest of the sample. Of the excluded participants one came from the 50s group, one came from the 60s group, and two from the 70s group. When these participants are accounted for in the analysis the differences between groups is still non-significant.
Endnotes


