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Emotion, Affect, and Risk Communication with Older Adults: Challenges and Opportunities

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Abstract

Recent research suggests that emotion, affect, and cognition play important roles in risk perception and that their roles in judgment and decision-making processes may change over the lifespan. This paper discusses how emotion and affect might help or hinder risk communication with older adults. Currently, there are few guidelines for developing effective risk messages for the world's aging population, despite the array of complex risk decisions that come with increasing age and the importance of maintaining good decision making in later life. Age-related declines in cognitive abilities such as memory and processing speed, increased reliance on automatic processes, and adaptive motivational shifts toward focusing more on affective (especially positive) information mean that older and younger adults may respond differently to risk messages. Implications for specific risk information formats (probabilities, frequencies, visual displays, and narratives) are discussed and directions for future research are highlighted.

Keywords

emotion; affect; risk communication; aging; older adults; judgment; decision making

1. INTRODUCTION

A growing body of research suggests that emotion,ⁱ affect,ⁱⁱ and cognition each play an important role in risk perception.^{1–6} Recent research also suggests that there are age-related changes in the roles that emotion, affect, and cognition play in judgment and decision making.^{7–13} This paper addresses the important question of how older adults should be informed about risk, based on what we know about decision processes across the lifespan.ⁱⁱⁱ In particular, this paper discusses how emotion and affect might help or hinder risk communication with older adults. Many previous studies focused on older adults' healthcare decisions. The current literature review reflects that emphasis.

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ⁱ“Emotion” refers to particular states (e.g., anger, fear, happiness) that are “intense, short-lived, and usually have a definite cause and clear cognitive content.”¹⁰¹

ⁱⁱ“Affect” is viewed as a subtler feeling than emotion. It refers to the experience (with or without consciousness) of “goodness” or “badness” associated with external events and objects or internal representations (e.g., memories).⁵⁶

ⁱⁱⁱIn research papers “older adults” are often defined as people 65 years or older since this corresponds to specific socio-economic milestones in the US (retirement, Medicare eligibility), but the definition may vary across studies depending on several factors such as the aims of the study, the hypotheses being tested, the sample available, and the decision problems and processes being examined. The focus of this article is on “normal” older adults without brain disease. Judgment and decision skills in the presence of a disease such as dementia require special assessment and intervention. Addressing the risk communication and decision support needs of specific patient groups is beyond the scope of this article.

Longer lifespans and the rapid aging of the world's population¹⁴ demand better risk communication with older adults. Good decision making about risky options during later life can prevent significant disruptions to an individual's physical and psychological well being. Understanding the most effective means of risk communication with any age group is increasingly important because risk information is becoming more available (e.g., via the internet) and laypeople are engaging more in decisions about risk. However, there are few guidelines for risk communication with older adults, despite the array of complex decisions that come with increasing age (e.g., managing multiple diseases, choosing an end-of-life directive) and an emphasis on "shared decision making" in the health-care setting.^{15,16} Based on a summary review of relevant literature, this paper highlights the implications of current research in the domains of risk perception, decision making, and aging for risk communication with older adults.

2. EMOTION AND AFFECT IN RISK DECISIONS ACROSS THE LIFESPAN

Two main approaches to understanding behavioral responses to risk have received considerable attention. *Risk as analysis* emphasizes decision makers' capacity to use analytic deliberation to assess risk. *Risk as feelings* emphasizes the tendency for decision makers to rely on intuitive experiences when assessing risk.¹ Across the lifespan, both analytic deliberation and experiential processes are needed for sound decision making about risk. However, the roles that emotion, affect, and cognition play in risk decisions may vary with age. A summary review of evidence for age differences in dual information processes is given below (see Carstensen and Mikels¹⁷ and Peters, Hess, Västfjäll, and Auman⁷ for more comprehensive reviews). Ideas about how specific information formats may help or hinder older adults' risk judgments and decisions are presented and opportunities for future research are highlighted.

2.1. Feelings as information

People may rely on emotion or affect in judgment and decision making as a source of information about whether or not they are at risk. Many theorists have given affect a direct and primary role in motivating behavior.^{4,18–20} Positive feelings act like a beacon of incentive, motivating people to act to reproduce those feelings, whereas negative feelings motivate actions to avoid those feelings. Emotions and affect provide potentially useful inputs to judgments and decisions, especially when knowledge about the events being considered is not easily remembered or expressed.⁴

Increasing age may come with increasing reliance on affective information in judgments and decisions for a variety of reasons. One main reason concerns age-related declines in memory, speed of processing, reasoning, and other basic cognitive skills associated with deliberative processes. For instance, Salthouse²¹ suggests that inefficient information processing in older adults may result in the products of early processing being lost by the time later processing occurs and/or lengthy early processing might mean that later processing does not occur. Other evidence suggests age-related deficits in explicit memory and learning.^{22–24} To the extent that good decision making depends on these abilities (e.g., when a decision task demands analysis of complex information), age-related declines in the accuracy or appropriateness of risk judgments and decisions may be expected.^{25,26}

To compensate for increasing analytic inefficiencies, older adults may rely on affective information in their judgment and decision-making processes.^{7,27} In some instances, this is an adequate and adaptive approach. For example, if the decision being faced is of low relevance or meaningfulness to the individual, it makes sense to conserve cognitive resources and to be selective about where effort is spent.²⁸ Hess, Germain, Rosenberg, Leclerc, and Hodges²⁹ showed how older, but not younger, adults' attitudes toward proposed legislation were influenced by irrelevant affective information (the likeability of the lawmaker proposing the

legislation) when the personal relevance of the legislation was low. In contrast, the irrelevant affective information did not influence older or younger adults' attitudes when the legislation was rated high in personal relevance. In situations where emotional information is important to consider (e.g., selecting a social partner), focusing on emotional information is critical for constructing an optimal environment.³⁰ Carstensen and Turk-Charles¹⁰ demonstrated that aging is associated with a decline in recall of neutral information, but stability in recall of emotional content, suggesting a shift toward disproportionate retention of emotional information in memory representation. In a related study, Fung and Carstensen³¹ found that older adults showed greater preference and superior memory than younger adults for emotional versus nonemotional advertisements.

Unfortunately, relying too heavily on affective information in decisions about risky options may sometimes lead to errors with significant consequences for older adults. A good illustration of the danger is shown in older adults' greater belief in false but familiar health statements. Skurnik, Yoon, Park, and Schwartz³² reported two studies in which older adults were found to be especially susceptible to misremembering a false health claim as true. After a 30-minute delay, older adults accurately remembered a claim that was identified repeatedly as false, but after a 3-day delay they were more likely to remember it inaccurately as true. The authors concluded that the repetition increased claim familiarity but decreased recollection of the claim's original context. (The repetition x delay interaction for older adults suggests that they did not fail to encode the truth-specifying context of false claims because repetition improved their accuracy with false information after 30 minutes.) This "illusion of truth" was stronger for older adults than younger adults. Although Skurnik et al.³³ did not measure affective responses to the claims, their findings are consistent with the notion that the affect associated with the mere (even subliminal) exposure to stimuli can influence preferences.^{34,35} Older adults may tend to forget important message details, relying instead on how they feel about the message to determine their evaluations and choices. The affect coming from the positive feelings of familiarity created by mere exposure to the message is less helpful information than the content of the message (at least in this case where the health claims are false). As a result, older adults might fall prey to marketers using affective appeals or repetitive, misleading information.^{36,37}

Given that emotion and affect may be used as a source of information in judgment and decision making, risk communicators need to be cognizant of the affective content of the messages they are imparting. When developing a message, risk communicators should ask: Are there age-related differences in responses to the affective information contained in or evoked by the message? Is the affective information helpful or unhelpful in creating accurate risk perceptions? Does the affective information motivate older adults to adopt appropriate protective actions?

2.2. Feelings help integrate information

A second reason that people might rely on emotion and affect in judgment and decision making is to help people integrate information.³⁸ Comparing risky options (e.g., alternative cancer treatment options such as surgery and radiation) that vary on multiple, qualitatively distinct dimensions can be a complex task unless there is some way to simplify the integration of available information. Comparing one's feelings about the options (e.g., via the affect heuristic³⁹) provides an efficient mechanism for decision making. The downside, of course, is that this simplification process may overlook important information. For example, too much weight may be placed on the negative feelings associated with the short-term costs of having an anesthetic and too little weight may be given to the positive feelings associated with reducing the risk of disease in the long term. An alternative approach may be to apply the affect heuristic to specific option dimensions. When heuristic processes occur automatically, however, their

influence on the way information is integrated may not be obvious to or controlled easily by the decision maker.

Increasing age may be associated with greater reliance on feelings to help simplify information integration because, in addition to declines in some cognitive abilities, older adulthood typically comes with expert knowledge and automatic processes.^{40,41} Prolonged practice with the demands of daily life allow rapid and effortless judgments and decisions to be made, in part because life experience leads to the development of automatic affective reactions.⁴² Studies have demonstrated age-related increases in compliance for practiced health behaviors such as taking the same dosage of a medication for several years or deciding among treatment options for a commonly experienced medical condition.⁴³ In the presence of relevant declarative knowledge about a problem (e.g., breast cancer), older adults may behave more like expert decision makers, seeking out less information, making decisions faster, and arriving at choices similar to those of younger adults.⁴⁴ Older adults have also been shown to be better than younger adults at acquiring prototype-based affective information. Hess, Pullen, and McGee⁴⁵ presented 60 descriptions of people varying in their similarity to a prototypical member of a fictitious social group; the prototype represented either an arbitrary or affectively coherent combination of multiple dimensions. Younger adults performed better than older adults in learning the arbitrary prototype, but age differences were absent or in favor of older adults when the prototype consisted of affectively consistent features. This supports an argument of overweighting of affective information in later life. To the extent that decisions about risky options are routine and predictable or in a domain where the decision maker has expertise or extensive experience, reliance on automatic affective processes may help to preserve good decision making in later life.⁴⁶

However, too much reliance on automatic affective processes can also come with problems. For instance, automatic processes may impede deliberation on important factors such as the credibility and relevance of information (e.g., has a piece of medical information come from a physician or a tabloid?). Wood et al.⁴⁷ suggest that lack of insight into automatic processes in some older adults may make these individuals less attentive to negative emotion or affect signaling red flags (e.g., scams) and result in less loss aversion. Older adults may be less socially vigilant when evaluating the intentions and abilities of physicians and salespeople. A recent study by Stanley and Blanchard-Fields⁴⁸ suggested that age-related declines in recognizing facial emotion may be related to poor deceit detection (at least for visual information about crime). Under time pressure, which is closer to real-life conditions and leads to a greater reliance on automatic processes,³⁹ older adults may be less able to be skeptical (i.e., less able to analyze a problem cautiously) than younger adults.⁴⁹ Of course, individual differences in skepticism may relate to other factors such as the availability and salience of information about and personal experience with scammers or mental and physical resilience in the face of persistent and persuasive people.

One main implication of automatic affective processes is that risk communicators need to identify when people are most likely to rely on feelings to help integrate information. In some situations, risk communicators could capitalize on this process to facilitate older adults' decision making (e.g., reinforcing well-learned adaptive practices such as asking a doctor before switching medications or altering a drug dosage). Other situations might require strategies to counteract automatic processes (e.g., a decision support system that structures options and attributes and/or integrates information might be especially useful for older adults facing a complex decision problem). The urgency of a decision environment and the physical/psychological resources of the decision maker will influence the extent to which specific strategies are most appropriate. For instance, medication overdosing likely needs immediate remedy, whereas health-plan choices can be supported over a longer period for healthy older adults.

2.3. The role of negative emotions

Negative emotions play a particularly powerful role in risk perceptions. First, they influence the depth of information processing. Persuasion research has shown that negative emotions tend to encourage more careful processing of messages;⁵⁰ less systematic and more heuristic processing occurs in positive feeling states.^{51–53} Baron et al.⁵⁴ report that negative emotional arousal (e.g., fear) increases a person's motivation to elaborate on stimuli that are relevant to the threat under consideration, but decreases the elaboration of irrelevant information.^{iv}

Other research suggests that negative emotions create temporary shifts in perception and influence choice unintentionally.^{5,55–58} For instance, incidental anger from one situation can increase optimism in another situation, possibly motivating a warranted response or creating an unwarranted feeling of invulnerability.^{59–62} Interestingly, fear seems to amplify risk estimates and anger attenuates them. Within their appraisal-tendency framework, Lerner and Keltner⁶¹ explain how each emotion activates a specific cognitive predisposition when people appraise future events. For instance, Lerner et al.⁶⁰ proposed that fear arises from appraisals of uncertainty and situational control and anger arises from appraisals of certainty and individual control. They showed (in a nationally representative sample of Americans aged 13–88) that a fear-inducing manipulation, compared with an anger-inducing manipulation, resulted in higher probabilities being assigned to five negative consequences of terror. Subsequent probability judgments of risks unrelated to the terrorism-related manipulations (e.g., getting the flu) were also affected by these emotions.

Aging research suggests that older adults are motivated to focus more on positive information and/or decrease their focus on negative information in some situations.⁶³ For example, Mather and Carstensen⁶⁴ found that, relative to younger adults, older adults show disproportionate attentional and memory biases for faces depicting positive (vs. negative) emotions. Mather and Johnson⁶⁵ found better memory in older adults than younger adults for positive over negative features of selected options (and negative over positive features of unselected options) in a decision task such as choosing between houses, even after controlling for recognition accuracy. Socio-emotional selectivity theory¹¹ posits that changes in time perspective result in emotional goals becoming more important as the end of life nears, which in turn results in greater monitoring of affective information and either greater attention to positive information or reduced attention to negative information (at least for options being pursued). By virtue of their age, older adults are nearer to the end of life and this comes with a tendency to focus on socio-emotional goals that optimize emotional experience and well being.^{66–68}

One implication of this socio-emotional selectivity is that fear-inducing campaigns designed to attract attention may in fact be ignored by older adults.⁶⁹ Risk messages are likely to be better remembered by older adults when they promise to help realize emotionally meaningful goals.³¹ Similarly, gain-versus-loss information may be used differently by older than younger adults in risk decisions such that losses may not loom as large for older adults.⁷ Coupled with the depth-of-processing findings from the persuasion research, avoidance of negative emotional experiences may also mean that older adults are less likely to thoroughly deliberate on threat information. However, little empirical work has been done to examine this idea. We also do not know whether different kinds of negative emotions (e.g., fear and anger) result in different appraisals by older adults as they do in younger adults.

2.4. Summary

In sum, there is a sparse but growing body of research on the role of emotion and affect in risk judgments and decisions across the lifespan. Empirical evidence reported thus far suggests that

^{iv}Of course, extreme fear may motivate people to completely avoid information or make them unable to process information.¹⁰²

emotion and affect may be used as a source of information or as a way to facilitate information integration in risk judgments and decisions. The influence of emotion and affect may increase with age because of aging-related declines in deliberative cognitive abilities, increases in automatic processes, or adaptive motivational shifts. Compared with younger adults, older adults can be expected to be selective in their use of cognitive resources and may focus more on affective information (especially positive content) as a way of optimizing their emotional well being. In some cases, age-related increases in reliance on emotion and affect is appropriate and helpful and older adults' perceptions of and responses to risk information will serve them well.

In other cases, however, too much reliance on emotion and affect may lead to biased judgments and decisions and result in difficulties for older adults. Thus, the implications of the changing role of emotion and affect across the lifespan for risk communication efforts will vary according to context.

3. PRESENTING RISK INFORMATION TO OLDER ADULTS

One of the main reasons for communicating risk to the public is to improve the correspondence between the assessed magnitude of a risk and people's responses to that risk.⁷⁰ The research presented above suggests that for risk communications to be effective, information may need to be presented differently for older versus younger adults. This section briefly discusses how some information formats might facilitate or impede older adults' understanding and use of information in their risk decisions.

3.1. Numeric displays

One common approach to presenting risk information is via numeric displays, but research results are mixed about whether percentage or frequency formats promote the greatest understanding of risk.⁷¹ Some authors have argued that frequency formats (compared with probability formats) lead to higher risk perceptions because they evoke more affect-laden images.⁷²⁻⁷³ Whether these affect-laden images help individuals assess risk accurately or respond to risk appropriately depends, of course, on the context. Klein and Stefanek⁷⁴ suggest that it may be useful to use a variety of formats to avoid the problems inherent in any one format. For example, they suggest presenting percentages (8%) along with multiple frequencies (e.g., 8 out of 100 or 80 out of 1000). However, it is unclear whether the additional information will be attended to and whether the affective features of frequency information will be eliminated or even diluted by the "dry" percentage information. Furthermore, as mentioned above, age-related increases in attention to affective content may make frequency information particularly potent for older adults. Guidelines could be provided to help people navigate multiple risk information formats. However, the automatic nature of affective processes means that they may not be easily counteracted and the guidelines may be ineffective.

3.2. Visual displays

Sometimes numeric information is too complex for lay decision makers to use sensibly. Information may be difficult to use because it represents complex concepts (e.g., a curvilinear relationship between a symptom and a medication⁷⁵) or is inconsistent, incomplete, and hard to read and understand (e.g., drug labels⁷⁶). Many Americans (especially older adults) read at lower than a sixth-grade level⁷⁷ and have difficulty with simple numeric tasks.⁷⁸⁻⁸⁰ To combat complexity, some information might be better represented with visual displays of affective images (e.g., warning symbols) to attract attention quickly and unambiguously. Research with younger adults suggests that visual displays can increase both comprehension and risk perceptions.⁸¹⁻⁸² Chua et al.⁸³ found that visual displays of gum disease influence cognitive and affective representations of risky options and increase people's willingness to

pay to decrease the risk. While age-related differences in the effect of visual displays on risk judgments has not been examined, we might expect that older adults' increased focus on emotional information^{11,84} makes the affective elements of visual displays more attention grabbing. This might be particularly true if the information is positive and addresses some of the socio-emotional goals most salient to older adults (e.g., improving health to allow more time with grandchildren). Naturally, the value of visual displays for evoking appropriate responses in older adults would need to be tested for specific risk scenarios.

3.3. Narratives

A third approach to communicating risk involves the use of narrative to capture and express the affective aspects of lay people's risk judgments.^{85,86} Still in its infancy, research on narratives as a risk information delivery device is based on the idea that the values held by lay stakeholders are typically articulated discursively; stories and conversations reflect the contextually, emotively, and morally rich experiences that guide our reactions to risk. Narratives have been found to improve respondents' ability to read about and comprehend a subject, consider and remember its content, and then link that content to a specific judgment.^{87–89} Given age-related declines in deliberative processes and increased attention to affective information, we expect that narrative might be a useful way to facilitate older adults' engagement in risk judgments and decisions. However, there are many dimensions along which a narrative might vary (e.g., the extent to which materials link to and elicit emotion from the readers' personal experiences and memories). Consequently, considerable research will be needed before we can accurately predict which narratives are more or less effective and why. Moreover, narratives may be particularly prone to misuse by unethical individuals wanting to manipulate decision makers (especially when the decision is difficult) and guidelines about the appropriate use of narratives need to be developed.

3.4. A note of caution

A note of caution is warranted here about the potency of affective information, regardless of whether it arises from frequency formats, visual displays, or narratives. For example, some research suggests that affect-laden images can make people insensitive to probabilities.^{5,90,91} Rottenstreich and Hsee⁹² showed that when potential outcomes (money, kisses, electric shocks) evoke strong positive or negative affect, ratings of the event's attractiveness or unattractiveness are relatively insensitive to variation in probability. Labeling this phenomenon "probability neglect," Sunstein⁹³ argues that the strong feelings associated with some threats (e.g., terrorism) causes public officials and private citizens to overreact: "When probability neglect is at work, people's attention is focused on the bad outcome itself, and they are inattentive to the fact that it is unlikely to occur" (p. 122). Age differences in these effects have not been examined, but older adults' increased attention to emotional information suggests that probability neglect might be particularly problematic in older adults. More specifically, Peters et al.⁷ speculate that if older adults (relative to younger adults) weight positive outcomes more or negative outcomes less, then we might see greater probability neglect for positive outcomes and less for negative outcomes, respectively.

In general, for people of all ages, the large gap in our knowledge about the sensitivity of risk perceptions to emotional manipulations has implications for people's role in personal and societal decision making and risk management.⁹⁴ Under- or over-estimating people's understanding of a risk and their ability to engage in a good quality decision process may lead to inappropriate inclusion or exclusion from a risk management process. Just as there are individual differences in the quality of younger adults' risk judgments and decisions, older adults may vary in their susceptibility to problems and biases when processing risk information. Many older adults live healthy and active lives; indeed, many of the most influential positions in our society are held by older adults, suggesting that their decision making can remain intact

despite cognitive declines.^{95,96} Nonetheless, poor risk judgment or decision making processes among older adults are particularly worrisome because these individuals have less time and physical resilience to recover from the “normal” ups and downs of everyday decision outcomes.²⁶ Reliable and valid assessment of individuals’ decision-making under uncertainty is needed to help predict real-world functioning and to determine what decision support is needed, if any.⁹⁷

3.5. Summary

In sum, choosing a format for conveying risk information is not an easy task. Careful attention needs to be given to testing messages with the target audience before attempting a communication on a large scale. Although age-related declines in deliberative cognitive abilities may increase older adults’ susceptibility to formatting effects, age-related strengths (e.g., added experience) and motivational adaptations may counteract the effects. Ultimately, the goal is to communicate information in a way that results in a well informed audience who can use the given information effectively in decision making. Of course, the very same strengths and adaptations may lead to problematic evaluations and choices if applied inappropriately or taken advantage of by unscrupulous individuals. In some instances, it may be optimal to set the “default” option in a decision problem to one that represents the best choice according to experts in the field. This would offer decision makers an explicit suggestion of an appropriate course of action, while still permitting them to reject the default option if desired.

4. DIRECTIONS FOR FUTURE RESEARCH AND CONCLUSIONS

The paucity of research on risk communication with older adults means that many questions still need to be addressed. One direction for future research is to test the extent to which specific messages unintentionally evoke emotion and affect in older adults. Incidental affect may vary considerably across individuals, in which case responses to risk communications will be diverse. A second direction for future research is to examine issues beyond the health domain. For example, older adults are faced with many complex financial decisions and problems such as predatory lending can have large consequences, especially for individuals on a fixed income.⁹⁸ Third, future research could examine the extent to which risk communications can be developed to help older adults to reflect on their judgment and decision processes and to be more analytic where necessary. Whether affective processes can be brought under conscious control in later life is an empirical question, but some research suggests that the positivity effect is a deliberate, strategic shift that could be amenable to redirection given appropriate motivation and/or resources.⁹⁹

In some areas, standardizing information presentation may improve decisions under risk and uncertainty. Centralized oversight of drug labeling standards, for instance, may help to reduce variability in risk information and enhance risk communication to provide more equitable care. On the other hand, standardization by definition imposes a deliberate framing of information and thus raises ethical questions about potential manipulation of consumers’ preferences. Given that no framing of information is neutral, Sunstein and Thaler¹⁰⁰ suggest that while individuals ultimately make their own choices, a program of “libertarian paternalism” should be adopted to decide which frames and formats are most likely to promote consumers’ welfare.

In sum, risk communicators need to think carefully about how to provide information to older adults. Current research on decision processes across the lifespan offers some clues about how emotion and affect influence older adults’ risk perceptions. Best practices in risk communication with older adults need to be developed in light of relevant knowledge from the fields of risk perception, decision making, and aging. Specific communication strategies then need to be tested for their effectiveness in improving older adults’ understanding of and response to risk judgments and decisions.

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References

1. Slovic P, Peters E. Risk Perception and Affect. *Current Directions in Psychological Science* 2006;15:322–325.
2. Slovic P, Peters E, Finucane ML, MacGregor D. Affect, risk and decision making. *Health Psychology* 2005;24:35–40.
3. Finucane ML, Holup J. Risk as value: Combining affect and analysis in risk judgments. *Journal of Risk Research* 2006;9:141–164.
4. Damasio, AR. *Descartes' error: Emotion, reason, and the human brain*. Avon; New York: 1994.
5. Loewenstein GF, Weber EU, Hsee CK, Welch ES. Risk as feelings. *Psychological Bulletin* 2001;127:267–286. [PubMed: 11316014]
6. Mellers BA, Schwartz A, Ho K, Ritov I. Decision affect theory: Emotional reactions to the outcomes of risky options. *Psychological Science* 1997;8:423–429.
7. Peters E, Hess TM, Västfjäll D, Auman C. Adult age differences in dual information processes: Implications for the role of affective and deliberative processes in older adults' decision making. *Perspectives on Psychological Science* 2007;2:1–23.
8. Peters, E.; Finucane, ML.; MacGregor, DG.; Slovic, P. National Research Council Committee on Future Directions for Cognitive Research on Aging. The bearable lightness of aging: Judgment and decision processes in older adults. In: Stern, PC.; Carstensen, LL., editors. *The aging mind: Opportunities in cognitive research*. National Academy Press; Washington, DC: 2000. p. 144–165.
9. Mather, M. A review of decision making processes: Weighing the risks and benefits of aging. In: Carstensen, LL.; Hartel, CR., editors. *When I'm*. Vol. 64. National Academies Press; Washington, D.C.: 2006. p. 145–173.
10. Carstensen LL, Turk-Charles S. The salience of emotion across the adult life span. *Psychology & Aging* 1994;9:259–264. [PubMed: 8054174]
11. Carstensen LL. The influence of a sense of time on human development. *Science* 2006;312:1913–1915. [PubMed: 16809530]
12. Blanchard-Fields, F. The role of emotion in social cognition across the adult life span. In: Schaie, KW.; Powell, LM., editors. *Annual review of gerontology and geriatrics*, Vol. 17: Focus on emotion and adult development. Springer; New York: 1998. p. 238–265.
13. Labouvie-Vief G. Dynamic integration: Affect, cognition, and the self in adulthood. *Current Directions in Psychological Science* 2003;12:201–206.
14. United Nations Population Division. *World population ageing*. 2002. p. 1950–2050.
15. Sheridan SL, Harris RP, Woolf SH. the Shared Decision-Making Workgroup of the U.S. Preventive Services Task Force. Shared decision making about screening and chemoprevention. A suggested approach from the U.S. Preventive Services Task Force. *American Journal of Preventive Medicine* 2004;26:56–66. [PubMed: 14700714]
16. Siminoff LA, Step MM. A communication model of shared decision making: Accounting for cancer treatment decisions. *Health Psychology* 2005;24 (suppl):S99–S105. [PubMed: 16045427]
17. Carstensen LL, Mikels JA. At the intersection of emotion and cognition. *Current Directions in Psychological Science* 2005;14:117–121.
18. Isen, AM. Positive affect and decision making. In: Goldstein, WM.; Hogarth, RM., editors. *Research on judgment and decision making: Currents, connections, and controversies*. Cambridge University; New York: 1997. p. 509–534.
19. Zajonc RB. Feeling and thinking: Preferences need no inferences. *American Psychologist* 1980;35:151–175.
20. Kahneman D. A perspective on judgment and choice. *American Psychologist* 2003;58:697–720. [PubMed: 14584987]

21. Salthouse TA. What and when of cognitive aging. *Current Directions in Psychological Science* 2004;13:140–144.
22. Salthouse TA. Attempted decomposition of age-related influences on two tests of reasoning. *Psychology and Aging* 2001;16:251–263. [PubMed: 11405313]
23. Salthouse TA, Ferrer-Caja E. What needs to be explained to account for age-related effects on multiple cognitive variables? *Psychology and Aging* 2003;18:91–110. [PubMed: 12641315]
24. Salthouse TA, McGuthry KE, Hambrick DZ. A framework for analyzing and interpreting differential aging patterns: Application to three measures of implicit learning. *Aging Neuropsychology & Cognition* 1999;6:1–18.
25. Finucane ML, Mertz CK, Slovic P, Schmidt ES. Task complexity and older adults' decision-making competence. *Psychology and Aging* 2005;20:71–84. [PubMed: 15769215]
26. Finucane ML, et al. Decision-making competence: An analysis of comprehension and consistency skills in older versus younger adults considering health-plan options. *Journal of Behavioral Decision Making* 2002;15:141–164.
27. Reyna VF. How people make decisions that involve risk. *Current Directions in Psychological Science* 2004;13:60–66.
28. Hess, TM. Aging-related constraints and adaptations in social information processing. In: Von Hecker, U.; Dutke, S.; Sedek, G., editors. *Generative mental processes and cognitive resources: Integrative research on adaptation and control*. Kluwer, Dordrecht; The Netherlands: 2000. p. 129–155.
29. Hess TM, Germain CM, Rosenberg DC, Leclerc CM, Hodges EA. Aging-related selectivity and susceptibility to irrelevant affective information in the construction of attitudes. *Aging, Neuropsychology, and Cognition* 2005;12:149–174.
30. Charles, ST.; Carstensen, LL. The role of time in the setting of social goals across the life span. In: Hess, TM.; Blanchard-Fields, F., editors. *Social cognition and aging*. Academic Press; San Diego, CA: 1999. p. 319–342.
31. Fung HH, Carstensen LL. Sending memorable messages to the old: Age differences in preferences and memory for advertisements. *Journal of Personality and Social Psychology* 2003;85:163–178. [PubMed: 12872892]
32. Bargh JA, Bond RN, Lombardi WJ, Tota ME. The additive nature of chronic and temporary sources of construct accessibility. *Journal of Personality and Social Psychology* 1986;50:869–878.
33. Skurnik I, Yoon C, Park DC, Schwarz N. How warnings about false claims become recommendations. *Journal of Consumer Research* 2005;31:713–724.
34. Murphy ST, Zajonc RB. Affect, cognition, and awareness: Affective priming with optimal and suboptimal stimulus exposures. *Journal of Personality and Social Psychology* 1993;75:1333–1349.
35. Zajonc RB. Mere exposure: A gateway to the subliminal. *Current Directions in Psychological Science* 2001;10:224–228.
36. Hess TM, Waters SJ, Bolstad CA. Motivational and cognitive influences on affective priming in adulthood. *Journals of Gerontology Series B-Psychological Sciences & Social Sciences* 2000;55B: 193–P204.
37. Jacoby LL. Ironic effects of repetition: Measuring age-related differences in memory. *Journal of Experimental Psychology: Learning, Memory, & Cognition* 1999;25:3–22.
38. Gray JR. Integration of emotion and cognitive control. *Current Directions in Psychological Science* 2004;13:46–48.
39. Finucane ML, Alhakami A, Slovic P, Johnson SM. The affect heuristic in judgments of risks and benefits. *Journal of Behavioral Decision Making* 2000;13:1–17.
40. Baltes, PB.; Baltes, MM. Psychological perspectives on successful aging: The model of selective optimization with compensation. In: Baltes, MM.; Baltes, PB., editors. *Successful aging: Perspectives from the behavioral sciences*. Cambridge University Press; Cambridge, England: 1990. p. 1–34.
41. Salthouse TA. Mediation of adult age differences in cognition by reductions in working memory and speed of processing. *Psychological Science* 1991;2:179–183.
42. Epstein S. Integration of the cognitive and the psychodynamic unconscious. *American Psychologist* 1994;49:709–724. [PubMed: 8092614]

43. Brown SC, Park DC. Theoretical models of cognitive aging and implications for translational research in medicine. *The Gerontologist* 2003;43:57–67. [PubMed: 12637690]
44. Meyer BJF, Russo C, Talbot AP. Discourse comprehension and problem solving: Decisions about the treatment of breast cancer by women across the life span. *Psychology and Aging* 1995;10:84–103. [PubMed: 7779321]
45. Hess TM, Pullen SM, McGee KA. Acquisition of prototype-based information about social groups in adulthood. *Psychology & Aging* 1996;11:179–190. [PubMed: 8726383]
46. Baltes PB. The aging mind: Potential and limits. *The Gerontologist* 1993;33:580–594. [PubMed: 8225002]
47. Wood S, Busemeyer J, Koling A, Cox CR, Hasker D. Older adults as adaptive decision makers: Evidence from the Iowa gambling task. *Psychology and Aging* 2005;20:220–225. [PubMed: 16029086]
48. Stanley JT, Blanchard-Fields F. Challenges older adults face in detecting deceit: The role of emotion recognition. *Psychology and Aging* 2008;23:24–32. [PubMed: 18361651]
49. Ybarra O, Park DC. The disconfirmation of person expectations by older and younger adults: Implications for social vigilance. *Journal of Gerontology: Psychological Sciences* 2002;57B:P435–P443.
50. Schwarz N, Bless H, Bohner G. Mood and persuasion: Affective states influence processing of persuasive communications. *Advanced Experimental Social Psychology* 1991;24:161–199.
51. Chaiken S. Heuristic versus systematic information processing and the use of source versus message cues in persuasion. *Journal of Personality and Social Psychology* 1980;39:752–766.
52. Chaiken, S.; Liberman, A.; Eagly, AH. Heuristic and systematic processing within and beyond the persuasion context. In: Uleman, JS.; Bargh, JA., editors. *Unintended thought*. Guilford Press; New York: 1989. p. 212–252.
53. Petty, RE.; Cacioppo, JT. The elaboration likelihood model of persuasion. In: Berkowitz, L., editor. *Advances in experimental social psychology*. Vol. 19. Academic Press; San Diego, CA: 1986. p. 123–205.
54. Baron RS, Logan H, Lilly J, Inman ML, Brennan M. Negative emotion and message processing. *Journal of Experimental Social Psychology* 1994;30:181–201.
55. Loewenstein, G.; Lerner, JS. The role of affect in decision making. In: Davidson, R.; Goldsmith, H.; Scherer, K., editors. *Handbook of Affective Science*. Oxford University Press; Oxford, United Kingdom: 2003. p. 619–642.
56. Finucane, ML.; Peters, E.; Slovic, P. Judgment and decision making: The dance of affect and reason. In: Schneider, SL.; Shanteau, J., editors. *Emerging perspectives on judgment and decision research*. Cambridge University Press; Cambridge, United Kingdom: 2003. p. 327–364.
57. Mellers BA, Schwartz A, Ritov I. Emotion-based choice. *Journal of Experimental Psychology: General* 1999;128:332–345.
58. Schwarz, N.; Clore, GL. How do I feel about it? Informative functions of affective states. In: Fiedler, K.; Forgas, J., editors. *Affect, cognition, and social behavior*. Hogrefe International; Toronto: 1988. p. 44–62.
59. Lerner JS, Gonzalez RM. Forecasting one's future based on fleeting subjective experiences. *Personality and Social Psychology Bulletin* 2005;31:454–466. [PubMed: 15743981]
60. Lerner JS, Gonzalez RM, Small DA, Fischhoff B. Effects of fear and anger on perceived risks of terrorism: A national field experiment. *Psychological Science* 2003;14:144–150. [PubMed: 12661676]
61. Lerner JS, Keltner D. Beyond valence: Toward a model of emotion-specific influences on judgment and choice. *Cognition and Emotion* 2000;14:473–493.
62. Lerner JS, Keltner D. Fear, anger, and risk. *Journal of Personality and Social Psychology* 2001;81:146–159. [PubMed: 11474720]
63. Charles ST, Mather M, Carstensen LL. Aging and emotional memory: The forgettable nature of negative images for older adults. *Journal of Experimental Psychology: General* 2003;132:310–324. [PubMed: 12825643]
64. Mather M, Carstensen LL. Aging and attentional biases for emotional faces. *Psychological Science* 2003;14:409–415. [PubMed: 12930469]

65. Mather M, Johnson M. Choice-Supportive Source Monitoring: Do Our Decisions Seem Better to Us as We Age? *Psychology and Aging* 2000;15:596–606. [PubMed: 11144319]
66. Carstensen LL, Fredrickson BF. Socioemotional selectivity in healthy older people and younger people living with the human immunodeficiency virus: The centrality of emotion when the future is constrained. *Health Psychology* 1998;17:1–10.
67. Blanchard-Fields F, Jahnke H, Camp C. Age differences in problem solving style: The role of emotional salience. *Psychology and Aging* 1995;10:173–180. [PubMed: 7662177]
68. Mather M, Carstensen LL. Aging and motivated cognition: The positivity effect in attention and memory. *Trends in Cognitive Sciences* 2003;9:496–502. [PubMed: 16154382]
69. Löckenhoff CE, Carstensen LL. Aging, Emotion, and Health-Related Decision Strategies: Motivational Manipulations Can Reduce Age Differences. *Psychology and Aging* 2007;22:134–146. [PubMed: 17385990]
70. Weinstein ND, Sandman PM. Some criteria for evaluating risk messages. *Risk Analysis* 1993;13:103–114.
71. Waters EA, Weinstein ND, Colditz GA, Emmons K. Formats for improving risk communication in medical tradeoff decisions. *Journal of Health Communication* 2006;11:167–182. [PubMed: 16537286]
72. Slovic P, Monahan J. Probability, danger, and coercion: A study of risk perception and decision making in mental health law. *Law and Human Behavior* 1995;19:49–65.
73. Slovic P, Monahan J, MacGregor DG. Violence risk assessment and risk communication: The effects of using actual cases, providing instructions, and employing probability vs. frequency formats. *Law and Human Behavior* 2000;24:271–296. [PubMed: 10846372]
74. Klein WMP, Stefanek ME. Cancer risk elicitation and communication: Lessons from the psychology of risk perception. *CA A Cancer Journal for Clinicians* 2007;57:147–167. [PubMed: 17507441]
75. Chasseigne G, Mullet E, Stewart TR. Aging and multiple cue probability learning: The case of inverse relationships. *Acta Psychologica* 1997;97:235–252. [PubMed: 9466241]
76. Shrank WH, Avorn J. Educating patients about their medications: The potential and limitations of written drug information. *Health Affairs* 2007;26:731–740. [PubMed: 17485751]
77. Gazmararian J, et al. *Journal of the American Medical Association* 1999;281:545–551. [PubMed: 10022111]
78. Lipkus IM, Samsa G, Rimer BK. General performance on a numeracy scale among highly educated samples. *Medical Decision Making* 2001;21:37–44. [PubMed: 11206945]
79. Peters E, Hibbard J, Slovic P, Dieckmann N. Numeracy skill and the communication, comprehension, and use of risk-benefit information. *Health Affairs* 2007;26:741–748. [PubMed: 17485752]
80. Schwartz LM, Woloshin S, Black WC, Welch HG. The role of numeracy in understanding the benefit of screening mammography. *Annals of Internal Medicine* 1997;127:966–972. [PubMed: 9412301]
81. Lipkus IM, Hollands JG. The visual communication of risk. *Journal of the National Cancer Institute: Monographs* 1999;25:149–163. [PubMed: 10854471]
82. Stone ER, et al. *Organizational Behavior and Human Decision Processes* 2003;90:19–36.
83. Chua HF, Yates JF, Shah P. Risk avoidance: Graphs versus numbers. *Memory and Cognition* 2006;34:399–410.
84. Carstensen, LL. A life-span approach to social motivation. In: Heckhausen, J.; Dweck, CW., editors. *Motivation and self-regulation across life span*. Cambridge University Press; New York: 1998. p. 341–364.
85. Satterfield TA, Slovic P, Gregory R. Narrative valuation in a policy judgment context. *Ecological Economics* 2000;34:315–331.
86. Finucane ML, Satterfield T. Risk as narrative values: A theoretical framework for facilitating the biotechnology debate. *International Journal of Biotechnology* 2005;7:128–146.
87. Sanfey A, Hastie R. Does evidence presentation format affect judgment? An experimental evaluation of displays of data for judgments. *Psychological Science* 1998;9:99–103.
88. Price V, Czilli EJ. Modelling patterns of news recognition and recall. *Journal of Communication* 1996;46:53–78.

89. Kearney AR. Understanding global change: A cognitive perspective on communicating through stories. *Climate Change* 1994;27:419–441.
90. Denes-Raj V, Epstein S. Conflict between intuitive and rational processing: When people behave against their better judgment. *Journal of Personality and Social Psychology* 1994;66:819–829. [PubMed: 8014830]
91. Epstein, S. Cognitive-experiential self-theory of personality. In: Millon, T.; Lerner, MJ., editors. *Handbook of psychology: Personality and social psychology*. Vol. 5. Wiley & Sons; Hoboken, NJ: 2003. p. 159-184.
92. Rottenstreich Y, Hsee C. Money, kisses, and electric shocks: On the affective psychology of risk. *Psychological Science* 2001;12:185–190. [PubMed: 11437299]
93. Sunstein C. Terrorism and probability neglect. *The Journal of Risk and Uncertainty* 2003;26:121–136.
94. Fischhoff B, Gonzalez RM, Lerner JS, Small DA. Judgments of Terror Risks: Foresight, Hindsight, and Emotion. *Journal of Experimental Psychology: Applied* 2005;11:124–139. [PubMed: 15998184]
95. Carstensen, LL. On the brink of a brand-new old age. *The New York Times*. Retrieved January 2, 2001 from *The New York Times On the Web*: <http://www.nytimes.com/2001/01/02/opinion/02CARS.html> (New York, 2001)
96. Salthouse, TA. Cognitive competence and expertise in the aging. In: Birren, JE.; Schaie, KW., editors. *Handbook of the psychology of aging*. Academic Press; New York: 1990. p. 310-319.
97. Bruine De Bruin W, Parker AM, Fischhoff B. Individual differences in adult decision-making competence. *Journal of Personality and Social Psychology* 2007;92:938–956. [PubMed: 17484614]
98. Willis LE. Decisionmaking and the limits of disclosure: The problem of predatory lending: price. *Maryland Law Review* 2006;65:707–840.
99. Mather M, Knight M. Goal-directed memory: The role of cognitive control in older adults' emotional memory. *Psychology and Aging* 2005;20:554–570. [PubMed: 16420131]
100. Sunstein CR, Thaler RH. Libertarian paternalism is not an oxymoron. *University of Chicago Law Review* 2003;70:1159–1202.
101. Forgas, JP. Affect in social judgments and decisions: A multiprocess model. In: Zanna, M., editor. *Advances in experimental social psychology*. Academic Press; San Diego, CA: 1992. p. 227-275.
102. Jepson C, Chaiken S. Chronic issue-specific fear inhibits systematic processing of persuasive communications. *Journal of Social Behavior and Personality* 1990;5:61–84.