



Published in final edited form as:

Cancer. 2008 December 15; 113(12 Suppl): 3556–3567. doi:10.1002/cncr.23944.

Age Differences in Dual Information-Processing Modes: Implications for Cancer Decision Making

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Abstract

Age differences in affective/experiential and deliberative processes have important theoretical implications for cancer decision making as cancer is often a disease of older adulthood. We examine evidence for adult age differences in affective and deliberative information processes, review the sparse evidence about age differences in decision making and introduce how dual process theories and their findings might be applied to cancer decision making. Age-related declines in the efficiency of deliberative processes predict poorer-quality decisions as we age, particularly when decisions are unfamiliar and the information is numeric. However, age-related adaptive processes, including an increased focus on emotional goals and greater experience, can influence decision making and potentially offset age-related declines. A better understanding of the mechanisms that underlie cancer decision processes in our aging population should ultimately allow us to help older adults to better help themselves.

Keywords

neoplasms; decision making; aged; judgment; affect; emotions; psychology; review

The problems and challenges of aging, long an important societal concern, are looming ever larger as persons over 65 years of age make up an increasing proportion of the world's population. According to a United Nations Population Division report¹, by 2050 the number of older persons (60 years and older) will surpass the number of younger persons (under age 15) for the first time in history. The fastest-growing age group in the world is the oldest old (age 80 and older). As the potential demands of this growing population place increasing strain on already-limited supports and resources, understanding the effects of aging on the maintenance of independent functioning and facilitating such functioning become critical. Judgment and decision-making processes are particularly relevant in this regard, given their importance in everyday life.²

Cancer tends to be a disease of aging. Surveillance, Epidemiology, and End Results (SEER) program data from 1994 to 1998 suggest that the majority of patients who die from cancer are 65 years or older. For example, 92% of deaths due to prostate cancer occur in men 65 years or older. The corresponding figures for colon cancer, lung cancer, and breast cancer are 78%, 71%, and 59%, respectively. Similarly, based on the same Surveillance,

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Epidemiology, and End Results (SEER) program data, incidence rates of all cancers, regardless of gender, increase monotonically from birth (20.6 per 100,000) to 80–84 years old (2,525.1 per 100,000); the rate levels off in the 85 year and older population (2,311.9 per 100,000). Although cancer places a disproportionate burden on the elderly population, advances in modern medicine allow cancer survivors to live longer than ever before. In addition, due to a shift away from the paternalistic system of the 1960s and 1970s, older adults are increasingly being asked to share in decisions about their health. Making this involvement in health decisions potentially more difficult is the trend toward geographically dispersed families, which means that older individuals may have limited access to knowledgeable and supportive family members. With responsibility for sound judgment and good decision making resting more on the individual than it has in the past, it is crucial for clinicians and researchers to understand the psychological processes that underlie health related judgments and decisions of older adults. This information, in turn, can guide efforts to help people face the challenges of aging.

The aim of the current review is to examine the state of the science with respect to adult age differences in affective and deliberative information processing modes in order to understand their potential impact on cancer judgments and decisions. We review evidence for the role of these dual processes in judgment and decision making and then review two representative life-span perspectives on the interplay between these processes, making relevant predictions for older-adult decisions. Finally, we review the sparse evidence about age differences in decision making and how theories and findings regarding dual processes could be applied to cancer decision making and decision aiding.

AFFECT AND DELIBERATION IN DECISION MAKING

Information in decision making appears to be processed using two different modes of thinking: affective/experiential and deliberative.^{3–8} Both modes of thought are important to forming decisions. The experiential mode produces thoughts and feelings in a relatively effortless and spontaneous manner. The operations of this mode are implicit, intuitive, automatic, associative, and fast. This system is based on affective (emotional) feelings. As shown in a number of studies, affect provides information about the goodness or badness of an option that might warrant further consideration and can directly motivate a behavioral tendency in choice processes.^{9–10}

The deliberative mode, in contrast, is conscious, analytical, reason-based, verbal, and relatively slow. It is the deliberative mode of thinking that is more flexible and provides effortful control over more spontaneous experiential processes. Kahneman⁸ suggests that one of the functions of the deliberative system is to monitor the quality of the affective/experiential system's information processing and its impact on behavior. Both modes of thinking are important and some researchers claim that good choices are most likely to emerge when affective and deliberative modes work in concert and decision makers think as well as feel their way through judgments and decisions.⁹

In this article, we focus mostly on the role of affect in experiential processing. Affect can be relevant to the decision at hand (e.g., the decision to stop taking chemoprevention drugs might be based on negative feelings learned from repeated experiences with the medication), in which case it is termed *integral affect*. Integral affect is defined as positive and negative feelings toward an external stimulus (e.g., cancer or a particular treatment). Affect can also be irrelevant to a decision but influence the decision nonetheless (e.g., the effect of a temporary mood state from a recent diagnosis); this affect is termed *incidental affect*.

Integral Affect

Decision makers appear to rely on affective meaning to guide judgments and decisions in everyday life.¹¹ According to the “affect heuristic,” all of the images in a person’s mind are tagged or marked to varying degrees with affect. The “affect pool” contains all positive and negative markers that are consciously or unconsciously associated with the images. Using this overall, readily available affective impression can be easier and more efficient than weighing the pros and cons of a situation or retrieving relevant examples from memory. This may be especially true when the required judgment or decision is complex or when mental resources are limited, as in conditions of time pressure, which often occur in treatment decision making.¹² Decision makers rely on integral affect in at least four ways in the decision-making process.¹³ ¹⁴ First, affect can act as information (as a substitute for other, sometimes more relevant information⁸) in judgments such as life satisfaction.¹⁵ Second, it can act as a common currency allowing people to integrate multiple pieces of information more effectively than when it is absent. Third, it can act as a spotlight focusing people’s attention on different information (e.g., numerical cues), which may then be used in judgments instead of the affect itself. Fourth, affect can motivate people to take some action such as getting a mammogram or working harder to find and process information about treatments and other options.

Incidental Affect Including Mood

A substantial body of research suggests that incidental positive or negative moods that are unrelated to a situation can nonetheless have systematic effects on decisions or judgments. Such decisions or judgments are similar to three of the four functions of integral affect just mentioned.¹⁶ ¹⁷ First, current mood may act as a spotlight influencing the content of people’s thoughts in a mood-congruent manner.¹⁸ ¹⁹ For instance, participants who are in a positive mood may more easily recall positive memories, whereas participants in a negative mood more easily recall negative memories¹⁶ (but see Fiedler²⁰). Second, positive and negative moods may act as a motivator of behavioral predispositions, motives for action, and information processing.²¹ ²² For instance, happy individuals tend to process information in a less elaborated and systematic manner than do people in a negative mood, but happy people will process information more systematically if it helps them maintain their positive mood.¹⁶ ²³ ²⁴ Inducing a happy mood may also increase cognitive flexibility and improve decision making.²³ Finally, the mood-as-information view assumes that when people make evaluative judgments about an object or situation they do not consult all available information, but instead rely on their affective reactions.²⁵ ²⁶ For example, people might ask themselves “how do I like the object?” and, while doing so, monitor their own feelings. Current mood may then be attributed—or misattributed—as affect integral to the target and used as information in the judgment. A state of depression which is commonly associated with a cancer diagnosis and subsequent treatment may result in a spotlight on mood-congruent (depressing) information and may influence the extent to which the individual processes information.²⁷

The Balance between Affect and Deliberation in Decision Processes

Affective and deliberative processes are critical to how individuals make decisions. These processes appear to be separable, but they also influence one another.³ ²⁸ ²⁹ For example, affect appears to have a relatively greater influence when deliberative capacity is lower.³⁰–³² Shiv and Fedorikhin³³ demonstrated that decision makers were more likely to choose an affect-rich option (and make a decision of the heart) when deliberative capacity was diminished by cognitive load. In cancer diagnoses, the distress experienced during the time of diagnosis may diminish deliberative capacity, one possible explanation of why patients often fail to process any information offered to them by physicians after the words of a diagnosis are uttered. Cassell and his colleagues, for example, demonstrated that, compared

to less sick patients, sicker adult patients showed cognitive performance more similar to young children.³⁴ Similarly, the perceived need to make a decision quickly, a common belief among cancer patients, might increase the use of affect and the use of the affect heuristic. As a result of distress and perceived time pressure both reducing deliberative capacity, cancer patients are predicted to rely more on affect than non-patients. As reviewed in the next two sections, age differences in affective and deliberative processes in non-patients have also been demonstrated and are expected to influence cancer decision making. For example, older patients, with the reduced deliberative capacity that occurs with aging, may rely even more on affect than younger patients and older healthy people.

Age-Related Deficits in the Deliberative System

Several lines of research suggest age-related declines in the controlled processes of the deliberative system. First, older adults process information less quickly than younger adults do.³⁵⁻³⁶ As a result, the products of older adults' early processing may be lost by the time later processing occurs and/or that later processing might not occur because early processing required so much time.³⁷ Second, the evidence indicates age-related deficits in explicit¹ memory and learning.³⁸⁻⁴⁰ Third, older adults may not inhibit false and irrelevant information as well as younger adults.⁴¹ Fourth, deliberative functions associated with the prefrontal cortex and the control and regulation of cognition decline with normal aging.⁴² Finally, older adults comprehend numeric and other information presented in tables and charts less well. Hibbard, Peters, Slovic, Finucane, and Tusler⁴³ presented employment-aged adults (18–64 years old; $n = 239$) and older adults (65–94 years old; $n = 253$) with 33 decision tasks that involved interpretation of numbers from tables and graphs. For example, participants were asked to identify the Health Maintenance Organization (HMO) with the lowest copayment from a table that included four HMOs with information about monthly premiums and copayments. A comprehension index reflected the total number of errors made across the 33 tasks. The youngest participants (aged 18–35) averaged 8% errors; the oldest participants (aged 85–94) averaged 40% errors; the correlation between age and the number of errors was .31 ($p < .001$). Scores on a simple 11-item numeracy test decrease significantly with age⁴⁴ and may influence the ability of older adults to understand health risks in cancer and follow complex medical regimens.⁴⁵ If good decisions depend on deliberation, such findings suggest that judgments and decisions will suffer as we age.

Impact of Deliberative Decline on Judgments and Decisions

Several studies have identified biases on judgment processes that increase with age and were linked with deliberative processes such as working memory. For example, research by Chen⁴⁶⁻⁴⁸ demonstrates that aging-related declines in deliberative processes negatively impact judgment processes. In these studies, participants were presented with information about an individual, some of which was identified as true and some as false (and thus to be ignored); then they were asked to make judgments based upon this information. Chen found that the judgments of older adults were more likely to be influenced by the false information than were those of younger adults. In addition, younger adults in a divided-attention condition performed similarly to older adults under full attention. These findings suggest that older adults may have more difficulty controlling attention and monitoring the accuracy of information in memory, which in turn makes judgments more prone to error based upon irrelevant information. A related study⁴⁹ found that older adults, when told that a consumer claim was false, were more likely than younger adults to later remember the claim as actually true, particularly if the claim (and the fact that it was false) had been repeated several times. These findings suggest that health care providers must take care to not repeat

¹In explicit tasks, “the subject is directly queried about the to-be-remembered material, and remembering is accompanied by a feeling of conscious awareness on the part of the subject”³⁵

false statements (e.g., people say that cancer is a death sentence; this is not true) as memory distortions might actually reinforce the false statements as true.

The level of difficulty in treatment decision making that is often encountered by cancer patients is illustrated well in the case of prostate cancer. Men diagnosed with localized prostate cancer are faced with a complex set of disease information and treatment challenges.⁵⁰ Yet, it is essential that they effectively process this disease and treatment information to participate as informed consumers in treatment decision-making. This is not an easy task for patients,^{50–57} as definitive data on the long-term efficacy of the two main treatment options (i.e., surgery and radiation) are just emerging and are not without controversy.^{58, 59} Treatments confer a high likelihood of side effects, often with debilitating effects on a patient's quality of life. Information presented to patients is fraught with medical and probabilistic terms, and physicians have a tendency to recommend therapies within their specialty. This often leaves patients to resolve contradictory medical opinions. Hence, in addition to adjusting to a potential life-threatening disease, having to cope with uncertainty about the efficacy and outcomes of different treatment options adds to the overall distress and may impair effective treatment decision-making. Making a treatment decision that is right for the patient is a difficult task; however, it becomes even more difficult in the context of the possible declines in deliberative processing discussed above and the obvious emotional impact conferred by a cancer diagnosis.

Given that comprehension of and adherence to medical treatment regimens is of great functional importance to older adults, efforts to aid their comprehension and decisions have focused in part, therefore, on how to support age-related declines in the efficiency of deliberative processes.⁶⁰ Medication instructions that were well organized, explicit, and compatible with preexisting schemas about the task improved memory and were preferred over other formats, suggesting that they could improve medication adherence.⁶¹ The use of external memory supports, such as organizational charts and medication organizers have also been shown to be beneficial to older adults' adherence behaviors.^{62, 63} The use of lists to convey information rather than presentation in paragraphs has reduced some age differences.⁶⁴ Overall, the testing of formats is critical because the intuition of even well-intentioned information providers is not always correct.⁶⁵

Other Age-Related Processes Compensate for Declining Resources

There are several findings from these studies, however, that might temper interpretation of the observed age differences in terms of declining resources. First is the observation that age differences in decision outcomes were rarely observed in these studies. Thus, even though older adults tended to sample less information and use less complex strategies than younger adults, the chosen options did not vary with age.^{66–69} Second, older adults appear to adapt to real or perceived declines in cognitive resources by becoming increasingly selective about where they spend cognitive effort.⁷⁰ In situations of low relevance or meaningfulness to the older individual, she or he may not bother expending the effort that would lead to a better decision. As relevance and meaningfulness increase, however, fewer age differences in judgments are seen.⁷¹ In addition and as reviewed in the next sections, age differences in experience and in the processing of affective and emotional information appear also to compensate for declining cognitive resources.

Processing of Affective and Emotional Information across the Life Span

Age differences in judgments and decisions may appear as the result of the impact of age on affective processes in addition to those changes that happen due to deliberative processes. Current evidence is mixed as to whether the processing of affective and emotional information is resilient to aging (remains constant across the life span unlike deliberative

processes which show robust declines) or whether such processing might be enhanced by aging. The implication of both possibilities is that affective and emotional information should be relatively more influential in the judgments and decisions of older adults than younger adults, either because affect becomes relatively more influential as deliberative abilities decline or because motivations change as the perceived end of life nears and affective information is selectively processed as a result.^{72, 73} We briefly review evidence for the motivational and deliberative-decline viewpoints below.

This increased reliance on affect may be learned over the life span as a particularly effective means of making decisions. Reyna,⁵ for example, argues that information processing in the affective system (she calls it the gist system) is more advanced, relative to the deliberative system. In support of this idea, she provides evidence that individuals process less information but process it more qualitatively as their development progresses both from childhood to adulthood and from less expertise to more expertise. Thus, an increased reliance on affect with aging (either due to compensation for deliberative decline or to motivated selective processing) may result in better decisions by older adults than younger adults in at least some situations, although worse decisions may emerge in unfamiliar situations. In either event, understanding the various impacts that such age changes may bring will be important ultimately to identifying ways to improve cancer decision making.

Motivational Perspectives

The most influential perspective regarding aging, affect, and motivation is socioemotional selectivity theory.⁷³ This theory posits that changes in time perspective result in emotional goals becoming increasingly important as the end of life nears, which in turn results in greater monitoring of affective information. Because older adults are, by virtue of age, closer to the end of life, age should be associated with an increased importance of emotional goals; increased attention to emotional content; and either an increased focus on positive information and/or a decreased focus on negative information, in order to optimize emotional experience. These latter predictions have potentially great relevance to the impact of affect and emotions in cancer judgment and decision making.

Recent empirical work has shown that aging is associated with an increase in recall of emotional content. For example, Carstensen and Turk-Charles⁷⁴ had adults in four different age groups (20–29, 35–45, 53–67, and 70–83) read and recall stories containing both neutral and emotion-laden content. Examination of the data revealed a linear decline across the four age groups in recall of neutral content with age, but stability in recall of emotional content. Thus, older adults recalled relatively more emotional content than neutral content, supporting the researchers' contention that there was a shift in the nature of the memory representation toward disproportionate retention of emotional information.

Socioemotional selectivity theory, however, also predicts a specific focus on positive information in later life as older adults seek to optimize emotional experience. Some evidence consistent with this expectation can be seen in age differences in mood states. Older adults tend to be in positive moods more often and negative mood states less often compared to younger adults.⁷⁵ Several behavioral studies of memory are also consistent with this expectation. For example, Charles, Mather, and Carstensen⁷⁶ found that overall picture recall declined with age but that older adults recalled a greater proportion of positive images than negative images, whereas young and middle-aged adults recalled similar amounts of each. Mather and Carstensen⁷⁷ also found that, relative to younger adults, older adults exhibited disproportionate attentional and memory biases in favor of faces depicting positive emotions over those depicting negative emotions. Importantly, younger adults tend to exhibit a similar bias when asked to focus on the emotional content of their choices.⁷⁷

Together, these findings suggest a motivational shift in processing rather than a deliberative deficiency.

Support for the motivational basis of the positivity effect also comes from a recent study by Mather and Knight,⁷⁸ who found that older adults who had more cognitive resources (due to better performance on tasks requiring cognitive control in one study and due to not being distracted by a divided attention task in a second study) remembered relatively more positive than negative pictures compared to those with fewer cognitive resources; younger adults showed no such effect. Thus, the positivity effect in memory appears to be driven by effortful, resource-demanding regulatory functions. An interesting implication of these data is that the positivity effect may not be a general aspect of aging but may be more characteristic of high-functioning older adults. If this is the case, its implications for cancer patient decision making needs to be studied carefully because the cognitive burdens of the illness, diagnosis, perceived time pressure to make treatment decisions, and the difficulties of finding good care and choosing treatments may result in the positivity effect mattering less on some particularly burdensome days and more on other days when the patient has greater resources to bring to bear on decisions.

Deliberative-Decline Perspectives—An alternative perspective on aging is that affective processes (both positive and negative affect) take on increased importance as deliberative functions decline in later life. One basis for this perspective is research suggesting that cortical structures associated with processing affect (e.g., the amygdala, the ventromedial prefrontal cortex) undergo less normative change with aging than those areas underlying executive or deliberative functions (e.g., the dorsolateral prefrontal cortex^{79–81}). This relative-preservation view is supported by neuropsychological data demonstrating that adult age differences in performance are minimal on those tasks thought to be supported by affective-processing systems.^{82, 83} These data contrast with the normative decline consistently observed on tasks associated with executive functions (for a review, see West⁸⁴).

According to the relative-preservation view, qualitative age differences (e.g., positivity effects) should not exist in the processing of affective information. Some research is consistent with this view. Researchers, for example, have shown that when participants are required to actively attend to emotional and neutral stimuli, younger and older adults exhibit similar patterns of memory for positive, negative, and neutral stimuli.^{82, 85} The relative-preservation view would not necessarily negate the possibility of qualitative differences arising in cognitively later stages of processing and when decision makers are not required to attend to all information but can instead choose what to process.

In sum, research suggests that aging is associated with a greater focus on emotional content and on positive over negative information, although this latter effect appears to be moderated by situational characteristics and available cognitive resources.

Implications of Age-Related Changes in the Role of Affect on Decisions

A relative preference for positive information or increased use of affective information has marked implications for cancer judgments and decisions. Health information often has both emotional content (feared diseases, worrisome side effects, hopeful benefits) and neutral content (names of unfamiliar body parts, test results, or procedures). Older cancer patients may be particularly likely to weigh emotional content (and especially positive content) over neutral information such as found in evidence-based medicine. Thus, older adults may process benefit-versus-risk information in treatment decisions differently than their younger counterparts who do not share this same focus. Older adults may be more likely to be in positive moods, states that have been associated with greater engagement in schema-based

processing and less-specific, bottom-up processing²⁰. These age differences in the experience of incidental affect may be misattributed to aging-related deficits in deliberative processes.

Alternatively, older adults may focus relatively more on affective information overall (both positive and negative information). Several effects on judgments and decisions might be observed if this is the case. First, more-affective sources of information such as anecdotal or hedonic (not utilitarian) information may receive greater weight.⁸⁶⁻⁸⁷ Consistent with this, Blanchard-Fields et al. found that older adults focus more than younger adults on emotional aspects of everyday problems.⁸⁸ Finally, incidental sources of affect (positive and negative moods; positive and negative primes) may influence older adults' judgments and decisions more than those of younger adults. An interesting study by Caruso and Shafir⁸⁹ demonstrated that merely considering one's feelings has an impact on choices. Younger-adult participants asked to consider their mood were more likely to choose a mood-relevant movie (a silly comedy) over a more highly rated dramatic movie, compared to participants who had not thought about their feelings. Socioemotional selectivity theory suggests that older adults' feelings are more salient and accessible than are younger adults' feelings, leading to the prediction that older adults overall may rely more on emotional information when making choices. Thus, older adults should make relatively more choices that are mood relevant. This might be particularly the case under conditions of heightened distress, such as after a cancer diagnosis. Patients might rush into a treatment decision because of very high levels of distress that, in their view, can only be lowered through rapid action. Evidence for such a mechanism has been reported in the health psychological and geriatric literature.⁹⁰⁻⁹²

Robust findings with younger adults indicate that losses tend to loom larger than gains, a negativity bias. Findings consistent with lifespan theories suggest that the negativity bias in older adults may be different from that of younger adults in any of three ways. First, the bias may be enhanced as affective information in general becomes more salient so that older adults would demonstrate a greater negativity bias. Alternatively, if positive information only is weighted more, then a positivity bias would be predicted. If negative information is suppressed (and not experienced in order to maintain positive moods), then less of a negativity bias should exist in older adults compared to younger adults. We call these three alternatives an affective bias, a positivity bias, and a lack-of-negativity bias.

These predictions can be tested within the domain of framing effects, in which the same decision problem is framed or described in a positive or negative format. Framing effects are important within the cancer context. In a famous example of lung-cancer decisions, McNeil, Pauker, Sox, and Tversky⁹³ elicited different medical-treatment choices by describing the likelihood of the outcome in terms of survival (a positive frame) or mortality (a negative frame). Presumably because a 90% chance of survival is less threatening than a 10% chance of death, patients and experienced physicians both chose the surgery option substantially more often in the positive/survival than the negative/mortality frame.

If a general affective bias is evident, then the negativity bias should be enhanced and older adults should produce stronger framing effects relative to younger adults, leaving them more vulnerable to possible manipulation through intentional or non-intentional framing. Indirect support for this interpretation comes from findings that framing effects were larger for undergraduate participants low in deliberative thinking.⁹⁴ In addition, Bennett⁹⁵ linked larger framing effects to the addition of emotion-laden visual portrayals. Three studies concerning age differences in framing effects have been conducted thus far and are inconclusive⁹⁶⁻⁹⁸; this issue deserves further attention.

THE IMPACT OF EXPERIENCE IN JUDGMENT AND DECISIONS

Other studies have emphasized the importance of experience—and associated knowledge—as a moderator of age differences in judgment and decision making and as a potential compensatory mechanism for declines in deliberative processes. Older adults' knowledge and experience appear to benefit them in familiar life situations. When older adults are faced with decisions or judgments in contexts they frequently encounter, previous experience may enable them to avoid bias that younger adults show in the same decisions.⁹⁹ Tentori et al. argued that older adults' everyday life experience provides them with knowledge of the situational variables that may influence their judgments so that they can discount irrelevant information (see also¹⁰⁰ for similar results).

Older adults' life experiences such as social interactions and health decisions appear to allow them to develop expertise in these areas that may benefit judgment and decision making. Certainly there are multiple areas in which expertise can be developed, depending on individuals' life circumstances. Hess and colleagues^{101–103} have examined social expertise in relation to social inferences that older adults make about other individuals. These studies have shown that older adults are skilled at making trait inferences about individuals and that older adults pay particular attention to the diagnostic value of behaviors. Perhaps of particular interest in these studies is that older adults did not exhibit a general bias in favor of positive information in constructing their judgments. Rather, the diagnostic value of the information—whether positive or negative—was the most influential factor in terms of differential processing. This finding suggests that older adults' expertise may counteract chronic goals in the presence of appropriate acute goals (e.g., task-specific instructions). In other words, the emotional goals associated with socioemotional selectivity theory might be viewed as the default in later life when cognitive resources are adequate, but such goals may be superseded by salient situational goals.

In the domain of health, Meyer, Russo, and Talbot¹⁰⁴ studied a group of women diagnosed with breast cancer and found that the older women behaved more like experts by seeking out less information, making decisions faster, and arriving at decision outcomes equivalent to those of younger women. A follow-up study¹⁰⁵ found that this effect was due to the availability of specific information about breast cancer. In other words, consistent with an expertise-based explanation, the presence of relevant declarative knowledge in the problem domain facilitated decision making in older women.

Like the Tentori et al.⁹⁹ study, these studies support older adults' ability to use their expertise when considering contextual variables and to prevent this context from influencing judgments and decisions. It is also important to acknowledge that this apparent expertise influence on performance could also easily be misinterpreted in terms of aging-related deficits in deliberative functions. For example, the results of Meyer et al.¹⁰⁴ are very similar to those of Johnson and colleagues⁶⁸ cited earlier. The findings of Meyer and colleagues suggest, however, that the shorter decision times and consideration of fewer pieces of information on the part of older adults might be reflections of greater knowledge rather than heuristic-based processing resulting from reduced cognitive resources. In other words, experience-based factors appear to moderate information searches. For example, in examining decisions about over-the-counter drugs, Johnson and Drungle⁶⁸ found that older adults were more likely to focus on active ingredients than were younger adults and were also more systematic in their information searches, presumably reflecting their greater experience with using these drugs. Stephens and Johnson¹⁰⁶ also found that older adults were more likely to focus on side effects and drug interactions than were young adults. Such issues are most likely based on experiences and obviously relevant to older adults, who are more likely than the young to be taking multiple prescription drugs at any one time.

CONCLUSIONS

In the present review we examined age differences in processes related to decision making that have been well studied in younger adults but little studied in older adults. We first reviewed evidence for age-related changes in information processes. The greater quantity of research about age changes in affective and deliberative information processes allows us to draw firmer conclusions than we can for age differences in decision making. Evidence of age-related declines in deliberative processes such as working memory and speed of processing is robust, but it does not provide a complete explanation of age differences in decision making. We also conclude that age differences in affective information processes are minimal but that a positivity effect is shown in memory by older adults when cognitive resources are adequate. More research is needed to clarify the interaction of cognitive resources with the role of affective information in processes important to decision making (e.g., memory, attention). Although for simplicity we have limited the present paper to considering relatively low-intensity affect, Labouvie-Vief¹⁰⁷ speculates that stronger-intensity affect and emotions will act more like a cognitive load on older adults when compared with their younger counterparts. The evidence base for this last hypothesis is not strong at this point, but may be critical for cancer decision making. Finally, mood disorders, such as depression, are relatively common in cancer patients¹⁰⁸ and are likely to influence information processing and, thus, decision making.²⁷ As a result, interventions for cancer decision making including pharmacologic (e.g., anti-depressants) and behavioral (e.g., therapy, exercise) strategies should be considered for patients who experience these states.

In terms of decision making, robust evidence for aging-related declines in deliberative processes predict that older adults will be more likely to show some decision biases, particularly in unfamiliar or less-meaningful situations. Older adults will tend to process less information in decisions more slowly and will demonstrate worse judgments and decisions than younger adults when complex or changing rules must be learned. They will tend to understand numeric information less well.⁴⁴ ¹⁰⁹ These findings point to the need to simplify unfamiliar and numeric information important for the decisions of older adults. Clinicians should also expect to give older cancer patients more time to assimilate information and make decisions. Providing written summaries of key information, encouragement to take notes and to bring a partner to the treatment consultation will help the older cancer patient retain and use important information.

Age-related adaptive processes, however, influence decision making in at least two ways. First, older adults focus relatively more than do younger adults on emotional content (and sometimes on positive content) in decisions. Decision aids based on highlighting affective meaning (e.g., by providing verbal labels such as excellent and fair) may be particularly helpful as a result. Clinicians should assess whether the older adult patient understands the meaning of information critical to the decision at hand and interpret the information for them as needed. For example, a verbal interpretation of numeric risk information may increase the patient's ability to understand and use it. Although risk judgments can be influenced by carefully induced specific emotions,¹¹⁰ older adults may show fewer effects of specific emotions due to greater experiences of mixed emotions.¹¹¹ Research focused on the impacts of valenced affect and mixed emotions in the elderly may prove quite fruitful. Second, the accumulated experience and knowledge of older adults compensate in some cases for age-related declines.

Decision making for cancer treatment provides its own challenges as decisions are made under elevated levels of distress, conditions of heightened uncertainty, and often under perceived or real time pressure. Age differences in decision making for prostate cancer, as an example of decision making under uncertainty, have not been investigated with regard to

deliberative and affective processing. Such research would provide a laboratory to examine the influence of deliberative processes as well as the functions of affect in a realistic setting.

Proposals for improving people's decision-making abilities^{30, 112} are based primarily on research results from young adults. Decision making is essential to life at all ages, however, and older adults are increasingly being asked to make their own decisions about vital life issues. No longer are health decisions left entirely to one trusted person, such as the family doctor. Instead, older adults are faced with more choices and more information conveyed by a greater number of and increasingly specialized physicians than they were in previous generations. This happens at a point in their lives when their abilities to deliberate carefully about important decisions may be declining. Thus, research-based advice on how to improve older adults' decision making is essential.

Finally, understanding the balance of affective and deliberative processes in judgment and choice is fundamental to the study of decision making. Decisions often involve both the head and the heart. In addition, decision makers sometimes have experience in a decision situation and are familiar with the tradeoffs and options; other times they are not. A better understanding of the mechanisms that underlie decision processes in our aging population should ultimately allow us to help older adults to better help themselves.

Acknowledgments

Sponsored by the National Cancer Institute's Office of Cancer Survivorship. The authors are indebted to Paul Slovic for numerous discussions on this and related topics. Preparation of this report was supported in part by NSF Grants SES-0111941 and SES-0339204 and NIA Grant AG21308-01 awarded to Ellen Peters. Presented at the Society of Behavioral Medicine preconference entitled, 'Cancer and Aging: Challenges and Opportunities Across the Cancer Control Continuum,' Washington, DC, March 21, 2007. Portions of this paper are based on Peters, E., Hess, T.M., Västfjäll, D., & Auman, C. (2007). 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*, 2(1), 1–23. The definitive version of this article was published as Peters, E., Diefenbach, M. A., Hess, T. M., & Västfjäll, D. (2008). Age differences in dual-information processing modes: Implications for cancer decision making. *Cancer*, 113, 3556–3567.

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