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Using a Three-Dimensional Model to Understand Age Differences in the Framing Effect

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Using a Three-Dimensional Model to Understand Age Differences in the Framing Effect

Tara E. Karns, M.S.

Dissertation submitted to the
Eberly College of Arts and Sciences
at West Virginia University
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for the degree of

Doctor of Philosophy
in
Psychology

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ABSTRACT

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Tara E. Karns, M.S.

The present study used a between-subjects design with three instruction conditions to investigate susceptibility to the framing effect among younger, middle-aged, and older adults. Participants were instructed to pay attention to the facts and numbers, to use their gut feelings, or to use their previous experiences to respond to two decision-making scenarios pertaining to treatment for lung cancer and a vaccination for a flu virus. Results revealed that, overall, the framing effect was present in the lung cancer scenario, but not the flu scenario. Instruction condition and age did not affect susceptibility to the framing effect; however, a frame by condition was identified for older adults in a flu scenario. The short-term survival information was more important to participants in the survival frame of the lung cancer scenario. Numeracy was not a significant predictor of the framing effect. Previous research has demonstrated mixed results concerning age differences in the framing effect. The current study further supports that there is no age difference in susceptibility to the framing effect and susceptibility may not be determined by the type of information that is used when making a decision.

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Using a Three-Dimensional Model to Understand Age Differences in the Framing Effect

The *framing effect* is the tendency for people to make different and potentially less optimal decisions depending on how the decision options are “framed” or structured (Tversky & Kahneman, 1981; see Strough, Karns, & Schlosnagle, 2011 for a review). Despite the differences in frames, whether they are structured as positive or negative, gains or losses, or even survival vs. mortality, in a rational decision, the frame of the decision options should not change the decision outcome. The framing effect has been demonstrated in domains such as medical decisions (e.g., McNeil, Pauker, Sox & Tversky, 1982), financial decisions (e.g., Mayhorn, Fiske, & Whittle, 2002), and most prominently in the work of Tversky and Kahneman (1981) using the classic “Asian Disease paradigm” (see Kühberger, 1998 for a review). The Asian disease situation requires participants to make a decision based on the number of lives saved (i.e., 200 people out of a total of 600 people will be saved) in the positive frame or the number of lives lost (i.e., 400 people out of a total of 600 people will die) in the negative frame. A close look at the number of lives saved vs. lost indicates that the same number of people will live or die in both situations. Despite this, people often make different decisions. The framing effect is especially relevant in medical situations where people are required to make decisions based on complex circumstances and numerical information involving short- and long-term outcomes.

In the current study, the framing effect in medical decision situations was examined among younger, middle-aged, and older adults using a recently proposed conceptual three-dimensional decision-making framework comprised of a deliberative, experiential, and affective condition (Strough et al., 2011). In addition, the influence of short- vs. long-term information on medical decisions was examined. Objective numeracy – participants’ ability to utilize and

understand numerical information (Reyna, Nelson, Han, & Dieckmann, 2009) – was used as a control variable to further inform possible explanations for the framing effect.

Measuring the Framing Effect

Stimuli

The framing effect has been examined in adults by using various different tasks ranging from computer-based tasks (e.g., Weller, Levin, & Denburg, 2011), concrete tasks such as the Balloon Analogue Risk Task (BART; see Lejuez et al., 2002) and the Cups task (see Levin, Weller, Pederson, & Harshman, 2007), and hypothetical vignettes (e.g., McNeil et al., 1982; Woodhead, Lynch, & Edelstein, 2011) and gain vs. loss monetary situations (e.g., Thomas & Millar, 2012). The hypothetical vignettes range from business (e.g., Tversky & Kahneman, 1986) and gambling scenarios (e.g., Kahneman & Tversky, 1979) to medical (e.g., McNeil et al., 1982), and social situations (e.g., Brewer & Kramer, 1986). In the hypothetical vignettes, participants choose between a “sure thing” vs. a “risky” option and participants do not usually receive any sort of substantial reward or loss for making their decisions. The Asian Disease paradigm is one such example of a hypothetical vignette.

In the current study, hypothetical medical vignettes were used. Medical decision situations are important to examine due to their complexity and possible life-changing implications. Although previous literature has used a variety of different types of vignettes, the current study used the lung cancer scenario developed by McNeil et al. (1982) in addition to a modified version of that vignette about getting the flu. Using a previously established vignette addresses issues in the framing effect literature (addressed later) and adds more cohesion to a body of literature that has many inconsistencies.

Measurement

Between- vs. within-subjects design. Frame (i.e., survival vs. mortality) has been used as both a between- and a within-subjects factor (e.g., Woodhead et al., 2011). Stanovich and West (2008), explain that differences in associations between the framing effect and individual differences in within- vs. between-subjects framing effect studies may occur. In a within-subjects study, participants recognize the inconsistencies in the vignettes when they are given the same situation (with slight numerical differences) more than once. Participants in a between-subjects study see the decision situation only once so they do not recognize a consistency issue. However, as Stanovich and West (2008) explain, this may result in a lack of associations between the framing effect and individual differences in between-subjects studies. Despite differences in consistency in between- and within-subjects designs, Woodhead et al. (2011) identified similar framing patterns in their between- and within-subjects studies. They gave the participants both frames (i.e., survival vs. mortality for lung cancer) of the decision-making scenarios in Study 1, while in Study 2, the participants were given only one frame (i.e., survival or mortality). Results revealed similar trends in the framing effect in both studies using frame as a predictor of decision choice. That is, in the survival frame, people had a tendency to choose the option with higher short-term risks (i.e., surgery) more frequently than in the mortality frame. As a result, people were more risk averse in the survival frame and risk seeking in the mortality frame. A between-subjects design in which each participant saw only one vignette of each pair of vignettes (i.e., cancer and flu) was used in the current study.

Types of framing. In tasks involving a choice between a sure thing or a risky option, the choices made in the gain vs. loss frames are compared to measure the framing effect. The type of framing effect that is identified using this comparison is called *standard framing* (Reyna & Ellis, 1994). That is, participants have a tendency to be risk seeking in loss (negative) frames but risk

averse in gain (positive) frames. *Preference reversal*, or *preference shift*, is measured by using data that is collected across trials (Tversky & Kahneman, 1981). People are more likely to take a gamble for a potential good outcome in gain frames but are more likely to choose an option which results in a sure thing in loss frames (Levin, Schneider, & Gaeth, 1998). For example, preference reversal, or shift, would be measured by examining the number of times that a participant chooses the sure thing in the gain frame and the risky choice in the loss frame.

In addition to traditional types of framing effects, resistance to framing has also been examined (e.g., Bruine de Bruin, Parker, & Fischhoff, 2007). *Resistance to framing* is a measure of how resistant people are to demonstrating the framing effect. The resistance to framing measure is comprised of “risky choice framing” and “attribute framing” items. Risky choice framing is presented as a single scale with the safe choice (or sure thing) presented at one end of the scale and the risky choice at the other end. Attribute framing refers to situations structured positively and negatively. In this type of measurement, each decision scenario is presented twice, framed either as a gain vs. a loss (risky-choice framing) or as a positive vs. a negative (attribute framing). For the attribute items, the person does not indicate a difference between two options but rather evaluates a quality of the item, such as the amount of fat in ground beef. In the current study, resistance to framing was measured using the attribute framing subscale of the Resistance to Framing scale (Bruine de Bruin et al., 2007). The Resistance to Framing measure (Bruine de Bruin et al., 2007) was used to ensure that the participants exhibit similar levels of resistance to framing at the start of the study.

Explanations for the Framing Effect

Affect Heuristic

Kahneman and Frederick (2007) examined neuroimaging data collected by DeMartino, Kumaran, Seymour, and Dolan (2006) and concluded that the framing effect occurs as the result of the use of an affective heuristic. An affective heuristic is a mental shortcut that uses emotion assigned to representations of objects and events in people's minds (Finucane, Alhakami, Slovic, & Johnson, 2000). Finucane et al. (2000) describes decision making using the affect heuristic as a process that requires the decision maker to consult an *affective pool*. The affective pool contains all of the positive and negative emotions associated with the representations. When a decision has to be made, the affect heuristic is activated. The person unconsciously consults their affective pool for the emotional marker that is assigned to that particular representation and uses that marker to help make their decision.

In terms of gains and losses, use of an affective heuristic causes decision makers to recognize sure gains as attractive and losses as aversive. As a result, decision makers are thought to demonstrate the standard framing effect, risk seeking in loss frames, but risk averse in gain frames (Cassotti et al., 2012). Cassotti et al.'s (2012) results are also consistent with the existence of an affective heuristic. After participants experienced a positive emotional manipulation, their susceptibility to the framing effect was eliminated. Particularly, positive emotion reduced loss aversion, limiting participants' tendency to exhibit risk taking in loss frames, but it did not influence risk-taking behavior overall. However, susceptibility to the framing effect was not reduced or increased after a negative emotion manipulation. Cheung and Mikels (2011) also identified positive affect as being associated with risk-seeking in loss frames. However, in gain frames, positive affect was not related to risk aversion. In addition, DeMartino et al. (2006) identified a significant association between the framing effect and the amygdala,

signifying an affective contribution. These findings provide further support that the framing effect may occur as a result of an affective heuristic that occurs during an affective process.

To investigate whether affect influences susceptibility to the framing effect, in the current study, participants were assigned to one of four instruction conditions: affective, experiential, deliberative, or control. Participants assigned to the affective condition were instructed to use their intuition and gut feelings to make their decision, which was hypothesized to result in an increased susceptibility to the framing effect. Because participants were instructed to pay attention to their affect, it was hypothesized that they would be likely to make their decisions based on negative affect in the mortality frame and positive affect in the survival frame, resulting in different decisions depending on the frame.

Fuzzy Trace Theory

More recently, Reyna advanced another explanation for the framing effect. Reyna (2004) explains the decision-making process as being comprised of two representations: gist and verbatim. Gist representations are easy to access and contain an overall representation of an idea. However, they tend to be less exact, or “fuzzy,” in comparison to verbatim representations which are the exact depiction of an idea. For example, when faced with the classic Asian Disease paradigm, people who use gist processing may come to the conclusion that it is “better to save some lives than none”. Fuzzy-trace theory also holds intuition as central. When people use gist representations to make a decision, they are often relying on their “gut feeling” or their intuition to guide the way.

Reyna and Brainerd (2011) concluded that the framing effect in adults is the result of the tendency to use gist processing rather than verbatim processing. Rather than carefully analyzing the details such as the numbers in a decision situation, people use the gist of the decision. As a

result, in situations framed as losses, people focus on the gist of loss and in situations framed as gains, people focus on the gist of gains. For example, when faced with the fatal disease situation framed with two alternatives to choose from (i.e., saving some people; saving some people or saving no one), people are more likely to choose the sure thing (i.e., saving some people).

However, when faced with the same situation framed as a loss with two alternatives to choose from (i.e., some people die; some people die or none die), the same heuristic is being used (i.e., valuing human life) so people are more likely to choose the gamble (i.e., some people die or none die). Gists, while efficient and sometimes resulting in rational decisions, prevent people from analyzing all the details of the decision situation such as the odds and probabilities of a disease occurring.

Prospect Theory

The framing effect has numerous explanations that span from individual differences to biological explanations (see Strough et al., 2011 for a review). However, since the development of *prospect theory* in 1981, it has become, perhaps, the most widely accepted theory for explaining the occurrence of the framing effect (Tversky & Kahneman, 1981). Within prospect theory, outcomes are described as deviations from a neutral reference point. The deviations may be positive or negative (or gains or losses) with the response to losses more extreme than the response to gains. The *value function* is the term used to describe how a person's response to losses is more extreme than their response to gains. That is, the negative feelings that occur in response to a monetary loss are more extreme than positive feelings associated with a monetary gain of the same amount. When demonstrating the framing effect, people tend to respond using value functions; that is, they tend to respond more strongly to losses than gains (e.g., lives lost vs. lives saved). *Loss aversion*, which depicts potential losses as being more influential than

potential gains (Kahneman & Tversky, 1979), is another term for value function that has been used frequently in the framing effect literature (Soman, 2004). In addition, there is a tendency to overweight low probabilities and underweight larger probabilities, called the *probability weighting function*. For example, people underweight a 2/3 (66%) chance of gaining \$150, but overweight a 1/3 (33%) chance of gaining \$0 (Thomas & Millar, 2012).

In the current study, participants who were randomly assigned to the deliberative condition (instructed to use the facts and figures) were hypothesized as being likely to exhibit loss aversion; that is, losses are more influential than gains. Because paying attention to the facts and figures highlights the number of people who die in the mortality frame (i.e., the loss), it was hypothesized that participants would be more likely to demonstrate the framing effect in the deliberative condition. That is, participants would be more likely to choose radiation in the mortality frame (risk seeking) because paying attention to the facts and figures highlights the number of people who die (i.e., the loss). Conversely, participants would be more likely to choose surgery (risk averse) in the survival frame.

Age Differences in the Framing Effect

The research examining the framing effect in younger and older adults has yielded inconsistent results (see Strough et al., 2011 for a review). For example, Mata, Josef, Samanez-Larkin, and Hertwig (2011) conducted a meta-analysis and identified younger and older adults as exhibiting similar risk-taking behavior for most of the tasks they examined. However, Mata and colleagues (2011) also identified an age difference in risk taking among younger and older adults as a function of decreased learning performance. When learning led to risk-avoidant behaviors, younger adults were more risk averse, but when learning led to risk-seeking behavior, older adults were more risk averse.

Furthermore, a study examining medical scenarios (i.e. the fatal disease problem and decision situations involving cancer) revealed that older adults demonstrated the framing effect while younger adults did not (Kim, Goldstein, Hasher, & Zacks, 2005). However, some previous research using only younger adults has demonstrated that they exhibit susceptibility to the framing effect (Wang, Simons, & Bredart, 2001) and in some cases, more susceptibility than older adults (e.g., McNeil et al., 1982). Conversely, a study that used a computer-based task to measure the framing effect found that the standard framing effect was more prevalent among younger adults (Mikels & Reed, 2009).

Other research has found very little to no difference between younger and older adults in susceptibility to the framing effect (Rönnlund, Karlsson, Lagnäs, Larsson, & Lindström, 2005). It appears that when decision situations are framed in terms of risky choices, the adult age difference is not strong. In a series of decisions on gains and losses, Rönnlund and colleagues (2009) identified younger and older adults as equally affected by frames. That is, both younger and older adults were more likely to choose the certain option in gain frames and the risky option in loss frames. Similarly, Mayhorn, Fisk, and Whittle (2002) also found adults of all ages to be equally susceptible to the framing effect. To date, no research has explicitly used middle-aged adults as a comparison group to examine the framing effect across adulthood.

As demonstrated above, the previous research on age-related differences in the framing effect is inconsistent. As a result, it is difficult to pinpoint a trend across the adult lifespan. To remedy some of the inconsistencies in the body of literature, the current study used younger, middle-aged, and older adults and vignettes similar to those in previous research (i.e., McNeil et al., 1982). To date, middle-aged adults have not been examined and using them as a separate age group helped to solidify a trend in the framing effect across the adult lifespan.

Dual-Process Decision-Making Theories

Judgment and decision making has been examined and explained in light of dual-process models comprised of two processes or systems: affective/experiential (Type 1) and deliberative (Type 2) systems (Kahneman, 2003; see Keren & Schul (2009) for a review of the different names for each system). The process of making a decision using the affective/experiential processing is quick, efficient, and requires less cognitive effort than the deliberative processing due to its reliance on mental heuristics, affect, intuition, or experience, among others (Evans, 2008; Osman, 2004). The decision outcomes of the affective/experiential processing are more susceptible to biases and often result in irrational decisions. Deliberative processing, on the other hand, is more effortful and has a higher reliance on rules and formal operations and tends to be more accurate than affective/experiential processing. A function of deliberative processing is to monitor the affective/experiential processing, although intuitive judgments sometimes slip through, creating flawed judgments (Kahneman & Frederick, 2007). Although several versions of dual-process theories exist, most theories share some major commonalities such as the overall functioning described above and an interaction effect, in which the processes overlap and work together. Although the processes work independently they also overlap in some domains and this overlap may result in conflicting responses to some situations (Osman, 2004).

Evans and Stanovich (2013) caution against referring to the two *processes* as *systems* due to the term's tendency to suggest that there are exactly two systems responsible for the processing. They suggest using the terms Type 1 and Type 2, which indicate that there are two types of processing. In addition, they recommend using the term *processing* rather than *systems*. This allows for the assumption that multiple cognitive systems may underlie the processing. Evans and Stanovich (2013_a) also make the distinction between *modes* and *types*, whereas modes

are types of cognitive processing that occur within what is considered Type 2 thinking. Evans and Stanovich (2013_a) define Type 2 processing (i.e., deliberative processing for this purpose) as "slow, sequential, and correlated with measures of general intelligence" (pg. 235). In addition, Type 2 processing is unique to humans in that it allows for "hypothetical thinking, mental simulation, and consequential decision making" (pg. 235). Type 1 processing (i.e., experiential/affective processing) requires minimal attention, lessening demands on working memory. It is also mandatory when stimuli that trigger it are present. For example, the acquired "waste not" heuristic. Although not necessary for Type 1 processing, execution has a tendency to be quick, central processing load is light, and associative. However, these qualities are correlated features and not required for a definition of Type 1 processing.

Critiques of Dual-Process Theories

Although research on dual-process theories is plentiful, the debate of the existence of these processes rages on. For example, recently, Evans and Stanovich (2013_a) examined five common critiques of the dual-process theories. They highlight mistakes that others have made in their critiques, and redefine the two processes. Despite this reexamination of the dual processes, Osman (2013), Kruglanski (2013), Keren (2013), and Thompson (2013) reiterated their issues with the dual-process theories and countered Evans and Stanovich's (2013_a) explanations and definitions.

That being said, dual-process theories can be helpful when trying to determine how a person makes a decision, especially when attempting to explain how a particular decision-making bias or error occurs. However, the critiques that have been offered make it clear that some issues with these models exist (e.g., Keren, 2013; Keren & Schul, 2009; Kruglanski, 2013; Osman, 2013; Strough et al., 2011; Thompson, 2013). These critiques have challenged previous

research which often distinguishes between the two systems, making them appear independent (Keren & Schul, 2009). Keren and Schul (2009) cite inconsistent definitions of the two systems, faults in the previous research that describe the systems as separate, and undetermined *isolability* as evidence that the dual-process theories need to be redefined. *Isolability* is described as each system working independently to perform its designated tasks, with no reliance on the other system. To account for some of these issues, the three-dimensional model proposed by Strough et al. (2011) of a three-dimensional decision-making process was used in the current study.

Commentary on Evans and Stanovich's (2013_a) review of critiques argue that Type 2 processes may also be triggered automatically (Thompson, 2013) and the completion of Type 2 processes require working memory and are more flexible than Type 1 processes. For example, if a decision outcome is not one of serious consequences, a decision maker may disregard any additional thought even though they are not completely satisfied with their decision. Kruglanski (2013) argues that even though Evans and Stanovich (2013_a) define the model as a dual-process default-interventionist model, it appears to be more unimodal. That is, Evans and Stanovich (2013_a) describe Type 1 processing as being overridden by Type 2 processing when confidence is lacking in the judgment or when the cognitive ability is absent to reason about a judgment. This overriding process makes the system appear to be more unimodal than dual-processing. Other commentators regard quantitative rather than qualitative differences in the two processes (Osman, 2013), vagueness of the definitions, and a lack of testable predictions (Keren, 2013). Evans and Stanovich (2013_b) counter this last point by explaining that they were not describing a testable theory but rather a metatheory that does not have testable predictions.

Three-Dimensional Decision-Making Model

In an attempt to lessen the issues with dual-processing models, Strough and colleagues (2011) described a three-dimensional model, in which three dimensions or aspects of the decision-making process (deliberative, experiential, and affective) are overlapping (see Figure 1; slight adaptations [a level of individual differences (age) and short- vs. long-term information have been added and decision domain, justification instructions, and investment amount and dimension have been removed] have been made for this study). In this three-dimensional model, the deliberative system is as described above: effortful and has a high reliance on rules and formal operations (Evans, 2008; Osman, 2004). However, the third domain is created by separating the affective and experiential systems. Critiques of the dual-processing models suggest that the two systems are not independent, lending to a degree of overlap (Keren & Schul, 2009; Kruglanski, 2013).

The current conceptual framework depicts the three dimensions as overlapping, demonstrating that it is likely that decisions occur as a result of the three dimensions working together rather than in isolability. For example, people often have an emotional reaction when thinking about a previous experience they are using to help them make a decision (Baumeister, Vohs, DeWall, & Zhang, 2007) and these experiences often have emotions connected to them as a sort of “somatic marker” (Bechara & Damasio, 2005). In this way, the affective and experiential processes are closely interacting. Furthermore, it is common for people to reason about their feelings when making a decision (Barrett, 2005), resulting in an interaction between the deliberative and affective processes (Strough et al., 2011). Similarly, people reason about their experiences, resulting in an overlap in the deliberative and experiential processes. In these examples, it is impossible to determine outright which system is responsible for making a decision without considering more than one system. The amount of involvement of the three

dimensions is one of degree, not a categorical difference. That is, in the three-dimensional framework, rather than determining *if* a particular system is used to make a decision, it is a matter of *how much* each system contributes to making the decision. In addition to examining circumstances under which the framing effect occurred in the current study, participants were also asked to indicate to what extent they used their deliberative, experiential, and affective systems, as indicated by instructions particular to each condition.

In the current study, participants were assigned to one of four instruction manipulation conditions: deliberative (i.e., use only logic and reasoning based on the facts and numbers), experiential (i.e., use only your previous and experiences of others that you are familiar with), affective (i.e., use only your initial reactions and gut feelings), and a control condition (i.e., make your decisions as you normally would). Participants were asked to what extent they used each condition as a manipulation check. It was expected that there would be overlap in the type of information the participants used in each condition, but the degree to which they used the information would differ, resulting in different decisions. Participants also completed the Cognitive Reflection Test (CRT; Frederick, 2005) and the General Decision-Making Styles questionnaire (GDMS; Scott & Bruce, 1995). The CRT categorizes participants as either intuitive or deliberative decision makers. The GDMS categorizes participants according to five categories: rational, intuitive, dependent, avoidant, and spontaneous.

Dual-Processes and Age Differences

Inconsistencies between younger and older adults' susceptibility to the framing effect are also apparent when they are instructed to utilize deliberative and experiential processes, according to previous research (e.g., Thomas & Millar, 2012; Woodhead et al., 2011). In a mixed between- (instructions and age) and within-subjects (frame) design, Thomas and Millar (2012)

found that both younger and older adults did not demonstrate the framing effect when they were required to calculate the expected value of the situation or were told to “think like a scientist.”

Thomas and Millar (2012) theorized that the framing effect was eliminated as the result of an indirect activation of analytic (deliberative) processes. However, when participants were instructed to use their “initial reactions” to make their decisions, they were more likely to demonstrate the framing effect. Based on the results of Thomas and Millar (2012), rational decision making may occur as a result of effortful, deliberate, analytic processing.

However, Thomas and Millar’s (2012) results are inconsistent to those of Woodhead and colleagues (2011) if their manipulation requiring participants to “think like a scientist” caused the participants to pay attention to the facts and figures in the decision situation. (However, because instructing someone to “think like a scientist” is ambiguous at best, it is impossible to tell what participants were doing when making their decisions.) Woodhead et al. (2011) identified differences regarding the type of decision-making strategy that younger vs. older adults utilized when making decisions about framing situations. Older adults were more likely to use an experience-related decision strategy and younger adults were more likely to use a data-driven strategy (Woodhead et al., 2011). Furthermore, participants who used the data-driven strategy (more typical of younger adults) were more susceptible to the framing effect than those who used the experience-related strategies. These results suggest that participants who use deliberative, effortful processes to make decisions (especially younger adults), may end up making irrational decisions, contrary to the results that Thomas and Millar (2012) reported. Less susceptibility to the framing effect has been suggested to occur due to an indirect activation of deliberative processing (e.g., Woodhead et al., 2011) *and* the experiential/affective processing

(e.g., Thomas & Millar, 2012), resulting in an unclear depiction of when each system results in demonstration of the framing effect and adult age differences.

Heuristics. One common assumption of dual-process models is that only the deliberative system results in unbiased decisions (Peters, Dieckmann, & Weller, 2010). However, heuristics (typical of the affective and experiential systems) are often used because they are efficient and result in favorable decisions. Heuristics are considered to be “fast and frugal” (Gigerenzer, 2008). Heuristics such as “avoid waste” result in decisions that are made quickly, and can result in good outcomes (Strough et al., 2011). Experience can also lead to good decision outcomes. For example, as people age, their experience leads to gains in wisdom (Worthy, Gorlick, Pacheco, Schnyer, & Maddox, 2011), or “life pragmatics” (Baltes, Lindenberger, & Staudinger, 2006). This experience and knowledge may increase the likelihood of unbiased decision outcomes. In this way, the affective and experiential systems yield unbiased decision outcomes and these outcomes are not necessarily synonymous with only one processing system. As a result, older adults may make unbiased decisions using the affective or experiential system.

Further research is needed to identify which system (including the affective system) results in the demonstration of the framing effect. In the current study, younger, middle-aged, and older adult participants were randomly assigned to an instruction manipulation group which cued deliberative, experiential, or affective processing (separately) and were asked to answer framing effect scenarios about lung cancer and the flu. They were also asked to indicate to what extent they used information pertaining to each condition to make their decision. Consequently, it was possible to see if cueing a particular decision-making dimension resulted in more or less demonstration of the framing effect, if the instruction manipulation worked, and to what degree the participants use all three dimensions.

Underlying psychological processes. Previous research has identified older adults as experiencing a decline in their deliberative processing (Peters, Hess, Västjäll, & Auman, 2007). As a result, they may be more susceptible to the framing effect. However, Peters and colleagues (2007) identified affect as being more resistant to the aging process and more influential as people age. This is thought to result in deliberative processing as having a weaker influence on decision making and affective processing as having a greater influence with age. Moreover, older adults tend to have more sophisticated affective processing than younger adults as demonstrated by evidence that people tend to process lesser amounts of information but focus more on the quality of the information as they age (Reyna, 2004). This focus on affective information requires the use of fewer cognitive resources than deliberation, lending to use of the affect heuristic (Peters et al., 2007).

People also experience a shift in the importance of emotional goals as they age (Carstensen, 2006). Due to a more limited time perspective, emotional goals are thought to become more important to older adults. In addition, older adults have a tendency to pay more attention to positive information (or less attention to negative information). Focusing on positive information tends to result in losses not looming larger than gains for older adults, as they do for younger adults (Mikels & Reed, 2009). Both the importance of emotional goals and attention to positive information of older adults result in an effort to optimize their current emotional experience.

In the current study, it was hypothesized that when older adults were instructed to use their deliberative processing, they would make decisions more like the decisions made by younger adults, and would demonstrate the framing effect as a result of the decline in their deliberative processing (See Figure 2 for a pictorial representation). However, when participants

were instructed to use their affective processing, younger adults would likely demonstrate the framing effect more frequently than older adults due to their less advanced affective processing and focus on losses as looming larger than gains. Conversely, it was also hypothesized that all participants would be less likely to demonstrate the framing effect when using experiential processing due to their use of outside information (their own or other's previous experiences) to make their decisions (see Figure 2).

Short- vs. Long-Term Risks and Benefits

Vignettes used to examine medical framing effects typically contain information regarding immediate, short-, and long-term risks and benefits. For example, McNeil et al. (1982) gave participants three types of information: an immediate treatment outcome, a short-term outcome, and a long-term outcome. Some research indicates that the frame of a decision influences what type of information, such as the risks or benefits, short- or long-term, is most salient to the decision maker (e.g., Kim et al., 2005; McNeil et al., 1982). In survival frames, participants have been more willing to trade short-term risks for long-term benefits, but this has not been seen in decisions framed as mortality (McNeil et al., 1982; O'Connor et al., 1985). Woodhead et al. (2011) identified participants who use data-driven decision-making strategies as more likely to focus on the long-term benefits in the survival frame and short-term risks in the mortality frame. Moreover, age differences in the focus on short- or long-term information have also been identified (Kim et al., 2005). In their study, Kim et al. (2005) identified older adults as more likely than younger adults to focus on long-term survival in the positive frame but short-term survival in the negative frame. However, this previous research fails to discriminate between the immediate and short-term outcomes. For instance, the lung cancer scenario provides participants with the likelihood of surviving surgery and radiation initially and also gives short-

term information (i.e., rate of survival after one month). Kim et al. (2005) and Woodhead et al. (2011) considered the immediate and short-term outcomes as short-term information, making it impossible to tell what is most important to the participants' decision-making process: the immediate outcome or the short-term risks of the decision situation.

In the current study, participants were asked to rate how important the short- and long-term information was to their decision, without the confounding immediate information. In addition, participants completed the Consideration of Future Consequences scale (Strathman, Gleicher, Boninger, & Edwards, 1994) as a means of measuring the participants' consideration of the consequences of their potential behaviors. Together, these measures granted the opportunity to examine the importance of short- vs. long-term information and future consequences with regards to the framing effect and age.

Numeracy and the Framing Effect

Factors that may influence susceptibility to the framing effect, such as intelligence (Parker & Fischhoff, 2005), expertise (Loke & Tan, 1992), need for cognition (Levin, Gaeth, Schreiber, & Lauriola, 2002), and numeracy (Peters et al., 2006) have been examined. Numeracy is an individual difference factor that has been examined and identified as making people more susceptible to the framing effect (Peters et al., 2006). Numeracy is broadly defined as "the ability to understand and use numerical information" (Reyna, Nelson, Han, & Dieckmann, 2009, p. 943).

In decision-making scenarios, particularly medical decisions, numerical information is often used to present frequencies and probabilities of an event occurring. For example, a probability that people will live or die such as the one given in the Asian Disease problem: "There is a one-third probability that nobody will die, and a two-third probability that 600 people

will die" (Tversky & Kahneman, 1981). People tend to range in their abilities to understand and use numerical information. Those low in numeracy have a tendency to be more susceptible to the framing effect, biases in judgment and decision making, and reduced compliance to medical directions (Lipkus, 2007; Reyna et al., 2009). Another factor to consider is that low numeracy is not only found among people who are low in intelligence (Reyna et al., 2009) and it has been cited as being related but separate from general intelligence (Peters, 2012). For example, accountants who were experiencing cognitive decline in memory associated with non-numerical information and retired bookkeepers with no cognitive decline were identified as having similar levels of numeracy (Castel, 2007). Peters cites many research studies which used SAT scores as a control resulting in an enduring significant effect of numeracy.

The numerical information may also lead people to determine the credibility of the risk information based on how accurate, relevant, useful, clear, and easy it is to understand (Lipkus, 2007). Furthermore, numbers often lack the sensitivity to trigger automatic reactions and intuition, preventing the use of deliberative processing. However, people often have difficulty understanding and applying necessary mathematical equations or concepts (such as converting decimals to percentages, etc.) (Lipkus, Samsa, & Rimer, 2001; Woloshin, Schwartz, Moncur, Gabriel, & Tosteson, 2001), leading to an increased susceptibility to demonstrating the framing effect. Despite this research, it is a common assumption that people are adept at using numbers and appreciate their value as a result of their education and daily use (Lipkus, 2007).

In spite of the research demonstrating a lack of numerical ability, the literature used to educate people on decision making indicates that people should pay close attention to the facts and figures in the decision situation (Thompson, 2004; Wargo, 2008). Current recommendations are to explain quantities such as the short-term risk of a treatment in a qualitative manner,

display numerical information pictorially, and to cue the retrieval of health-related knowledge (Wargo, 2008). This consideration is important especially for complex decisions such as medical decisions due to the occurrence of numerical values and probabilities presented in medical decisions. However, Woodhead and colleagues' (2011) results demonstrating the framing effect when deliberation was used suggest that it may be inappropriate to encourage people to use the data in the decision situations to make their decisions. Furthermore, the research on numeracy indicates that most people are not good with numbers. Together, these factors suggest that it is important to investigate numeracy as a factor that contributes to the framing effect.

In the present study, numeracy was evaluated as a control variable. Because studies on decision making often use vignettes containing numerical values and require simple mathematical procedures, numeracy is an important topic to evaluate. Furthermore, using numeracy as a covariate helped control for individual differences in numerical ability.

Summary

Because the research regarding adult age differences in the framing effect has continued to yield inconsistent results, the current study examined younger, middle-aged, and older adults' susceptibility to the framing effect. In addition, there has not been a clear distinction in susceptibility to the framing effect with regards to the use of deliberative and affective/experiential processing. The present study separated affective and experiential processing by using an instruction manipulation to cue deliberative, affective, or experiential processing. Moreover, participants were asked to indicate whether the short- or long-term information was most salient to their decision making. Participants' consideration of future consequences was also measured to investigate whether their focus on short- or long-term information is related to how they consider future consequences of their behaviors. In addition,

numeracy has been identified as a potential factor that makes people more susceptible to the framing effect. Using numeracy as a covariate eliminated it as an individual-difference variable that may affect participants' susceptibility to the framing effect.

The current study is innovative in that it is the first of its kind to examine the framing effect using a three-dimensional decision-making framework. The current study also sought to resolve the inconsistencies in the literature regarding age differences in demonstration of the framing effect. Moreover, the current study eliminated the confound between immediate and short-term information to more thoroughly examine the influence of short- vs. long-term information.

Statement of the Problem

Previous research has identified differences in susceptibility to the framing effect depending on the type of processing (Thomas & Millar, 2012) and decision-making strategy that is used (Woodhead et al., 2011). Although the framing effect has been examined extensively, results regarding age differences remain inconsistent. As a result and in light of the recent research suggesting differences in susceptibility to the framing effect depending on whether deliberative or experiential processing is activated, age differences should be examined more thoroughly. Furthermore, a third dimension, the role of affective processing, needs to be better understood because age differences in affect regulation are becoming increasingly well-documented.

The current study is novel in that it included an instruction manipulation that instructed younger, middle-aged, and older adult participants to either use only logic and reasoning based on the facts and numbers (deliberative processing), to use only their initial reactions and gut feelings (affective processing), or to use only their previous experiences and experiences of

others (experiential processing) to come to a decision. Some recommendations for making rational medical decisions explain that people should use the data in the decision-making scenario to make a rational decision (Thompson, 2004; Wargo, 2008). The results Thomas and Millar (2012) found are counter to this practice. The current study manipulated the type of information that participants were to pay attention, allowing an exploration into what type of processing is most reliable. Furthermore, by including age as a predictor, more information was obtained regarding the type of information that is most pertinent to younger, middle-aged, and older adults. In addition, an age-related difference in susceptibility to the framing effect was also examined, a trend that, at this point, has failed to be determined.

Furthermore, by including age as a predictor, more information pertaining to the type of information pertinent to each age group was identified in addition to which age group is more susceptible to the framing effect, a trend that has yet to be determined.

Previous research has also identified differences in the influence of short- vs. long-term information, but has failed to distinguish between the immediate outcomes and the short-term outcomes of the decision-making situation (Kim et al., 2005; Woodhead et al., 2011). The current study addressed this issue by eliminating the immediate outcomes from the decision-making situation to focus on the difference between the short- and long-term outcomes. It was expected that the frame of the decision situation would influence what type of information (short- vs. long-term) is most salient to the decision maker. It was the goal of the current study to contribute to the literature by examining the information that is most influential to participants when deliberation, affect, and experience are cued.

Additionally, people low in numeracy have been identified as less able to make rational decisions and more susceptible to the framing effect (Peters, 2012). Because medical decisions

are complex and often contain numerous numerical values and require an understanding of probabilities and odds, numeracy was measured and used as a covariate. The current study further investigated how objective numeracy affected susceptibility to the framing effect in light of deliberation, experience, and affect. Participants who have low numeracy were likely to be more susceptible to demonstrating the framing effect, especially those instructed to use deliberation (i.e., pay attention to the facts and figures).

Research Questions and Hypotheses

Research Question 1

Do younger, middle-aged, or older adults in the deliberative, affective, or experiential conditions demonstrate the framing effect more frequently?

Hypothesis 1a. Woodhead et al. (2011) identified participants who use data-driven decision-making strategies as more likely to demonstrate the framing effect. Based on these results, participants in the deliberative condition were hypothesized to be more likely to demonstrate the framing effect than participants in the affective or experiential conditions.

Hypothesis 1b. Woodhead et al. (2011) identified younger adults as using data-driven strategies more frequently than older adults. Reyna (2004) identified older adults as having a more sophisticated affective system. In the current study, younger adults in the deliberative and affective conditions were hypothesized to demonstrate the framing effect more frequently than younger adults in the experiential condition.

Hypothesis 1c. Based on Woodhead et al. (2011), older adults in the deliberative condition were hypothesized to be more likely to demonstrate the framing effect than older adults in the experiential and affective conditions.

Hypothesis 1d. Because affect becomes more influential as people age (Peters et al., 2007) and the affective system becomes more sophisticated with age (Reyna, 2004), older adults in the affective system were hypothesized to demonstrate the framing effect less frequently than younger adults in the affective condition.

Research Question 2

Are the short-term risks or long-term benefits more influential to decisions among younger, middle-aged, or older adults in the survival or mortality (or flu or no flu) frame depending on the instruction manipulation (deliberative, affective, or experiential)?

Hypothesis 2a. Woodhead et al. (2011) identified participants who use data-driven strategies as more likely to focus on the long-term benefits in the survival frame and short-term risks in the mortality frame. Drawing from these results, in the current study, participants' decisions were hypothesized to be influenced more by the short-term information in the mortality (or getting the flu) frame and by the long-term information in the survival (or not getting the flu) frame when instructed to use their deliberative system.

Hypothesis 2b. Kim et al. (2005) identified older adults as more likely than younger adults to focus on long-term survival in the positive frame. In the current study, the long-term information in the survival (or not getting the flu) frame was hypothesized to influence older adults' decisions more than younger and middle-aged adults.

Hypothesis 2c. Kim et al. (2005) also identified older adults as being more likely than younger adults to focus on short-term survival in the negative frame. Based on these results, the short-term information in the mortality (or getting the flu) frame was hypothesized to influence older adults' decisions more than younger and middle-aged adults.

Research Question 3

Does numeracy affect susceptibility to the framing effect among younger, middle-aged, and older adults when instructed to use the deliberative, affective, or experiential system?

Hypothesis 3. Peters et al. (2006) identified participants who are lower in numeracy as more susceptible to the framing effect. As a result, in the current study, participants who have low numeracy were hypothesized to be more susceptible to the framing effect than participants higher in numeracy.

Method

Design

A between-subjects design was used. The independent variables were the instruction manipulation (deliberative, experiential, or affective processing), short- vs. long-term information, frame (e.g., survival vs. mortality), and age. The dependent variable was the decision outcome (e.g., surgery or radiation). Objective numeracy was used as a control variable.

Participants

Three hundred and forty-three participants (119 younger adults; 18-37; $M = 27.24$, $SD = 4.73$, 118 middle-aged adults; 40-58; $M = 47.08$, $SD = 4.87$, and 108 older adults; 60-87; $M = 64.47$; $SD = 4.22$) were recruited from Amazon Mechanical Turk (Buhrmester, Kwang, & Gosling, 2011) during the course of 3 days. Amazon Mechanical Turk is a web-based interface that permits the recruitment of participants via Human Intelligence Tasks (HITs). Researchers post advertisements for their studies in the HITs and qualified participants can take the surveys for payment. Participants accrue money as they participate in HITs, allowing them to remove the funds as Amazon gift cards or later be paid to their bank account. In the current study, participants were paid \$1.50 as compensation for their survey completion that took an average of 31 minutes to complete. This amount of payment is typical of Amazon Mechanical Turk as the

program is set up so that participants accrue money as they participate in multiple studies. In the current study, participants were limited to those with an approval rate greater than 95%, greater than 500 approved HITs, and those who live in the United States. The study was not visible to participants who did not meet those requirements. Table 1 contains demographic information for the participants.

Procedure

Participants read the consent form and indicated their consent before participating in the study. Participants were rerouted from the Amazon Mechanical Turk website to an external link via Qualtrics (Qualtrics Labs, Inc.) to complete the study. Before completing the framing items, participants completed the demographic questionnaire (Appendix B). They also completed the General Decision-Making Styles scale (GDMS; Scott & Bruce, 1995; Appendix C), the Numeracy scale (Lipkus et al., 2001; Appendix D), and the Resistance to Framing measure (Bruine de Bruin, et al., 2007; Appendix E) before they completed the framing effect questions.

Participants were randomly assigned to one of four instruction manipulation conditions: deliberative, experiential, affective, or control (see Appendix A). Participants in all conditions completed the same questionnaires. They first read instructions telling them to either answer the decision situation using "only logic and reasoning based on the facts and numbers," "based on their initial reactions and gut feelings," to make their decisions based on "only their previous experiences and experiences of others that they are familiar with," or to "make their decisions as they normally would" depending if they have been randomly assigned to the deliberative, affective, experiential, or control condition, respectively. They then read two vignettes detailing a medical situation (i.e., lung cancer or the flu) in which a decision needed to be made regarding

their medical treatment (Appendix A). They were presented with each vignette once, framed as survival or mortality.

After completing each framing effect vignette (cancer and flu), they were asked to what extent they used each type of processing in their decision making (manipulation check). They were then asked to indicate whether the short- or long-term information was most important to their decisions and finished the study by completing the Consideration of Future Consequences scale (CFC; Strathman et al., 1994; Appendix F) and the Cognitive Reflection Test (CRT; Frederick, 2005; Appendix G). When participants completed all of the measures, they were debriefed about the purpose of the study. The participants were compensated via their Amazon Mechanical Turk account.

Measures

Demographics. The demographic questionnaire that was completed by each participant assessed gender, race, ethnicity, age, sex, marital status, highest education attained, current or previous major, type of job of longest employment, current job, income, and questions regarding difficulty paying bills (Appendix B). Participants were also asked to rate their experience with economic principles and their personal and vicarious experience with medical decision making, lung cancer, and the flu on a scale from 1 (no experience) to 5 (much experience). Participants also indicated their perceived decision-making ability in light of their own aging as better, the same, or not as good (Appendix B).

General Decision-Making Style. Decision-making style was measured using the General Decision Making Style scale (GDMS; Scott & Bruce, 1995; Appendix C). The GDMS is comprised of 25 items that are broken into 5 subscales: rational, intuitive, dependent, avoidant, and spontaneous. Participants responded to each item on a 5 point Likert scale (*1 = strongly*

disagree; 5 = *strongly agree*). A total score for each subscale was computed by averaging across items from each of the subscales. An example rational item is the following: “I double-check my information sources to be sure I have the right facts before making decisions.” Reliability for the five subscales is as follows (Loo, 2000): rational ($\alpha = .81$), intuitive ($\alpha = .79$), dependent ($\alpha = .62$), avoidant ($\alpha = .79$), and spontaneous ($\alpha = .76$). The ranges, means, and standard deviations for the subscales are as follows: rational (2.00-5.00; $M = 3.20$, $SD = .43$), intuitive (1.80-5.00; $M = 3.16$, $SD = .49$), dependent (1.40-5.00; $M = 3.08$, $SD = .59$), avoidant (1.00-4.40; $M = 2.53$, $SD = .63$), and spontaneous (1.75-4.20; $M = 2.90$, $SD = .42$).

Numeracy Scale. Numeracy was measured by using the Numeracy scale (Appendix D) developed by Lipkus et al. (2001). The Numeracy scale is comprised of 11 items that evaluate how well participants can understand and use probabilities, percentages, and simple mathematical procedures. An example item is the following:

“Which of the following numbers represents the biggest risk of getting a disease? Please circle only one choice that best represents your answer.

A) 1 in 100

B) 1 in 1,000

C) 1 in 10”

Two out of 11 items are multiple choice items while the other nine are open-ended questions. Participants’ numeracy scores are determined by adding the number of correct items. Scores ranged from 0-11.00 ($M = 8.62$, $SD = 2.09$).

Resistance to framing. Each participant’s resistance to the framing effect was measured using the attribute framing subscale of the Resistance to Framing measure (Bruine de Bruin et al., 2007; Appendix E). Fourteen items measured attribute framing. Items used to measure

attribute framing are framed in positive and negative manners (seven items of each). Participants completed this measure prior to undergoing the instruction manipulation. The following is an example of an attribute item framed positively:

“Imagine that a new technique has been developed to treat a particular kind of cancer. This technique has a 50% chance of success, and is available at the local hospital. A member of your immediate family is a patient at the local hospital with this kind of cancer. Would you encourage him or her to undergo treatment using this technique?”

Participants responded on a 6-point Likert scale (1 = *definitely no*; 6 = *definitely yes*). Scores for were determined by calculating the difference between the analogous items and then averaging across the items. The Cronbach’s alpha is .80. Scores ranged from -1.67-3.43 ($M = .36$, $SD = .74$).

Instruction manipulation condition. Participants were randomly assigned to one of four instruction manipulation groups: deliberative, experiential, affective, or a control condition (see Appendix A). Pilot testing was conducted to determine an effective instruction manipulation for each condition. Upon examination of the pilot data, the framing effect was most prevalent using the instruction manipulations described below. These instruction manipulations also resulted in significant differences from one another in a manipulation check (see below) verifying the information that participants were paying attention to while making their decisions in the pilot study. The instruction manipulations for this study have been modified from the manipulation used by Thomas and Millar (2012). The instructions for each condition were as follows (also found in Appendix A):

[Deliberative condition]: "Please read the following scenarios. Use only logic and reasoning based on the facts and numbers to make your decision on the following page."

Participants were reminded of the instructions before reading the decision situations with the following instructions: "Please use only logic and reasoning based on the facts and numbers presented in the scenarios to make your decision."

[Affective condition]: "Please read the following scenarios. Use only your initial reactions and gut feelings to make your decision on the following page." Participants were reminded of the instructions before reading the decision situations with the following instructions: "Please use only your initial reactions and gut feelings to make your decision."

[Experiential condition]: "Please read the following scenarios. Use only your previous experiences and experiences of others that you are familiar with to make your decision on the following page." They were reminded of the instructions before reading the decision situations with the following instructions: "Please use only your previous experiences and those of others to make your decision."

[Control condition]: "Please read the following scenarios and make your decision as you normally would." They were reminded of the instructions before reading the decision situations with the following instructions: "Please make your decision as you normally would."

Framing effect. The framing effect was measured by presenting participants with one pair of medical vignettes adapted from McNeil et al. (1982) and a pair of medical vignettes created for this study based on McNeil et al. (1982) (see Appendix A). The vignettes were edited by eliminating the immediate information from the decision-making vignettes to remove the confound between the immediate- and short-term information. The McNeil et al. (1982) vignettes require participants to consider treatment for cancer and the other pair required participants to determine how they would like to receive a vaccination for the flu (modeled after McNeil et al.'s (1982) vignettes but designed for this study; Appendix E). The cancer vignettes

are framed in terms of either survival or mortality. The flu vignettes are framed in terms of either getting the flu or not getting the flu. Before reading and answering the vignettes, participants read a short description of each option, including symptoms of each option and recovery time (see Appendix A). The following is an example of two of the framing decision situations for the cancer scenario, framed in terms of survival:

Of 100 patients having radiation therapy, 77 patients live for more than 1 year, and 23 patients live for more than 5 years.

Of 100 patients having surgery, 68 patients live for more than 1 year, and 32 patients live for more than 5 years.

Participants were then asked to decide rather they would choose radiation or surgery. The cancer and flu decision situations were analyzed individually as separate decision choices. In the analyses, frame was used as a predictor for decision outcome. Specifically, frame (e.g., survival vs. mortality) as a significant predictor of decision outcome (e.g., surgery vs. radiation) indicated that the framing effect occurred. That is, different decisions were made based on the frame of the decision situation.

Manipulation check. As a manipulation check for the instruction manipulation, participants indicated to what extent they used logic and reasoning based on the facts and numbers, their experiences and those of others, and their initial reactions and gut feelings (see Appendix H). Participants answered each question regardless to which condition they were randomly assigned. The questions were presented after participants answered each framing vignette to gauge the type of information that they used to make their decision.

Short- vs. long-term information. To assess whether the short- or long-term information was most salient in the participants' decision making, they were asked to rate how

important the short- and long-term information was to their decision (see Appendix H). The following is an example asking the participants to rate the short-term information: “How important was the short-term information (i.e., the number of patients living or who had died one year after receiving the treatment) to you in your decision making?”

Consideration of Future Consequences. Participants completed the Consideration of Future Consequences (CFC) scale (Strathman et al., 1994; Appendix F) to measure individual differences in people’s consideration of distant vs. immediate consequences of potential behaviors. The scale is comprised of 12 items to which the participants responded on a scale of 1 (*extremely uncharacteristic*) to 5 (*extremely characteristic*). To score the CFC scale, items 3, 4, 5, 9, 10, 11, and 12 were reversed scored. All of the items were then summed, with higher scores indicating that a participant has a greater consideration of future consequences. The Cronbach’s alpha was .88 and scores ranged from 1.63-5.00 ($M = 3.48$, $SD = .66$)

Cognitive Reflection Test. The Cognitive Reflection Test (Frederick, 2005) is comprised of three hypothetical vignettes that require the participants to give a solution to a simple mathematical question (e.g., asking how much an item costs given the price of another item; Appendix G). The three vignettes are simple enough that participants easily understand them when they are explained, but often yield incorrect decisions, likely as a result of participants relying on their intuition (Frederick, 2005). Participants’ answers are classified as either deliberative or intuitive. Intuitive answers are frequently given, but yield incorrect answers. An intuitive answer was given a score of 0. A deliberative answer is a correct decision and was given a score of 1. Total scores were calculated by summing across the 3 vignettes for a range of 0-3.00 ($M = 1.53$, $SD = 1.24$).

Results

Data Cleaning

See Table 2 for steps taken to ensure data quality such as removal of data based on trap questions, inconsistently reported birth years and Amazon Mechanical Turk IDs. Table 2 also contains information pertaining to outliers and multicollinearity. Within the survey were three "trap" questions designed to assess the participants' level of attention throughout the survey. In addition, participants were asked to verify their birth year and Mechanical Turk ID on two separate occasions, once in the beginning of the survey and once near the end of the survey prior to being given their survey code to enter into the Mechanical Turk system.

Preliminary Analyses

Pearson correlations were also conducted between the measures (see Table 3). Close inspection reveals that CFC and the importance of long-term information were positively correlated. Age and perceived decision-making ability were also positively correlated. An analysis of variance (ANOVA) or multivariate analysis of variance (MANOVA) was conducted for each measure (i.e., GDMS, Resistance to Framing, CRT, CFC, and numeracy) for each condition and age group.

Manipulation check. A one-way ANOVA was performed to assess differences in the three instruction manipulations: the extent to which participants used their logic and reasoning based on the facts and numbers, their experiences and those of others, and their initial reactions and gut feelings to make their decisions. Participants were asked to respond to three questions post-framing vignettes (see description in Measures above).

Deliberative. An ANOVA was used to examine the difference in extent that participants used the deliberative information (i.e., their logic and reasoning based on the facts and numbers) to answer the framing vignettes. There was a significant difference in the extent to which

participants indicated that they used the deliberative information by condition, $F(1,340) = 17.74$, $p < .001$, $\eta^2 = .14$. That is, participants in the deliberative condition ($M = 4.40$, $SD = .63$) indicated that they used the facts and figures significantly more than participants in the experiential ($M = 3.65$, $SD = 1.03$), affective ($M = 3.42$, $SD = 1.03$), and control ($M = 3.80$, $SD = .96$) conditions. Participants in the experiential condition did not differ in the extent to which they used the deliberative information from participants in the control and affective conditions. However, participants in the control condition indicated that they used the facts and figures significantly more than participants in the affective condition.

Experience. There was a significant difference in the extent to which participants indicated that they used the experiential information (i.e., their previous experiences or those of others that they are familiar with) to answer the framing vignettes in the experiential condition, $F(1,340) = 17.36$, $p < .001$, $\eta^2 = .13$. Participants in the experiential condition ($M = 3.62$, $SD = 1.11$) indicated that they used their previous experiences significantly more than participants in the deliberative ($M = 2.40$, $SD = 1.23$), affective ($M = 2.77$, $SD = 1.28$), and control ($M = 2.66$, $SD = 1.13$) conditions. No differences existed between participants in the deliberative and affective conditions, the deliberative and control conditions, and the affective and control conditions.

Affect. There was a significant difference in the extent to which participants indicated that they used the affective information (i.e., their initial reactions and gut feelings) to answer the framing vignettes in the affective condition, $F(1,340) = 17.25$, $p < .001$, $\eta^2 = .13$. Participants in the affective condition ($M = 3.77$, $SD = 1.06$) used their gut feelings and intuition significantly more than participants in the deliberative ($M = 2.56$, $SD = 1.30$), experiential ($M = 3.23$, $SD = 1.08$), and control ($M = 2.95$, $SD = 1.06$) conditions. Participants in the experiential condition

also used their gut feelings and intuition more than participants in the deliberative condition. No other significant differences were noted.

General Decision-Making Scale. An age difference was present for the avoidant subscale (see Table 4). Specifically, younger adults ($M = 2.65$, $SD = .61$) were more avoidant than middle-aged adults ($M = 2.41$, $SD = .59$). There was no difference between younger and older adults ($M = 2.54$, $SD = .66$) and older and middle-aged adults. There were no other significant differences in age, condition, or an interaction between age and condition (see Table 4).

Resistance to Framing. There was no age difference in resistance to framing, $F(1,331) = .24$, $p = .78$, $\eta^2 = .001$. Younger, ($M = .34$, $SD = .66$), middle-aged ($M = .39$, $SD = .77$), and older adults ($M = .33$, $SD = .76$) did not differ. There was also no difference in instruction manipulation condition, $F(1,331) = .79$, $p = .50$, $\eta^2 = .007$. Resistance to framing did not differ depending on the deliberative ($M = .34$, $SD = .78$), experiential ($M = .46$, $SD = .68$), affective ($M = .30$, $SD = .75$), and control ($M = .31$, $SD = .72$) condition. The interaction between age and instruction manipulation condition was also not significant.

Cognitive Reflection Test. There was no age difference in cognitive reflection, $F(1,331) = 1.38$, $p = .25$, $\eta^2 = .01$. Specifically, younger ($M = 1.68$, $SD = 1.21$), middle-aged ($M = 1.48$, $SD = 1.30$), and older adults ($M = 1.43$, $SD = 1.20$) did not differ. There was also no difference in instruction manipulation condition in cognitive reflection, $F(1,331) = .96$, $p = .41$, $\eta^2 = .001$. Cognitive reflection did not differ depending on the deliberative ($M = 1.43$, $SD = 1.20$), experiential ($M = 1.53$, $SD = 1.27$), affective ($M = 1.47$, $SD = 1.22$), and control ($M = 1.71$, $SD = 1.26$) condition. The interaction between age and instruction manipulation condition was also not significant, $F(1,331) = 1.39$, $p = .22$, $\eta^2 = .03$.

Consideration of Future Consequences. There was no age difference in consideration of future consequences, $F(1,331) = .98, p = .38, \eta^2 = .006$. Younger ($M = 3.50, SD = .69$), middle-aged ($M = 3.53, SD = .63$), and older adults ($M = 3.41, SD = .62$) did not differ. There was also no difference in instruction manipulation condition in consideration of future consequences, $F(1,331) = .42, p = .74, \eta^2 = .004$. Consideration of future consequences did not differ depending on the deliberative ($M = 3.44, SD = .64$), experiential ($M = 3.54, SD = .64$), affective ($M = 3.51, SD = .68$), and control ($M = 3.45, SD = .66$) condition. The interaction between age and instruction manipulation condition was also not significant, $F(1,331) = .66, p = .68, \eta^2 = .01$.

Numeracy. There was no age difference in numeracy, $F(1,331) = 1.06, p = .35, \eta^2 = .006$. Younger ($M = 8.52, SD = 2.16$), middle-aged ($M = 8.53, SD = 2.08$), and older adults ($M = 8.88, SD = 1.95$) did not differ. There was also no difference in instruction manipulation condition in numeracy, $F(1,331) = .217, p = .09, \eta^2 = .02$. Numeracy did not differ depending on the deliberative ($M = 8.71, SD = 2.02$), experiential ($M = 8.66, SD = 1.81$), affective ($M = 8.17, SD = 2.64$), and control ($M = 8.99, SD = 1.63$) condition. The interaction between age and instruction manipulation condition was also not significant, $F(1,331) = .58, p = .75, \eta^2 = .01$.

Framing Effect

In the current study, frame (e.g., survival vs. mortality) was used as a predictor for the decision outcome (e.g., surgery or radiation). That is, participants are more likely to choose surgery (exhibit risk aversion) in the survival frame and radiation in the mortality frame (exhibit risk seeking). Table 5 gives the frequencies and percentages for each decision choice per vignette for each instruction condition by frame. These frequencies demonstrate that participants were more likely to indicate that they would choose surgery in the survival frame and radiation in the

mortality frame for the lung cancer vignette. The only exception is in the affective instruction condition, in which participants indicated for both the survival and morality frame that they would be more likely to choose radiation, 53.7% and 69.8% respectively. For the flu vignette, overall participants indicated that they would choose the vaccination shot over the nasal spray despite the frame and instruction condition. Table 6 gives the frequencies and percentages for each decision choice per vignette for each instruction condition, frame, and age difference.

Research Question 1

Hypotheses 1a-1d.

[1a] *Participants in the deliberative condition were hypothesized to be more likely to demonstrate the framing effect than participants in the affective or experiential conditions.*

[1b] *Younger adults in the deliberative and affective conditions were hypothesized to demonstrate the framing effect more frequently than younger adults in the experiential condition.*

[1c] *Older adults in the deliberative condition were hypothesized to be more likely to demonstrate the framing effect than older adults in the experiential and affective conditions.*

[1d] *Older adults in the affective system were hypothesized to demonstrate the framing effect less frequently than younger adults in the affective condition.*

Overall Framing Effect

Lung cancer. A 2 (frame: survival vs. mortality) x 2 (surgery vs. radiation) chi-square was used to examine the framing effect. The chi-square value was significant, $\chi^2(1, N = 343) = 16.40, p < .001, \phi = .22$. In the mortality frame, 107 participants (62.2%) chose radiation and

65 participants (37.8%) chose surgery. In the survival frame, 68 participants (39.8%) chose radiation and 103 participants (60.2%) chose surgery.

Flu. A 2 (frame: no flu vs. get flu) x 2 (vaccination shot vs. nasal spray) chi-square was used to examine the framing effect. The chi-square value was not significant, $\chi^2(1, N = 344) = 2.60, p = .085, \phi = .10$. In the negative (get flu) frame, 115 participants (66.1%) chose the vaccination shot and 59 participants (33.9%) chose the nasal spray. In the positive (no flu) frame, 97 participants (57.1%) chose the vaccination shot and 73 participants (42.9%) chose the nasal spray.

Age by Instruction Condition by Frame Interaction

Logistic regression models for each predictor individually can be found in Appendix I. Reported below are the logistic regression models with the all of the predictors in the model (i.e., age, instruction condition, and frame) and models containing numeracy as a control variable.

Lung cancer. A logistic regression was performed to assess the impact of frame (survival or mortality), age (younger, middle-aged, and older adults), and instruction condition (deliberative, experiential, affective, and control) as predictors and decision choice (surgery or radiation) for lung cancer treatment as the outcome. The full model was not significant, $\chi^2(23, N = 342) = 34.99, p = .052$ (Cox and Snell R Square, 9.7%; Nagelkerke R Square, 13%), indicating that the model did not significantly distinguish between participants who indicated they would choose surgery and participants who indicated they would choose radiation. The model correctly classified 64.3% of cases. Frame, instruction condition, age, and the interactions were not significant predictors of decision (see Table 7).

Lung cancer: Numeracy as a covariate. A logistic regression was performed to assess the impact of frame (survival or mortality), age (younger, middle-aged, and older adults), and

instruction condition (deliberative, experiential, affective, and control) as predictors, numeracy as a covariate, and decision choice (surgery or radiation) for lung cancer treatment as the outcome. Numeracy was entered at step 1 and frame, age, and instruction condition were entered at step 2. The model at step 1 was not significant, $\chi^2(1, N = 342) = .024, p = .88$. The model at step 2 was approaching significance, $\chi^2(23, N = 342) = 34.97, p = .052$ (Cox and Snell R Square, 9.7%; Nagelkerke R Square, 13%). The model correctly classified 64.3% of cases. None of the predictors nor the interactions between predictors were significant (see Table 8).

Flu. A logistic regression was performed with frame (get the flu or not get the flu), age (younger, middle-aged, and older adults), and instruction condition (deliberative, experiential, affective, and control) as predictors and decision choice (vaccination shot or nasal spray) for flu prevention as the outcome. The full model was not significant, $\chi^2(23, N = 343) = 25.00, p = .35$ (Cox and Snell R Square, 7.0%; Nagelkerke R Square, 9.5%). The model correctly classified 64.4% of cases. There was a significant age by condition by frame interaction for older adults in the control condition and positive flu frame (odds ratio .023). This indicates that older adults in the control condition and positive flu frame were less than 1 times more likely to choose nasal spray over the vaccination shot than participants in the deliberative instruction condition (see Table 9). In addition, there was a significant age by condition interaction for older adults in the affective condition (odds ratio 12.96), indicating that these participants were over 12 times as likely to choose the nasal spray over the vaccination shot (see Table 9).

Flu: Numeracy as a covariate. A logistic regression was performed with frame (get the flu or not get the flu), age (younger, middle-aged, and older adults), and instruction condition (deliberative, experiential, affective, and control) as predictors, numeracy as a covariate, and decision choice (vaccination shot or nasal spray) for flu prevention as the outcome. Numeracy

was entered at step 1 and frame, age, and instruction condition were entered at step 2. The model at step 1 was not significant, $\chi^2(1, N = 343) = .10, p = .75$. The model at step 2 was not significant, $\chi^2(23, N = 344) = 24.90, p = .36$ (Cox and Snell R Square, 7.0%; Nagelkerke R Square, 9.5%). The model correctly classified 64.7% of cases. None of the predictors were significant (see Table 10). However, an age by condition interaction was present. Older adults in the control condition (odds ratio 12.99) were over 12 times as likely to choose the nasal spray over the vaccination shot (see Table 10).

Summary for Hypotheses 1a-1d

In summary, the framing effect was present in the lung cancer scenario overall, with participants in the survival condition indicating that they would choose surgery over radiation. The framing effect was not present in the flu scenario. There were no age-related or instruction condition differences in the framing effect for the lung cancer and flu scenarios. However, an age by instruction condition interaction was present in the flu scenario (with and without numeracy as a covariate).

Research Question 2

Hypothesis 2a. *Participants' decisions were hypothesized to be influenced more by the short-term information in the mortality (or getting the flu) frame and by the long-term information in the survival (or not getting the flu) frame when instructed to use their deliberative system.*

Lung cancer. A 2 (information: short- vs. long-term information) x 2 (frame: survival vs. mortality) multivariate analysis of variance (MANOVA) was used to examine the effect of short- and long-term information in the survival vs. mortality frames of participants in the deliberative condition. Results revealed a significant difference in frame for the short-term information,

$F(1,340) = 5.79, p = .02, \eta^2 = .02$. Participants in the mortality frame indicated that the short-term information ($M = 3.86, SD = 1.06$) influenced their decision more than participants in the survival frame ($M = 3.57, SD = 1.14$). No difference in frame was identified for the long-term information, $F(1,340) = 3.72, p = .05, \eta^2 = .01$.

Flu. A 2 (information: short- vs. long-term information) x 2 (frame: no flu vs. got flu) multivariate analysis of variance (MANOVA) was used to examine the effect of short- and long-term information in the no flu vs. got flu frames of participants in the deliberative condition. There was no difference in short-term information in the no flu and got flu frames, $F(1,341) = .14, p = .71, \eta^2 = .00$. The influence of the short-term information did not differ in the got flu frame ($M = 3.59, SD = 1.23$) and the no flu frame ($M = 3.54, SD = 1.14$).

No difference was found in the long-term information, $F(1,341) = .72, p = .40, \eta^2 = .002$. The importance of the long-term information did not differ in the got flu ($M = 3.68, SD = 1.15$) and no flu frame ($M = 3.78, SD = 1.04$).

Summary for Hypothesis 2a

The short-term information was more important to participants' decisions in the mortality frame than the survival frame in the deliberative condition. There was no difference in importance of the long-term information in the survival and mortality frames. In the flu scenario, there was no difference in the importance of short- or long-term information in either the no flu or got flu frames.

Hypothesis 2b. *The long-term information in the survival (or not getting the flu) frame was hypothesized to influence older adults' decisions more than younger and middle-aged adults.*

Lung cancer. A 2 (information: short- vs. long-term information) x 3 (age group: younger, middle-aged, older) multivariate analysis of variance (MANOVA) was used to examine the effect of short- and long-term information in the survival frame. Results revealed no difference in age group for short-term information, $F(1,167) = 1.90, p = .15, \eta^2 = .02$. The importance of short-term information did not differ among younger ($M = 3.37, SD = 1.12$), middle-aged ($M = 3.64, SD = 1.21$), and older adults ($M = 3.78, SD = 1.03$). Similarly, no difference was identified for long-term information $F(1,167) = .24, p = .79, \eta^2 = .003$. The importance of the long-term information did not differ among younger ($M = 3.97, SD = 1.01$), middle-aged ($M = 4.03, SD = 1.07$), and older adults ($M = 4.10, SD = 1.01$).

Flu. A 2 (information: short- vs. long-term information) x 3 (age group: younger, middle-aged, older) multivariate analysis of variance (MANOVA) was used to examine the effect of short- and long-term information in the no flu frame. Results revealed no difference in age group for short-term information, $F(1,167) = .12, p = .88, \eta^2 = .001$. The importance of the short-term information did not differ among younger ($M = 3.60, SD = 1.12$), middle-aged ($M = 3.49, SD = 1.19$), and older adults ($M = 3.54, SD = 1.11$). Results revealed no difference in age group for long-term information, $F(1,167) = .30, p = .74, \eta^2 = .004$. The importance of long-term information did not differ among younger ($M = 3.82, SD = .97$), middle-aged ($M = 3.81, SD = 1.12$), and older adults ($M = 3.69, SD = 1.04$).

Summary for Hypothesis 2b

There was no main effect of age or instruction condition on the importance of short- and long-term information in the survival (no flu) frame. Furthermore, there was no interaction between age and instruction condition in the importance of the short- and long-term information in the survival (no flu) frame.

Hypothesis 2c. *The short-term information in the mortality (or getting the flu) frame was hypothesized to influence older adults' decisions more than younger and middle-aged adults.*

Lung cancer. A 2 (information: short- vs. long-term information) x 3 (age group: younger, middle-aged, older) multivariate analysis of variance (MANOVA) was used to examine the effect of short- and long-term information in the mortality frame. Results revealed no difference in age group for short-term information, $F(1,168) = .59, p = .55, \eta^2 = .01$. The importance of short-term information did not differ among younger ($M = 3.75, SD = 1.18$), middle-aged ($M = 3.97, SD = .91$), and older adults ($M = 3.86, SD = 1.10$). Similarly, no difference was identified for long-term information $F(1,167) = .99, p = .37, \eta^2 = .01$. The importance of long-term information did not differ among younger ($M = 3.86, SD = 1.12$), middle-aged ($M = 3.92, SD = 1.10$), and older adults ($M = 3.62, SD = 1.26$).

Flu. A 2 (information: short- vs. long-term information) x 3 (age group: younger, middle-aged, older) multivariate analysis of variance (MANOVA) was used to examine the effect of short- and long-term information in the got flu frame. Results revealed no difference in age group for short-term information, $F(1,169) = .38, p = .68, \eta^2 = .01$. The importance of short-term information did not differ among younger ($M = 3.48, SD = 1.11$), middle-aged ($M = 3.64, SD = 1.27$), and older adults ($M = 3.65, SD = 1.36$). Results revealed no difference in age group for long-term information, $F(1,169) = .77, p = .47, \eta^2 = .01$. The importance of long-term information did not differ among younger ($M = 3.77, SD = 1.09$), middle-aged ($M = 3.53, SD = 1.17$), and older adults ($M = 3.73, SD = 1.21$).

Summary for Hypothesis 2c

There was no main effect of age or instruction manipulation on the importance of short- and long-term information in the mortality (got flu) frame. In addition, there was no interaction

between age and instruction condition in the importance of the short- and long-term information in the mortality (got flu) frame.

Research Question 3

Hypothesis 3. *Participants who have low numeracy were hypothesized to be more susceptible to the framing effect than participants higher in numeracy.*

Lung cancer. A logistic regression was performed to assess the contribution of numeracy and frame on the likelihood that participants would indicate that they would choose surgery or radiation for lung cancer. The full model was significant, $\chi^2(3, N = 343) = 17.53, p = .001$ (Cox and Snell R Square, 5.0%; Nagelkerke R Square, 6.6%), indicating that the model significantly distinguished between participants who indicated they would choose surgery and participants who indicated they would choose radiation. The model correctly classified 61.2% of cases. However, neither frame nor numeracy (or the interaction) significantly contributed to the model (see Table 11).

Flu. A logistic regression was performed to assess the contribution of numeracy and frame on the likelihood that participants would indicate that they would choose the vaccinator the nasal spray for the flu. The full model was not significant, $\chi^2(3, N = 343) = 3.76, p = .29$ (Cox and Snell R Square, 1.1%; Nagelkerke R Square, 1.5%), indicating that the model did not distinguish between participants who indicated they would choose the vaccination shot and participants who indicated they would choose the nasal spray. The model correctly classified 61.6% of cases. However, neither frame nor numeracy (or the interaction) significantly contributed to the model (see Table 12).

Summary for Hypothesis 3

The full model for the lung cancer and flu scenarios was significant; however, neither frame nor numeracy was a significant predictor and there was no interaction between frame and numeracy.

Discussion

Results revealed that decisions in the lung cancer scenario differed depending on frame; specifically, participants were more likely to choose radiation in the mortality frame and surgery in the survival frame. However, manipulating instructions according to deliberative, experiential, or affective processing did not affect demonstration of the framing effect. Moreover, age-related differences in the framing effect were not identified. On the other hand, interactions were identified for the flu scenario: older adults in the affective condition were more likely to indicate that they would choose the nasal spray than the vaccination shot in the positive flu frame. Older adults were also more likely to choose nasal spray over the vaccination shot when in the control condition and positive flu frame than those in the deliberative condition. As hypothesized, short-term information was more salient to participants' decision in the mortality frame (lung cancer); contrarily, there was no difference in the importance of long-term information (lung cancer or flu).

Instruction Manipulation

Contrary to Thomas and Millar (2012), no differences were identified in demonstration of the framing effect by processing group (deliberative, experiential, affective, and control). Despite similarities in the instruction manipulation, participants in the current study responded to medical decision-making vignettes, whereas Thomas and Millar (2012) had participants respond to gambling scenarios. The medical decisions were much more complex and the outcomes more serious (life vs. death or getting the flu vs. no flu) than in the gambling scenarios. As a result, it

is possible that all participants, despite their instruction condition, thought more critically about their decisions, resulting in similar vulnerability to the framing effect.

Although no differences were found as a result of the instruction manipulation, a manipulation check revealed that the participants were correctly using the information they were told to use to make their decisions. Specifically, in the deliberative condition, participants indicated that they paid the most attention to the facts and figures; in the experiential condition participants indicated that they used their previous experiences and those of others; and in the affect condition, participants indicated that they used their gut feelings and intuition. However, the analyses also revealed that participants in the control condition indicated that they used the facts and figures more than participants in the affect condition and participants in the experiential condition indicated that they used their gut feelings and intuition more than participants in the deliberative condition. These results indicate that some overlap may have occurred in the extent to which participants used the type of information they were told to use. This speaks to the *degree* of overlap that is described by Strough et al. (2011) in the three processes. Specifically, participants likely experienced competing processes when making their decision even after being instructed to use particular elements of the decision-making scenario.

In addition, it could be that in situations requiring high mental cognitive function, people are less sensitive to the framing effect, consistent with Thomas and Millar (2012). Thomas and Millar (2012) found that the framing effect was eliminated when participants were primed to use more analytical thinking by having them complete probability calculations in between blocks of decision situations. Thus, when decisions require working memory and higher-level thinking, people may be more prone to use their deliberative system or will think through their decisions rather than using automatic processing or heuristics. In the current study, the decision-making

vignettes were cognitively intense, requiring participants to think through various details about the situations (see Appendix A).

Another possibility is that priming heuristics through the experiential and affective conditions may also increase vulnerability (Cassotti et al., 2012). People have a tendency to respond more strongly to losses than gains, also known as loss aversion or value function (Kahneman & Tversky, 1979; Tversky & Kahneman, 1981). People could have also been overweighting low probabilities and underweighting larger probabilities, a *probability weighting function* (Soman, 2004). For example, people could have underweighted the probability of dying after 5 years and overweighted the probability of dying after 1 year.

It is also possible that the type of processing influences people's decisions, but other information related to the decision situation has a greater influence. For example, short-term information was a significant predictor of decision in the mortality frame within the deliberative condition. People could be using this information to make their decision, overriding their drive to use a particular type of processing. Another possibility derived from the results regarding the short-term information is that people could have been using their gist of the situation to make their decision. That is, as Reyna (2004) described, gist representations are easy to access and are comprised of an overall picture of the situation. However, the details are "fuzzy," and people have a tendency to rely on their broad understanding of the situation to guide the way. In terms of mortality, perhaps the short-term information is what is being used to create the gist (e.g., the length of time that people will have before they die after treatment), creating a reliance on the short-term information to make their decisions with the end result of making different decisions depending on the frame.

Finally, the prior experience that people have regarding hypothetical vignettes may lead to differences in demonstration rates of the framing effect regardless of which decision-making process is primed using instructions. Overall, 7.2% of participants indicated that they had a lot or much experience with lung cancer and 31.9% of participants indicated that they had a lot or much experience with the flu. However, 61.6% of participants indicated that they had a lot or much experience with making medical decisions for themselves or others in the past 5 years. A possibility is that participants did not have enough experience with making the types of decisions that were asked of them to elicit a true response. A majority of the participants had a lot of experience with making medical decisions in the past year, but did not have experience with the flu or lung cancer. As a result, participants could have defaulted to thinking thoroughly about the medical situations in an attempt to understand all of the information that was being given to them regarding the decision they needed to make. In addition, the lack of significance regarding the flu vignette could be a result of the unfamiliarity with a nasal spray as a vaccination method for the flu. Participants could have chosen the treatment that they are the most knowledgeable about. Contrarily, very few participants had experience with lung cancer, but radiation and surgery are both commonly understood as treatments for lung cancer.

Age Differences

No age differences were found in demonstration of the framing effect. Despite differences being identified in previous literature (Kim et al., 2005; McNeil et al., 1982; Mikels & Reed, 2009; Wang et al., 2001), in the current study, only frame was a significant predictor of decision outcome. This finding is consistent with previous research that has found little to no age-related differences in demonstration of the framing effect (e.g., Mayhorn et al., 2002; Rönnlund et al., 2005).

Although it was hypothesized that age differences would be present, perhaps frame is a more important predictor than age when making decisions. As a result, it may be more prudent for doctors or other influential personnel to frame decisions in a particular manner as to prevent the framing effect. For example, by presenting the outcomes in terms of both survival and mortality people will have all of the information and may be able to make better decisions.

A potential explanation for these findings is that reading scenarios dealing with survival vs. mortality primed participants to contemplate the end of their life, therefore, limiting their time perspective. Previous research has identified a limited time perspective as being more consistent with older adults (Carstensen, 2006). According to socioemotional selectivity theory, people seek to optimize their current experiences when their time perspective is limited (Carstensen, 2006; Carstensen & Charles, 1998). Because time is viewed as limited, people seek to capitalize on their current experiences and minimize their losses. In the current study, the lung cancer scenario was a life or death scenario, possibly limiting people's time perspective, resulting in decisions that are similar to older adults' decisions. In the mortality frame, they were more likely to pay attention to the short-term. Because the short-term information was framed to indicate the number of people who would die within 6 months, people may have been seeking to use that information to maximize their current experience. That is, their limited time perspective led them to pay close attention to the short-term information. In previous research, manipulating younger adults' time perspectives to induce a limited time perspective leads them to behave like older adults in examinations of a decision making bias called the sunk-cost fallacy (Strough, Schlosnagle, Karns, Lemaster, & Pichayayothin, 2013).

Limitations

The results presented here should be considered in light of some limitations. Despite the quick, efficient data collection Amazon Mechanical Turk allows, as with any study, the quality of the data may come into question. Trap questions were included to eliminate participants who answered without reading the questions or were not paying enough attention, but participants on Mechanical Turk are likely used to these types of questions, and may be able to easily identify them. Furthermore, the instruction manipulation may work in a lab setting where outside factors, such as background noise, attention to other tasks, etc., are being controlled. Conducting an online study does not allow for control of these noise variables. However, laboratory settings do not allow for broad generalizability or a national sample in most cases.

In addition, because the data was collected online, the sample of older adults was limited to those ranging in age from 60 to 87 with the average age being 64.47. This range is younger than the average older adult age reported in a meta-analysis by Mata et al. (2011) ($M = 69$). Consequently, the results of the current study may be a factor of cohort differences rather than age differences. The design of this study was also a between-subjects design. Although a between-subjects design eliminates the possibility of participants recognizing a consistency issue (Stanovich & West, 2008), it does not allow for comparisons within participants. Another limitation of the current study is the unconfirmed conceptual model. No previous research has attempted to investigate decision-making from a three-dimensional framework so this study serves as a preliminary investigation.

Finally, the external validity of the current study may be limited by the methodology. Participants were asked to imagine themselves in a medical situation and were told what type of information to pay attention to. Previous research (Siminoff & Fetting, 1989) has found that people who are making actual medical decisions are less susceptible to the framing effect than

people who are asked to imagine themselves in a decision situation. This is likely because people are more thorough with decisions that may directly affect them in the near and distant future. Future research should examine this three-dimensional decision-making framework among people who are making actual medical decisions.

Strengths

The current study is the first to expand the dual-process theory to a three-dimensional conceptual decision-making framework. Previous research (Keren, 2013; Keren & Schul, 2009; Kruglanski, 2013; Osman, 2013; Strough et al., 2011; Thompson, 2013) has demonstrated that two processing systems may not be sufficient for explaining decision making, lending to a debate as to whether two processes exist. Debates have raged on regarding the definitions of the two processes, the terminology used to name the processes, and the characteristics that make up each process. Although the results did not indicate a vulnerability to the framing effect depending on the instruction condition, future research could examine other manipulations and decision situations.

Moreover, the current study focused on medical decisions, decisions that are often life-changing and threatening to people's well-being, physically and mentally. Some past research has used medical decisions (e.g., Kim et al., 2005; McNeil et al., 1982), but other research has used gain vs. loss scenarios (e.g., Thomas & Millar, 2012) and computer-based tasks (Weller et al., 2011).

In addition, previous research has found mixed results regarding age-related differences in the framing effect. The current study found further support for no age-related differences in susceptibility to the framing effect, similar to Rönnlund et al. (2005) and Mayhorn et al. (2002). In terms of real life decisions, this may be an indication that people do not become more

susceptible to the framing effect as they age, a good sign for older adults. However, ways of eliminating the framing effect (specifically in terms of mortality vs. survival) should be further investigated.

Future Research

Future research should replicate the current study using a within-subjects design to further validate that the framing effect is not variable across ages and instruction manipulation conditions. Future research should also expand the older adult age range to gather data from oldest-old adults, a potential age range that may be more or less susceptible to the framing effect. An investigation of other types of medical decisions that pertain to a wide age range such as diabetes or asthma care could also be conducted. Both diseases have potentially harmful outcomes that can be limited by sufficiently treating them on a daily basis, adhering to doctors' recommendations and treatment plans. Moreover, more research should be done to examine the types of instructions that are given to people when they are making their decisions. Although numeracy did not differ by age, overall, the average numeracy score was rather low. This indicates that people are generally bad at manipulating numbers, even for simple problems, which is an issue that should be addressed more fully in future research.

Conclusions

The current study provides further support for no age differences in demonstration of the framing effect. Furthermore, numeracy may not be a factor that contributes to the framing effect. Future research should include a more thorough investigation of the framing effect among other medical decisions, specifically information regarding the short- and long-term outcomes of these decisions, and among real-life medical decisions. Furthermore, to broaden the scope regarding age differences in the framing effect, future research should examine cohort differences.

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Table 1

Demographic characteristics

	Young Adults (<i>N</i> = 121)	Middle-Aged Adults (<i>N</i> = 119)	Older Adults (<i>N</i> = 108)
Age	<i>M</i> = 27.22 (<i>SD</i> = 4.69)	<i>M</i> = 47.02 (<i>SD</i> = 4.89)	<i>M</i> = 64.50 (<i>SD</i> = 4.22)
Gender	F (<i>n</i> = 64; 52.9%)	F (<i>n</i> = 76; 63.9%)	F (<i>n</i> = 54; 50%)
Marital status	Never married (<i>n</i> = 63; 52.1%)	Married (<i>n</i> = 58; 48.7%)	Married (<i>n</i> = 61; 56.5%)
Ethnicity	Not Hispanic/Latino (<i>n</i> = 107; 88.4%)	Not Hispanic/Latino (<i>n</i> = 113; 95%)	Not Hispanic/Latino (<i>n</i> = 100; 92.6%)
Race	White or Caucasian (<i>n</i> = 95; 78.5%)	White or Caucasian (<i>n</i> = 99; 83.2%)	White or Caucasian (<i>n</i> = 97; 89.8%)
Time zone	Eastern (<i>n</i> = 60; 49.6%)	Eastern (<i>n</i> = 52; 43.7%)	Eastern (<i>n</i> = 55; 50.9%)
Employment	Full time (<i>n</i> = 58; 47.9%)	Full time (<i>n</i> = 62; 52.1%)	Fully retired (<i>n</i> = 44; 40.7%)
Education	H.S. or GED (<i>n</i> = 49; 40.5%)	H.S. or GED (<i>n</i> = 48; 40.3%)	Bachelor's (<i>n</i> = 43; 39.8%)
Income	< \$10k (<i>n</i> = 29; 24%)	\$10k-19k (<i>n</i> = 24; 20.2%)	\$20k-29k (<i>n</i> = 30; 27.8%)
Financial Difficulty	A little (<i>n</i> = 44; 36.4%)	A little (<i>n</i> = 41; 34.5%)	No difficulty (<i>n</i> = 40; 37%)

Table 2

Data cleaning, trap questions, outliers, and multicollinearity

Steps	Situation	Remedy
1. Removal of data	Most participants removed ($n = 64$) did not complete the first questionnaire.	Removal of incomplete data.
2. Mechanical Turk ID Matching	MTurk ID's entered at the beginning and end of participation were compared. The only mismatched ID's occurred due to an extra space at the beginning of the ID.	Space was removed.
3. Birth years	Participants' birthyear was collected at the beginning and end of survey.	No mismatched birth years were detected.
4. Scoring of trap questions	Three trap questions were assessed for correctness.	Participants who correctly answered less than 2 trap questions were removed ($n = 5$)
5. Outliers	The SPSS function of Explore was used to assess the presence of outliers.	No outliers were detected.
6. Multicollinearity	Multicollinearity of the predictors used in the logistic regression analyses was examined.	No multicollinearity was detected.

Note. $N = 412$ prior to cleaning data. 68 participants were removed, resulting in $N = 343$.

Table 3

Correlations between measures

	Age	CFC	GDMS: Rational	GDMS: Intuition	GDMS: Dependent	GDMS: Spontaneous	GDMS: Avoidant	Resistance to Framing	CRT	Perceived Decision Making	Numeracy
Age	1	-.043	-.052	-.031	-.033	-.015	-.068	.009	-.087	.349**	.044
CFC		1	-.180**	-.261**	-.212**	-.176**	-.365**	.105	.120*	-.181**	.165**
GDMS: Rational			1	.529**	.334**	.360**	.373**	-.061	-.128*	.017	-.168**
GDMS: Intuition				1	.605**	.525**	.578**	-.059	-.175**	.100	-.188**
GDMS: Dependent					1	.466**	.572**	-.147**	-.103	.135*	-.087
GDMS: Spontaneous						1	.644**	-.071	-.139**	.098	-.023
GDMS: Avoidant							1	-.119*	-.195**	.185**	-.145**
Resistance to Framing								1	-.037	-.071	.024
CRT									1	-.061	.480**
Perceived Decision making										1	-.067
Numeracy											1

Note. ** $p < 0.01$ level * $p < 0.05$ level

Table 4

ANOVAs for the General Decision-Making Style scale

	GDMS	df	<i>F</i>	<i>p</i>	Partial Eta Squared
Age Group	Rational	2	2.830	.060	.017
	Intuition	2	.812	.445	.005
	Dependent	2	2.121	.122	.013
	Spontaneous	2	1.265	.284	.008
	Avoidant*	2	4.113	.017	.024
Instruction Condition	Rational	3	.453	.715	.004
	Intuition	3	1.148	.330	.010
	Dependent	3	.392	.759	.004
	Spontaneous	3	2.061	.105	.018
	Avoidant	3	.964	.410	.009
Age Group x Instruction Condition	Rational	6	1.523	.170	.027
	Intuition	6	1.009	.419	.018
	Dependent	6	1.165	.325	.021
	Spontaneous	6	.277	.948	.005
	Avoidant	6	.203	.976	.004

Note. * $p < .05$.

Table 5

Frequencies and percentages for each decision choice by frame and instruction condition

Lung Cancer				
	Survival		Mortality	
	Surgery	Radiation	Surgery	Radiation
Deliberative	26 (60.5%)	17 (39.5%)	14 (32.6%)	29 (67.4%)
Experiential	29 (65.9%)	15 (34.1%)	19 (44.2%)	24 (55.8%)
Affective	19 (46.3%)	22 (53.7%)	13 (30.2%)	30 (69.8%)
Control	29 (67.4%)	14 (32.6%)	19 (44.2%)	24 (55.8%)

Flu				
	Positive		Negative	
	Vaccination Shot	Nasal Spray	Vaccination Shot	Nasal Spray
Deliberative	22 (50%)	22 (50%)	29 (67.4%)	14 (32.6%)
Experiential	25 (58.1%)	18 (41.9%)	30 (68.2%)	14 (31.8%)
Affective	26 (61.9%)	16 (38.1%)	24 (57.1%)	18 (42.9%)
Control	24 (58.5%)	17 (41.5%)	32 (71.1%)	13 (28.9%)

Table 6

Frequencies and percentages for decision vignettes per age group, frame, and instruction condition

Lung Cancer					
		Survival		Mortality	
		Surgery	Radiation	Surgery	Radiation
Younger Adults	Deliberative	11 (64.7%)	6 (35.3%)	6 (42.9%)	8 (57.1%)
	Experiential	10 (66.7%)	5 (33.3%)	9 (64.3%)	5 (35.7%)
	Affective	8 (53.5%)	7 (46.7%)	3 (25.0%)	9 (75.0%)
	Control	10 (66.7%)	5 (33.3%)	9 (56.3%)	7 (43.8%)
Middle-Aged Adults	Deliberative	7 (53.8%)	6 (46.2%)	4 (26.7%)	11 (73.3%)
	Experiential	10 (66.7%)	5 (33.3%)	6 (33.3%)	12 (66.7%)
	Affective	6 (46.2%)	7 (53.8%)	7 (41.2%)	10 (58.8%)
	Control	13 (72.2%)	5 (27.8%)	3 (33.3%)	6 (66.7%)
Older Adults	Deliberative	8 (61.5%)	5 (38.5%)	4 (28.6%)	10 (71.4%)
	Experiential	9 (64.3%)	5 (35.7%)	4 (36.4%)	7 (63.6%)
	Affective	4 (33.3%)	8 (66.7%)	3 (21.4%)	11 (78.6%)
	Control	6 (60.0%)	4 (40.0%)	7 (38.9%)	11 (61.1%)
Flu					
		Positive		Negative	
		Vaccination Shot	Nasal Spray	Vaccination Shot	Nasal Spray
Younger Adults	Deliberative	10 (55.6%)	8 (44.4%)	9 (64.3%)	5 (35.7%)
	Experiential	9 (69.2%)	4 (30.8%)	10 (62.5%)	6 (37.5%)
	Affective	8 (66.7%)	4 (33.3%)	9 (60.0%)	6 (40.0%)
	Control	7 (50.0%)	7 (50.0%)	14 (82.4%)	3 (17.6%)
Middle-Aged Adults	Deliberative	6 (54.5%)	5 (45.5%)	10 (58.8%)	7 (41.2%)
	Experiential	6 (33.3%)	12 (66.7%)	10 (66.7%)	5 (33.3%)
	Affective	10 (58.8%)	7 (41.2%)	6 (46.2%)	7 (53.8%)
	Control	8 (61.5%)	5 (38.5%)	11 (78.6%)	3 (21.4%)
Older Adults	Deliberative	6 (40.0%)	9 (60.0%)	10 (83.3%)	2 (16.7%)
	Experiential	10 (83.3%)	2 (16.7%)	10 (76.9%)	3 (23.1%)
	Affective	8 (61.5%)	5 (38.5%)	8 (61.5%)	5 (38.5%)
	Control	9 (64.3%)	5 (35.7%)	7 (50.0%)	7 (50.0%)

Table 7

*Logistic regression: Lung Cancer: Age by Instruction
Condition by Frame Interaction*

	B	S.E.	Wald	df	p	Odds ratio
Condition			4.332	3	.228	
Experiential	.875	.776	1.272	1	.259	2.400
Affective	-.811	.858	.893	1	.345	.444
Control	.539	.739	.532	1	.466	1.714
Age Groups			1.000	2	.607	
Middle-aged adults	-.724	.795	.828	1	.363	.485
Older adults	-.629	.801	.616	1	.433	.533
Survival frame	.894	.741	1.455	1	.228	2.444
Age Groups by Frame by Condition			2.978	6	.812	
Middle-aged adults by Survival by Experiential	1.009	1.536	.431	1	.511	2.743
Middle-aged adults by Survival by Affective	-1.302	1.570	.687	1	.407	.272
Middle-aged adults by Survival frame by Control	.935	1.591	.345	1	.557	2.547
Older adults by Survival frame by Experiential	.550	1.594	.119	1	.730	1.733
Older adults by Survival frame by Affective	-1.118	1.654	.457	1	.499	.327
Older adults by Survival frame by Control	-.077	1.558	.002	1	.961	.926
Age Groups by Frame			.201	2	.904	

	B	S.E.	Wald	df	p	Odds ratio
Middle-aged adults by Survival frame	.272	1.095	.062	1	.804	1.312
Older adults by Survival frame	.492	1.106	.198	1	.656	1.636
Age Groups by Condition			3.919	6	.688	
Middle-aged adults by Experiential	-.557	1.093	.260	1	.610	.573
Middle-aged adults by Affective	1.466	1.149	1.628	1	.202	4.331
Middle-aged adults by Control	-.221	1.178	.035	1	.851	.802
Older adults by Experiential	-.519	1.160	.200	1	.655	.595
Older adults by Affective	.428	1.229	.121	1	.728	1.534
Older adults by Control	-.075	1.063	.005	1	.944	.928
Frame by Condition			1.148	3	.766	
Survival frame by Experiential	-.788	1.077	.536	1	.464	.455
Survival frame by Affective	.338	1.123	.091	1	.763	1.403
Survival frame by Control	-.452	1.050	.185	1	.667	.636

Table 8

Lung Cancer with Numeracy as a Covariate: Age by Instruction Condition by Frame Interaction

	B	S.E.	Wald	df	p	Odds ratio
Numeracy	.005	.057	.006	1	.936	1.005
Age Groups			1.001	2	.606	
Middle-aged adults	-.723	.795	.827	1	.363	.485
Older adults	-.631	.802	.620	1	.431	.532
Survival frame	.896	.741	1.459	1	.227	2.449
Condition			4.305	3	.230	
Experiential	.875	.776	1.272	1	.259	2.400
Affective	-.808	.859	.885	1	.347	.446
Control	.538	.739	.530	1	.466	1.713
Age Groups by Frame by Condition			2.969	6	.813	
Middle-aged adults by Survival frame by Experiential	1.006	1.537	.428	1	.513	2.734
Middle-aged adults by Survival frame by Affective	-1.303	1.570	.689	1	.407	.272
Middle-aged adults by Survival frame by Control	.932	1.591	.343	1	.558	2.541
Older adults by Survival frame by Experiential	.541	1.597	.115	1	.735	1.718

	B	S.E.	Wald	df	p	Odds ratio
Older adults by Survival frame by Affective	-1.124	1.655	.461	1	.497	.325
Older adults by Survival frame by Control	-.077	1.558	.002	1	.961	.926
Age Groups by Frame			.203	2	.903	
Middle-aged adults by Survival frame	.271	1.095	.061	1	.805	1.311
Older adults by Survival frame	.497	1.108	.201	1	.654	1.643
Age Groups by Condition			3.925	6	.687	
Middle-aged adults by Experiential	-.558	1.093	.261	1	.609	.572
Middle-aged adults by Affective	1.469	1.149	1.633	1	.201	4.344
Middle-aged adults by Control	-.219	1.178	.035	1	.852	.803
Older adults by Experiential	-.518	1.160	.199	1	.655	.596
Older adults by Affective	.429	1.229	.122	1	.727	1.536
Older adults by Control	-.075	1.063	.005	1	.943	.927
Frame by Condition			1.131	3	.770	
Survival frame by Experiential	-.784	1.078	.529	1	.467	.456
Survival frame by Affective	.336	1.124	.089	1	.765	1.399
Survival frame by Control	-.452	1.050	.185	1	.667	.637

Table 9

Logistic regression: Flu: Age by Instruction Condition by Frame Interaction

	B	S.E.	Wald	df	<i>p</i>	Odds ratio
Age Groups			1.897	2	.387	
Middle-aged adults	.231	.744	.096	1	.756	1.260
Older adults	-1.022	.955	1.146	1	.284	.360
No flu frame	.365	.732	.248	1	.618	1.440
Condition			2.232	3	.526	
Experiential	.077	.760	.010	1	.919	1.080
Affective	.182	.767	.056	1	.812	1.200
Control	-.953	.846	1.268	1	.260	.386
Age Groups by Condition by Frame			9.474	6	.149	
Middle-aged adults by Experiential by No flu frame	1.877	1.524	1.516	1	.218	6.532
Middle-aged adults by Affective by No flu frame	-.033	1.533	.000	1	.983	.968
Middle-aged adults by Control by No flu frame	-.521	1.608	.105	1	.746	.594
Older adults by Experiential by No flu frame	-1.756	1.754	1.002	1	.317	.173
Older adults by Affective by No flu frame	-1.363	1.648	.683	1	.408	.256
Older adults by Control by No flu frame	-3.778	1.644	5.285	1	.022*	.023
Age Groups by Frame			2.633	2	.268	

	B	S.E.	Wald	df	<i>p</i>	Odds ratio
Middle-aged adults by No flu frame						
Older adults by No flu frame	1.650	1.189	1.926	1	.165	5.208
Age Groups by Condition			7.200	6	.303	
Middle-aged adults by Experiential	-.413	1.059	.153	1	.696	.661
Middle-aged adults by Affective	.329	1.068	.095	1	.758	1.389
Middle-aged adults by Control	.010	1.176	.000	1	.993	1.010
Older adults by Experiential	.329	1.269	.067	1	.796	1.389
Older adults by Affective	.957	1.230	.605	1	.437	2.604
Older adults by Control	2.562	1.266	4.099	1	.043*	12.963
Condition by Frame			3.338	3	.342	
Experiential by No flu frame	-.665	1.079	.380	1	.538	.514
Affective by No flu frame	-.652	1.090	.358	1	.550	.521
Control by No flu frame	1.176	1.108	1.127	1	.288	3.241

Note. **p* < .05

Table 10

Logistic regression: Flu with Numeracy as a Covariate: Age by Instruction Condition by Frame Interaction

	B	S.E.	Wald	df	p	Odds ratio
Age Groups	.002	.057	.002	1	.967	1.002
Middle-aged adults	.231	.744	.096	1	.756	1.260
Older adults	-1.022	.955	1.147	1	.284	.360
No flu frame	.366	.733	.249	1	.617	1.442
Condition			2.233	3	.525	
Experiential	.077	.760	.010	1	.919	1.081
Affective	.183	.768	.057	1	.811	1.201
Control	-.953	.846	1.269	1	.260	.386
Age Groups by Condition by Frame			9.475	6	.149	
Middle-aged adults by Experiential by No flu frame	1.873	1.527	1.506	1	.220	6.509
Middle-aged adults by Affective by No flu frame	-.032	1.533	.000	1	.983	.968
Middle-aged adults by Control by No flu frame	-.525	1.610	.106	1	.745	.592
Older adults by Experiential by No flu frame	-1.758	1.755	1.004	1	.316	.172
Older adults by Affective by No flu frame	-1.364	1.649	.685	1	.408	.256

	B	S.E.	Wald	df	p	Odds ratio
Older adults by Control by No flu frame						
Age Groups by Frame			2.634	2	.268	
Middle-aged adults by No flu frame	-.189	1.071	.031	1	.860	.827
Older adults by No flu frame	1.651	1.189	1.928	1	.165	5.214
Age Groups by Condition			7.199	6	.303	
Middle-aged adults by Experiential	-.414	1.059	.153	1	.696	.661
Middle-aged adults by Affective	.329	1.068	.095	1	.758	1.389
Middle-aged adults by Control	.011	1.176	.000	1	.992	1.011
Older adults by Experiential	.328	1.269	.067	1	.796	1.389
Older adults by Affective	.957	1.230	.605	1	.437	2.604
Older adults by Control	2.564	1.266	4.100	1	.043*	12.985
Condition by Frame			3.335	3	.343	
Experiential by No flu frame	-.663	1.080	.377	1	.539	.515
Affective by No flu frame	-.652	1.090	.358	1	.550	.521
Control by No flu frame	1.176	1.108	1.128	1	.288	3.243

Table 11

Logistic regression: Numeracy and frame for lung cancer vignette

	B	S.E.	Wald	df	<i>p</i>	Odds ratio
Numeracy	-.016	.081	.038	1	.845	.984
Survival frame	.631	.952	.440	1	.507	1.880
Survival frame by Numeracy	.033	.107	.094	1	.760	1.033

Table 12

Logistic regression: Numeracy and frame for flu vignette

	B	S.E.	Wald	df	<i>p</i>	Odds ratio
Numeracy	-.063	.090	.479	1	.489	.939
No flu frame	-.481	1.001	.231	1	.631	.618
No flu frame by Numeracy	.100	.112	.784	1	.376	1.105

Figure 1. Three dimensional decision-making framework adapted from Strough, Karns, and Schlosnagle (2011) for this study.

Figure 2. Pictorial representation of hypothesized age differences in the framing effect by processing system.

Appendix A

Instruction Manipulation and Framing Vignettes (McNeil et al., 1982)

Cancer Scenario

[**Deliberative instructions:** Please read the following scenarios. Use only logic and reasoning based on the facts and numbers to make your decision on the following page.]

[**Affective instructions:** Please read the following scenarios. Use only your initial reactions and gut feelings to make your decision on the following page.]

[**Experiential instructions:** Please read the following scenarios. Use only your previous experiences and experiences of others that you are familiar with to make your decision on the following page.]

[**Control instructions:** Please read the following scenarios and make your decision as you normally would.]

The following contains specific information about cancer treatments at several area hospitals. Each hospital has its own doctors and policies regarding patient care, approaches to treatment, and different survival rates for the various types of treatment. For each hospital, please indicate whether you prefer surgery or radiation therapy. Below are general descriptions of the treatments.

Surgery for lung cancer involves an operation on the lungs. Most patients are in the hospital for two to three weeks and have some pain around their incisions; they spend a month or so recuperating at home. After that they generally feel fine.

Radiations therapy for lung cancer involves the use of radiation to kill the tumor and requires coming to the hospital about four times a week for 6 weeks. Each treatment takes a few minutes, and during the treatment patients lie on a table as if they were having an x-ray. During the course of treatment, some patients develop nausea and vomiting, but by the end of 6 weeks they generally feel fine.

Thus, after the initial 6 weeks, patients treated with either surgery or radiation therapy feel about the same.

[**Deliberative instructions:** Please use only logic and reasoning based on the facts and numbers presented in the scenarios to make your decision.]

[**Affective instructions:** Please use only your initial reactions and gut feelings to make your decision.]

[**Experiential instructions:** Please use only your previous experiences and those of others to make your decision.]

[**Control instructions:** Please make your decision as you normally would.]

[**Survival]**

Of 100 patients having radiation therapy, 77 patients live for more than 1 year, and 23 patients live for more than 5 years.

Of 100 patients having surgery, 68 patients live for more than 1 year, and 32 patients live for more than 5 years.

[Mortality]

Of 100 patients having radiation therapy, 23 patients die by 1 year and 77 patients die by 5 years.

Of 100 patients having surgery, 32 patients die by 1 year and 68 patients die by 5 years.

Would you choose radiation or surgery?

Flu Vaccination Scenario

[Deliberative instructions: Please read the following scenarios. Use only logic and reasoning based on the facts and numbers to make your decision on the following page.]

[Affective instructions: Please read the following scenarios. Use only your initial reactions and gut feelings to make your decision on the following page.]

[Experiential instructions: Please read the following scenarios. Use only your previous experiences and experiences of others that you are familiar with to make your decision on the following page.]

[Control instructions: Please read the following scenarios and make your decision as you normally would.]

The following contains specific information about vaccinations for a new flu given at several area medical centers. Each medical center has its own doctors and policies regarding patient care, approaches to treatment, and different rates of getting the new flu. For each medical center, please indicate whether you prefer a vaccination shot or a nasal spray vaccination. Below are general descriptions of the vaccinations.

The vaccination shot involves a shot given in the arm. Most patients spend about 30 minutes to an hour in the medical center office and have minimal pain around the area of the shot. No recuperation time is necessary in most cases, though some individuals may feel slightly ill for the duration of the day. After that they generally feel fine.

The nasal spray vaccination involves a spray which patients must inhale into their nose. Most patients spend about an hour to an hour and a half in the medical center office and have minimal pain regarding the nasal spray, though a burning sensation in the nasal cavity may occur. No recuperation time is necessary in most cases, though the patients must stay in the medical center office for a period of a half an hour due to possible dizziness from the nasal spray. After this initial dizziness, they generally feel fine.

Thus, after the initial day of the shot or nasal spray, patients treated with either feel about the same.

[Deliberative instructions: Please use only logic and reasoning based on the facts and numbers presented in the scenarios to make your decision.]

[Affective instructions: Please use only your initial reactions and gut feelings to make your decision.]

[Experiential instructions: Please use only your previous experiences and those of others to make your decision.]

[Control instructions: Please make your decision as you normally would.]

[Negative]

Of 100 patients who had the vaccination shot, 23 got the new flu within month 1 and 77 got the new flu within 6 months.

Of 100 patients who had the nasal spray vaccination, 32 got the new flu within month 1 and 68 got the new flu within 6 months.

[Positive]

Of 100 patients who had the vaccination shot, 77 did not get the new flu within 1 month and 23 did not get the new flu within 6 months.

Of 100 patients who had the nasal spray vaccination, 68 did not get the new flu within 1 month and 32 did not get the new flu within 6 months.

Would you choose the vaccination shot or nasal spray?

Appendix B

Demographics Questionnaire

Are you 18 years of age or older?

- ☐ Yes
- ☐ No

Please enter your MTurk ID.

Please indicate your sex:

- ☐ Male
- ☐ Female
- ☐ Other

Please indicate your marital status:

- ☐ Never married
- ☐ Married
- ☐ Not married
- ☐ Not married, but living together
- ☐ Widow/widower
- ☐ Divorced
- ☐ Other (please specify) _____

Please indicate your age (in years; e.g. "22"):

Please indicate your ethnicity:

- ☐ Hispanic or Latino
- ☐ Not Hispanic or Latino
- ☐ Prefer not to answer

Please indicate your race:

- ☐ White or Caucasian
- ☐ Black or African American
- ☐ Asian
- ☐ American Indian or Alaska Native
- ☐ Native Hawaiian or Other Pacific Islander
- ☐ Biracial or Multi-racial
- ☐ Other
- ☐ Prefer not to answer

Please select your time zone.

- ☐ Eastern
- ☐ Central
- ☐ Mountain
- ☐ Pacific
- ☐ Hawaiian
- ☐ Alaskan

What is your current employment status?

- ☐ Employed full time
- ☐ Employed part time
- ☐ Partially retired (i.e., retired, but working part time)
- ☐ Fully retired (i.e., no longer working)
- ☐ Unemployed
- ☐ Other (please specify) _____

Please indicate your highest education:

- ☐ High school diploma or GED
- ☐ Associate's degree
- ☐ Bachelor's degree
- ☐ Master's degree
- ☐ Doctoral degree

If you are a full-time student, how long have you been enrolled (i.e., college or a degree-awarding program) (e.g., 3 years)?

If you are currently a college student, please indicate your class status:

- ☐ Freshman/1st year
- ☐ Sophomore/2nd year
- ☐ Junior/3rd year
- ☐ Senior/4th year
- ☐ Graduate student
- ☐ Other (please specify) _____

If you are a college graduate (or currently enrolled in college), please indicate your major:

If you are a college student, please indicate your GPA:

How much financial difficulty do you have paying your bills?

- ☐ No difficulty
- ☐ A little difficulty
- ☐ Some difficulty
- ☐ A great deal of difficulty

Please estimate your gross income from the past 12 months (including wages, social security earnings, tips, etc.).

- ☐ Less than \$10,000
- ☐ \$10,000-\$19,000
- ☐ \$20,000-\$29,000
- ☐ \$30,000-\$39,000
- ☐ \$40,000-\$49,000
- ☐ \$50,000-\$59,000
- ☐ \$60,000-\$69,000
- ☐ \$70,000 or more
- ☐ I don't know.

If you are working, please indicate your current or former occupation. If you are a full-time student, please write student. If you are retired, please write retired.

If you are working, how long have you spent at this occupation (e.g., 10 years)?

In the past 5 years, how much experience have you had making medical decisions for yourself or others?

- ☐ 1 No experience
- ☐ 2
- ☐ 3
- ☐ 4
- ☐ 5 Much experience

How much training do you have in economic principles?

- ☐ 1 No training
- ☐ 2
- ☐ 3
- ☐ 4
- ☐ 5 A lot of training

How much experience do you have with the flu?

- ☐ 1 No Experience
- ☐ 2
- ☐ 3
- ☐ 4
- ☐ 5 Much experience

How much experience do you have with lung cancer?

- ☐ 1 No experience
- ☐ 2
- ☐ 3
- ☐ 4
- ☐ 5 Much experience

Please indicate your birth year (e.g., 1977):

As I have gotten older, my ability to make decisions is:

- ☐ Better
- ☐ The Same
- ☐ Not as Good

As I have gotten older, my ability to make decisions about things that affect other people is:

- ☐ Better
- ☐ The Same
- ☐ Not as Good

As I have gotten older, my ability to make decisions about things that affect only me is:

- ☐ Better
- ☐ The Same
- ☐ Not as Good

Appendix C

General Decision-Making Styles

(Scott & Bruce, 1995)

Instructions: Listed below are statements describing how individuals go about making *important decisions*. Please indicate whether you agree or disagree with each statement.

5 point scale; 1 = strongly disagree; 5 = strongly agree

Rational

1. I double-check my information sources to be sure I have the right facts before making decisions.
2. I make decisions in a logical and systematic way.
3. My decision making requires careful thought.
4. When making a decision, I consider various options in terms of a specific goal.

Intuition

5. When making decisions, I rely upon my instincts.
6. When I make decisions, I tend to rely on my intuition.
7. I generally make decisions that feel right to me.
8. When I make a decision, it is more important for me to feel the decision is right than to have a rational reason for it.
9. When I make a decision, I trust my inner feelings and reactions.

Dependent

10. I often need the assistance of other people when making important decisions.
11. I rarely make important decisions without consulting other people.
12. If I have the support of others, it is easier for me to make important decisions.
13. I use the advice of other people in making my important decisions.
14. I like to have someone to steer me in the right direction when I am faced with important decisions.

Avoidant

15. I avoid making important decisions until the pressure is on.
16. I postpone decision making whenever possible.
17. I often procrastinate when it comes to making important decisions.
18. I generally make important decisions at the last minute.
19. I put off making many decisions because thinking about them makes me uneasy.

Spontaneous

20. I generally make snap decisions.
21. I often make decisions on the spur of the moment
22. I make quick decisions.
23. I often make impulsive decisions.
24. When making decisions, I do what seems natural at the moment.

Appendix D

Numeracy

(Lipkus et al., 2001)

The following questions concern the general concepts of number and probability. To the best of your ability, please write down your answer to each question. In case you do try to figure out but you still do not know an answer for a particular question, you may specify “I don’t know.”

1. Imagine that we roll a fair, six-sided die, 1,000 times. Out of 1,000 rolls, how many times do you think the die would come up even (2, 4, or 6)?

Your answer:

2. In the BIG BUCKS LOTTERY, the chances of winning a \$10.00 prize are 1%. What is your best guess about how many people would win a \$10.00 prize if 1,000 people each buy a single ticket from BIG BUCKS?

Your answer:

3. In the ACME PUBLISHING SWEEPSTAKES, the chance of winning a car is 1 in 1,000. What percent of tickets of ACME PUBLISHING SWEEPSTAKES win a car?

Your answer:

4. Which of the following numbers represents the biggest risk of getting a disease? Please circle only one choice that best represents your answer.

a.	b.	c.
1 in 100	1 in 1,000	1 in 10

5. Which of the following represents the biggest risk of getting a disease? Please circle only one choice that best represents your answer.

a.	b.	c.
----	----	----

1%

10%

5%

6. If Person A's risk of getting a disease is 1% in ten years, and Person B's risk is double that of A's, what is B's risk?

Your answer:

7. If Person A's chance of getting a disease is 1 in 100 in ten years, and Person B's risk is double that of A's, what is B's risk?

Your answer:

8. If a chance of getting a disease is 10%, how many people would be expected to get the disease out of 100?

Your answer:

9. If a chance of getting a disease is 10%, how many people would be expected to get the disease out of 1,000?

Your answer:

10. If a chance of getting a disease is 20 out of 100, this would be the same as having a _____% chance of getting disease.

Your answer:

11. The chance of getting a viral infection is .0005 out of 10,000 people, about how many of them are expected to get infected?

Your answer:

Appendix E

Resistance to Framing: Attribute Framing

(Bruine de Bruin et al., 2007)

INSTRUCTIONS: Each of the following problems ask you to rate your judgment of a product or a situation. Each problem is presented with a scale ranging from 1 (representing one option) through 6 (representing the other option). For each problem, please choose the number on the scale that best reflects your judgment. Some items may seem similar. Answer each item with your judgment of the product or situation.

Because of changes in tax laws, you may get back as much as \$1200 in income tax. Your accountant has been exploring alternative ways to take advantage of this situation. He has developed two plans: If Plan A is adopted, you will lose \$800 of the possible \$1200. If Plan B is adopted, you have a 33% chance of losing none of the money, and a 67% chance of losing all \$1200. Which plan would you use?

- ☐ 1 Definitely would choose A
- ☐ 2
- ☐ 3
- ☐ 4
- ☐ 5
- ☐ 6 Definitely would choose B

Imagine that recent evidence has shown that a pesticide is threatening the lives of 1,200 endangered animals. Two response options have been suggested: If Option A is used, 600 animals will be lost for sure. If Option B is used, there is a 75% chance that 400 animals will be lost, and a 25% chance that 1,200 animals will be lost. Which option do you recommend to use?

- ☐ 1 Definitely would choose A
- ☐ 2
- ☐ 3
- ☐ 4
- ☐ 5
- ☐ 6 Definitely would choose B

Imagine that your doctor tells you that you have a cancer that must be treated. Your choices are as follows:

Surgery: Of 100 people having surgery, 90 live through the operation, and 34 are alive at the end of five years.

Radiation therapy: Of 100 people having radiation therapy, all live through the treatment, and 22 are alive at the end of five years. Which treatment would you choose?

- ☐ 1 Definitely would choose surgery
- ☐ 2
- ☐ 3
- ☐ 4
- ☐ 5
- ☐ 6 Definitely would choose radiation

Imagine that your client has \$6,000 invested in the stock market. A downturn in the economy is occurring. You have two investment strategies that you can recommend under the existing circumstances to preserve your client's capital. If strategy A is followed, \$2,000 of your client's investment will be saved. If strategy B is followed, there is a 33% chance that the entire \$6,000 will be saved, and a 67% chance that none of the principal will be saved. Which of these two strategies would you favor?

- ☐ 1 Definitely would choose A
- ☐ 2
- ☐ 3
- ☐ 4
- ☐ 5
- ☐ 6 Definitely would choose B

Imagine that recent evidence has shown that a pesticide is threatening the lives of 1,200 endangered animals. Two response options have been suggested: If Option A is used, 600 animals will be saved for sure. If Option B is used, there is a 75% chance that 800 animals will be saved, and a 25% chance that no animals will be saved. Which option do you recommend to use?

- ☐ 1 Definitely would choose A
- ☐ 2
- ☐ 3
- ☐ 4
- ☐ 5
- ☐ 6 Definitely would choose B

Imagine that in one particular state it is projected that 1000 students will drop out of school during the next year. Two programs have been proposed to address this problem, but only one can be implemented. Based on other states' experiences with the programs, estimates of the outcomes that can be expected from each program can be made. Assume for purposes of this decision that these estimates of the outcomes are accurate and are as follows: If Program A is adopted, 400 of the 1000 students will stay in school. If Program B is adopted, there is a 40% chance that all 1000 students will stay in school and 60% chance that none of the 1000 students will stay in school. Which program would you favor for implementation?

- ☐ 1 Definitely would choose A
- ☐ 2
- ☐ 3
- ☐ 4
- ☐ 5
- ☐ 6 Definitely would choose B

Imagine that your doctor tells you that you have a cancer that must be treated. Your choices are as follows:

Surgery: Of 100 people having surgery, 10 die because of the operation, and 66 die by the end of five years.

Radiation therapy: Of 100 people having radiation therapy, none die during the treatment, and 78 die by the end of five years. Which treatment would you choose?

- ☐ 1 Definitely would choose surgery
- ☐ 2
- ☐ 3
- ☐ 4
- ☐ 5
- ☐ 6 Definitely would choose radiation

Imagine a hospital is treating 32 injured soldiers, who are all expected to lose one leg. There are two doctors that can help the soldiers, but only one can be hired: If Doctor A is hired, 20 soldiers will keep both legs. If Doctor B is hired, there is a 63% chance that all soldiers keep both legs and a 37% chance that nobody will save both legs. Which doctor do you recommend?

- ☐ 1 Definitely would choose A
- ☐ 2
- ☐ 3
- ☐ 4
- ☐ 5
- ☐ 6 Definitely would choose B

Imagine that the U.S. is preparing for the outbreak of an unusual disease, which is expected to kill 600 people. Two alternative programs to combat the disease have been proposed. Assume that the exact scientific estimates of the consequences of the programs are as follows: If Program A is adopted, 200 people will be saved. If Program B is adopted, there is a 33% chance that 600 people will be saved, and a 67% chance that no people will be saved. Which program do you recommend to use?

- ☐ 1 Definitely would choose A
- ☐ 2
- ☐ 3
- ☐ 4
- ☐ 5
- ☐ 6 Definitely would choose B

Imagine that your client has \$6,000 invested in the stock market. A downturn in the economy is occurring. You have two investment strategies that you can recommend under the existing circumstances to preserve your client's capital. If strategy A is followed, \$4,000 of your client's investment will be lost. If strategy B is followed, there is a 33% chance that the nothing will be lost, and a 67% chance that \$6,000 will be lost. Which of these two strategies would you favor?

- ☐ 1 Definitely would choose A
- ☐ 2
- ☐ 3
- ☐ 4
- ☐ 5
- ☐ 6 Definitely would choose B

Imagine that in one particular state it is projected that 1000 students will drop out of school during the next year. Two programs have been proposed to address this problem, but only one can be implemented. Based on other states' experiences with the programs, estimates of the outcomes that can be expected from each program can be made. Assume for purposes of this decision that these estimates of the outcomes are accurate and are as follows: If Program A is adopted, 600 of the 1000 students will drop out of school. If Program B is adopted, there is a 40% chance that none of the 1000 students will drop out of school and 60% chance that all 1000 students will drop out of school. Which program would you favor for implementation?

- ☐ 1 Definitely would choose A
- ☐ 2
- ☐ 3
- ☐ 4
- ☐ 5
- ☐ 6 Definitely would choose B

Because of changes in tax laws, you may get back as much as \$1200 in income tax. Your accountant has been exploring alternative ways to take advantage of this situation. He has developed two plans: If Plan A is adopted, you will get back \$400 of the possible \$1200. If Plan B is adopted, you have a 33% chance of getting back all \$1200, and a 67% chance of getting back no money. Which plan would you use?

- ☐ 1 Definitely would choose A
- ☐ 2
- ☐ 3
- ☐ 4
- ☐ 5
- ☐ 6 Definitely would choose B

Imagine that the U.S. is preparing for the outbreak of an unusual disease, which is expected to kill 600 people. Two alternative programs to combat the disease have been proposed. Assume that the exact scientific estimates of the consequences of the programs are as follows: If Program A is adopted, 400 people will die. If Program B is adopted, there is a 33% chance that nobody will die, and a 67% chance that 600 people will die. Which program do you recommend to use?

- ☐ 1 Definitely would choose A
- ☐ 2
- ☐ 3
- ☐ 4
- ☐ 5
- ☐ 6 Definitely would choose B

Imagine a hospital is treating 32 injured soldiers, who are all expected to lose one leg. There are two doctors that can help the soldiers, but only one can be hired: If Doctor A is hired, 12 soldiers will lose one leg. If Doctor B is hired, there is a 63% chance that nobody loses a leg and a 37% chance that all lose a leg. Which doctor do you recommend?

- ☐ 1 Definitely would choose A
- ☐ 2
- ☐ 3
- ☐ 4
- ☐ 5
- ☐ 6 Definitely would choose B

Appendix F

Consideration of Future Consequences

(Strathman et al., 1994)

For each of the statements below, please indicate whether or not the statement is characteristic of you. If the statement is extremely uncharacteristic of you (not at all like you) please write a "1" to the left of the question; if the statement is extremely characteristic of you (very much like you) please write a "5" next to the question. And, of course, use the numbers in the middle if you fall between the extremes. Please keep the following scale in mind as you rate each of the statements below.

1 = extremely uncharacteristic; 5 = extremely characteristic

1. I consider how things might be in the future, and try to influence those things with my day to day behavior.
2. Often I engage in a particular behavior in order to achieve outcomes that may not result for many years.
3. I only act to satisfy immediate concerns, figuring the future will take care of itself.
4. My behavior is only influenced by the immediate (i.e., a matter of days or weeks) outcomes of my actions.
5. My convenience is a big factor in the decisions I make or the actions I take.
6. I am willing to sacrifice my immediate happiness or well-being in order to achieve future outcomes.
7. I think it is important to take warnings about negative outcomes seriously even if the negative outcome will not occur for many years.
8. I think it is more important to perform a behavior with important distant consequences than a behavior with less-important immediate consequences.
9. I generally ignore warnings about possible future problems because I think the problems will be resolved before they reach crisis level.
10. I think that sacrificing now is usually unnecessary since future outcomes can be dealt with at a later time.
11. I only act to satisfy immediate concerns, figuring that I will take care of future problems that may occur at a later date.
12. Since my day to day work has specific outcomes, it is more important to me than behavior that has distant outcomes.

Appendix G

Cognitive Reflection Test

(Frederick, 2005)

1. A bat and a ball cost \$1.10 in total. The bat costs \$1.00 more than the ball. How much does the ball cost?
_____ cents
2. If it takes 5 machines 5 minutes to make 5 widgets, how long would it take 100 machines to make 100 widgets?
_____ minutes
3. In a lake, there is a patch of lily pads. Every day, the patch doubles in size. If it takes 48 days for the patch to cover the entire lake, how long would it take for the patch to cover half of the lake?
_____ days

Appendix H

Manipulation Check & Short- vs. Long-Term Information Questions

Manipulation Check:

To what extent did you use logic and reasoning based on the facts and numbers in the decision situation to make your decision?

- ☐ 1 Not at all
- ☐ 2
- ☐ 3
- ☐ 4
- ☐ 5 A great deal

To what extent did you use your gut feelings and initial reactions to make your decision?

- ☐ 1 Not at all
- ☐ 2
- ☐ 3
- ☐ 4
- ☐ 5 A great deal

To what extent did you use your previous experiences or those of others to make your decision?

- ☐ 1 Not at all
- ☐ 2
- ☐ 3
- ☐ 4
- ☐ 5 A great deal

Short- vs. Long-term Information:

How important was the short-term information (i.e., the number of people who got the flu or did not get the flu within 1 month) to you in your decision making?

- ☐ 1 Not at all important
- ☐ 2
- ☐ 3
- ☐ 4
- ☐ 5 Very important

How important was the long-term information (i.e., the number of people who got the flu or did not get the flu within 6 months) to you in your decision making?

- ☐ 1 Not at all important
- ☐ 2
- ☐ 3
- ☐ 4
- ☐ 5 Very important

Appendix I

Logistic Regression Models for Individual Predictors

Instruction Condition

Lung cancer. A logistic regression was performed with frame (survival vs. mortality) and instruction condition (deliberative, experiential, affective, and control) as predictors and decision choice (surgery or radiation) for lung cancer treatment as the outcome. The full model was significant, $\chi^2(7, N = 342) = 25.27, p = .001$ (Cox and Snell R Square, 6.1%; Nagelkerke R Square, 8.2%), indicating that the model significantly distinguished between participants who indicated they would choose surgery and participants who indicated they would choose radiation. The model correctly classified 62.1% of cases. Frame was a significant predictor of decision outcome with an odds ratio of 3.17 (see Table 1a). This indicates that participants who were in the survival condition were over 3 times as likely to indicate that they would choose surgery over radiation as participants in the mortality frame. Instruction condition and the interaction between instruction condition and frame were not significant predictors of decision choice (see Table 1a below).

Table 1a

Logistic regression: Lung cancer: Frame and Instruction Condition

	B	S.E.	Wald	df	<i>p</i>	Odds Ratio
Survival frame	1.153	.451	6.544	1	.011	3.168
Deliberative			3.017	3	.389	
Experiential	.495	.447	1.222	1	.269	1.640
Affective	-.108	.465	.054	1	.816	.898
Control	.495	.447	1.222	1	.269	1.640
Frame by Condition			.534	3	.911	
Survival frame by Experiential	-.260	.631	.170	1	.680	.771
Survival frame by Affective	-.463	.642	.522	1	.470	.629
Survival frame by Control	-.191	.635	.091	1	.763	.826

Flu. A logistic regression was performed with frame (get the flu or not get the flu) and instruction condition (deliberative, experiential, affective, and control) as predictors and decision choice (vaccination shot or nasal spray) for flu prevention as the outcome. The full model was not significant, $\chi^2(7, N = 344) = 6.41, p = .49$ (Cox and Snell R Square, 6.1%; Nagelkerke R Square, 8.2%). The model correctly classified 61.6% of cases. Frame, instruction condition, and the interaction were not significant predictors of decision outcome (see Table 1b).

Table 1b

Logistic regression: Flu: Frame and Instruction Condition

	B	S.E.	Wald	df	<i>p</i>	Odds ratio
Deliberative			2.105	3	.551	
Experiential	-.034	.459	.005	1	.941	.967
Affective	.441	.451	.955	1	.328	1.554
Control	-.173	.463	.139	1	.709	.842
No flu frame	.728	.444	2.694	1	.101	2.071
Condition by Frame			2.464	3	.482	
Experiential by No flu frame	-.295	.630	.219	1	.640	.745
Affective by No flu frame	-.926	.628	2.171	1	.141	.396
Control by No flu frame	-.172	.637	.073	1	.787	.842

Age Differences

Lung cancer. A logistic regression was performed with frame (survival vs. mortality) and age (younger, middle-aged, and older adults) as predictors and decision choice (surgery or radiation) for lung cancer treatment as the outcome. The full model was significant, $\chi^2(5, N = 342) = 21.61, p < .001$ (Cox and Snell R Square, 6.1%; Nagelkerke R Square, 8.2%), indicating that the model significantly distinguished between participants who indicated they would choose surgery and participants who indicated they would choose radiation. The model correctly classified 61.2% of cases. However, neither frame nor age was a significant predictor of decision outcome (see Table 2a).

Table 2a

Logistic regression: Lung cancer: Age and Frame

	B	S.E.	Wald	df	<i>p</i>	Odds ratio
Age Groups			3.855	2	.146	
Middle-aged adults	-.596	.384	2.417	1	.120	.551
Older adults	-.702	.391	3.224	1	.073	.496
Survival frame	.600	.375	2.556	1	.110	1.821
Age Groups by Frame			.994	2	.608	
Middle-aged adults by Survival frame	.516	.536	.927	1	.336	1.676
Older adults by Survival frame	.378	.552	.471	1	.493	1.460

Flu. A logistic regression was performed with frame (get the flu or not get the flu), age (younger, middle-aged, and older adults) as predictors and decision choice (vaccination shot or nasal spray) for flu prevention as the outcome. The full model was not significant, $\chi^2(5, N = 343) = 4.68, p = .46$. The model explained between 1.4% (Cox and Snell R Square) and 1.8% (Nagelkerke R squared) of the variance in decision outcome and correctly classified 61.5% of cases. However, neither frame nor age was a significant predictor of decision outcome (see Table 2b).

Table 2b

Logistic regression: Flu: Age and Frame

	B	S.E.	Wald	df	<i>p</i>	Odds ratio
Age Groups			.406	2	.816	
Middle-aged adults	.222	.382	.337	1	.562	1.249
Older adults	.020	.402	.002	1	.961	1.020
No flu frame	.351	.383	.840	1	.359	1.421
Age Groups by Frame			.158	2	.924	
Middle-aged adults by No flu frame	.135	.536	.063	1	.801	1.144
Older adults by No flu frame	-.081	.559	.021	1	.885	.922