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Personal factors, domain specificity, and risky decision-making

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PERSONAL FACTORS, DOMAIN SPECIFICITY, AND RISKY DECISION-MAKING

By

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A Dissertation Presented in Partial Fulfillment Of the Requirements for the Degree Doctor of Philosophy

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We hereby recommend that the dissertation prepared under our supervision by Rose Niles entitled Personal Factors, Domain Specificity, and Risky Decision-Making be accepted in partial fulfillment of the requirements for the Degree of Doctor of Philosophy Counseling Psychology.

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ABSTRACT

Adults make many risky decisions daily, such as choosing to drive over the speed limit or going outside without previously applying sunscreen. How and why adults make such decisions remains relatively unknown and has gained much research attention. Traditional models of decision-making, such as Expected Utility Theory (Bernoulli, 1954) and Prospect Theory (Kahneman & Tversky, 1972) have proven too simplistic, as they do not account for the regular deviations from expected decision-making processes. Likewise, models that attempt to categorize individuals as risk seeking and risk-averse do not hold up well when decisional-domain is examined (Blais & Weber, 2006). Contemporary research has cited many individual factors that influence or interfere with decision-making processes, such as age, cognitive abilities, and impulsivity, to name a few. What is missing, however, is a comprehensive model that examines domain specific risky decision-making processes that are employed across the adult lifespan.

This study examined the moderating effects of the Domain Specific Risk Taking Scale (DOSPERT; Weber, Blais, & Betz, 2002) subscales (perceived risk, attitudes toward risk, and expected benefits of risky behavior) and impulsivity on the established relationships among cognitive abilities (general intelligence and numeric ability) and risky financial and health related decisions. Participants included younger adults, sampled from undergraduate level courses and older adults (55+ years), sampled from adult fitness programs. The participants completed a survey packet that included demographic questions, measures of cognitive abilities, trait impulsivity, the DOSPERT
(Weber et al., 2002), and several hypothetical financial and health-related risky decisions. Possible moderator effects were examined using hierarchical linear regression.

Males made more risky health and financial decisions than females. Similarly, younger adults made more domain-specific risky decisions (health and finance) than older adults. There were age and gender differences on all aspects of risk propensity (risk perception, risk taking, and expected benefits). Measures of risk propensity (risk perception, risk taking, and expected benefits of risk) and trait impulsivity did not moderate the relationship between cognitive abilities and domain-specific risky decisions. Practical and clinical implications are discussed. Additionally, limitations and directions for future research are reviewed.
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CHAPTER ONE

INTRODUCTION

For several decades, investigators have examined factors that influence individual decision-making processes. Traditional models of decision-making, such as Expected Utility Theory (Bernoulli, 1954) and Prospect Theory (Kahneman & Tversky, 1979) often fail to account for regular deviations from expected decision-making processes. Additionally, these models are poor predictors of risky decision-making and do not take into account personal factors that have been shown to significantly influence risky decision-making (Rothman & Salovey, 1997; Slovic, 1995). Models which seek to conceptualize individuals as risk-seeking or risk-averse have also proven too simplistic, as contemporary research suggests that personal factors and decisional domain are important determinants of risky decisions (Byrnes, Miller, & Schafer, 1999; Davis, Patte, Tweed, & Curtis, 2007; Finucane et al., 2002; Lipkus, Samsa, & Rimer, 2001; Petty & Cacioppo, 1979; Weber, Blais, & Betz., 2002).

Much research has shown the influence of a variety of personal factors on decision-making processes. For instance, some research suggests that older and younger adults differ in their ability to make decisions, with older adults evidencing less decision-making competence. Numerous factors have been proposed to account for these age related differences, including changes in cognitive abilities (Finucane & Gullion, 2010; Lipkus et al., 2001), complexity of the problem for which a decision is required
(Finucane, Mertz, Slovic, & Schmidt, 2005) and the context of the decision (Finucane et al., 2002). Individual differences in numeric ability may also influence one’s ability to make competent decisions, especially if such decisions are dependent upon numeric information. If adults are unable to understand the data that is presented among a set of risky decisions, this will lead to confusion and difficulty understanding the inherent risk involved in various courses of actions. Some research has examined the direct effect of numeric ability on health-related risky decisions (Lipkus et al., 2001). Individual differences in numeric ability also have the potential to interfere with decision-making processes in other domains, such as finances.

Research has also consistently reported gender differences in risky decision-making, wherein males tend to make riskier decisions than females (Byrnes et al., 1999). Females, however, may be more likely than males to take risks when there is the potential of a positive consequence, such as winning a contest, with little involved cost (Harris, Jenkins, & Glaser, 2006). Among the leading explanations for these gender differences is that males and females are differentially affected by their own perceptions of enjoyment in the proposed risky behavior, perceptions of the likelihood of negative consequences, and the severity of such consequences (Harris et al., 2006; Hillier & Morrongiello, 1998; Weber et al., 2002). Weber et al. (2002) also argue that decisional domain significantly influences risk propensity, suggesting that risk tolerance is not a stable trait.

Non-clinical impulsiveness, such as that which is part of regular personality, also affects an individual’s ability to make effective decisions. For instance, research suggests that people who are more impulsive, or less disinhibited, are more likely to make poor judgment decisions on gambling tasks compared to people with greater impulse control
Although gambling experiments approximate real life conditions of risky decision-making, they often fail to measure how invested one is in making an accurate decision because the stakes are not real. Some research suggests that issue involvement, or the degree to which one is invested or involved in a particular decision, affects decision-making processes. For instance, Petty and Cacioppo (1979) found that high issue involvement affected the persuasiveness of messages regarding policy changes. Thus, it is possible that such approximated real life situations as the gambling tasks are not particularly salient to the individual, which may account for more impulsive decision-making. Accordingly, the effects of impulsivity and issue involvement should be assessed across a variety of decisional domains, which may be more or less salient to the participant, thus affecting risk decision-making processes.

**Statement of the Problem**

People make many risky decisions every day. Moreover, the older adult population in the U.S. is expected to continue to rise until at least 2050 (Administration on Aging, n.d.). Thus, many older adults will be in the position of making important risky life decisions than ever before. Such decisions will not only affect the decision-maker him or herself, but also have the potential to impact society. For instance, making poor financial or health-related risky decisions may affect family members and potentially the health and financial sectors of society. Contemporary research has examined factors that may affect or interfere with older adults’ ability to make competent decisions, such as general cognitive abilities, but a holistic model of factors that influence decision-making across the adult lifespan is lacking.
A wealth of research regarding risky decision-making suggests that there are numerous factors that influence or interfere with one's ability to make competent risky decisions, including personal factors that were previously discussed. Much of this research has isolated individual factors, such as age or gender, and assessed the influence on risky decision-making. Consequently, comprehensive models of risky decision-making that take into account these influential personal factors are needed. Moreover, the existing literature does not support traditional models of decision-making that seek to categorize decision-makers as either risk-seeking or risk-averse; rather, domain-specific perceptions and attitudes about risk as well as expected benefits of engaging in risky behavior appear to be influential factors of risky decisions (Weber et al., 2002). Based on the state of the current literature, as well as the noted shortcomings, a holistic model of the adult risky decision-making process is required.

Models of Decision-Making

There are several competing theories about the processes in which individuals engage while making decisions. Expected Utility Theory posits that individuals make decisions by comparing risky choices based on expected utility values (Bernoulli, 1954). From this perspective, rational decision makers should choose the option with the greatest expected value, where expected value represents the product of the value of each outcome by the probability of that outcome occurring. Thus, when people make choices that follow certain logical patterns, such as maximizing value, they are said to be engaging in the axiomatic approach to decision-making (Stanovich, 2010). This approach is concerned with maximization of utility. Therefore, rational decisions should evidence
consistent and coherent relationships. For instance, one of these relationships is transitivity. If you prefer A to B and B to C, then you should prefer A to C. If you do not have such a preference, then you have violated rationality. The axiomatic approach to decision-making should also make people immune to irrelevant contextual information because contextual influence would render decisions unstable, thus reducing their maximum utility. Although this simple model makes conceptual sense, a plethora of research has shown that people often make irrational decisions as evidenced by deviations from this model (Stanovich, 2010).

Kahneman and Tversky (1979) argue that Expected Utility Theory does not adequately capture the decision-making process when risk is involved because decision makers often violate the proposed axioms. Specifically, people are likely to violate expected utility decisions in the context of gains when certainty, probability, and possibility are considered. For example, Kahneman and Tversky note that when making risky decisions, people's decisions will often violate axiomatic decision-making because they will choose an outcome that does not maximize utility when weighing certainty of outcomes. For instance, participants were asked to choose between two options in two choice sets. Option A stated that they had a .80 probability of obtaining 4,000 and option B stated a 1.0 probability, or certainty, that they would obtain 3,000. Options C yielded a .20 probability of obtaining 4,000 and option D yielded a .25 probability of obtaining 3,000. In this situation, 80% of participants chose option B, which implied that “utility(3,000) / utility(4,000) > 4/5” (Kahneman & Tversky, 1979, p. 266). Interestingly, 65% of participants chose option C to option D, which implied a reverse inequality. Thus,
the participants outweighed estimates that they assumed were certain over those that were perceived as less certain, or probable. They call this phenomenon the certainty effect. The tendency to overweigh certain estimates violates the expected utility model (Kahneman & Tversky, 1979).

Kahneman and Tversky (1979) also argue that Expected Utility Theory does not accurately capture the decision-making process in the context of loss. For instance, participants were asked to choose between two options in two choice sets. In problem 3', there was a .80 probability of losing 4,000 and a 1.0 probability, or certainty, of losing 3,000. In this situation, 92% of the participants selected the option with the .80 probability of losing 4,000 over a sure loss of 3,000, although there was a lower expected value. In Problem 4', there was a .20 probability of losing 4,000 or a .25 probability of losing 3,000. Under these circumstances, the majority of participants, 58%, switched their preference and chose the .25 probability of losing 3,000. Thus, outcomes that are certain outweigh outcomes that are uncertain, even if the uncertain outcomes have a greater probability of yielding maximum utility. Thus, participants are more likely to evidence risk seeking behavior for a loss that is probable compared to a smaller loss that is certain. This phenomenon is referred to as the reflection effect (Kahneman & Tversky, 1979).

Given the limitations of Expected Utility Theory to account for irrational choices in the contexts of gains and losses, Kahneman and Tversky developed Prospect Theory, which is a model of decision-making under risk.

Kahneman and Tversky's (1979) theory posits that there are two phases of choice, editing and then evaluation. In the editing phase, the individual will preliminarily
evaluate the various prospects, and this leads to the formation of simpler representations of these prospects. Kahneman and Tversky argue that during the editing phase various operations are carried out that convert the probabilities associated with each of the various prospects, including coding, combining, simplification, and dominance. Additionally, they note that many deviations of preference, such as those discussed as weaknesses of Expected Utility Theory, occur during the editing phase. Coding, or the tendency to perceive outcomes as gains or losses relative to a neutral point of reference, is a key tenet of this theory (Kahneman & Tversky, 1979; Stanovich, 2010). Kahneman and Tversky argue that this coding influences people to be risk averse for gains or risk seeking for losses.

Another key tenet of this theory is that wealth or welfare are the carriers of value, rather than final states as suggested in Expected Utility Theory. Thus, value of a decision is compared to a given reference point. For example, $100.00 may be interpreted as petty cash by one person and a lot of money by another depending upon their economic assets. Value is thus a function of two components: the reference point, or asset position, and the degree of change from the reference point. Based on these tenets, Kahneman and Tversky propose that in terms of wealth, the value, or utility, function will normally be concave above the reference point and convex below the reference point, indicating that the marginal value of gains and losses usually shrink with their magnitude. Finally, prior to making a decision, the decision maker must internally multiply the value of each possible outcome by a decision weight. Decision weights are subjectively determined from the choices and are not probabilities, so they do not have to adhere to probability axioms.
According to Kahneman and Tversky, decision weights assess the influence of events on the attractiveness of prospects, rather than the perceived likelihood of the events. For example, imagine that someone could win $1,000.00 based on the toss of a fair coin. For most people, the probability of winning this gamble is .50, but for some people, the decision weight $\pi(.50)$ that is determined from the choices is likely to be less than .50 (Kahneman & Tversky, 1979).

Although Kahneman and Tversky’s (1979) Prospect Theory provides a better account for decision-making under risky conditions, people still have a tendency to deviate from the expectations presented within this model. In fact, Tversky and Kahneman (1981) note that decision-makers often violate rationality when making decisions and that the frame of a message is important. Specifically, they argue that messages can be framed in terms of relative costs, which are referred to as loss frames, or gain frames, which emphasize the benefits of a given behavior. For instance, the Asian disease problem describes an unusual disease that is expected to kill 600 people. The participant is asked to select between two programs to implement, both of which will save some lives, but not all. The loss frame presents the program in terms of how many lives will be lost, while the gain frame presents the program in terms of how many lives will be saved. Tversky and Kahneman found that when presented with a gain frame, participants consistently prefer the option that yields a certain gain and less risk, such as 200 lives saved, versus the risky prospect of equal expected value, such as a 1/3 chance that all 600 people will be saved and a 2/3 chance that no one will survive. Comparatively, when programs are framed in terms of losses, participants show a
reversal and prefer the risky choice frame (e.g. 1/3 chance that no one will die and a 2/3 chance that everyone will die) rather than the certain loss frame (e.g. 400 people will die). Consequently, those people who choose gain frames are often risk averse, while those who choose loss frames are often risk seeking. Such framing problems can be based on acts, contingencies, and outcomes. These findings suggest that the frame, or way in which the information is presented, affects the way in which the information is understood and consequently affects decisional outcomes (Tversky & Kahneman, 1981). In a review of message framing research, Mahoney, Buboltz, and Levin (2011) suggest that framing effects have been examined in the areas of consumer behavior, political advocacy, and health-related behavior. Thus, framing effects are not domain-specific.

Rothman and Salovey (1997) have also analyzed the influence of message frame on risky choice decisions. They note that framing effects influence risky choice even when these messages describe equivalent outcomes, such as those previously described by Kahneman and Tversky (1981). Rothman and Salovey suggest that there are three stages in the decision-making process for loss and gain framed messages, which will determine whether an individual responds to a risky choice in a manner consistent with the decision-making process proposed by Prospect Theory. First, mental representations of the issue are dependent upon the amount of attention directed towards the message. Messages can be processed systematically, where one attends to the details of the message, or by using heuristics, where one attends to the surface details of the message. They argue that systematic processing is likely to lead to the integration of the relevant information into one’s mental representation of the larger issue. Moreover, interest in an
issue is likely to activate systematic processing and research suggests that personal involvement moderates the relationship between message framing and health behavior (Maheswaran & Meyers-Levy, 1990; Rothman & Salovey, 1997).

Next, experience and one’s current life situation are important influential factors in the receptivity of the message and represent the second stage in the decision-making process (Rothman & Salovey, 1997). Rothman and Salovey (1997) suggest that mood, disposition, knowledge, and life experience will influence an individual’s willingness to adopt a given healthy behavior. Specifically, they argue that one’s mood may influence the accessibility of mood-congruent information, which may affect whether a message is processed as mood-congruent. For instance, they note that a sad mood may highlight the potential of incurring loss, whereas a happy mood may highlight the potential of gain. Additionally, optimists may be more responsive to gain frames, whereas pessimists may be more responsive to loss frames. Rothman and Salovey also argue that research suggests that those health related messages that are personally relevant may lead to counterarguments among recipients. Comparatively, messages about health risks that are not personally relevant are less likely to elicit such counterarguments and thus have a lessened effect on risky choice.

Finally, the function of the behavior presented in the message frame, such as prevention, detection, or recuperative, is going to influence one’s actual behavior. This influence represents Rothman and Salovey’s (1997) third stage in the decision-making process for risky choice decisions. They argue that the decision-makers’ beliefs about the effectiveness of the behavior as well as their ability to successfully perform that behavior
will affect whether or not they actually carry out a recommended behavior. Rothman and Salovey report that research supports the notion that self-efficacy is a strong determinant of behavior.

Collectively, research regarding models of decision-making suggests that when making risky decisions, people often violate expected rational decision-making processes, such as those suggested by Expected Utility Theory. For instance, research on the influence of decisional context has shown that decisional consistency varies across ages. For example, Slovic (1995) found that younger adults exhibit less consistent decision-making as a function of constructive processes that are influenced by decisional context. Likewise, Finucane et al. (2002) report that there is strong evidence supporting the notion that age-related changes in working-memory affect the judgmental heuristics that are used and render older adults more susceptible to being influenced by the decisional context. Based on these findings, it is possible that judgmental heuristics are differentially used by older and younger adults, highlighting an important deviation from models of decision-making. Rothman and Salovey (1997) also suggest that a variety of personal factors, including attention, personal involvement, experience, life situation, and contextual information are highly influential when making risky decisions. Accordingly, future research should seek to determine models of risky decision-making that examine the influence of a variety of personal factors such as those discussed by Rothman and Salovey as well as the context of the decision. Such a model may yield more predictive power and stronger explanations of how individuals make risky decisions.
Decisional Heuristics

Research has consistently shown that people use heuristics, or mental shortcuts, when making decisions (Finucane et al., 2002; Tversky & Kahneman, 1974). It has been suggested that individuals engage such heuristics because they lack the mental capacity to process all of the necessary information in a timely manner. Thus, heuristics are evolutionarily adaptive strategies that allow people to process some information quickly and make a decision. However, the increased speed comes at the cost of reduced accuracy (Finucane et al., 2002). Tversky and Kahneman (1974) argue that there are three commonly used heuristics that help people make decisions regarding probabilities and predicted values: Representativeness, Availability, and Adjustment and Anchoring heuristics.

The Representativeness heuristic is commonly used to help estimate probabilities based on how much one item or condition resembles another item or condition. For instance, “what is the probability that object A belongs to class B? What is the probability that event A originates from process B? What is the probability that process B will generate event A?” (Tversky & Kahneman, 1974, p. 1124). Tversky and Kahneman (1974) argue that there are several ways that the Representativeness heuristic interferes with an individual’s ability to use probability information. For instance, their research has shown that base rates, or prior probabilities, have little effect on estimates of probability. Thus, individuals consistently fail to use base rate information when evaluating representativeness and making estimates of probability. Similarly, people are often impervious to sample size when making judgments about the similarity of a sample
statistic to the larger population. Even when sample size is stressed, people continually make this error. People also misperceive the occurrence of chance events. For instance, Tversky and Kahneman report that people are more likely to consider the results of a coin toss to be T-H-T-H-H-T, rather than T-T-T-H-H-H, as the second sequence does not appear random. In this example, they argue that people expect the properties of the process to be represented more fairly. Additionally, chance is often conceived of as a self-correcting process, where the occurrence of one deviation will be corrected by the occurrence of the other deviation on the subsequent trial. In this example, there is a 50/50 chance of having either a heads or tails turn up on any given toss and participants believe that if it turns up heads on the first toss that the process should re-establish equilibrium by having a tails on the second toss (Tversky & Kahneman, 1974).

The Availability heuristic may be used to help individuals estimate the frequency, category, or probability of an event based on how easily similar instances or occurrences come to mind. The underlying assumption of this heuristic is that more frequently encountered or probable examples of a class or group will be amassed more quickly and with less effort than rare examples. The payoff of using this heuristic, however, is that the ease with which examples are retrieved may bias one's estimates of frequency or probability leading to overestimates (Tversky & Kahneman, 1974). Additionally, Tversky and Kahneman (1974) argue that salience may affect retrievability, thus biasing estimates of frequency or probability. For instance, they suggest that estimates of probability are likely to be influenced by personal experience or encounters with an event opposed to no such experience or encounter. Likewise, recently encountered events or objects are more
easily retrievable than events or objects encountered in the past. People may also make errors of frequency or probability based on the use of faulty search sets. Finally, availability of information regularly leads people to make illusory correlations about events due to overestimates of the frequency of co-occurrence of two events (Tversky & Kahneman, 1974).

Finally, many people make errors of adjustment when using initial starting points, where the adjustments are often insufficient. This type of error is known as the Adjustment and Anchoring heuristic. Anchoring refers to estimates that are made based upon the initial starting point, as various starting points will lead to different estimates. In order to make quick decisions, people often only engage a few mathematical computations when making estimates that usually lead to underestimates (Tversky & Kahneman, 1974). For example, Tversky and Kahneman (1974) had participants estimate the number of African countries in the United Nations in the form of percentages from zero to 100. Initially, the participant spun a wheel of fortune and then had to indicate whether the estimated percentage was higher or lower than the number displayed on the wheel. Additionally, they had to estimate the quantity by which they would have to increase or decrease the percentage. They found that those participants who spun a lower number tended to estimate lower numbers, while those who spun a higher number estimated higher numbers. They also report that payoffs for correct guesses did not reduce this anchoring effect (Tversky & Kahneman, 1974).

Taken together, these heuristic models suggest that people do not make decisions in a consistent fashion. Moreover, there is research to suggest that people are susceptible...
to making bad decisions, even when they try to avoid erroneous decision-making processes (Kahneman & Tversky, 1979; Stanovich, 2010; Tversky & Kahneman, 1974). Indeed, there are many factors that influence the decision-making process. Finucane et al. (2002) suggest that there are five basic abilities that are required for good decision-making, including the ability to comprehend and recall pertinent information, organize the various facets of a decision and choices, understand the personal significance of the information, control or overcome impulsivity, and appropriately combine and consider all of the information. Some of these abilities will be explored further.

Risk Taking and Decision-Making

Traditional models of decision-making have attempted to capture the risky decisional process, but they have several shortcomings. Specifically, these models have been relatively simplistic and cannot explain regular deviations from proposed rational decisional processes (Stanovich, 2010; Tversky & Kahneman, 1979). Byrnes et al. (1999) argue that there are three major theoretical categories of risky decision-making (Lopes, 1987). The first category seeks to examine the differences between those people who take risks and those who do not. Thus, these theories conceptualize people as risk-seeking or risk-averse. The second category examines contextual differences that promote risk taking or risk aversion. Finally, the last category seeks to explain both individual differences and situational differences in risky decision-making. Accordingly, such theories seek to explain why certain people take risks in specific situations. Previous research also suggests that several factors influence risky decision-making. Some investigators argue that personal factors, such as age, gender, cognitive ability, and
personality traits are influential in risky decision-making (Finucane et al., 2002; Byrnes et al., 1999; Li, Baldassi, Johnson, & Weber, 2013; Davis et al., 2007), whereas others argue that decisional domain is influential in making such decisions (Hanoch, Johnson, & Wilke, 2006; Weber et al., 2002).

**Personal Factors Related to Decision-Making**

Research suggests that there are relationships among demographic variables - specifically age and gender - and decision-making (Byrnes et al., 1999; Charness & Gneezy, 2012; Finucane et al., 2002; Li, et al., 2013; Slovic, 1995). For instance, younger and older adults may vary considerably on the ways in which they make decisions as well as their decisional consistency (Finucane et al., 2002; Slovic, 1995). Specifically, Finucane et al. (2002) note that age-related cognitive changes in processing speed and memory may lead older adults to depend on simpler decision-making strategies, which could lead to a discrepancy in decision-making responses to identical questions framed differently. In fact, Finucane et al. (2005) found that older adults are more susceptible to framing effects compared to younger adults. Despite these differences, Finucane et al. warn investigators against interpreting such results as indicative of underlying biological differences and suggest considering other alternatives, such as education or motivation, to name a few. Accordingly, future research should seek to examine the influence of other, personal factors such as age-related changes in information processing styles that may affect decision-making. Research has also consistently found that males are more prone to risky decisions compared to females (Byrnes et al., 1999; Charness & Gneezy, 2012);
however, this research has not examined gender differences in risky decisions made across various decisional domains.

**Decision-making competence of younger and older adults.** Decision-making competence generally refers to two things. First, whether an individual is capable of making important life decisions. Secondly, and more generally, however, the term refers to whether competence is a function of age, and more specifically, if older and younger adults differ in their ability to make good decisions (Finucane et al., 2002). Research on age-related changes in decision-making abilities are mixed, with some investigators reporting that older adults make less accurate decisions, while others argue that older adults make equally or more accurate decisions than younger adults (Li et al., 2013). These differences in decision-making ability have been interpreted in various ways, but what is clear, is that further investigation into these differences are required.

Finucane et al. (2002) compared comprehension and consistency abilities of younger and older adults. Participants were required to make decisions in the three decisional domains of health, finance, and nutrition. Participants were provided with information regarding several Health Maintenance Organizations (HMOs) in tabular format and asked various literal and inferential questions about the information in order to assess general comprehension. The answers were presented in multiple-choice format. The investigators found that the older adults made significantly more errors than the younger adults, with the largest differences resulting from inferential questions. These findings suggest that older adults are more sensitive to the format of information and then such formats become more complex, comprehension suffers (Finucane et al., 2002).
Finucane et al. (2002) also assessed judgment consistency with respect to values assigned to several dimensions of the health care plans of the various HMOs. In this task, participants were presented with two hypothetical HMO plans, each with two pieces of information. Participants first evaluated each plan separately and then were presented side by side. For one problem, the investigators found both older and younger adults evidenced a preference reversal, where one plan was more attractive than the other when presented separately but when presented together, the opposite plan was judged as more attractive. Thus, the context of information significantly affected the participants’ judgments of attractiveness. Likewise, both groups of participants showed a strengthening of preference for one set of HMO plans when presented jointly compared to individually generated preference ratings. These findings are consistent with Hsee’s (1996) evaluability hypothesis, where judgment consistency will arguably suffer when information is presented within a context of comparison, thus allowing for alterations in the relative value assigned to options when additional, meaningful information is presented (Finucane et al., 2002).

Finucane et al. (2002) also asked participants to report their preferences for delegation and decision-making style. They found that older adults reported a stronger preference for delegating the responsibility of choosing their health care plan, whereas younger adults showed a significantly lower preference for delegation. Likewise, older adults perceived themselves as less rational-vigilant in their decision-making compared to younger adults. Older adults also reported significantly less skill in using information presented in tables and charts than younger adults. In a final analysis, Finucane et al.
found that age accounted for approximately five percent of the variance associated with performance on these tasks. Taken together, these findings suggest that informational context and decisional complexity significantly affect older adults’ ability to make competent decisions. Furthermore, older adults may recognize the increased difficulty associated with making competent decisions, which may lead them to delegate important decisions to others. A limitation of this study, however, was that decisional importance was not assessed. It is possible that decisions that are deemed more important by the individual will lead to increased effort or desire to make competent decisions for oneself. Additionally, it is unclear whether older adults are actually less accurate at making such decisions, or if they are more realistic about their abilities to use various types of data when making decisions.

Bruine de Bruin, Parker, and Fischhoff (2007) report that age does not negatively affect older adults’ ability to make competent decisions across all domains. Specifically, they found that, compared to younger adults, older adults performed better on tasks associated with recognizing social norms and resistance to sunk costs. They argue that this may reflect the fact that older adults have more knowledge and life experiences, which can assist them in making certain types of decisions. Furthermore, this lifetime knowledge may counter the effects of age-related changes to general cognitive abilities (Bruine de Bruin et al., 2007). Li et al. (2013) suggest that there are multiple pathways to optimal decisions and these pathways may depend on various forms of intelligence. Specifically, they argue that crystallized intelligence taps one’s accumulated knowledge gained through experience, while fluid intelligence captures one’s ability to generate,
transform, and manipulate information. Moreover, Li et al. note that crystallized intelligence appears to increase with age, plateauing around 60 years of age, while fluid intelligence diminishes slowly starting in one's twenties. Accordingly, age-related changes in intelligence and cognitive abilities may explain age-related differences in decision-making abilities.

Li et al. (2013) argue that older adult’s stable crystallized intelligence may provide an alternative route to good decisions, fully or partially making up for lower fluid intelligence. They have referred to this as the complementary capabilities hypothesis (CCH). Based on this model, decision quality depends on age as well as the relative influence of crystallized and fluid intelligence. Li et al. tested this hypothesis in a sample of 173 younger adults, aged 18 to 29 years, and 163 older adults, aged 60 to 82 years. Using structural equation modeling (SEM), they assessed whether older and younger adults differed on types of intelligence and five decision-making traits: temporal discounting, loss aversion, financial literacy, debt literacy, and anchoring. Temporal discounting measured the participant’s decision to receive immediate or delayed gifts taking into consideration an annual discounting factor. For example, would you prefer to receive a $60 gift certificate today or a $75 gift certificate in three months? Loss aversion assessed the participant’s sensitivity to fixed and varied losses in a number of binary gambles. Financial literacy measured the participant’s knowledge of essential economic concepts, while debt literacy assessed understanding of compound interest and credit card debt. Finally, anchoring examined numerical estimations based on various levels of anchor points (Li et al., 2013).
Li et al. (2013) found that the older adults performed equal to or better than the younger adults on these measures of decision-making and that participant age and type of intelligence partially explained differences in performance. Specifically, SEM provided evidence for the CCH effects on temporal discounting, financial literacy, and debt literacy. For financial literacy, direct effects of age were found, while for debt literacy age effects were exaggerated after controlling for types of intelligence. Li et al. note that these findings suggest that there is a component of the decision-making process that was not captured by this cognitive model, such as domain-specific knowledge. Furthermore, they argue that future research should seek to examine the influence of cognitive abilities and domain-specific knowledge on older and younger adults’ decisions.

Taken together, these findings suggest that there are some age-related differences in decision-making, where some tasks may be more difficult for older compared to younger adults. Comparatively, tasks that require the use of crystallized knowledge may be easier for older adults, as they generally have more crystallized knowledge than younger adults do. These findings also suggest that contextual factors play an important role in decision-making. Research also suggests that older and younger adults may use different types of intelligence, and consequently, different pathways to optimal decision-making. What is less clear, however, are how other personal factors, such as personality characteristics affect decision-making abilities. Furthermore, these studies did not examine age-related differences in risky decisions, which likely require more thorough, deliberate decisional processes.
Gender differences in risky decision-making. Research has consistently found that men possess a greater propensity to take risks compared to women (Byrnes et al., 1999; Wilson & Daly, 1985). Byrnes et al. (1999) conducted a meta-analysis on 150 studies that compared risk taking tendencies of males and females. The studies were categorized into three groups based on the type of task employed by the investigators: hypothetical choice, self-reported behavior, and observed behavior. Hypothetical choice tasks were those where the participants were asked to pick one of two imaginary options or choose a tolerable level of risk for a given hypothetical situation. Self-reported behavior tasks were those where the participant reported the frequency of engaging in various types of risky behaviors. Finally, observed behavior tasks had participants engage in various behaviors that were judged to have some degree of inherent risk and an observer-recorded behavior. The studies were further categorized based on task content. Three categories emerged for hypothetical choices, which included choice dilemma tasks, framing tasks, and other, which consisted of all other studies that did not fall into either of the previous categories. For the self-reported behavior tasks, five categories emerged and included drinking and drugs, driving, sexual activities, smoking, and other. Eight content categories emerged in the observed behavior studies: informed guessing, physical activity, driving, physical skills, gambling, risky experiments, intellectual risk taking, and other. Byrnes et al. also categorized all tasks based on ambiguity, where tasks were either ambiguous or unambiguous. Finally, the studies were coded based on age of the participants, year of publication, and type of publication.
Bynes et al. (1999) found that across 150 studies that examined gender differences in various types of risk taking behaviors, males were more likely to take risks than females. Moreover, they found that gender differences in risky behavior were also related to the participant’s age and the context of the risk. Results indicated that some tasks revealed significant gender differences based on the age of the participants. For instance, older participants evidenced greater gender differences in driving behavior than younger participants. Comparatively, some tasks were associated with smaller gender differences across all age groups, such as smoking. Interestingly, some behaviors (i.e. sexual activities) had greater gender differences for younger versus older participants, representing age-related shifts in perceptions of inherent risk (Bynes et al., 1999). These findings provide further evidence in favor of the argument that individuals may possess different attitudes towards risky behavior depending upon the context in which the behavior is situated. Furthermore, these findings suggest that as people age, the relative importance, or riskiness of various behavioral domains may change. Thus, risk propensity and tolerance may be more dynamic than previously thought.

A fundamental problem with these studies relates to the methods used to measure risk taking behavior and decisions. As Bynes et al. (1999) note, there are numerous definitions of risk taking and most definitions involve factors such as goals, options, outcomes, and values. Accordingly, variations in operational definitions of risk taking affect the ways in which risky behavior and decisional processes are measured. Broad definitions of risk taking conceptualize risk as involving the selection and application of alternatives that could lead to negative or undesirable outcomes. Such definitions allow
for the inclusion of various kinds of risky behavior, including those that may seem innocuous, such as raising one’s hand in class, to those that are considered dangerous, such as engaging in unprotected sex. Comparatively, narrow definitions generally reduce the inclusion of innocuous behaviors (Byrnes et al., 1999).

Charness and Gneezy (2012) note that there is extensive variation among the measures used to examine risk taking behavior, thus making cross-experimental comparisons difficult. In order to address this weakness, Charness and Gneezy compared the results of several studies conducted by various investigators that all used the same measure of risk taking. Specifically, participants were given an amount of money, $X$, and asked to report how much money they would like to invest in a risky investment option, $x$, and how much they would like to keep. The amount of money that is invested is subject to a dividend, $kx$ ($k > 1$), with a probability of $p$ and is lost with probability $1 - p$. Thus, the payoffs of these investments are $(X - x + kx)$ with probability $p$, and $(X - x)$ with $1 - p$ (Charness & Gneezy, 2012). In this investment game, $k$ and $p$ are set, such that the product of them is greater than one, which renders the expected value of investing greater than that of not investing. Accordingly, the choice of $x$, or the amount to invest, is the only decision that the participant makes. Risk-seeking participants are expected to invest more money, while risk averse participants are expected to invest less (Charness & Gneezy, 2012).

Charness and Gneezy (2012) found that across all studies, which were conducted by different investigators and subject to vast environmental differences, consistent gender differences on this task were reported. Specifically, men invested more money than
women, indicating that on this investment task, men were more risk-seeking than women. Based on these findings, Charness and Gneezy conclude that women make smaller investments in risk assets than men, suggesting general gender differences in financial risk taking decisions and behavior. One important limitation of this study is that only one domain of risk taking and decision-making was considered: financial. It is not clear whether there are more general gender differences in risky decisions and risk taking behavior. Accordingly, future research should seek to examine gender differences in risky decision-making across a variety of domains.

Given these consistent gender differences in risk taking behavior, investigators are examining possible factors that may lead males and females to evaluate risk differently. Hillier and Morrongiello (1998) proposed that school-age males and females may differ in their appraisals of risk as well as their beliefs regarding their vulnerability to personal injury. In this study, school-aged children, ages 6 – 10 years, were shown pairs of photographs, one depicting an unsafe situation and the other depicting a safe situation for which they had to make decisions about vulnerability to injury, severity of injury, and overall relative and absolute riskiness. There were three situations: stairs, bicycle, and playground, which varied on level of risk: no-risk, low-risk, medium-risk, and high-risk.

Hillier and Morrongiello (1998) found that girls rated the various situations as riskier than the boys, but found no gender differences for relative risk judgments. They also found gender differences in the most significant predictor of absolute risk ratings. Girls’ rating of the vulnerability to injury was the most significant predictor of absolute
risk ratings, whereas boys’ rating of severity of injury was the most significant predictor of absolute risk ratings. Therefore, when making judgments of risk, girls seem to question, “Will I get hurt”, whereas boys wonder, “How will I get hurt” (Hillier & Morrongiello, 1998, p. 235). Accordingly, they argue that such differences may translate into different approaches to risk taking behavior, where girls may be more likely to avoid taking risks when they perceive themselves as vulnerable to injury, whereas boys may engage in such risky behavior if they do not perceive possible injuries to be severe. Likewise, girls may be more likely to learn to avoid certain risk taking behaviors if they have previously resulted in minor injury, whereas boys may not be deterred from acting if they have obtained minor injuries in the past.

Interestingly, Hillier and Morrongiello (1998) did not find significant gender differences in the children’s ability to identify hazards across the various scenarios, suggesting that boys and girls differentially process injury-related cues, thus leading them to make different decisions about engaging in risky activities. Also interesting, the investigators did not find age differences in perceptions of overall risk, although there were age differences in perceived vulnerability to risk. They suggest that children perceive the same degree of injury severity across ages and that despite age-related reductions in ratings of perceived vulnerability to injury, overall risk perceptions remain stable across age. Younger children were slower to rate a situation as risky, which has much practical significance. Specifically, faster identification of potential risk allows greater precautionary measures to be taken, thus slower risk assessments may render younger children more vulnerable to actual risks. Collectively, these findings suggest that
males and females may differentially evaluate and weigh various cues of risk, leading to gender differences in risky behavior and decision-making. It is possible that these gender differences in cue perception and evaluation are stable, which could explain the consistent findings of gender differences in risky decision-making and behavior across all ages.

Given the abundance of literature that supports the notion of gender differences in risky decision-making, a new line of research seeks to investigate gender differences in risky decision-making across various decisional domains, such as financial, recreational, and social, to name a few. Weber et al. (2002) argue that gender differences in risk perception may vary by content domain in which the decision is to be made, suggesting that gender differences may be the result of domain-specific differences in perceived risk attitude. Accordingly, these investigators created the Domain-Specific Risk-Attitude Scale (DOSPERT), which measures risk perception and behavior across five domains: social, financial, recreational, health/safety, and ethics. They found that in a sample of 560 adults (307 women and 253 men), males and females significantly differed in their risk perception scores across all domains except for social, where women perceived the risks to be greater, although this difference was not statistically significant. Similarly, males and females reported differences in risk taking behavior across these domains except for social, wherein males reported that they were more likely to take risks in all domains. Interestingly, Weber et al. also found that at the level of the individual participant, risk attitude was not consistent across all domains, where no one was consistently risk-averse across all domains, and only a small number (four participants)
were consistently risk-seeking across all domains. Accordingly, these findings suggest that males and females differ in their perceptions of risk as well as their risk taking behavior; however, these differences do not necessarily suggest that males are risk-seeking in all decisional domains and females are risk-averse in all domains. Rather, these findings suggest that there are stable gender differences but that content domain is an important determinant in both risk perception and risk taking behavior.

Similarly, Harris et al. (2006) found consistent gender differences in risk perception across four domains: gambling, health, recreational, and social decisions. For each type of scenario, the participants rated their perceptions of the probability of negative consequences, the likelihood of engaging in the risky behavior, the severity of the perceived negative consequences, and perceived enjoyment from engaging in each behavior. Compared to women, men reported significantly greater likelihoods of engaging in a variety of risky behaviors in the gambling, health, and recreational domains. Across these three domains, women judged the probability of negative consequences as more likely and the severity of these consequences to be greater in the gambling and health domains. Males reported greater perceived enjoyment in these risky behaviors across all domains compared to females. In the social domain however, males and females did not significantly differ in the reported probability of engaging in the risky behaviors, nor were there differences in perceived negative consequences or ratings of enjoyment of such activities. Comparatively, women rated the severity of possible consequences as greater for all behaviors in the social domain compared to men. Mediation analysis found that perceptions of negative consequences and perceived
enjoyment of engaging in the risk behavior partially mediated the gender differences in reported probability of engaging in the risky behavior. For the gambling and health domains, severity of the possible negative consequences was also a significant partial mediator of the likelihood of engaging in these risky behaviors. These findings dovetail those of Weber et al. (2002) and suggest that males and females may be differentially affected by perceptions of the likelihood of negative consequences, severity of these consequences, and perceived enjoyment of the behavior while making risky decisions across a variety of domains.

Harris et al. (2006) also examined positive risky behaviors, which were those with a small potential for substantial gain with a limited certain cost. An example of such a behavior includes calling into a radio contest or purchasing a lottery ticket. For these types of risky behaviors, women reported being more likely to engage in risky behaviors and perceived greater probabilities of positive outcomes compared to men. Accordingly, when there is no severe risk of negative consequences and instead a potential to gain positive outcomes, women are more likely than men to engage in risky behaviors. Mediation analysis suggests that women are more likely to judge the possible positive consequences as more likely to occur and they judge these consequences as more influential than men. These findings suggest that when making risky decisions, men and women differentially use probabilities of negative and positive consequences, where women appear to be more averse to negative possible consequences.

Accordingly, the research on domain-specific risk taking propensity and behavior suggest that there are stable gender differences, with males being more likely to engage
in risky behavior with possible negative outcomes. This line of research also suggests that males are not necessarily risk-seeking and females risk-averse; rather, risk taking behavior is largely influenced by the decisional domain. Moreover, men and women appear to use different domain-specific assessments of the probability of positive or negative consequences and beliefs about the severity of such consequences when making risky decisions. The next logical step in this line of research is to investigate age, or generational differences in risk-propensity and risk taking behavior. Furthermore, such research may seek to examine age by gender differences, which will further illuminate risky decision-making processes.

**Impulsivity and Decision-Making**

In general, impulsivity refers to the tendency to act without much forethought, which may lead to reckless or risky behavior (Davis et al., 2007). Eysenck and Eysenck (1978) proposed that impulsiveness relates to two personality dimensions: extraversion and psychoticism. Accordingly, they argue that venturesomeness, or a disposition to act, regardless of knowledge of the risk involved in the behavior, is related to extraversion. Comparatively, impulsiveness, or one’s inclination to engage in a behavior without much forethought and failure to recognize the inherent risk in such behavior, relates to psychoticism. From this perspective, it is possible that individual differences in personality and impulsiveness will relate to differences in behavior, including one’s tendency to engage in risky behaviors. Furthermore, impulsivity may play a critical role in decision-making, especially when considering risky decisions.
Previous research suggests that impulsivity is a multidimensional construct (White et al., 1994); however, investigators disagree on which factors characterize impulsivity (Miller, Joseph, & Tudway, 2004). Miller et al. (2004) examined the component structure of four widely used self-report measures of impulsivity, which included the Barratt Impulsiveness Scale 11 (BIS-11; Patton, Stanford, & Barratt, 1995), the Eysenck Impulsivity Inventory (IVE); also called the Impulsiveness Questionnaire or I7 (Eysenck, & Eysenck, 1978), the Dickman Impulsivity Inventory (DII; Dickman, 1990), and the Behavioral Inhibition and Behavioral Activation Scales (BIS/BAS; Carver & White, 1994). The investigators were interested in determining whether these scales measured broad or narrow components of impulsivity. The proposed factor structure of the BIS-11 was not supported in this study. Miller et al. note that the subscales of BIS-11 may not be orthogonal and may represent interrelated sub-factors of a super factor of impulsivity. Likewise, the proposed factor structure of the BAS scale was not supported. Specifically, the subscales of the BAS all loaded highly onto one factor, suggesting that the BAS may be unidimensional (Miller et al., 2004). Taken together, these findings suggest that the BIS-11 and the BAS may be better understood as unidimensional measures of impulsivity. Given the literature supporting multidimensional conceptualizations of impulsivity (White et al., 1994), these assessments may not be ideal for measuring impulsivity.

Miller et al.’s (2004) findings suggest that the DII and I7 scales have similar two-component structures. Additionally, the strong correlations among subscales indicate that both scales measure the same aspects of impulsiveness. These findings also support the
notion that impulsiveness can be conceptualized as a multidimensional construct and thus should not be examined using unidimensional measures. Miller et al. propose that impulsivity may be ideally conceptualized as consisting of three components. Given that Eysenck and Eysenck (1978) conceptualized impulsivity as an aspect of personality, it is likely that impulsivity uniquely affects one’s decision-making process, especially when making risky decisions, which require more deliberate decisional processes. Likewise, greater impulsivity may cause clinically significant impairments across a variety of domains, including social, occupational, and educational, which also affects one’s decision-making abilities. For instance, individuals with Kleptomania repeatedly fail to control the impulse to steal objects even when such objects are not necessary for personal use or hold no monetary value (APA, 2013). Consequently, failure to control the impulse to steal overrides one’s decision-making abilities because there is no apparent reason for stealing. For the purposes of this study, non-clinical impulsivity that is characteristic of normal personality functioning will be examined.

Previous research suggests that impulsivity affects risky decision-making (Crone, Vendel, & van der Molen, 2003; Davis et al., 2007; Penolazzi, Gremigni, & Russo, 2012). For instance, Crone et al. (2003) examined the effects of disinhibition and age on performance on the Iowa Gambling Task (IGT) and the reverse IGT in a sample of adolescents and adults. The IGT is an experimental gambling card task where participants are given fake money and must make a series of card selections from four decks of cards. Like real gambling, the goal is to generate as much profit as possible. The decks of cards are rigged, such that two of the decks result larger immediate gain, but are
disadvantageous in the end as there are larger penalties. The other two decks produce a smaller immediate gain and lead to greater future advantages due to lower penalties. The participants are allowed to choose cards from any of the decks as they wish, but are not told how many card selections they will be required to make (Bechara, Damasio, Damasio, & Anderson, 1994). In the reverse IGT, penalties are administered upfront and reward is gained later. Those decks with higher penalties also yielded higher rewards and those decks with lower penalties yielded lower rewards. Again, the high paying decks result in equivalent net gains as did the low paying decks (Crone et al., 2003).

Crone et al. (2003) slightly altered the original IGT insofar as money was substituted with apples, where the participants were gambling apples. The investigators found that as the IGT progressed, the low-disinhibited participants made more advantageous choices, evidencing learning, whereas the disinhibited individuals did not. On the reverse task, however, the disinhibited individuals appeared to make more advantageous choices as the task progressed. Crone et al. report that these findings are consistent with previous literature and may suggest that such individuals make poor decisions in their real lives. This suggests that disinhibited individuals may use faulty response sets that are less attuned to processing future consequences which may require a shift in response set or approach. Their finding that disinhibited people performed better on the reverse IGT is surprising and suggests that perhaps disinhibited people are sensitive to rewards opposed to future consequences.

There were also age-related differences on task performance. The youngest participants (12 – 13 year olds) had the fastest response times compared to the older
adolescents (15 – 16 years) and young adults (college students). In fact, the young adults had the slowest response times of all groups. Additionally, participants who were disinhibited had faster reaction times compared to the inhibited group. These findings are consistent with age-related trends that Crone and van der Molen (2007) found in another sample. Specifically, these findings suggest that younger individuals are less sensitive to future outcomes than older samples (Crone et al., 2003; Crone & van der Molen, 2007). Accordingly, these findings suggest there may be age-related changes in disinhibition, or impulsivity, where older participants evidence less disinhibition than younger participants. A limitation of this study, however, was that they did not examine age-related changes in impulsivity in adult samples. Specifically, they failed to address whether or not people become more inhibited as they age, or if this trend plateaus at some point during adulthood.

Davis et al. (2007) also found that participants who were more impulsive performed more poorly on the IGT. Specifically, they found that those participants who failed to learn the task well enough to generate a positive amount of money over the five blocks, were significantly more impulsive than the learners. They conclude that highly impulsive people may perform more poorly on decisions that require the decision maker to learn from previous mistakes and adjust behavior accordingly. With respect to risky decisions, highly impulsive participants were likely to make fast, poorly judged, and inconsistent decisions (Davis et al., 2007). Overall, these findings are consistent with those of Crone et al. (2003) insofar as individuals who are disinhibited or more impulsive tend to make poorly judged decisions that may be less sensitive to future consequences.
Interestingly, there is evidence to suggest that as highly impulsive individuals age they may become less disinhibited; however, Davis et al. findings suggest that impulsivity continues to negatively affect the decision-making abilities of adults in their 30s and 40s. An important limitation of these studies is that longitudinal data regarding individual changes in impulsivity has not been collected. Thus, it is difficult to make conclusions about how individual differences in impulsivity affect decision-making across the life span. Future research should seek to explore this limitation.

Penolazzi et al. (2012) suggest that the decisional context, as well as the available information regarding the decision, directly influences the type of decision-making resources that are activated. These investigators assessed various factors related to decision-making, including impulsivity, and how these factors affected performance on the Columbia Card Task (CCT). The CCT is similar to the IGT insofar as the participants are instructed to try to maximize their game score through deciding upfront the number of cards they would like to draw from a deck of 32, which possesses both gain and loss cards. Three aspects of the game influence their decision: the amount of loss cards in the deck, the amount of points gained by choosing a gain card, and the amount of points lost by choosing a loss card. There are two versions of the game, the Hot task and Cold task versions. During the Hot task, the participant makes stepwise card selections by revealing one card at a time and receiving immediate feedback. The participants are allowed to decide when they would like to discontinue playing, thus taking the round payoff, or they continue to play until they reveal a loss card, at which point the game ends. The Cold task of the CCT requires the participant to indicate upfront the number of cards that they
would like to turn over during a given condition. Only at the end of each session will the participant receive feedback regarding their decision.

Penolazzi et al. (2012) found that participants who had higher trait impulsivity as measured by the I7 were more likely to select more cards during the Cold task of the CCT than participants with low trait impulsivity. They argue that the Cold task of the CCT has been shown to stimulate deliberative decision-making strategies, opposed to affective decision-making strategies. In this study, highly impulsive participants appeared to utilize affective decision-making strategies on a task that required more careful consideration. Furthermore, Penolazzi et al. suggest that these findings may indicate that impulsive people may struggle with real world cognitive based decisions requiring careful consideration of various options and outcomes. Although this study examined how personality characteristics such as impulsivity influence risky decision-making processes as measured by an experimental gambling task, the investigators did not examine how impulsivity affects risky decisions across a variety of decisional domains.

Taken together, these findings suggest that impulsivity, or disinhibition, negatively affects decision-making processes and can lead to inferior decisions. Additionally, there is evidence to suggest that there are age-related differences in impulsiveness, which adds another element to this analysis. Much of the research that has examined the relationships among impulsivity and decision-making have utilized gambling type tasks, which arguably represent real life risky decisions. One important limitation of such research is that decisional domain has been largely unexplored. Some investigators suggest that risky decisions may be related to the domain in which the
decision must be made, where some domains may yield higher risk tolerance than others (Hanoch et al., 2006; Weber et al., 2002). Given that previous research has shown that risk propensity is a function of decisional domain (Weber et al., 2002), future research should examine how impulsivity affects risky decisions made across a variety of decisional domains.

**Issue Involvement and Decision-Making**

Previous research has found that issue involvement is an influential factor in decision-making (Petty & Cacioppo, 1979; Petty & Cacioppo, 1990; Maheswaran & Meyers-Levy, 1990; Pham, 1998). Issue involvement refers to the degree to which one is invested or involved in a particular issue or decision. Petty and Cacioppo (1979) suggested that the degree to which one is invested in an issue will increase or decrease the effects of persuasion, as the individual will be more motivated to attend to and process relevant information, thus affecting decision-making. They also note that there are two types of issue involvement. One type of issue involvement pertains to whether the attitudinal issue is of personal importance. This has also been referred to as ego-involvement, personal involvement, and personal relevance (Petty & Cacioppo, 1979; Pham, 1998). Comparatively, the second type of issue involvement, referred to as response involvement, pertains to whether the response is of importance. This has also been referred to as task involvement (Petty & Cacioppo, 1979).

Petty and Cacioppo's (1979) research has focused on the first type of issue involvement. They note that highly involved individuals report a sense of intrinsic importance in the issue and perceive the issue as having a significant impact on their
They report that most of the early work concerning issue involvement sought groups of participants that naturally differed on the extent to which they were involved with a particular issue, while later work sought to manipulate the level of involvement. Such manipulations translated into presenting participants with issues with which they were highly involved, such as the possibility of increasing tuition for college students, and issues with which they had low levels of involvement, such as expanding public park acreage in a nearby park. Additionally, manipulation studies used message framing designs that made participants believe that proposed changes would or would not directly affect them (Petty & Cacioppo, 1979).

Petty and Cacioppo (1979) conducted a manipulation study to examine the cognitive response framework of the effects of issue involvement. In this study, they had 24 male college students listen to arguments about changes in university policies regarding mixed-sex visitation and these arguments were either of high or low importance. This study involved a 2x2 design, where importance and attitude were manipulated. High importance arguments were those where the policy changes were proposed to be instated at the students’ current school, while low importance arguments suggested that the policy changes would be instated at a school in the area. The Participants either heard a message that was for (proattitudinal) or against (counterattitudinal) such policy changes. Petty and Cacioppo predicted that high involvement would enhance message processing. In order to measure the participants’ attitudes, Petty and Cacioppo had participants read the following statement and rate their position on four scales: “Because your own opinion about the position advocated on the
tape may influence the way you rate the quality of the tape, we would like to obtain a measure of how you feel about the views proposed by the speaker on each scale below” (1979, p. 1918).

Petty and Cacioppo (1979) found that those participants in the high involvement condition indeed found the arguments more involving than those participants in the low involvement condition. They also found that issue involvement significantly reduced the effectiveness of the counterattitudinal message and heightened the effectiveness of the proattitudinal message. Furthermore, they found that high issue involvement amplified persuasion for strong messages and reduced the persuasion of weak messages. These findings suggest that issue involvement affects the perceived importance of a message, thus influencing the persuasion of an argument (Petty & Cacioppo, 1979).

Maheswaran and Meyers-Levy (1990) reported similar findings and suggested that when issue involvement was low, participants based their attitudes and responses on simple inferences. When issue involvement was high, however, participants appeared to process the message in detail and integrate it with issue-relevant information, yielding greater persuasiveness. They also found an interaction between issue involvement and message framing, where under low involvement conditions, participants were more likely to be persuaded by positive frames compared to negative frames. Under high involvement conditions, however, they found that participants assigned disproportionate weight to negatively framed messages, thus making them more persuasive than positively framed messages. Maheswaran and Meyers-Levy argue that these findings suggest that
decision-making processes are complex and appear to be dependent upon the integration of relevant information, such as message frame and issue involvement.

One limitation of these studies is that they have only examined issues involvement within the context of message framing studies. Consequently, research has not investigated how issue involvement, decisional domain, and other personal factors, such as age, influence risky decisions made in various domains. It may be that people are more or less prone to making risky decisions when those decisional domains are of significant importance.

**Cognition, Numeric Ability, and Decision-Making**

Research suggests that there are age-related changes in cognitive abilities, such as executive functioning (EF), intelligence (crystalized and fluid), working memory, and numeric ability (Del Missier, Mäntylä, & Bruine de Bruin, 2012). Moreover, such changes may affect the ways in which people make decisions and overall decision-making competence. For instance, Finucane and Gullion (2010) found that crystalized intelligence scores remained relatively high across groups of older adults aged 25 to 97 years. Comparatively, fluid intelligence scores were negatively related to age, with the oldest group of participants (ages 75 to 97 years) having the lowest scores. Lower fluid intelligence has been associated with greater susceptibility to framing effects (Finucane et al., 2005) and poor application of decisional rules (Bruine de Bruin et al., 2007). Finucane et al. (2005) also report that cognitive skills, including fluid and crystalized intelligence, accounted for approximately 46% of the variance associated with performance on comprehension problems in this sample of adults. Accordingly, cognitive
abilities play an important role in decision-making processes and persons of various ages may make risky decisions differentially based on their cognitive abilities.

Li et al. (2013) hypothesized that the type of intelligence required to make various types of decisions may lead to different decisional outcomes among older and younger adults. Specifically, they suggest that older adults may perform better on decisions that require strong crystallized intelligence compared to younger adults. Likewise, they hypothesize that decisional performance that is based on fluid intelligence may suffer in older compared to younger samples due to age-related decreases in fluid intelligence. They also proposed a complimentary effects hypothesis, which stated that older adults’ intact crystalized intelligence will provide an alternative pathway leading to good decisions and may at least partially buffer the negative effects of lowered fluid intelligence. They found that in a sample of younger (age range: 18 – 29 years, $M = 24.76, SD = 2.91$) and older adults (age range: 60 – 82 years, $M = 66.39, SD = 4.93$), the younger adults outperformed their counterparts on measures of fluid intelligence, while the older adults outperformed the younger participants on measures of crystallized intelligence (Li et al., 2013).

Li et al. (2013) also assessed the influence of intelligence, temporal discounting, loss aversion, financial literacy, and anchoring, which are traits that affect decision-making processes, on various economic decisions. Temporal discounting refers to the extent to which one discounts future gains or losses and research suggests that it has a significant influence on financial decisions, such as whether to borrow money with a credit card. Loss aversion refers to the extent to which the value of potential loss
outweighs the value of potential gains and has been shown to affect financial decisions regarding stocks and investments, to name a few. Financial literacy refers to the extent to which one comprehends financial information and decisions as well as the ability to make competent decisions related to debt contracts and interest rates. Financial literacy has a significant influence on consumer's borrowing and saving behavior. Finally, vulnerability to anchoring refers to the degree to which one number may influence later number judgments. Susceptibility to anchoring has been shown to influence consumer judgments of buying and selling prices, perceptions of product values, and credit card repayment decisions.

Li et al. (2013) found that older and younger adults did not significantly differ on measures of economic decision-making. Furthermore, they report that type of intelligence partially explained age-related differences on the four types of decision-making traits. Specifically, they report that the older adults' higher levels of crystalized intelligence offset their lower levels of fluid intelligence on decisions that were affected by temporal discounting, financial literacy, and debt literacy. Despite this finding, age had a direct effect on economic decisions affected by financial literacy and the effects of age were intensified after controlling for type of intelligence on debt literacy decisions. Li et al. suggest that these two areas may be affected by domain-specific knowledge, which was not measured in this study. Accordingly, future research should seek to obtain a baseline measure of domain-specific knowledge when assessing the effects of cognitive abilities on decision-making processes.
Del Missier et al. (2012) examined the effects of specific types of cognitive abilities, namely fluid intelligence and numeric ability, and executive functioning on decision-making competence of adults. Specifically, they were interested in determining whether type of cognitive ability mediated the relationship between executive functioning and cognitively demanding decision-making tasks as measured by the Iowa Gambling Task. Del Missier et al. found that type of cognitive ability and executive functioning are related to performance on demanding decision-making tasks. Specifically, they found that fluid intelligence was positively correlated with decision-making performance, with the strongest correlations with the most demanding decisional tasks. Accordingly, fluid intelligence is one type of cognitive ability that appears to influence individual performance on decision-making tasks. An important limitation of this study is that only one type of decisional task was utilized. Thus, it is difficult to extend these findings to other, non-financial risky decisions that people make on a regular basis. Consequently, Del Missier et al. suggest that future research should seek to examine the influences of cognitive ability and executive functioning, as well as task specificity on decision-making processes.

Based on these previous findings, it appears that different types of cognitive abilities, such as type of intelligence, may differentially affect performance on risky decision-making tasks. Furthermore, it appears that age-related changes in cognitive abilities may add another layer of complexity to this relationship. Specifically, it has been suggested that as people age, they may rely more heavily on task nonspecific resources, such as crystalized intelligence when working a problem that taps into fluid intelligence.
It has been suggested that this reliance, or compliment, may buffer the effects of age-related changes in cognitive abilities on task performance. Another type of cognitive ability, numeracy, is also important when making decisions, especially those that are based on numeric information.

One of the most critical aspects of understanding risk communication relates to the respondent’s ability to understand numerical expressions of risk, such as probabilities, percentages, proportions, and frequencies. Peters (2008) suggests that when respondents do not understand the data pertaining to the risk, it leads to confusion and difficulty in understanding the consequences of the risk not only for themselves, but for others as well. Such confusion reduces the respondent’s ability to make an effective decision. Finucane and Gullion (2010) found that numeric ability accounted for 3.9% of the variance associated with performance on comprehension problems for a sample of adults. Research also suggests that innumeracy may actually interfere with an individual’s ability to make risky decisions, especially those related to personal health risks (Lipkus et al., 2001; Schwartz, Woloshin, Black, & Welch, 1997).

Schwartz et al. (1997) examined the relationship between numeric ability and women’s ability to discern the benefit of mammography after receiving quantitative information regarding health benefits of this screening. The sample included women aged 27 to 88 years and 96% of this sample had completed high school. Numeric ability was assessed with three questions that examined familiarity with probabilities, percentages, and proportions. Each participant also received one of four types of risk reduction data that only differed in how the messages were framed. These messages were either framed
in a percentage of risk reduction, percentage along with baseline data regarding the risk of dying from breast cancer within the next 10 years, probability of risk reduction, or the probability of risk reduction along with baseline information regarding the risk of breast cancer death in the next 10 years. The investigators also examined the women’s perceived risk for death from breast cancer using two scenarios, one of which asked them to report on the number of women per 1000 whom they believed would not get screened yearly and the other asked them to report the number of women per 1000 they believed would get screened yearly. Risk accuracy was assessed by comparing the women’s responses about death rates per 1000 for not getting screened and their responses about death rates per 1000 with screening. The accuracy was determined based on how well the women were able to apply the risk reduction data to their perceived risk of death, thus the change in perceived risk with and without screening was of importance (Schwartz et al., 1997).

Schwartz et al. (1997) found that almost half of the sample did not answer a simple probability question regarding a coin flip correctly. The women in this study also evidenced difficulty with converting percentages to probabilities, with difficulty of conversion leading to more errors. Surprisingly, 30% of this sample did not answer any of the three numeric questions correctly. Furthermore, the investigators found that after reading about risk reduction data, most women erroneously applied this information to estimates of perceived risk of death of breast cancer both with and without mammography. It appeared that all four types of risk reduction data were similarly poorly applied to estimates of risk. The investigators found that higher numeric ability was
associated with more accurate applications of relative risk information (Schwartz et al., 1997). Taken together, these findings suggest that there is a strong association between numeric ability and risky decision-making. Perhaps most alarming is that almost all of this sample had a high school education, yet was unable to solve simple numeric problems. It is clear that innumeracy negatively affected the women’s ability to make accurate decisions regarding relative risk. These findings raise important implications for advertisers and medical professionals who regularly use quantitative data in their communication of risk.

Lipkus et al. (2001) examined global numeric ability in a sample of 463 well-educated adults aged 40 years and older who had post-secondary education. They used two scales to assess numeric ability: a general scale, which consisted of three questions that tapped into probability, percentage, and proportion ability, and an extended numeracy scale that assessed these same areas, but within a health risk context. They found that approximately 40% of their sample was not able to correctly respond to the general numeracy items, such as converting a percentage to a proportion. Likewise, they found that converting probabilities to proportions was the most difficult task, as indicated by poorest performance in this sample. Overall, they found that approximately 15% to 21% of the sample was able to correctly respond to all general numeracy items, whereas 29% to 34% correctly responded to all of the expanded numeracy items. Taken together these results suggest that even well-educated adults have difficulty accurately using and interpreting risk communications that involve basic mathematics. Furthermore, the authors suggest that accurate performance to numeracy items posed within the context of
health risks does not mean that the respondent will understand the consequences of the risk or apply this information to themselves. Thus, these findings suggest that numeric ability may influence risky decision-making; however, other factors may intervene and prevent the respondent from personalizing the presented risk.

Schwartz et al. (1997) note that the majority of research pertaining to numeric ability and risky decision-making has been situated within message framing paradigms, where identical information is presented in different ways in order to determine the influence of the message context, or frame on decision-making. Peters et al. (2006) report that less numerate individuals show greater susceptibility to framing effects. They also argue that those with greater numeric ability may be better able to access the required numeric principles that allow them to transform the information within the frame more accurately. Much less research has examined the role of decisional domain on perceptions of risk and risk behavior (Weber et al., 2002).

**Decisional Domain, Risk Taking, and Decision-Making**

Recently, a number of investigators have begun to challenge the widely held belief that people can be classified as generally risk taking or risk averse. This dichotomy suggests that one's risk propensity is a stable trait (Blais & Weber, 2006; Hanoch et al., 2006; Weber et al., 2002). Weber et al. (2002) argue that people generally differ in their attitudes towards risk and previous measures of risk taking attitudes have failed to adequately measure this concept. Specifically, they argue that previous measures situated within the expected utility (EU) framework lack cross-domain consistency and predictive validity. Accordingly, these investigators created the Domain-Specific Risk-
Taking Scale (DOSPERT), which seeks to examine one’s perception of risk, attitude towards perceived risks, and expected benefits from engaging in the risky behavior.

Hanoch et al. (2006) examined the external validity of the DOSPERT using homogeneous samples of risk taking individuals. In order to achieve this, they selected samples of people who are risk seekers in each domain, including but not limited to skydivers, smokers, and gamblers, as well as individuals who are risk averse in the health domain, using gym attendance as a proxy measure of health consciousness. They hypothesized that within each domain, the target subsample would show greater risk tolerance compared to the other subsamples. Furthermore, they hypothesized that the subsamples would not show the same risk propensity across all domains, suggesting that risk tolerance is domain specific. Finally, they hypothesized that the subsample of risk adverse individuals (gym attendees) would show less risk behavior in the health domain.

Hanoch et al. found that there was a significant domain by subsample interaction, where the subsamples of risk-takers evidenced greater risk propensity in the target domain compared to the other subsamples. Likewise, the risk adverse subsample of gym attendees had significantly lower risk tolerance compared to the risk-seeking smokers within the health domain. Accordingly, these results support the validity of the DOSPERT in identifying individual differences in domain-specific risk tolerance.

Hanoch et al. also found that the subsamples reported significantly different levels of expected benefit for engaging in the risky behavior across the domains, suggesting that those who are risk seeking in a given domain perceive greater benefits compared to those who are less risk seeking or risk adverse. Interestingly, Hanoch et al. found that the
subsample of gamblers had significantly lower risk perceptions than the other subsamples. Taken together, Hanoch et al. reported that these findings suggest that the expected benefits of engaging in domain-specific risky behavior may be more influential in determining risk propensity than perceived risk. Likewise, these results show that individual differences in expected benefits and risk propensity relate to differences in risky behavior across a variety of domains (Hanoch et al., 2006).

Hanoch et al. (2006) report that there are mixed results in the literature pertaining to predictors of risky behavior. Specifically, they found that domain-specific expected benefits of risky behavior were more predictive of risk propensity than perceived risk; whereas Weber et al. (2002) and Blais and Weber (2006) found that perceived risk was more predictive. In fact, Blais and Weber found that controlling for risk perception reduced the within-individual, or domain-level, variance in risk taking by 59%. One reason for these inconsistent findings may be due to the study participants. Hanoch et al. selected participants who were risk seeking or risk adverse across domains in an effort to test the external validity of the DOSPERT. Comparatively, Weber et al. used a heterogeneous group of college students. Based on these findings, future research should seek to examine the predictive nature of the DOSPERT using both heterogeneous and homogeneous samples. Additionally, investigators should examine whether predictors of risk differ for individuals who have high versus low risk tolerance across the decisional domains.
Significance of the Present Study

As previously noted, traditional models of risky decision-making do not accurately capture the complexity of decision-making processes. Likewise, much of the contemporary literature has examined single factors that interfere with decision-making processes, but fail to provide a holistic model of universal personal factors that influence risky decision-making. Research also suggests that people may vary in their tendency to make risky decisions depending on the domain in which the decision is required. To date, only a few studies have examined the effect of decisional domain on the decision-making process. Likewise, little is known about the stability of decision-making processes across the adult lifespan. Accordingly, this study tested comprehensive models of risky financial and health-related decision-making that examined the influence of personal factors including age, gender, cognitive abilities (including crystallized and fluid intelligence), numeric ability, trait impulsivity, and domain-specific risk perception, attitude, and expected benefits of risky decisions.

The Present Study

The present study utilized hierarchical linear regression analysis to test the moderating effects of the DOSPERT subscales (expected benefit of engaging in risky behavior, perceived risk, and attitudes towards risk) and impulsivity on the relationships between cognitive abilities (intelligence and numeric ability), and health and financial risky decisions. Young adults enrolled in college psychology courses as well as older adults enrolled in fitness programs were included in this study.
Hypothesis 1

It was predicted that males and females would differ in the number of risky domain-specific decisions that they make.

**Hypothesis 1a.** Males will make more risky financial decisions than females.

**Hypothesis 1b.** Males will make more risky health decisions than females.

**Justification for Hypotheses 1a and 1b**

Previous research indicates that males make riskier decisions and engage in more risky behavior than females (Byrnes et al., 1999; Charness & Gneezy, 2012; Harris et al., 2006; Hillier & Morrongiello, 1998; Weber et al., 2002). This gender trend has also been replicated in domain-specific risk taking behavior (Harris et al., 2006; Weber et al., 2002). It was predicted that gender differences in risky decision-making in financial and health domains will be replicated in this study. It was also proposed that significant gender differences in risky decision-making would be controlled in subsequent analyses.

Hypothesis 2

It was predicted that older and younger adults would differ in the number of risky domain-specific decisions that they made. Specifically, younger adults would make more domain-specific risky decisions than older adults.

**Justification for Hypothesis 2**

Previous research regarding decision-making competence among older and younger adults yields mixed findings (Li et al., 2013). Additionally, research suggests that a variety of factors, such as the context of information under consideration and intelligence may affect older and younger adults’ ability to make competent decision
Collectively, research suggests that there may be some age-related differences in decision-making abilities of older and younger adults; however, additional research is required to assess age-related differences in domain-specific risky decision-making. It was proposed that if older and younger adults differed in the amount of domain-specific risky decisions that they made then age would be entered as a covariate in subsequent analyses.

**Hypothesis 3**

It was predicted that subscale scores of the DOSPERT (Perception of risk, Attitudes towards risk, and Expected benefits of risky behavior) would moderate the relationships between cognitive abilities (total cognitive abilities and numeric ability) and risky financial decisions (see *Figure 1*).
Hypothesis 3a. Hypothesis 3a stated that cognitive abilities will be significantly and negatively related to risky decision-making, but this relationship will be moderated by risk perception, such that risk perception will increase the impact of cognitive abilities on risky financial decision-making.

Hypothesis 3b. Hypothesis 3b stated that cognitive abilities will be significantly and negatively related to risky decision-making, but this relationship will be moderated
by risk taking, such that risk taking will decrease the impact of cognitive abilities on risky financial decision-making.

**Hypothesis 3c.** Hypothesis 3c stated that cognitive abilities will be significantly and negatively related to risky decision-making, but this relationship will be moderated by expected benefits, such that expected benefits will decrease the impact of cognitive abilities on risky financial decision-making.

**Justification for Hypotheses 3a, 3b, and 3c**

Previous research indicates that there is a direct relationship between cognitive abilities and risky financial decision-making and it is has been suggested that this relationship is affected by domain-specific knowledge (Li et al., 2013). Similarly, perception of risk, attitudes towards risk, and expected benefits of engaging in risky behavior are significant predictors of risky financial decision-making (Blais & Weber, 2006; Hanoch et al., 2006; Weber et al., 2002). In the present study, domain-specific risk perception, risk taking, and expected benefits of risky behavior were proposed to moderate the relationship between cognitive abilities and risky financial decision-making as these variables may influence the relative salience of risk communication, thus altering the existing relationship between cognitive abilities and risky financial decision-making.

It was hypothesized that risk perception would increase the impact of cognitive abilities on risky financial decision-making as risk perception has been shown to differentially affect estimates of relative gains and losses and lead to more or less risk taking behavior (Sitkin & Weingart, 1995). Similarly, risk taking was hypothesized to
moderate the relationship between cognitive abilities and risky financial decisions such that it would decrease the impact of cognitive abilities on risky financial decision-making, as previous research has found that risk propensity significantly affects the salience of relative threat or opportunity in risk communication (Sitkin & Weingart, 1995). Finally, expected benefits of risky financial decision-making was hypothesized to decrease the impact of cognitive abilities on risky financial decision-making. Hanoch et al. (2006) found that subsamples of risk seeking individuals significantly differed in their ratings of expected benefits of domain-specific risky behavior, increasing their likelihood of engaging in domain-specific risky behavior. Accordingly, they argued that expected benefits of risky behavior significantly affected the decision-making process whereby subsamples of risk seekers were more likely to engage in risky domain-specific behavior.

**Hypothesis 4**

It was predicted that subscale scores of the DOSPERT (Perception of risk, Attitudes towards risk, and Expected benefits of risky behavior) would moderate the relationships between cognitive abilities and risky health decisions (see Figure 2).
Hypothesis 4a. Hypothesis 4a stated that cognitive abilities will be significantly and negatively related to risky decision-making, but this relationship will be moderated by risk perception, such that risk perception will increase the impact of cognitive abilities on risky health decision-making.

Hypothesis 4b. Hypothesis 4b stated that cognitive abilities will be significantly and negatively related to risky decision-making, but this relationship will be moderated
by risk taking, such that risk taking will decrease the impact of cognitive abilities on risky health decision-making.

**Hypothesis 4c.** Hypothesis 4c stated that cognitive abilities will be significantly and negatively related to risky decision-making, but this relationship will be moderated by expected benefits, such that expected benefits will decrease the impact of cognitive abilities on risky health decision-making.

**Justification for Hypotheses 4a, 4b, and 4c**

Published research demonstrates a relationship between cognitive abilities and risky health decision-making (Schwartz et al., 1997). Moreover, the risky decision-making process is affected by domain-specific knowledge and risk propensity, including risk perception, risk taking, and expected benefits (Blais & Weber, 2006; Hanoch et al., 2006; Weber et al., 2002). Measures of risk propensity (risk perception, risk taking, and expected benefits) are hypothesized to moderate the relationship between cognitive abilities and risky health decisions as these factors may alter the salience of risk communication. For instance, risk perception may influence approximations of relative gains and losses presented in risk communication. Similarly, risk taking, or one's general inclination toward risky behavior may differentially underscore the relative threat or opportunity in risk communication, thus affecting risky decision-making (Sitkin & Weingart, 1995). Expected benefits of risky behavior have been found to predict actual risky decision-making and again may influence the ways in which risk communication is processed when making risky decisions (Hanoch et al., 2006; Weber et al., 2002).
Hypothesis 5

It was predicted that impulsivity would moderate the relationship between cognitive abilities and domain-specific risky decisions.

**Hypothesis 5a.** Hypothesis 5a stated that cognitive abilities will be significantly and negatively related to risky financial decision-making, but this relationship will be moderated by impulsivity, such that impulsivity will decrease the impact of cognitive abilities on risky financial decision-making (see Figure 3).

![Figure 3](image-url)

*Figure 3.* Hypothesized moderating effects of impulsivity on the relationship between cognitive abilities and financial risky decisions.
**Hypothesis 5b.** Hypothesis 5b stated that cognitive abilities will be significantly and negatively related to risky health decision-making, but this relationship will be moderated by impulsivity, such that impulsivity will decrease the impact of cognitive abilities on risky health decision-making (see Figure 4).

Figure 4. Hypothesized moderating effects of impulsivity on the relationship between cognitive abilities and health risky decisions.

**Justification for Hypotheses 5a and 5b**

Previous research indicates that impulsivity affects risky decision-making processes (Crone et al., 2003; Davis et al., 2007; Penolazzi et al., 2012). Additionally,
research suggests that trait impulsivity may influence the type of decision-making strategy used by decision-makers. Penolazzi et al. (2012) found that more highly impulsive individuals have been found to engage in more affective decision-making compared to deliberative decision-making. These quick, poorly judged and affectively driven decisions may override one's ability to engage in thorough and deliberate cognitive processes such as those required in this study. Accordingly, it was predicted that higher levels of trait impulsivity would negatively affect one’s ability to engage in deliberative reasoning and thus reduce the strength of the relationship between cognitive abilities and domain-specific risky decision-making. Moreover, it was predicted that those individuals with higher trait impulsivity would make more risky decisions than those participants with lower levels of trait impulsivity.
CHAPTER TWO

METHOD

Pilot Study

In order to measure domain specific risky decision-making, hypothetical risk
taking scenarios were created and pilot tested. The risky decision-making literature was
reviewed, and in particular, items and scenarios that investigators have used to measure
risky decision-making were examined (Mahoney, Buboltz, Levin, Doverspike, &
Svyantek, 2011). In line with similar research, twenty hypothetical risky scenarios were
created, 10 of which assessed risky financial decisions and 10 of which assessed risky
health-related decisions (See Appendix G). In order to remain consistent with DOSPERT
Health/Safety items, the health items also included safety behavior, such as wearing
sunscreen for example. Issue involvement was induced in each scenario in order to make
the decisions more salient to the respondent, as previous research indicates that issue
involvement affects the decision-making process (Petty & Cacioppo, 1979). Likewise,
numeric information including percentages, base rates, and timelines were included in the
scenarios as research indicates that numeric ability affects the decision-making process
(Lipkus et al., 2001). Participants were instructed to read each hypothetical risky scenario
and choose between two options, A or B, one of which reflected higher risk and the other
of which reflected lower risk. High and low risk options were counterbalanced among
scenarios such that option A did not always indicate high risk. Participants were informed
that there were no right or wrong answers. High risk options were assigned a value of one
and low risk options were assigned a value of zero. Domain-specific riskiness was calculated by summing the corresponding domain-specific items to yield an overall measure of domain-specific risky decision-making.

The 20 risky decision-making hypothetical scenarios were administered to 91 undergraduate students at a mid-sized Southern university. Prior to recruitment, approval to conduct this research was granted by the Institutional Review Board (IRB). Announcements regarding the study were made by course instructors in undergraduate psychology classes. All potential volunteers were informed of the nature of the study, including the expected benefits and possible risks of participation. Volunteers were informed of their right to withdraw participation at any time without penalty.

Data were screened for inclusion criteria and 13 participants were removed from analysis as they did not meet the age (18+ years) criterion that was clearly stated in the informed consent. Additionally, data was screened for missing values and participants with 10% or more missing data were removed from the sample ($N = 10$). The final sample consisted of 68 participants, 43 females (63%) and 24 males (35%). One participant did not indicate their gender. Participants ranged in age from 18 – 56 years ($M = 25.43, SD = 8.63$). Twenty-seven participants identified as seniors (39.7%), followed by 23 Master’s level (33.8%), six juniors (8.8%), five sophomores (7.4%), and four freshmen (5.9%), respectively. The ethnic distribution was restricted, with the majority of participants identifying as Caucasian (70.6%), followed by African American (16.2%), Hispanic (5.9%), Asian/Pacific Islander (4.4%), and “Other” (1.5%). The participant who identified as “Other” indicated that they were of mixed ethnicity. Two participants did not report their ethnic identity.
Participant responses were analyzed for response variability, where variability indicated that participants responded to scenarios in different ways. All items yielded response variability. Table 1 displays these findings. Next, the 20 risky decision-making items were administered to an expert panel for review. The expert panel consisted of faculty and doctoral level students (N = 5), including individuals not associated with the current study. Experts were provided with the following definitions of risky and risky decision-making: “Risky refers to exposure to something that has the potential to cause danger, harm, or loss. Risky decision-making then refers to how an individual navigates a choice situation that has the potential to cause harm, danger, or loss, yet at the same time, provides an opportunity to obtain an outcome that is perceived as positive or favorable.”

Expert reviewers were instructed to read each scenario and using a 5-point Likert-type scale ranging from 1 (Not at all risky and/or not representative of risk domain) to 5 (Highly risky and/or representative of risk domain), to indicate the degree to which each item represented a health or financial risky decision. Mean riskiness of each scenario was calculated and presented in Table 1.

Based on the results of the pilot study and review by the expert panel, the final risky decision-making scenarios were reduced from 20 to 11 hypothetical scenarios (see Appendix A). The Health risky decisions were reduced to six scenarios, and the Finance risky decisions were reduced to five scenarios that were most highly rated by the expert panel. High risk items were worth one point and low risk items were worth zero points. Domain-specific scenarios were summed, with higher scores indicating greater domain-specific risky decision-making. The health domain risky decision scenarios yielded a
Kuder-Richardson 20 coefficient of -.188 and the financial domain risky decision scenarios yielded a Kuder-Richardson 20 coefficient of -.220.

Table 1

*Risky Decision-Making Scenarios Descriptive Statistics*

<table>
<thead>
<tr>
<th>Item</th>
<th>Option (A and B)</th>
<th>Frequency</th>
<th>Percent(%)</th>
<th>Item Mean</th>
<th>KR-2 if Deleted</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 A</td>
<td>50</td>
<td>73.5</td>
<td>3.4</td>
<td>.66</td>
<td></td>
</tr>
<tr>
<td>B</td>
<td>18</td>
<td>26.5</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2 A</td>
<td>20</td>
<td>29.4</td>
<td>2.8</td>
<td>.44</td>
<td></td>
</tr>
<tr>
<td>B</td>
<td>48</td>
<td>70.6</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3 A</td>
<td>17</td>
<td>25.0</td>
<td>3.2</td>
<td>.43</td>
<td></td>
</tr>
<tr>
<td>B</td>
<td>51</td>
<td>75.0</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4 A</td>
<td>19</td>
<td>27.9</td>
<td>2.6</td>
<td>.42</td>
<td></td>
</tr>
<tr>
<td>B</td>
<td>49</td>
<td>72.1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5 A</td>
<td>13</td>
<td>19.1</td>
<td>3.4</td>
<td>.45</td>
<td></td>
</tr>
<tr>
<td>B</td>
<td>55</td>
<td>80.9</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6 A</td>
<td>8</td>
<td>11.8</td>
<td>2.6</td>
<td>.45</td>
<td></td>
</tr>
<tr>
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<td>60</td>
<td>88.2</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>7 A</td>
<td>16</td>
<td>23.5</td>
<td>2.8</td>
<td>.38</td>
<td></td>
</tr>
<tr>
<td>B</td>
<td>52</td>
<td>76.5</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
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<td>7</td>
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<td>3.0</td>
<td>.43</td>
<td></td>
</tr>
<tr>
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<td></td>
<td></td>
</tr>
<tr>
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<td>64</td>
<td>94.1</td>
<td>4.0</td>
<td>.55</td>
<td></td>
</tr>
<tr>
<td>B</td>
<td>4</td>
<td>5.9</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>10 A</td>
<td>8</td>
<td>11.8</td>
<td>4.8</td>
<td>.41</td>
<td></td>
</tr>
<tr>
<td>B</td>
<td>60</td>
<td>88.2</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>11 A</td>
<td>22</td>
<td>32.4</td>
<td>4.2</td>
<td>.19</td>
<td></td>
</tr>
<tr>
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<td>49</td>
<td>72.1</td>
<td>4.4</td>
<td>.22</td>
<td></td>
</tr>
<tr>
<td>B</td>
<td>19</td>
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<td>35</td>
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<td>B</td>
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<td>48.5</td>
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<td>83.8</td>
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<td>17 A</td>
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<td>B</td>
<td>46</td>
<td>67.6</td>
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<td></td>
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</tbody>
</table>
Note. Frequency = number of participants who endorsed item choice A or B. Percent (%) = percentage of participants who endorsed item choice A or B. Item Mean = mean riskiness of scenario as rated by expert panel, ranging from 1 (Not at all risky and/or not representative of risk domain) to 5 (Highly risky and/or representative of risk domain). KR-20 if Deleted = Kuder-Richardson 20 reliability coefficient if item were deleted from set. The first ten items are financial domain risky scenarios. Refer to Appendix A to review measure.

Sample and Participant Selection

Several inclusion and exclusion criteria were applied. All participants were required to be of legal age to consent to research participation. Participants were also required to complete the survey packets during one of the specified time slots available. Participants were required to be within the age limits under investigation, which were 18 – 30 and 55 – 89 years of age. No participants were excluded from the final sample due to age. Participants were required to complete the informed consent form and no participants were removed from the sample due to non-consent. Any participant who scored within the impaired range (IQ below 70) on the Shipley-2 would have been removed from the sample; however, no participants scored within this range. Finally, those participants who had 15% or more missing data on any given measure were excluded (N = 9). A power analysis was conducted in order to calculate the sample size required to detect a medium-sized effect with a power level of .95. Based on this analysis, 107 participants were recommended in order to achieve a medium sized effect of $f^2 = 0.15$ with a power level of $\beta = 0.95$. Similarly, Green (1991) argues that if a researcher
seeks to test the overall fit of a regression model, $R^2$, then the following formula should be used to determine the minimum sample size, $50 + 8k$, where $k$ indicates the number of predictors in the model. He also suggests that if investigators seek to test the individual predictors in the model then the following formula should be used, $104 + k$, where $k$ again refers to the number of predictors. Based on these formulas, the target minimum sample size was estimated at 106 – 111. The initial sample consisted of 143 adults and eleven participants were removed due to excessive missing data.

The final sample included 133 adults. The younger adult sample, aged 18-30 years, consisted of 108 (81.2%) adults from a midsized southern United States university. Comparatively, the older adult sample, aged 55-89 years, consisted of 25 (18.8%) participants from two older adult fitness programs located in the southern and Midwestern United States. The final sample consisted of 80 (60.2%) females, 52 (39.1%) males, and one transgender (0.8%) individual. Participants ranged in age from 18 to 83 years ($M = 29.01, SD = 20.35$). The ethnic distribution was restricted, where 108 (81.2%) participants were Caucasian/White, 17 (12.8%) were African American/Black, four (3.0%) were Asian, three (2.3%) were Native American, and one participant (0.8%) identified as “Other”, and this participants self-reportedly identified as Hispanic. Twenty-four (18.0%) participants indicated that they had previously been diagnosed with Attention-Deficit/Hyperactivity Disorder.

**Younger Adult Sample**

Younger adult participants (18-30 years) were recruited from undergraduate psychology courses at a southern US university. Permission to sample participants from these courses was obtained prior to participant recruitment.
Older Adult Sample

Older adult participants (55-89 years) were recruited from older adult fitness programs tailored to the specific needs and abilities of community-dwelling older adults. One program was run through a southern US university’s Department of Kinesiology and the other was run through a Midwestern parks and recreation organization. Permission to sample participants from these programs was obtained prior to participant recruitment.

Measures

Demographic Survey

Participants answered several questions pertaining to demographic characteristics. These questions included participant age, race/ethnicity, gender, education level, annual household income, marital status, employment status, as well as other personal information. Additionally, participants answered three questions about their financial independence, political orientation, and level of religiosity using 5-point Likert-type scales (See Appendix B).

Impulsiveness Questionnaire (I7)

The I7 (Eysenck, & Eysenck, 1978) consists of 54 questions and three subscales, Impulsiveness, Venturesome, and Empathy. Impulsiveness refers to the tendency to act without much thought and failing to realize the risk involved in such behavior. Venturesome refers to the tendency to act, despite knowledge of the inherent risk in such behavior. Empathy refers to “a vicarious emotional response to the perceived emotional experiences of others” (Mehrabian & Epstein, 1972, p.525). The I7 uses a true/false response format (Eysenck, & Eysenck, 1978). Eysenck, Pearson, Easting, and Allsopp (1985) reported good internal consistency reliability for the Impulsiveness subscale for
males and females, 0.84 and 0.83, respectively. They also found good internal consistency reliability for the Venturesomeness subscale in males and females, 0.85 and 0.84, respectively. Finally, they found acceptable internal consistency reliability, 0.69, for the Empathy subscale for males and females (Eysenck et al., 1985). The I_7 also has good test-retest reliabilities for men and women on the Venturesomeness (.078) and Impulsiveness (0.90) scales. The I_7 also has moderate to strong correlations with similar measures of impulsiveness, such as the Dickman Impulsivity Inventory (0.37 – 0.34), the BIS/BAS Scales (0.26 – 0.58), and the Barratt Impulsiveness Scale (0.52 – 0.58). Thus, the I_7 has adequate convergent validity (Miller et al., 2004; See Appendix C). For the purposes of this study, only the Impulsiveness subscale was included in the statistical model.

**Domain-Specific Risk Taking Scale (DOSPERT)**

The DOSPERT (Weber et al., 2002) consists of 40 questions and two major scales, Risk Behavior and Risk Perception (Blais & Weber, 2006). Risky behavior and perceptions of risk are measured across five domains: Ethical, Health/Safety, Recreation, Finance, and Social. These domains were selected because they represent common areas of risk taking.

For the purposes of this study, only the financial and health/safety domain questions were administered to the participants. Each domain consists of eight questions, thus participants answered 16 of the 40 questions. Respondents were required to answer each question three times, once as it pertained to risk behavior and twice as it related to risk perception. For the Risk Behavior scale, participants are asked to indicate on a 5-point Likert scale, from 1(*Very unlikely*) to 5(*Very likely*), the likelihood that they would
engage in the stated behavior. Comparatively, the Risk Perception scale asked participants to rate on a 5-point Likert scale, from 1(Not at all risky) to 5(Extremely risky) how risky each behavior was perceived to be. Likewise, participants were asked to rate the expected benefits of each scenario on a 5-point Likert scale from 1(No benefits at all) to 5(Great benefits) (Weber et al., 2002).

Weber et al. (2002) found that the Risk Behavior and Risk Perception scales have good internal consistency reliability, 0.88 and 0.89, respectively. They found that the Financial and Social subscales of the Risk Behavior scale had low test-retest reliabilities, 0.44 and 0.58, respectively, while the Health, Ethics, and Recreation subscales had respectable test-retest reliabilities, 0.75, 0.72, and 0.80, respectively. A similar trend was found when they examined the Risk Perception subscales, where Financial and Social (0.42 and 0.47, respectively) were less stable than the Health, Ethics, and Recreation subscales (0.66, 0.67, and 0.56, respectively) (Weber et al., 2002).

Weber et al. (2002) reported that the Risk Behavior subscales of the DSOPERT had good convergent validity with similar measures. For instance, Budner’s (1962) Scale for intolerance of ambiguity correlated with all of the Risk Behavior subscales of the DOSPERT, suggesting adequate convergent validity. Likewise, all Risk Behavior subscales correlated highly with measures of sensation seeking, such as Zuckerman’s (1994) Sensation-seeking scale, suggesting good convergent validity (Weber et al., 2002; See Appendix D).

**Shipley-2**

The Shipley-2 (Shipley, Gruber, Martin, & Klein, 2009) is a brief measure of fluid and crystalized intelligence that provides an estimate of general cognitive ability.
and functioning. The Shipley-2 is self-administered and takes approximately 20 to 25 minutes to complete and can be administered individually or within group settings. It has been normed on a large population of children and adults from the ages of seven to 89 years. In order to complete this assessment, the examinee must have a fourth grade reading level. The Shipley-2 provides both composite fluid and crystallized intelligence scores as well as an overall score of cognitive ability. Additionally, the Shipley-2 includes an index of impairment to screen for cognitive impairments. Crystallized intelligence is measured by the Vocabulary scale, whereas fluid intelligence can be measured using either the Abstraction or Block Patterns scales. The Abstraction scale consists of 25 numeric and alpha puzzles to be solved by the examinee. The Block Patterns scale is a nonverbal measure of fluid reasoning where participants solve patterns based on block representations. Examinees are given a maximum of 10 minutes to complete the Verbal scale, 12 minutes to complete the Abstraction scale, and 10 minutes to complete the Block Patterns scale (Shipley et al., 2009).

The Shipley-2 scales and composite scores have good to excellent internal consistency reliabilities. All reliability scores are reported for adults aged 17 – 89 years. The Vocabulary scale has internal consistency reliabilities that range from 0.85 to 0.92. The Abstraction scale has internal consistency reliabilities ranging from 0.66 to 0.91. The Block Patterns scale has internal consistency reliabilities ranging from 0.74 to 0.94. The Vocabulary + Abstraction Composite (Composite A) score ranges from 0.88 to 0.97, whereas the Vocabulary + Block Patterns Composite (Composite B) score ranges from 0.91 to 0.95. The authors also reported good test-retest reliabilities for the Vocabulary, Abstraction, and Block Patterns scales, 0.94, 0.87, and 0.90, respectively. Composite A
and B scores also yielded excellent test-retest reliabilities, 0.94 and 0.93, respectively (Shipley et al., 2009). The Shipley-2 also has moderate to strong correlations with the Wechsler Adult Intelligence Scale-III (WAIS-III; Wechsler, 1997). Shipley et al. (2009) note that the correlation strength is partially related to the content of the various scales under comparison. The Shipley-2 composite scores and the WAIS-III Full Scale IQ (FSIQ) have strong positive correlations, suggesting that the Shipley-2 measures similar components of intelligence as the Wechsler system.

In this study, participants completed the Verbal and Block Patterns scales. The Block Patterns scale was selected because it generally has greater internal consistency reliability than the Abstraction scale and takes less time to complete. The Composite B score was used as a measure of general cognitive abilities.

**Numeracy Scale**

The Numeracy Scale (Lipkus et al., 2001) consists of two scales, the General Numeracy Scale and the Expanded Numeracy Scale. The General Numeracy scale consists of three items, each one separately assessing probability, percentage, and proportion numeric ability. These questions are open-ended. Alpha reliabilities for the general items ranged from .57 to .63. The Expanded Numeracy scale consists of seven items that examine probability, percentage, and proportion numeric abilities within the context of health risks. These questions utilize both multiple choice and open-ended response formats. Lipkus et al. (2001) reported that this scale is best interpreted as a unidimensional measure, which indicates that both scales assess global numeric ability. Alpha reliabilities for the Expanded scale ranged from .70 to .75 (Lipkus et al., 2001; See Appendix E).
Marlowe-Crowne Social Desirability Scale Short Form C

The Marlowe-Crowne Social Desirability Scale Short Form C is a measure of social desirable responding, or the perceived need of the respondent to respond to test items in a culturally appropriate and acceptable manner in order to gain social approval. Thus, this scale measures a respondent’s tendency to “fake good” or “fake bad” on questionnaire responses (Crowne & Marlowe, 1960). The Marlowe-Crowne Social Desirability Scale Short Form C was adapted from the original Marlowe-Crowne Social Desirability Scale (Crowne & Marlowe, 1960). The short form consists of 13 true or false statements, of which eight are keyed true and five false. The original scale yielded high internal consistency, .88, and test-retest reliability of .89. Additionally, the original measure correlated moderately with the validity scales of the Minnesota Multiphasic Personality Inventory (MMPI), which also measure aspects of socially desirable responding and suggests good convergent validity. The short form also yields moderate correlations (-.52 -.59) with the MMPI validity scales, suggesting good convergent validity (Robinette, 1991). The short form c yields good reliability, $r = .76$, and correlates highly with the original form, $r = .93$, $p < .001$. Thus, the Marlowe-Crowne Social Desirability Scale Short Form C is a reliable and valid measure of socially desirable responding (See Appendix F).

Risky-Decision Scenarios

Eleven financial and health-related risky decision scenarios were be created by the investigator to measure domain-specific risky decision-making. Participants were required to read each scenario and choose between two decision options, A or B, one of which reflected higher risk and the other which reflected lower risk. The response options
were coded, where 0 = less risky and 1 = more risky, and domain-specific risk taking was represented by summing the health and finance scenarios. Higher scores indicated greater domain-specific risk taking. (See Appendix H).

Procedure

Prior to participant recruitment, approval from the Institutional Review Board was granted to conduct this research. Ethical standards for human research were followed and participation in this study was voluntary. Participants were informed of their right to discontinue participation at any point without penalty. No personally identifiable information was kept and privacy of the participants was maintained. Informed consent forms and survey packets were collected separately in order to ensure anonymity. The survey packets were only accessible to the primary investigator, research assistants, and dissertation chair of this study. Survey packets were stored in secure environments.

In order to recruit younger adults, undergraduate psychology professors were notified of this study and asked if the primary investigator could post a flyer about this study onto the course website. Flyers provided brief information about his study, including dates and times for participation. Some professors may have offer extra course credit to students for research participation.

In order to recruit the older adults, permission to announce this study during fitness classes will first be obtained from the Adult Fitness Program Directors. Fitness class instructors were notified of this study and granted permission for the investigator or research assistants to make announcements in fitness classes. Interested volunteers were provided with information regarding this study, including times and dates for study participation.
Volunteers presented at a specified location in order to complete a survey packet. Data were collected over several recruitment days that spanned ten months. Participants completed the survey packets in one sitting. Surveys were administered to groups of participants ranging from one to twenty volunteers. Survey packets were administered in rooms without computers or other electronic devices, in order to deter cheating on the cognitive and computational components of the study. Upon arrival, participants were given a survey packet, including the informed consent form. Participants were instructed to read and sign the informed consent form prior to further participation. Participants were allowed to use those materials that were required to complete these measures, namely, a pencil and eraser. All participants completed the Shipley-2 first, as there were general instructions regarding the entire test as well as the subtests. Additionally, these were timed tests and having all participants complete the subtests at the same time ensured that participants did not use extended time, which would invalidate their scores. All instructions were read verbatim to participants (see Appendices I and J). Participants first heard general instructions about this study and then were introduced to the Shipley-2 cognitive tests. Next, the participants were read the instructions for the Verbal test. Participants had 10 minutes to complete the verbal test, at which point they were instructed to stop working. Next, the participants were read the instructions for the Block Patterns test. The participants had 10 minutes to complete the Block Patterns test, at which point they were instructed to stop working. Participants were reminded that they had unlimited time to complete the remaining measures in the survey packet. The remaining measures were counterbalanced in the survey packet. Participants required approximately 30 – 60 minutes to complete the survey packets.
CHAPTER THREE

RESULTS

Data were analyzed using Chronbach’s coefficient alpha, the Kuder-Richardson reliability coefficient, Independent samples t tests, the Mann-Whitney U test, one-way analysis of variance (ANOVA), and multiple regression analysis. Data were first screened for missing values and outliers, which were replaced using the person-mean substitution method, as it is an effective way of replacing missing data (Downey & King, 1998). Influential cases and outliers were assessed, which will be discussed below as they pertain to each analysis. Four outliers were detected and removed from the analyses conducted in hypotheses 1 and 2. Specifically, two multivariate outliers were detected using Mahalanobis distance and removed. Additionally, two univariate outliers were detected and removed (Field, 2009; Mertler & Vannatta, 2010).

Cronbach’s alpha was used to examine scale reliability. The DOSPERT (Weber et al., 2002) overall scale reliability was .69. The separate dimensions achieved a mean reliability of .76, ranging from .73 to .78. The Risk Taking subscale yielded an acceptable reliability of .73 (Cortina, 1993). The Risk Perception subscale also yielded an acceptable reliability of .76. Finally, the Expected Benefits subscale yielded the highest reliability of .78, which is also considered acceptable (Cortina, 1993). Finally, the internal reliability of the Impulsiveness subscale of the I (Eysenck, & Eysenck, 1978) was also calculated using Cronbach’s alpha, which yielded an acceptable reliability of .78 (Cortina, 1993). The Kuder-Richardson 20 (Kuder & Richardson, 1937) was used to examine the domain
specific risky decision scenarios reliabilities, as these scenarios use forced choice
dichotomous responses. The health scenarios yielded a reliability of .195 and the finance
scenarios yielded a reliability of .103. Additionally, variable descriptive statistics are
included in Table 2.

Table 2

*Variable Descriptive Statistics*

<table>
<thead>
<tr>
<th>Variable</th>
<th>M</th>
<th>SD</th>
<th>Reliability</th>
<th>Skew</th>
<th>Kurt</th>
</tr>
</thead>
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<tr>
<td>Risk Taking</td>
<td>35.14</td>
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<td>.73</td>
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<td>Risk Perception</td>
<td>60.15</td>
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<td>.76</td>
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<td>.231</td>
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<td>Expected Benefits</td>
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<td>7.43</td>
<td>.78</td>
<td>1.37</td>
<td>-.922</td>
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<td>3.81</td>
<td>3.79</td>
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<td>-3.73</td>
<td>-.454</td>
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<td>Intelligence</td>
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<td>-2.02</td>
<td>-.043</td>
</tr>
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<td>Health</td>
<td>1.74</td>
<td>1.16</td>
<td>.19</td>
<td>1.54</td>
<td>.316</td>
</tr>
<tr>
<td>Finance</td>
<td>1.00</td>
<td>.891</td>
<td>.10</td>
<td>2.71</td>
<td>-1.08</td>
</tr>
</tbody>
</table>

*Note.* M = mean. SD = standard deviation. Skew = skewness. Kurt = kurtosis.

The Mann-Whitney U test was used to assess group differences on the
independent and moderating variables as stated in hypotheses 1 and 2. Parametric
assumptions were assessed prior to analysis. The assumptions of interval level data and
independence were satisfied. Normality was assessed using several methods, including
the Kolmogorov-Smirnov test, skewness and kurtosis scores, as well as visual inspection
of histograms with normality plots and p-p plots (Field, 2009; Mertler & Vannatta, 2010).
Aside from the DOSPERT Risk Taking and Risk Perception variables, all other variables failed the assumption of normality. Accordingly, a square root transformation was applied to correct for non-normally distributed data (Field, 2009). Several variables, including: Numeracy, Block Design, Finance Domain Risky Decisions, and Health Domain Risky Decisions, were not sufficiently corrected to satisfy the assumption of normality. Additionally, homogeneity of variance was assessed using the Levene’s statistic and one analysis did not satisfy this assumption (older and younger adult risk taking behavior comparison). Accordingly, non-parametric tests such as the Mann-Whitney U test were used to assess group differences, as such tests are assumption free (Field, 2009). Bivariate correlations among the study variables are presented in Tables 3 and 4.

Table 3

Bivariate Correlations for Health Decisions

<table>
<thead>
<tr>
<th>Measure</th>
<th>1</th>
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<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
<th>8</th>
<th>9</th>
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</thead>
<tbody>
<tr>
<td>1 Gen</td>
<td></td>
<td>.16</td>
<td>-.24**</td>
<td>-.28**</td>
<td>-.19*</td>
<td>-.07*</td>
<td>-.41**</td>
<td>.35**</td>
<td>-.24**</td>
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<tr>
<td>2 Age</td>
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<td></td>
<td>-.26*</td>
<td>.21*</td>
<td>.07</td>
<td>-.36**</td>
<td>-.47**</td>
<td>.36**</td>
<td>-.36**</td>
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</table>
Note. Correlations between continuous variables indicate Pearson product moment correlations. Those between a continuous and dichotomous variable indicate a point-biserial correlation. Gen = participant gender. Age = participant age. Heal = health domain total score. Num = numeracy. IQ = total estimated intelligence. Imp = trait impulsivity. RT = DOSPERT risk taking behavior subscale score. RP = DOSPERT risk perception subscale score. EB = DOSPERT expected benefits subscale score. N = 129; *p < .05; **p < .01.

Table 4

Bivariate Correlations for Financial Decisions

<table>
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<tr>
<th>Measure</th>
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<th>3</th>
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<th>5</th>
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<td>-.28**</td>
<td>-.19*</td>
<td>-.07</td>
<td>-.41**</td>
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<td>2 Age</td>
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<td>.21*</td>
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<td>-.47**</td>
<td>.36**</td>
<td>-.37**</td>
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<td>3 Finance</td>
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</tbody>
</table>

Note. Correlations between continuous variables indicate Pearson product moment correlations. Correlations between a continuous and dichotomous variable indicate a point-biserial correlation. Gender = participant gender. Age = participant age. Finance = financial domain total score. Num = numeracy. IQ = total estimated intelligence. Impuls = trait impulsivity. RT Beh = DOSPERT risk taking behavior subscale score. RP = DOSPERT risk perception subscale score. EB = DOSPERT expected benefits subscale score. N = 129; *p < .05; **p < .01.

Across both types of risky decision domains (health and finance), males scored higher on measures of numeracy, intelligence, risk taking (attitudes toward risk), and expected benefits of risk. Comparatively, across the health and finance domains, females
scored more highly on measures of risk perception. Similarly, across health and financial
domains, older adults scored higher on measures of numeracy and risk perception than
younger adults, while younger adults had higher levels of trait impulsivity, risk taking,
and expected benefits of risky behavior (see Tables 3 and 4).

For risky health decisions, there were a number of correlations among study
variables. Males had higher levels of trait impulsivity and made more risky health
decisions ($r = -.235$) than females. Younger adults made more risky health decisions
($r = -.255$) than older adults. There were significant and positive relationships among
impulsivity and risk taking, indicating that people who were more impulsive were more
likely to engage in risky behavior. There was a significant, positive relationship between
numeracy and intelligence, indicating that those participants with greater numeracy skills
also had higher intelligence. Intelligence and impulsivity were significantly, negatively
related, indicating that participants of higher levels of intelligence had lower levels of
trait impulsivity. Impulsivity and risk taking were positively related, which indicates that
participants with greater trait impulsivity were more likely to take risks. Risk taking and
expected benefits ($r = .687$) of risky behavior were also significantly, positively related,
indicating that those who perceived more possible benefits of engaging in risky behavior
were more likely to endorse risk taking. Risk perception was negatively related to risk
taking ($r = -.539$) and expected benefits ($r = -.406$) of risky behavior, indicating that
participants who perceived more risk were less likely to make risks or expect benefits of
risky behavior (see Table 3).

There were also several correlations among study variables related to risky
financial decisions. There were significant, positive relationships among financial risky
decisions, risk taking \((r = .231)\), and expected benefits \((r = .193)\), indicating that those participants who expected greater benefits of risky financial behavior and endorsed greater risk taking behavior made more risky financial decisions. There was also a significant, positive relationship between numeracy and intelligence, where participants who had greater numeracy skills were also of higher intelligence. Intelligence was negatively related to impulsivity and risk perception, where participants of higher intelligence were less impulsive and perceived less risk in various risky scenarios. Risk taking and impulsivity \((r = .230)\) were significantly and positively related, which indicates that participants who endorsed more trait impulsivity also endorsed more risk taking. Risk perception and risk taking \((r = -.406)\) were significantly and negatively related, which indicates that participants who perceived greater risk endorsed less risk taking behavior. Expected benefits of risk taking \((r = .678)\) were significantly, positively related; those who perceived greater possible benefits of risky behavior endorsed greater risk taking behavior. Finally, there was a significant, negative relationship between risk perception and expected benefits \((r = -.539)\); participants who perceived greater risk expected greater possible benefits of risky behavior (see Table 4).

**Hypothesis 1**

Hypothesis 1 stated that males and females will differ in the number of risky domain-specific decisions they make.

**Hypothesis 1a**

Males will make more risky financial decisions than females. The Mann-Whitney U Test was used to compare males and females on financial risky decisions. Males \((M_{\text{Rank}} = 70.11)\) and females \((M_{\text{Rank}} = 64.16)\) did not significantly differ on the number of risky
financial decisions that they made, $U = 1892.50$, $z = -.925$, $p = .178$, $r = -.020$. Therefore, males did not make significantly more risky financial decisions compared to females. Thus, hypothesis 1a is not supported.

**Hypothesis 1b**

Males will make more risky health decisions than females. The Mann-Whitney U Test was used to compare males and females on risky health decisions. Males and females significantly differed on the number of risky health decisions that they made, $U = 1663.50$, $z = -.1.999$, $p = .023$, $r = -.173$, where males ($M_{\text{Rank}} = 74.51$) made significantly more risky health decisions compared to females ($M_{\text{Rank}} = 61.29$). Thus, hypothesis 1b is supported.

**Hypothesis 2**

Hypothesis 2 stated that younger adults would make significantly more domain-specific risky decisions than older adults. The Mann-Whitney U Test was used to compare older and younger adults on domain-specific risky decisions. Older and younger adults significantly differed on the number of risky health decisions they made, $U = 929.00$, $z = -.2.498$, $p = .012$, $r = -.216$, where younger adults ($M_{\text{Rank}} = 70.90$) made significantly more risky health decisions than older adults ($M_{\text{Rank}} = 50.16$). Comparatively, older ($M_{\text{Rank}} = 69.46$) and younger ($M_{\text{Rank}} = 66.43$) adults did not significantly differ on the number of risky financial decisions that they made, $U = 1288.50$, $z = -.375$, $p = .718$, $r = -.032$. Thus, hypothesis 2 was partially supported.

Parametric assumptions for regression analysis were tested and violations of assumptions are discussed in each moderation analysis. Normality of residuals were assessed using several methods, including visual inspection of the P-P plots, histograms
with normal curves, the Kolmogorov-Smirnov test, skewness, and kurtosis. Several variables failed the assumption of residual normality as discussed below. Linearity and homoscedasticity were assessed via visual inspection of the residual scatterplots, with rectangular plots indicating homoscedasticity. Several variables failed the assumption of homoscedasticity as discussed below. Tabachnick and Fidel (2013) note that failure of such assumptions does not necessarily invalidate regression analysis so much as it weakens the results because these violations have been shown to have little to no adverse effects on the analysis. Similarly, Bohrnstedt and Carter (1971) note that regression analysis is robust; violations of normality and homoscedasticity generally do not lead to significant statistical distortions because the distribution of the errors tends to be normally distributed despite the shape of the original distribution. Thus, regression analysis were conducted when variables failed these assumptions and are discussed in the limitations of this study. Multicolinearity was assessed using various methods, including visual inspection of correlation matrices, the variance inflation factor (VIF), and the tolerance statistic. The Durbin Watson statistic was used to assess for independent errors. Finally, all data were either categorical or quantitative, which satisfied the assumptions related to variable types (Field, 2009; Tabachnick & Fidel, 2013).

Hypotheses 3-5 were examined using a hierarchical regression analysis and the steps identified by Frazier, Tix, and Barron (2004). First, all predictor and moderator variables were standardized. Next, interaction terms were created using the new standardized variables (impulsivity x numeracy, impulsivity x IQ, risk taking x numeracy, risk taking x IQ, risk perception x numeracy, risk perception x IQ, expected benefits x numeracy, and expected benefits x IQ). Eight separate moderation analyses
were conducted to test the effects of each moderator using a block entry design. A Bonferroni adjustment was used to control the family-wise Type I error rate when testing regression coefficients with a corrected criterion of significance of \( p < .00625 \) (Field, 2009; Mundfrom, Perrett, Schaffer, Piccone, & Roozeboom, 2006). In the first step, age and gender were entered as control variables. In the second step, the independent variables (numeracy and IQ) and the moderator variables (impulsivity, risk taking, risk perception, expected benefits) were entered. In the third and final step, the associated interaction terms were entered (see above). The sections below present the results for each moderation analysis.

**Hypothesis 3**

Hypothesis 3 stated that subscale scores of the DOSPERT (Risk Perception, Risk Taking, and Expected Benefits) will moderate the relationship between cognitive abilities (total estimated intelligence and numeracy) and risky financial decisions.

**Hypothesis 3a**

After controlling for the effects of age and gender, perception of financial risk will moderate the relationship between cognitive abilities (numeracy and total estimated intelligence) and risky financial decision-making. Three multivariate outliers were discovered. Regression analyses were conducted with and without these outliers to determine their effect on the overall statistical model. Removal of these outliers had no significant impact on residual normality or the regression analysis, and thus they were not removed. The financial risk standardized residuals, \( D(133) = .098, Z_{\text{skewness}} = .636, Z_{\text{kurtosis}} = -1.592 \), were significantly non-normal and thus failed the Kolmogorov-Smirnov test of normality. According to Field (2009), large samples with small standard
errors may produce significant deviations from normality. Thus, he argues that for samples of this size, a z-score cutoff of ±2.58 should be used to assess for significant deviations of normality. According to this standard, the residuals were approximately normally distributed. The data failed the assumption of homoscedasticity. Several investigators argue that moderate heteroscedasticity does not invalidate regression results, rather it weakens the results (Tabachnick & Fidell, 2013; Mertler & Vannatta, 2010). Moreover, Borhntedt and Carter (1971) argued that regression analysis is robust to violations of homoscedasticity. The assumptions of no multicollinearity and independent errors were satisfied. Results of the moderation analysis are presented in Table 5.

Table 5

<table>
<thead>
<tr>
<th>Variable</th>
<th>$R^2$</th>
<th>$\Delta R^2$</th>
<th>$B^a$</th>
<th>SE B</th>
<th>$\beta^b$</th>
<th>t</th>
<th>95% CI</th>
</tr>
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<tbody>
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<td>.004</td>
<td>.030</td>
<td>.313</td>
<td>-.007, .010</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Gender | -.024 | .172 | -.013 | -.138 | -.364 | .317
Numeracy | .155 | .097 | .169 | 1.603 | -.036 | .346
IQ | -.079 | .097 | -.083 | -.820 | -.271 | .112
Risk Perception | -.132 | .093 | -.137 | -1.419 | -.315 | .052
NumxRiskPer | -.069 | .110 | -.071 | -.622 | -.278 | .150
IQxRiskPer | .225 | .109 | .236* | 2.071 | .010 | .440

*Note. Gender was coded 0 = male 1 = female, Numeracy = numeracy, IQ = total estimated intelligence, Risk Perception = DOSPERT Risk Perception, NumxRiskPer = interaction between numeracy and risk perception, IQxRiskPer = interaction between total estimated intelligence and risk perception.

The results indicate that the control variables (age and gender) did not significantly account for variance in risky financial decisions, $R^2 = .008$, $R^2_{adj} = -.007$, $F(2, 130) = .513, p = .600$, as presented in Table 5. In the second step, cognitive abilities (numeracy and total estimated intelligence) and risk perception did not significantly contributed to the variance explained in risky financial decisions, $\Delta R^2 = .026, p = .342$, $F(5, 127) = .880, p = .496$. In the third step, the interactions between cognitive abilities (numeracy and total estimated intelligence) and risk perception did not significantly contribute to the amount of variance explained in risky financial decisions, $\Delta R^2 = .039$, $F_{change}(2, 125) = 2.596, p = .079$. Based on these results, hypothesis 3a was not supported.

**Hypothesis 3b**

After controlling for the effects of age and gender, attitudes towards (risk taking) financial risk will moderate the relationship between cognitive abilities (numeracy and total estimated intelligence) and risky financial decisions. Eight multivariate outliers were
identified. Moderation analysis was run with and without them to determine their influence on the overall model statistics. Removal of these outliers did not have a significant impact on residual normality or the regression analysis, and thus were not removed. The financial risk standardized residuals, $D(125) = .126$, $p < .001$, $Z_{\text{skewness}} = 2.594$, $Z_{\text{kurtosis}} = -.090$, were significantly non-normal according to the Kolmogorov-Smirnov test of normality. Field’s (2009) z-score cutoff of ± 2.58 was utilized to determine residual normality. Moreover, several investigators note that moderate violations of residual normality do not invalidate regression analysis, as regression is robust to violations of normality (Borhntedt & Carter, 1971; Mertler & Vannatta, 2010; Tabachnick & Fidell, 2013). Thus, the residuals were approximately normally distributed. The assumptions of no multicollinearity and independent errors were satisfied. Results of the moderation analysis are presented in Table 6.

Table 6

Risk Taking as a Moderator of the Relationship Between Cognitive Abilities and Financial Domain Risky Decisions

<table>
<thead>
<tr>
<th>Variable</th>
<th>$R^2$</th>
<th>$\Delta R^2$</th>
<th>$B^a$</th>
<th>SE $B$</th>
<th>$\beta^b$</th>
<th>$t$</th>
<th>95% CI</th>
</tr>
</thead>
<tbody>
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<td>.008</td>
<td></td>
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<td></td>
</tr>
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<td>Age</td>
<td></td>
<td>.002</td>
<td>.004</td>
<td>.039</td>
<td>.444</td>
<td></td>
<td>-.006, .010</td>
</tr>
<tr>
<td>Gender</td>
<td></td>
<td>-.155</td>
<td>.160</td>
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<td>-.972</td>
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<td>-.472, .161</td>
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<tr>
<td>Step 2</td>
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</tr>
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<td>-.003, .015</td>
</tr>
<tr>
<td>Gender</td>
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<td>.511</td>
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<td>-.256, .435</td>
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<tr>
<td>Numeracy</td>
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<td>.094</td>
<td>.121</td>
<td>1.186</td>
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<td>-.074, .297</td>
</tr>
<tr>
<td>IQ</td>
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<td>.093</td>
<td>-.030</td>
<td>-.314</td>
<td></td>
<td>-.213, .155</td>
</tr>
</tbody>
</table>
Risk Taking  .307  .103  .309*  2.970  .102, .511
Step 3 .105  .019
Age .007  .005  .152  1.493  -.002, .016
Gender .115  .176  .064  .654  -.234, .464
Numeracy .149  .096  .162  1.543  -.042, .340
IQ -.043  .093  -.045  -.460  -.227, .142
Risk Taking .310  .106  .312*  2.916  .100, .520
NumxRiskTak .162  .101  .162  1.611  -.037, .361
IQxRiskTak -.097  .097  -.098  -1.000  -.290, .095

Note. Gender was coded 0 = male 1 = female, Numeracy = numeracy, IQ = total estimated intelligence, Risk Taking = DOSPERT Risk Taking, NumxRiskTak = interaction between numeracy and risk taking, IQxRiskTak = interaction between total estimated intelligence and risk taking.

Results indicate that the control variables (age and gender) did not significantly account for any variance in risky financial decisions, $R^2 = .008$, $R^2_{adj} = -.007$, $F(2, 130) = .513$, $p = .600$, as presented in Table 6. In the second step, cognitive abilities (numeracy and total estimated intelligence) and risk taking (attitude toward risk) did not significantly contribute to variance explained in risky financial decisions, $\Delta R^2 = .078$, $F_{change}(3, 127) = 3.590$, $p = .016$, as the criterion of significance $p < .00625$ was employed. In the third step, the interactions between cognitive abilities (numeracy and total estimated intelligence) and risk taking did not significantly contribute to the variance explained in risky financial decisions, $\Delta R^2 = .019$, $F_{change}(2, 125) = 1.343$, $p = .265$. Based on these results, hypothesis 3b was not supported, as the moderators did not significantly account for variance in risky financial decisions.
Hypothesis 3c

After controlling for the effects of age and gender, expected benefits of risk financial decisions will moderate the relationship between cognitive abilities (numeracy and total estimated intelligence) and risky financial decisions. Seven multivariate outliers were identified. Moderation analysis was run with and without them to determine their influence on the overall model statistics. Removal of these outliers had no significant impact on residual normality or the regression analysis; they were not removed from the analysis. The financial risk standardized residuals, $D(133) = .095, p = .005, Z_{skewness} = 2.233, Z_{kurtosis} = -1.340$, were significantly non-normal according to the Kolmogorov-Smirnov test of normality. Field's (2009) $z$-score cutoff of $\pm 2.58$ was utilized to determine residual normality. Thus, the residuals were approximately normally distributed. The data also failed the assumption of homoscedasticity. Several investigators argue that heteroscedasticity does not invalidate regression as regression analysis is robust to this type of violation (Borhntedt & Carter, 1971; Mertler & Vannatta, 2010; Tabachnick & Fidell, 2013). The assumptions of no multicollinearity and independent errors were satisfied. Results of the moderation analysis are presented in Table 7.

Table 7

Expected Benefits as a Moderator of the Relationship Between Cognitive Abilities and Health Domain Risky Decisions

<table>
<thead>
<tr>
<th>Variable</th>
<th>$R^2$</th>
<th>$\Delta R^2$</th>
<th>$B^a$</th>
<th>SE $B$</th>
<th>$\beta^b$</th>
<th>$t$</th>
<th>95% CI</th>
</tr>
</thead>
<tbody>
<tr>
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<td>Gender</td>
<td>Numeracy</td>
<td>IQ</td>
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<td>NumxExpBen</td>
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<td>-.062</td>
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<td>-.080</td>
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<td>.232</td>
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<td>-.010</td>
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<td>1.138</td>
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<td>.232</td>
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</table>

Note. Gender was coded 0 = male 1 = female, Numeracy = numeracy, IQ = total estimated intelligence, Expected Benefits = DOSPERT Expected Benefits, NumxExpBen = interaction between numeracy and expected benefits, IQxExpBen = interaction between total estimated intelligence and expected benefits.

Results indicate that the control variables (age and gender) did not significantly account for variance in finance domain risky decisions, $R^2 = .008$, $R^2_{adj} = -.007$, $F(2, 130) = .513, p = .600$, as presented in Table 7. In the second step, cognitive abilities (numeracy and total estimated intelligence) and expected benefits of risky behavior did not
significantly account for variance in risky financial decisions, $\Delta R^2 = .063, F_{change}(3, 127) = 2.863, p = .039$, as the criterion of significance $p < .00625$ was employed. In the third step, the interactions between cognitive abilities (numeracy and total estimated intelligence) and expected benefits did not explain significant variance in risky financial decisions, $\Delta R^2 = .013, F_{change}(2, 125) = .868, p = .422$. Based on these results, hypothesis 3c was not supported because the moderator variables did not significantly account for any variance in risky financial decisions.

**Hypothesis 4**

Hypothesis 4 stated that subscale scores of the DOSPERT (Risk Perception, Risk Taking, and Expected Benefits) will moderate the relationship between cognitive abilities (total estimated intelligence and numeracy) and risky health decisions.

**Hypothesis 4a**

After controlling for the effects of age and gender, perception of health risk will moderate the relationship between cognitive abilities (numeracy and total estimated intelligence) and risky health decisions. One univariate outlier was identified and remained in the analysis as it did not have a significant effect on the overall statistical model. The assumptions of normally distributed residuals, no multicollinearity, and independent errors were satisfied. The assumption of homoscedasticity was not satisfied. Several investigators argue that heteroscedasticity does not invalidate regression, as it is robust against moderate violations of homoscedasticity (Borntedt & Carter, 1971; Mertler & Vannatta, 2010 Tabachnick & Fidell, 2013). Results of the moderation analysis are presented in Table 8.
Table 8

*Risk Perception as a Moderator of the Relationship Between Cognitive Abilities and Health Domain Risky Decisions*

<table>
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<th>$\Delta R^2$</th>
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<tr>
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<td>-.018</td>
<td>-.190</td>
<td>-.259, .213</td>
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<td>-.174</td>
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<td>-.191*</td>
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<td>.118</td>
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<td>-.170</td>
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<td>IQxRiskPer</td>
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<td>-1.257</td>
<td>-.435, .097</td>
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</tbody>
</table>

*Note.* Gender was coded 0 = male 1 = female, Numeracy = numeracy, IQ = total estimated intelligence, Risk Perception = DOSPERT Risk Perception, NumxRiskPer = interaction between numeracy and risk perception, IQxRiskPer = interaction between total estimated intelligence and risk perception.
Results indicate that the control variables (age and gender) accounted for 9.0% of the variance in health domain risky decisions, $R^2 = .090$, $R^2_{adj} = .076$, $F(2, 130) = 6.464$, $p = .002$, as presented in Table 8. In the first step, both age ($\beta = -.21, p = .013$) and gender ($\beta = -.18, p = .036$) had negative relationships with health domain risky decisions. This indicates that males made more risky health-related decisions than females (gender was coded 0 for males and 1 for females), and that older adults made fewer risky health related decisions than younger adults. In the second step, cognitive abilities (numeracy and total estimated intelligence) and risk perception did not explain significant variance in health domain risky decisions, $\Delta R^2 = .038, p = .142, F(5, 127) = 3.746, p = .003$. In the third step, the interactions between cognitive abilities (numeracy and total estimated intelligence) and risk perception did not significantly account for variance in health domain risky decisions, $\Delta R^2 = .020, F_{change}(2, 125) = 1.448, p = .239$. Based on these results, males and younger adults made more risky health decisions compared to females and older adults. Given that the moderator did not significantly account for variance in risky health decisions, hypothesis 4a was not supported.

**Hypothesis 4b**

After controlling for the effects of age and gender, attitudes towards health risk will moderate the relationship between cognitive abilities (numeracy and total estimated intelligence) and risky health decisions. Seven multivariate outliers were identified. Regression analysis was run with and without these outliers to determine their effect on the overall model. These outliers significantly affected the regression model and were...
removed. The assumptions of normally distributed residuals, no multicollinearity, and independent errors were satisfied. The assumption of homoscedasticity was not satisfied. Several investigators argue that moderate violations of homoscedasticity are permissible, regression analysis is robust to violations of this assumption (Borhntedt & Carter, 1971; Mertler & Vannatta, 2010; Tabachnick & Fidell, 2013). Results of the moderation analysis are presented in Table 9.

Table 9

Risk Taking as a Moderator of the Relationship Between Cognitive Abilities and Health Domain Risky Decisions

<table>
<thead>
<tr>
<th>Variable</th>
<th>$R^2$</th>
<th>$\Delta R^2$</th>
<th>$B^a$</th>
<th>SE $B$</th>
<th>$\beta^b$</th>
<th>$t$</th>
<th>95% CI</th>
</tr>
</thead>
<tbody>
<tr>
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<td>.072*</td>
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<td>.005</td>
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</tr>
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<td></td>
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<td>.174**</td>
<td></td>
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<td></td>
<td></td>
<td>.000</td>
<td>.006</td>
<td>.006</td>
<td>.064</td>
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<td></td>
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<td>.208</td>
<td>-.009</td>
<td>-.104</td>
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<td>.096</td>
<td>.980</td>
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<td>.009</td>
<td>.103</td>
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<td>.136</td>
<td>.487**</td>
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<td>.006</td>
<td>.000</td>
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<tr>
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<td></td>
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<td>.213</td>
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<td>-.056</td>
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<td></td>
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<td>.129</td>
<td>.084</td>
<td>.811</td>
<td>-.151, .360</td>
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<td>.023</td>
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<td></td>
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<td>.138</td>
<td>.485**</td>
<td>4.970</td>
<td>.414, .962</td>
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</table>
Results indicate that the control variables (age and gender) did not significantly account for any of the variance in risky health decisions, $R^2 = .072$, $R^2_{adj} = .056$, $F(2, 122) = 4.700$, $p = .011$, as the criterion of significance $p < .00625$ was employed. Results are presented in Table 9. In the second step, cognitive abilities (numeracy and total estimated intelligence) and risk taking (attitude toward risk) significantly contributed to the amount of variance explained in risky health decisions, $\Delta R^2 = .174$, $F_{change}(3, 119) = 9.140$, $p < .001$. Risk taking (attitudes toward risk; $\beta = .48$, $p < .001$) was positively related to risky health decisions, indicating that as risk taking increased, participants made more risky health decisions. In contrast, gender ($\beta = -.009$, $p = .917$), age ($\beta = .006$, $p = .949$), numeracy ($\beta = .09$, $p = .329$), and total estimated intelligence ($\beta = .009$, $p = .918$) did not significantly account for variance in risky health decisions. In the third step, the interactions between cognitive abilities (numeracy and total estimated intelligence) and risk taking did not account for variance in health domain risky decisions, $\Delta R^2 = .001$, $F_{change}(2, 117) = .105$, $p = .900$. Accordingly, participants with greater risk taking behavior made more risky health decisions. Given that the moderator variables did not account for variance in risky health decisions, hypothesis 4b was not supported.
Hypothesis 4c

After controlling for the effects of age and gender, expected benefits of risky health decisions will moderate the relationship between cognitive abilities (numeracy and total estimated intelligence) and risky health decisions. No multivariate outliers were identified. The assumptions of normally distributed residuals, no multicollinearity, and independent errors were satisfied. The assumption of homoscedasticity was not satisfied. Regression analysis is argued to be robust to moderate violations of homoscedasticity and thus regression analysis was conducted (Borhntedt & Carter, 1971; Mertler & Vannatta, 2010; Tabachnick & Fidell, 2013). Results of the moderation analysis are presented in Table 10.

Table 10

*Expected Benefits as a Moderator of the Relationship Between Cognitive Abilities and Health Domain Risky Decisions*

<table>
<thead>
<tr>
<th>Variable</th>
<th>$R^2$</th>
<th>$\Delta R^2$</th>
<th>$B^a$</th>
<th>SE $B$</th>
<th>$\hat{B}^b$</th>
<th>t</th>
<th>95% CI</th>
</tr>
</thead>
<tbody>
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<tr>
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<td>-.012</td>
<td>.005</td>
<td>-.213*</td>
<td>-2.509</td>
<td>-.022</td>
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<tr>
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<td>.198</td>
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<td>-.810</td>
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<td>.063*</td>
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<tr>
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<td>.005</td>
<td>-.154</td>
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<td>-.019</td>
<td>.002</td>
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<tr>
<td>Gender</td>
<td></td>
<td>-.223</td>
<td>.207</td>
<td>-.095</td>
<td>-1.076</td>
<td>-.632</td>
<td>.187</td>
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<tr>
<td>Numeracy</td>
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<td>.117</td>
<td>.092</td>
<td>.932</td>
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<td>.340</td>
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<td>IQ</td>
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<td>.248*</td>
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<td>.082</td>
<td>.521</td>
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<td>.002</td>
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</table>
The results indicate that the control variables (age and gender) accounted for 9.0% of the variance in health domain risky decisions, $R^2 = .090$, $R^2_{adj} = .076$, $F(2, 130) = 6.464$, $p = .002$, as presented in Table 10. In the first step, both age ($\beta = -.21, p = .013$) and gender ($\beta = -.18, p = .036$) had significant, negative relationships with risky health decisions. This indicates that males made more risky health related decisions than females and that younger adults made more risky health related decisions than older adults. In the second step, cognitive abilities (numeracy and total estimated intelligence) and expected benefits significantly contributed to variance explained in health domain risky decisions, $AR^2 = .063$, $p = .028$, $F(5, 127) = 4.596$, $p < .001$. Expected benefits ($\beta = .24, p = .007$) had a positive relationship with risky health decisions, indicating that as perceived expected benefits of risky behavior increased, participants made more risky health decisions. However, age ($\beta = -.15, p = .098$), gender ($\beta = -.09, p = .248$), numeracy
(β = .09, p = .353), and total estimated intelligence (β = .01, p = .869) were not significantly related to risky health decisions. In the third step, the interactions between cognitive abilities (numeracy and total estimated intelligence) and expected benefits did not add to the variance explained in health domain risky decisions, ΔR² = .002, F_{change}(2, 125) = .124, p = .884. Based on these results, males and younger adults made more risky health decisions than females and older adults. Additionally, as expected benefits of risky health decisions increased, participants made more risky health decisions. Given that the moderator did not significantly account for any of the variance in risky health decisions, hypothesis 4c was not supported.

Hypothesis 5

Hypothesis 5 stated that impulsivity will moderate the relationship between cognitive abilities (numeracy and total estimated intelligence) and domain-specific risky decisions.

Hypothesis 5a

After controlling for the effects of age and gender, trait impulsivity will moderate the relationship between cognitive abilities (numeracy and total estimated intelligence) and financial risky decisions. Nine multivariate outliers were identified. Moderation analysis was run with and without them to determine their influence on the overall model statistics. Multivariate outliers significantly affected the model statistic and were removed. The financial risk standardized residuals, D(124) = .097, p = .006, Z_{skewness} = 2.594, Z_{kurtosis} = -1.102, were significantly non-normal and thus failed the assumption of normality. Accordingly, data were transformed using the square root transformation and reanalyzed for normality, D(124) = .121, p < .001, Z_{skewness} = -.783, Z_{kurtosis} = -2.835.
which also failed the assumption for residual normality. Given the fact that the
transformed data did not correct the non-normally distribution of the residuals, the
untransformed data was used in this analysis. Although the data violated the assumption
of normally distributed errors, regression analysis was conducted as several investigators
argue that regression is robust to moderate violations of residual normality (Borhntedt &
Carter, 1971; Mertler & Vannatta, 2010; Tabachnick & Fidell, 2013). Results of the
moderation analysis are presented in Table 11.

Table 11

Impulsivity as a Moderator of the Relationship Between Cognitive Abilities and Financial
Domain Risky Decisions

<table>
<thead>
<tr>
<th>Variable</th>
<th>$R^2$</th>
<th>$\Delta R^2$</th>
<th>$B$</th>
<th>SE</th>
<th>$\beta$</th>
<th>t</th>
<th>95% CI</th>
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<td>.084</td>
<td>.922</td>
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<tr>
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<td>-.367,.261</td>
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<td>.005</td>
<td>.065</td>
<td>.643</td>
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<td>.297,.359</td>
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<td>-.499</td>
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<td>.110</td>
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<td>-.068</td>
<td>-.650</td>
<td>-.261,.132</td>
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<td></td>
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</tbody>
</table>
The results show that the control variables (age and gender) did not significantly account for any of the variance in financial domain risky decisions, $R^2 = .007$, $R^2_{adj} = .007$, $F(2, 121) = .450$, $p = .638$, as presented in Table 11. In the second step, cognitive abilities (numeracy and total estimated intelligence) and impulsivity did not significantly contributed to the amount of variance explained in risky financial decisions, $\Delta R^2 = .035$, $p = .239$, $F(5, 118) = 1.037$, $p = .399$. In the third step, the interactions between cognitive abilities (numeracy and total estimated intelligence) and impulsivity did not significantly contribute to the amount of variance explained in risky financial decisions, $\Delta R^2 = .058$, $F_{change}(2, 116) = .964$, $p = .384$. Based on these results, age, gender, cognitive abilities, and impulsivity do not explain variance in risky financial decisions. Accordingly, Hypothesis 5a was not supported.

**Hypothesis 5b**

After controlling for the effects of age and gender, trait impulsivity will moderate the relationship between cognitive abilities (numeracy and total estimated intelligence) and risky health decisions. Four multivariate outliers were identified. Regression analysis was run with and without these cases to determine the influence on the regression model.
Multivariate outliers significantly affected the regression model and were removed. The assumptions of normally distributed residuals, no multicollinearity, and independent errors were satisfied. The assumption of homoscedasticity was not satisfied. Regression analysis is argued to be robust to moderate violations of homoscedasticity and thus regression analysis was conducted (Borntedt & Carter, 1971; Mertler & Vannatta, 2010; Tabachnick & Fidell, 2013). Results of the moderation analysis are presented in Table 12.

Table 12

*Impulsivity as a Moderator of the Relationship Between Cognitive Abilities and Health Domain Risky Decisions*

<table>
<thead>
<tr>
<th>Variable</th>
<th>(R^2)</th>
<th>(\Delta R^2)</th>
<th>(B^a)</th>
<th>SE (B)</th>
<th>(\beta^b)</th>
<th>(t)</th>
<th>95% CI</th>
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<td>-.155</td>
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<td>.281*</td>
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<td>-.131</td>
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<td>.103</td>
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<td>.113</td>
<td>.265*</td>
<td>2.927</td>
<td>.107, .553</td>
</tr>
</tbody>
</table>
The results show that the control variables (age and gender) accounted for 10.4% of the variance in health domain risky decisions, $R^2 = .104$, $R^2_{adj} = .090$, $F(2, 126) = 7.309, p = .001$, as presented in Table 12. In the first step, both age ($\beta = -.22, p = .010$) and gender ($\beta = -.20, p = .021$) had negative relationships with health domain risky decisions. This indicates that males made more risky health related decisions than females and that younger adults made more risky health-related decisions than older adults. In the second step, cognitive abilities (numeracy and total estimated intelligence) and trait impulsivity explained significant variance in health domain risky decisions, $\Delta R^2 = .075, p = .013, F(5, 123) = 5.377, p < .001$. Trait impulsivity ($\beta = .281, p = .002$) was positively related to risky health decisions, such that as trait impulsivity increased, participants made more risky health decisions. However, age ($\beta = -.15, p = .091$), gender ($\beta = -.15, p = .085$), numeracy ($\beta = .09, p = .325$), and total estimated intelligence ($\beta = .06, p = .472$) did not significantly account for variance in risky health decisions. In the third step, the interactions between cognitive abilities (numeracy and total estimated intelligence) and impulsivity did not add to the variance explained in health domain risky decisions, $\Delta R^2 = .007, F_{change}(2, 121) = .541, p = .584$. Based on the preceding results, males and younger adults made more risky health decisions than females and older adults.
adults. Additionally, participants with greater trait impulsivity made more risky health decisions. Given that the moderator did not significantly account for variance in risky health decisions, hypothesis 5b was not supported.

Posthoc Analyses

An independent samples t-test assessed whether the older and younger adults differed on self-reported levels of trait impulsivity. The groups significantly differed on self-reported trait impulsivity, \( t(127) = 4.337, p < .001, r = .359, M_{\text{Younger}} = 2.739; M_{\text{Older}} = 1.952 \), where the younger adults had higher levels of trait impulsivity than older adults. An independent samples t-test assessed whether males and females differed on self-reported levels of trait impulsivity. The groups did not significantly differ in levels of self-reported trait impulsivity, \( t(126) = 1.414, p = .160, r = .124, M_{\text{Males}} = 2.716; M_{\text{Females}} = 2.498 \).

A one-way ANOVA tested whether older and younger adults significantly differed on their risk perception, risk taking, and perceived expected benefits of engaging in risky behavior. Older and younger adults significantly differed on all aspects of risk tolerance as measured by the DOSPERT subscales. Homogeneity of variance was not assumed for hypothetical risk taking behavior, \( F(1, 127) = 10.986, p = .001 \). Thus, the Welch’s \( F \) statistic was used to assess group differences. Welch’s \( F(1, 79.678) = 89.203, p < .001, r = .475, M_{\text{Older}} = 26.42, M_{\text{Younger}} = 36.11 \), which indicates that the younger adults were more likely to take hypothetical risks based on various risk taking scenarios than older adults. Older adults perceived greater risk in various health and financial-related risky scenarios than younger adults, \( F(1, 127) = 19.578, p < .001, r = .365, M_{\text{Older}} = 66.63, M_{\text{Younger}} = 59.55 \). Similarly, younger adults perceived greater possible benefits of
engaging in risky decision-making than older adults, $F(1, 127) = 20.364, p < .001, r = .371, M_{Older} = 5.061; M_{Younger} = 5.671$. A one-way ANOVA assessed whether males and females significantly differed on risk perception, risk taking behavior, and expected benefits of engaging in risky behavior. Males and females also significantly differed on all aspects of risk tolerance as measured by the DOSPERT subscales. Males and females significantly differed on hypothetical risk taking behavior, $F(2, 126) = 12.411, p < .001, r = .405, M_{Males} = 38.30, M_{Females} = 31.85$, showing that males had a greater likelihood of domain-specific risk taking behavior than females. The groups also significantly differed on risk perception, $F(2, 126) = 8.943, p < .001, r = .352, M_{Males} = 57.57, M_{Females} = 62.88$, revealing that females perceived greater risk in each domain-specific risky scenario than males. Finally, males perceived greater possible benefits from engaging in domain-specific risky behavior than females, $F(2, 126) = 4.482, p = .013, r = .257, M_{Males} = 5.761, M_{Females} = 5.433$.

The Mann-Whitney test examined whether older and younger adults significantly differed on numeracy and measures of nonverbal intelligence. The reverse square root numeracy and block score variables were used as data were significantly, negatively skewed. Accordingly, results must be reverse interpreted such that lower scores indicate greater numeric and nonverbal intelligence. Groups significantly differed on numeracy, $U = 808.0, z = -2.762, p = .006, r = -.243$, where older adults ($M = 46.17$) scored significantly higher on numeracy than younger adults ($M = 69.30$). In contrast, the groups did not differ in nonverbal intelligence, $U = 1254.50, z = -.33, p = .733, r = -.029, M_{Older} = 65.23$ and $M_{Younger} = 64.95$. A one-way ANOVA tested whether age groups differed on measures of verbal and overall intelligence. The groups did not differ in verbal
intelligence, \( F(1, 127) = .984, p = .323, M_{\text{Older}} = 10.365 \) and \( M_{\text{Younger}} = 10.243 \), or in overall intelligence, \( F(1, 127) = .766, p = .383, M_{\text{Older}} = 10.404 \) and \( M_{\text{Younger}} = 10.293 \).

The Mann-Whitney test assessed whether males and females significantly differed on numeracy and measures of nonverbal intelligence. The reverse square root numeracy and block score variables were used as the data were significantly, negatively skewed. Lower scores indicated greater performance on measures of numeracy and nonverbal intelligence than higher scores. Males \((M = 52.79)\) scored higher than females \((M = 72.01)\) on numeracy, \(U = 1364.50, z = -2.887, p = .004, r = -.254\). However, males and females did not significantly differ in nonverbal intelligence, \(U = 1680.50, z = -1.318, p = .188, r = -.116\). A one-way ANOVA tested whether males and females differed on measures of verbal and overall intelligence. They did not differ in verbal intelligence, \(F(2, 126) = 1.423, p = .051, M_{\text{Males}} = 10.381 \) and \( M_{\text{Females}} = 10.204 \), or in overall intelligence, \(F(2, 126) = 2.807, p = .064, M_{\text{Males}} = 10.436 \) and \( M_{\text{Females}} = 10.24 \).
CHAPTER FOUR

DISCUSSION

Overview of Results

The purpose of this study was to examine the moderating effects of trait impulsivity and risk tolerance (risk taking, risk perception, and expected benefits of risky behavior) on the relationship between cognitive abilities (intelligence and numeric ability) and domain-specific risky decision-making (financial and health), after controlling for age and gender. Additionally, this study sought to examine gender and age related differences in domain specific risky decision-making. The participants of this study were 133 adults, split into two age groups: younger adults \(N = 108; 81.2\%\) age 18 – 30 years, and older adults \(N = 25; 18.8\%\) age 55 – 83 years.

Gender Differences in Risky Decision-Making

Hypothesis 1 stated that males and females would differ in the number of domain-specific risky decisions they made. Males made more risky financial and health decisions than females. These gender differences in risky decision-making are consistent with published results in the risky decision-making literature (Byrnes et al., 2009; Charness & Gneezy, 2012). Specifically, males and females significantly differed on all aspects of risk propensity on the DOSPERT subscales (risk taking, risk perception, and expected benefits), where males endorsed more risk taking behavior and expected greater possible benefits or enjoyment of such risky behavior than females. Relative to men, however, women perceived greater potential risk in various risky health and finance scenarios.
Several investigators have examined further the consistent gender differences in risk perception and have found that these judgments are based upon different factors for males and females. When possible severe negative consequences are present in a risky decision, males are more likely to engage in risk taking behavior than females. Closer examination has revealed that for females, probability of incurring negative consequences as well as perceived severity of such consequences affects the risky decision-making process. Moreover, probability of incurring and estimated severity of negative consequences appear to be stable and significant deterrents of risky decision-making for females from childhood through at least early adulthood (Harris et al., 2006; Hillier & Morrongiello, 1998). In the present study, probability of incurring negative consequences and perceptions of severity of risky decisions were not measured.

**Age Differences in Risky Decision-Making**

Hypothesis 2 stated that older and younger adults would differ in the number of domain-specific risky decisions they made. Younger adults made more risky financial and health decisions than older adults. Older and younger adults also differed on all aspects of risk propensity (risk taking, risk perception, and expected benefits of risky behavior). Specifically, younger adults had more risk taking behavior, expected more possible benefits or enjoyment of such behavior, and less perceived risk associated with risk taking behavior compared to older adults. These findings are also consistent with the literature on age differences in risky decision-making. For instance, Rolison, Hanoch, Wood, and Liu (2013) found that relative to younger adults, older adults make fewer risky health and financial decisions. Moreover, age-related changes in health risk taking tend to decline smoothly over time, whereas financial risk taking seems to sharply decline
with age. Mata, Josef, Samanez-Larkin, and Hertwig (2011) argued that there are age-related changes in motivations toward loss prevention, where older adults are more likely to make choices that prevent loss than younger adults. It is also likely that there are domain-specific differences in the impact that generational changes and lived historical events, such as economic booms and busts, have on risk taking behavior (Rolison et al., 2013).

Mata et al. (2011) argue that age-related differences in risky decision-making are related to the type of decisional task. When participants were provided with complete descriptive information about probabilities and outcomes, younger adults made more risky decisions than older adults, a finding replicated in this study. It is possible that these findings highlight proposed differences in how older and younger adults process risk communications when making risky decisions (Li et al., 2013).

**Age Differences in Cognitive Abilities**

In this sample, older adults significantly outperformed younger adults on measures of numeracy, but not on intelligence, despite the significant correlations among intelligence and numeracy. In the present study, fluid or nonverbal intelligence was measured using a block design task, which assessed the ability to manipulate and transform information while utilizing visual-spatial and working memory abilities, all of which underlie solving mathematical problems (Shipley et al., 2009). Previous research has indicated that crystalized or verbal intelligence tends to increase with age, while fluid intelligence tends to decrease (Li et al., 2013). Given these reported age-related changes in cognitive abilities, younger adults should have outperformed the older adults on measures of numeracy. There are several possible explanations for these findings. The
most likely explanation is that the older adults in this study possess greater numeric ability than their age-related peers who have been included in previous studies. Another possibility is that the group level measure of numeracy was biased, as females performed more poorly than males on measures of numeracy and females comprised 60% of the younger adult sample.

In the present study, numeric ability was not related to the overall number of risky health and financial decisions. Previous research has indicated that numeric ability affects a decision-maker’s ability to comprehend information and make competent decisions (Lipkus et al., 2001; Schwartz et al., 1997). For instance, Schwartz et al. (1997) found that numeric ability was related to the application of risk information, where participants with less numeric ability made less accurate decisions about relative risk. Further, Lipkus et al. (2001) found that even well-educated adults experience difficulty interpreting risk communication when mathematical information was part of the risk message. What is less clear however, is whether numeric ability leads one to make more or less risky decisions, as researchers have primarily investigated the effects of numeracy on decision-making competence. One explanation for the current findings may be that other factors, such as trait impulsivity, more significantly affected the participants’ risky decision-making process and that numeric ability differentially led to some participants to make more risky decisions, while others made fewer risky decisions.

**Moderators of the Effect of Cognitive Abilities on Risky Health and Financial Decision-Making**

The present study adds to the domain-specific risky decision-making literature as it is the only known study to this investigator to examine the moderating effects of risk
propensity (risk perception, risk taking, and expected benefits) and trait impulsivity on the relationship between cognitive abilities (intelligence and numeric ability) and risky financial and health decision-making. Previous research indicates that there is a relationship between cognitive abilities, such as intelligence and numeracy, and decision-making (Bruine de Bruin et al., 2007; Del Missier et al., 2012; Finucane et al., 2005; Li et al., 2013). Some investigators argue that risk propensity may alter the relative salience of aspects of risk communication, such as relative gains and losses, thus affecting the ways in which risky decisions are processed (Sitkin & Weingat, 1995). Similarly, impulsivity may affect the type of decision-making strategy that is utilized, leading one to make affectively driven decisions rather than deliberate analytical decisions (Penolazzi et al., 2012). It was hypothesized that measures of risk propensity (risk taking, risk perception, and expected benefits) and trait impulsivity would moderate the relationship between cognitive abilities and domain-specific risky decision-making (see hypotheses 3-5).

All moderation analyses in this study were non-significant; however, all moderator variables (risk taking, risk perception, expected benefits, and impulsivity) individually accounted for variance in domain-specific risky decisions. Specifically, hypothesis 3 stated that attitudes toward risk, risk perception, and expected benefits of risky behavior would moderate the relationship between cognitive abilities and risky financial decisions. The results of this study did not support this hypothesis. One possible explanation for this finding is that risky financial decision-making was measured inadequately in this study as risky scenarios were created and yielded poor internal consistency reliabilities. Thus, it is likely that the scenarios were measuring different aspects of risky financial decision-making, creating much variance in the data. Similar
studies of risky financial decision-making have typically utilized gambling paradigms and had participants make one type of risky financial decision. It is also possible that the participants of this study were equally exposed to some aspects of younger adults in this sample had little exposure to risky financial decision-making, thus creating more variability in response due to inexperience or poor understanding of the task.

Hypothesis 4 stated that attitudes toward risk, risk perception, and expected benefits of risky behavior would moderate the relationship between cognitive abilities and risky health decisions. The results of this study did not support this hypothesis. There are several possible explanations for this finding. Again, risky health decision-making was measured using risky scenarios that were created and yielded poor internal consistency reliability. Of note, the scenarios used in this study were designed to measure health and safety decisions, which may be too distinct to measure together. Additionally, items were written to induce high issue involvement to elicit deliberative processing. It is possible that these hypothetical scenarios did not elicit high issue involvement as expected and led to affectively based decisions, thus increasing overall response variability.

Hypothesis 5 stated that impulsivity would moderate the relationship between cognitive abilities and risky health and financial decisions. The results of this study did not support this hypothesis. It is possible that trait impulsivity is not severe enough to interrupt the decision-making process. Similarly, it is possible that the adults sampled in this study are unrepresentative of the larger older and younger adult populations, as these participants consisted of university students and community dwelling individuals, both of whom theoretically possess greater intellectual abilities than the public. Thus, it is
possible that greater cognitive abilities buffer the impact of trait impulsivity on decision-making processes.

Another likely explanation for these moderation findings is that incorrect theoretical and statistical models were employed. Specifically, it is possible that a curvilinear relationship exists between the proposed independent, dependent, and moderating variables. For instance, it is possible that as measures of intelligence and numeracy increase, so does domain-specific risky decision-making up to a certain point, at which time participants may become more risk averse. It is also possible that measures of risk propensity and impulsivity do not moderate the relationship between cognitive abilities and risky decision-making. Some investigators have found that risk perception and risk propensity mediate the relationship between risky decision outcome history, problem framing, and risky decision-making behavior (Sitkin & Weingart, 1995). Similarly, Harris et al. (2006) found that risk perception, risk taking, and expected benefits of risky behavior all significantly and partially mediated the relationship between gender and risky health and gambling decisions. Thus, it is possible that trait impulsivity and risk propensity (risk taking, risk perception, and expected benefits) mediate the relationships between cognitive abilities and risky health and financial decisions.

Although the moderation analyses were not significant, each moderator variable significantly accounted for some variance in domain-specific risky decision-making, which is consistent with published findings (Byrnes et al., 1999; Crone et al., 2003; Harris et al., 2006; Weber et al., 2002). When examining the overall amount of risky decisions made, males and younger adults made more risky decisions than females and younger adults; however, for risky financial decisions, age and gender did not
significantly account for variance in risky decision-making. This finding is inconsistent with previous research that has found significant interactions between age and gender when examining risky financial decisions, where younger and middle aged men evidenced greater risk taking attitudes about financial risks than women. By older adulthood, however, this gap had significantly reduced and men endorsed less financial risk taking, bringing their risk taking attitudes more in line with those of older adult women (Rolison et al., 2013). One possible explanation for this finding is that financial decision-making was measured more broadly in the current study than in previous studies, which have primarily used gambling tasks to measure risky financial decision-making.

For health related risky decisions, age and gender accounted for variance in risky health decisions. This finding is consistent with previous research that has found an age by gender interaction in risky health decisions, where older adults make fewer risky health decisions and the amount of risky health decisions reduced more steeply for men over time than for women (Rolison et al., 2013). Some investigators argue that women are generally more cognizant of health risks and engage in greater preventative behavior than men (Rolison et al., 2013). Additionally, it is possible that there are generational differences in risk taking, as things that are considered risky to a younger generation may not be considered risky to older adults. Given the differences across decisional domains, these findings also provide support for contemporary theories of domain-specific risky decisions-making (Blais & Weber, 2006; Hanoch et al., 2006; Weber et al., 2002).

Trait impulsivity accounted for a significant amount of variance in risky health decisions, where participants with greater trait impulsivity made more risky health
decisions. The majority of literature regarding the relationship between impulsivity and risky decision-making has utilized gambling paradigms and has thus examined risky financial decisions (Davis et al., 2007; Crone et al., 2003). Within these models, there appears to be a trend where individuals that are more impulsive make more risky decisions. Interestingly, trait impulsivity did not account for any of the variance in risky financial decisions in the present study. It is unclear as to why trait impulsivity only significantly affected risky health decisions and not financial decisions. One significant difference between this study design and those in the literature pertains to the way in which participants made risky financial decisions. In the present study, a descriptive forced choice risky scenarios paradigm was employed, while much of the previous research has used gambling tasks (Davis et al., 2007; Penolazzi et al., 2012). Thus, it is possible that the way in which risky financial decision-making was measured led to these inconsistent findings.

It is also possible that trait impulsivity as measured in this study was not severe enough to disrupt the decision-making process across various decisional domains. While some investigators (Penolazzi et al., 2012) have found that higher scores on measures of trait impulsivity such as the I7 disrupt the risky decision-making process, participants of this study scored within the average range on the I7 as compared to the general population across the adult lifespan (Eysenck et al., 1985). Moreover, 18% of this sample reported that they had previously been diagnosed with Attention-Deficit/Hyperactivity Disorder (ADHD), which is consistent with national rates of ADHD (Chamorro et al., 2012). Although participants were not asked to report whether or not they currently take any prescription medication to help manage symptoms of ADHD, it is possible that
symptoms are well managed and groups means on measures of trait impulsivity were elevated due to well manage clinical impulsivity. Given the instability of the effects of trait impulsivity on domain-specific risky decision-making, it is also possible that these findings provide further support for the domain-specific risk taking theory.

Both risk taking and expected benefits had significant, positive relationships with risky financial and health decisions, indicating that as attitudes toward risk (risk taking) and expected benefits or enjoyment of risky behavior increased, participants made more risky health and financial decisions. Previous research has found that both of these factors impact risky decision-making, yet also note consistent gender differences where males endorse more risk taking and expected benefits than females (Harris et al., 2006; Weber et al., 2002). In this study, gender was a significant contributor to health but not financial decisions. Similarly, risk perception and gender did not account for risky decisions in financial domain, which is not consistent with previous literature that has cited strong gender differences in risk perception (Harris et al., 2006; Weber et al., 2002). One possible explanation for these findings is that participants did not understand the all of the risky financial decisions, thus leading to greater variability in response. It is also possible that participants did not experience high issue involvement when making these decisions and engaged in more affectively driven decision-making.

The lack of consistency regarding the influence of various personal factors across decisional domains provides evidence in support of the domain-specific risky decision-making theory; otherwise, we would expect to see findings that are more consistent across decisional domains, gender, and age of participants. Furthermore, these findings suggest that various personal factors do affect the risky decision-making process. Two
likely explanations for these inconsistent findings are that the model used to understand these relationships was incorrect and that poor internal consistency reliability of the outcome measure led to significant variation in responses.

**Practical and Clinical Implications**

The findings of this study yield both practical and clinical implications. Practically speaking, understanding the ways in which various personal factors affect the risky decision-making process will allow for more effective risk communication, leading to greater comprehension and competent decision-making. For instance, much risk communication is presented in the form of percentages, probabilities, and proportions. Research indicates that even well-educated people experience difficulty converting and appropriately applying this type of risk communication, thus reducing decision-making competence. Moreover, there are age and gender differences in numeric and cognitive abilities, which also affect one’s ability to make competent decisions (Finucane & Gullion; Schwartz et al., 1997). These difficulties may be exacerbated when other personal factors, such as impulsivity and risk propensity, influence the ways in which risk communication is processed.

Given the current demographic trends, adults are living longer and are faced with increasing numbers of risky financial and health decisions than ever before. Some investigators have found that older adults are more sensitive to the presentation of information, which affects their decision-making competence (Finucane et al., 2002). When decision-making competence is threatened, people are at risk of making poor decisions or deferring decisions to younger care providers, such as adult children. Accordingly, understanding the ways in which older and younger adults are differentially
affected by risk propensity and impulsivity when making risky decisions can allow for greater specificity of risk communication. Tailored risk communication may provide opportunities for older adults to remain competent in their decision-making as long as possible, thus respecting individual autonomy. Tailored risk communication can also reduce some of the burden experienced by adult caregivers of older parents.

Within applied health and mental health fields, better understanding of risky decision-making can allow providers greater opportunity to assess decision-making competence, which may have direct effects on treatment. For instance, in the field of applied clinical or counseling psychology, therapists are required to explain the potential risks and benefits of treatment prior to obtaining consent to treatment. Theoretically speaking, if clients cannot understand risk communication, then they cannot provide true consent to treatment, thus violating ethical practice (American Psychological Association, 2010). Again, understanding how to tailor risk communication can allow for greater decision-making competence and respect for autonomy of risky decision-making.

Limitations

There are a few important limitations of this study that must be addressed. Although the overall sample size ($N = 133$) exceeded the suggested minimum sample based on various power and design estimates ($N > 106$), the vast majority of the sample consisted of college students and thus may be unrepresentative of the larger population. Specifically, the final older adult sample consisted of 26 (18.4%) adults between the ages of 55-89 years, which is approximately one-third of the original target sample ($N = 75$).
Consequently, this small sample size limits generalizability of these results to adults over the age of 55 years.

The older adult sample consisted of adults who were recruited from two separate fitness programs, one in the southern United States and one in the Midwestern United States. Although research indicates that older adults who engage in regular exercise may be more similar than dissimilar (Boyette et al., 2002), it is possible that geographical location may have an impact on factors that affect risky decision-making. Research also indicates that older adults who engage in fitness programs differ significantly from those adults who do not participate in such programs. For instance, Boyette et al. (2002) found that older adults who participate in regular exercise are typically more highly educated, of higher socioeconomic status (SES), and are in better overall physical health than those adults who do not. Moreover, some investigators suggest a link between exercise and cognition: older adults who engage in regular exercise tend to outperform sedentary older adults on components of executive functioning, including reasoning, working memory, reaction time (Clarkson-Smith & Hartley, 1989), multi-tasking, planning, and inhibition (Hillman, Erickson, & Kramer, 2008; Voss, Nagamatsu, Liu-Ambrose, & Kramer, 2011).

Results of neuroimaging studies also indicate that regular physical exercise may lead to structural and functional changes in localized brain regions that are responsible for executive functioning and overall cognitive abilities (Guiney & Machado, 2013). These findings suggest that older adults who engage in physical exercise differ on a variety of demographic factors, such as SES, educational background and cognitive abilities from those who do not exercise. It is likely that the older adults of this study represent a subset of older adults that may be of greater physical and cognitive functioning than other
samples, such as those who do not participate in regular physical exercise. Thus, the results of this study as they pertain to older adults should be generalized with caution, as the sample size was small and not representative of diversity of older adults. Future research should include a more heterogeneous sample of older adults that are representative of the larger population.

Given that research has found links between physical exercise and cognitive abilities, exercise habits of all study participants should have been assessed; however, the exercise habits of the young adults were not. Research regarding the cognitive effects of regular exercise among young adults is less available and findings are mixed (Hillman et al., 2008; Voss et al., 2011), with some studies supporting increases in working memory, reaction time, selective attention, and inhibitory control (Guiney & Machado, 2013), all of which may significantly affect one’s decision-making abilities. Future research should solicit information about exercise habits as well as assess how such habits may influence the risky decision-making process.

Another limitation is that the younger adults were sampled from undergraduate psychology classes at a southern American university. Grohol (2010) notes that this longstanding tradition of oversampling college youth within psychological research is often done out of convenience, cost restraints, tradition, and “good enough” data that can be generalized to the larger population. Similarly, Henrich, Heine, and Norenzayan (2010) argue that college students represent a "WEIRD; Western, Educated, Industrialized, Rich, and Democratic" sample that is often vastly different from the larger population of less educated Americans. For instance, Turkheimer, Haley, Waldron, D’Onofrio, and Gottesman (2003) found that the influence of environment and genetics
on intelligence differ based on socioeconomic status, where for children raised in lower-SES areas, environment accounted for approximately 60% of the variance in intelligence and the genetic influence was almost zero. Opposing results were found among children who were raised in high-SES environments. Given the financial and scholastic requirements to get into college, it is likely that the majority of this study sample is from middle to upper-SES backgrounds and of average to above average intelligence. Thus, future research should include a more heterogeneous sample of young adults.

Another limitation pertains to how risky health and financial decisions were measured. Rather than having participants engage in real risky decision-making, such as a gambling task, participants were required to make a dichotomous forced choice decision based on hypothetical scenarios. Although scenarios were written to have high issue involvement, it is likely that these scenarios elicited less involvement than a real risky decision with consequences, such as winning or losing money in a gambling task. Additionally, the health and financial outcome measures yielded very low scale reliabilities, falling into a range that is considered unacceptable. Low scale reliabilities indicate that individual items within a scale are measuring different constructs and thus lack internal consistency. Given that the individual items on the health and financial risky decision-making measures were written to tap various types of risk, including disease prevention, medical treatment, injury prevention, financial investment, saving and spending, and gambling, it is not surprising that the scales yielded low reliabilities. Future research should measure risky financial and health decision-making with real world risky tasks or use measures with greater scale reliability. For instance, future investigation
could require participants to make risky decisions regarding food choice after being provided with information regarding the impact of dietary choices on health.

Similarly, this study measured personal factors (intelligence, numeracy, impulsiveness), risk tolerance (risk taking, risk perception, and expected benefits), and risky decision-making via self-report measures. Although self-report measures are useful ways of tapping into a respondent’s inner psychological processes, they can also add to measurement error and produce distorted results (Baumeister, Vohs, & Funder, 2007; Podsakoff, MacKenzie, Lee, & Podsakoff, 2003). For instance, research on affective forecasting has shown that participants regularly make prediction errors about how they will react and feel (Wilson & Gilbert, 2003). Similarly, research on judgment and decision-making has found that when participants make risky gambling decisions in a hypothetical scenario that they are much less risk averse than when they make similar risky decisions with real currency (Holt & Laury, 2002). Finally, self-report measures may be more vulnerable to processes such as socially desirable responding, item social desirability, and item complexity and/or ambiguity, which may further distort results (Podsakoff et al., 2003).

It is widely accepted among scholars that parametric statistics such as those used in this study should adhere to parametric assumptions, as these assumptions allow for generalizability of results (Field, 2009; Osborne & Waters, 2002; Tabachnick & Fidel, 2013; Williams, Grajales, & Kurkiewicz, 2013). Although violations of parametric assumptions may not invalidate statistical findings, they may weaken results and thus greatly reduce the generalizability of findings beyond the original study sample (Bohrnstedt & Carter, 1971; Tabachnick & Fidel, 2013). In this study, several of the
parametric assumptions for multiple regression analysis were violated, thus limiting the applicability of these findings beyond the sample tested.

Implications for Future Research

Both the results and limitations of this study provide useful insights for future research into the risky decision-making process. First, future research should explore domain-specific decision-making processes across the adult lifespan to better understand the stability, or lack thereof, of decision-making processes. To date, a few studies including the present study, have examined age differences in risky decision-making via cross-sectional designs; however, longitudinal data is lacking. Thus, future research should examine domain-specific risky decision-making across the adult lifespan utilizing within-subjects longitudinal designs. Moreover, heterogeneous samples of adults should be included in order to increase generalizability of findings.

Some investigators have found consistent gender differences in the ways in which males and females perceive and determine relative risk (Harris et al., 2006; Hillier & Morrongiello; 1998). Determinants of risk perception, such as the probability of incurring negative consequences and perceptions of severity of possible consequences have been studied more thoroughly in children and young adults; however, little is known about the stability of these gender differences through middle and older age. Additionally, research that has investigated risk perception in older age has used cross-sectional research designs, which do not provide information about the stability of such determinants. Thus, future research should investigate determinants of risk perception through the adult lifespan using longitudinal designs to better understand how risk perception affects domain-specific risky decision-making across the lifespan.
It is also believed that emotions significantly affect the ways in which people make risky decisions. Furthermore, some investigators argue that emotional processing changes throughout the lifespan and may therefore differentially affect the decision-making process for older and younger adults (Rolison et al., 2013). Future research should include measures of emotional processing when examining domain-specific risky decision-making processes in order to better understand how it affects different types of risky decisions.

Finally, future research should examine the effects of personal factors, such as risk propensity and impulsivity on domain-specific risky decision-making processes. When possible, these studies should engage participants in making real world risky decisions that yield actual relative consequences, such as gambling to win or lose money because designs will mimic most closely actual risky decision-making.
APPENDIX A

HUMAN USE COMMITTEE APPROVAL
TO: Dr. Walter Buboltz and Ms. Rose Niles
FROM: Dr. Stan Napper, Vice President Research & Development
SUBJECT: HUMAN USE COMMITTEE REVIEW
DATE: February 12, 2015

In order to facilitate your project, an EXPEDITED REVIEW has been done for your proposed study entitled:

“Personal Factors, Domain Specificity, and Risky Decision-Making”
HUC 1279

The proposed study’s revised procedures were found to provide reasonable and adequate safeguards against possible risks involving human subjects. The information to be collected may be personal in nature or implication. Therefore, diligent care needs to be taken to protect the privacy of the participants and to assure that the data are kept confidential. Informed consent is a critical part of the research process. The subjects must be informed that their participation is voluntary. It is important that consent materials be presented in a language understandable to every participant. If you have participants in your study whose first language is not English, be sure that informed consent materials are adequately explained or translated. Since your reviewed project appears to do no damage to the participants, the Human Use Committee grants approval of the involvement of human subjects as outlined.

Projects should be renewed annually. This approval was finalized on February 12, 2015 and this project will need to receive a continuation review by the IRB if the project, including data analysis, continues beyond February 12, 2016. Any discrepancies in procedure or changes that have been made including approved changes should be noted in the review application. Projects involving NIH funds require annual education training to be documented. For more information regarding this, contact the Office of University Research.

You are requested to maintain written records of your procedures, data collected, and subjects involved. These records will need to be available upon request during the conduct of the study and retained by the university for three years after the conclusion of the study. If changes occur in recruiting of subjects, informed consent process or in your research protocol, or if unanticipated problems should arise it is the Researchers responsibility to notify the Office of Research or IRB in writing. The project should be discontinued until modifications can be reviewed and approved.

If you have any questions, please contact Dr. Dr. Mary Livingston at 257-2292 or 257-5066.
APPENDIX B

DEMOGRAPHIC SURVEY
Please answer each of the following questions. For multiple choice questions, select the most appropriate response.

1. Age: ______

2. Gender (please circle one): Male Female Transgender Other

3. If you chose “Other” above, please explain:

4. Ethnicity (please circle one): African American/Black Asian Caucasian/White Hispanic Native American Other

5. If you chose “Other” above, please explain:

6. Current marital status: Single Married Divorced Widowed

7. How many children do you have? ______

8. What is the highest level of education that you have received (please circle one):

   None Elementary High school or equivalent Some college/university Associate’s degree Bachelor’s degree Master’s degree Ph.D. degree

9. What is your current student classification (please circle one):

   Freshman Junior Sophomore Senior

10. Are you currently employed? Yes No

11. What is your approximate annual household income (please circle one):

   Less than $10,000 $10,001 – $19,999 $20,000 – $35,000 $35,001 – $41,999 $42,000 – $51,999 $52,000 – $58,999 $59,000 – $73,999 $74,000 – $100,000 $100,001 – $200,000 More than $200,000
12. Using the 5-point scale below, how financially-independent are you? That is, how much do you pay for your own room and board, tuition, groceries, bills, etc. without the assistance of others (e.g. parents, spouse, family members, etc.)?

<table>
<thead>
<tr>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
</tr>
</thead>
<tbody>
<tr>
<td>Extremely Financially Dependent</td>
<td>Slightly Financially Dependent</td>
<td>Neither Financially Dependent nor Financially Independent</td>
<td>Slightly Financially Independent</td>
<td>Extremely Financially Independent</td>
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</table>

13. Using the 5-point scale below, where do you fall on the liberal-conservative political continuum? I am

<table>
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<tr>
<th>1</th>
<th>2</th>
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<th>4</th>
<th>5</th>
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</thead>
<tbody>
<tr>
<td>Very Liberal</td>
<td>Somewhat Liberal</td>
<td>Middle of the Road</td>
<td>Somewhat Conservative</td>
<td>Very Conservative</td>
</tr>
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</table>

14. Using the 5-point scale below, where do you fall on the continuum of religiousness? I am

<table>
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</thead>
<tbody>
<tr>
<td>Extremely Unreligious</td>
<td>Slightly Unreligious or unreligious</td>
<td>Not religious</td>
<td>Slightly Religious</td>
<td>Extremely Religious</td>
</tr>
</tbody>
</table>
APPENDIX C

IMPULSIVENESS QUESTIONNAIRE (I₁)
Instructions: Please answer each question by putting a circle around the ‘YES’ or the ‘NO’ following the questions. There are no right or wrong answers, and no trick questions. Work quickly and do not think too long about the exact meaning of the question.

PLEASE REMEMBER TO ANSWER EACH QUESTION

1. Would you enjoy water skiing?
2. Usually do you prefer to stick to brands you know are reliable, to trying new ones on the chance of finding something better?
3. Would you feel sorry for a lonely stranger?
4. Do you quite enjoy taking risks?
5. Do you often get emotionally involved with your friends’ problems?
6. Would you enjoy parachute jumping?
7. Do you often buy things on impulse?
8. Do unhappy people who are sorry for themselves irritate you?
9. Do you generally do and say things without stopping to think?
10. Are you inclined to get nervous when others around you seem to be nervous?
11. Do you often get into a jam because you do things without thinking?
12. Do you think hitch-hiking is too dangerous a way to travel?
13. Do you find it silly for people to cry out of happiness?
14. Do you like diving off the highboard?
15. Do people you are with have a strong influence on your moods?
16. Are you an impulsive person?
17. Do you welcome new and exciting experiences and sensations, even if they are a little frightening and unconventional?
18. Does it affect you very much when one of your friends seems upset?
19. Do you usually think carefully before doing anything?
20. Would you like to learn to fly an aeroplane?
21. Do you ever get deeply involved with the feelings of a character in a film, play or novel?
22. Do you often do things on the spur of the moment?
23. Do you get very upset when you see someone cry?
24. Do you sometimes find someone else’s laughter catching?
25. Do you mostly speak without thinking things out?
26. Do you often get involved in things you later wish you could get out of?
27. Do you get so ‘carried away’ by new and exciting ideas that you never think of possible snags?
28. Do you find it hard to understand people who risk their necks climbing mountains?
29. Can you make decisions without worrying about other people’s feelings?
30. Do you sometimes like doing things that are a bit frightening?
31. Do you need to use a lot of self-control to keep out of trouble?
32. Do you become more irritated than sympathetic when you see someone cry?
33. Would you agree that almost everything enjoyable is illegal or immoral?
34. Generally do you prefer to enter cold sea water gradually, to diving or jumping straight in?
35. Are you often surprised at people’s reactions to what you do or say?
36. Would you enjoy the sensation of skiing very fast down a high mountain slope?
37. Do you like watching people open presents?
38. Do you think an evening out is more successful if it is unplanned or arranged at the last moment?
39. Would you like to go scuba diving?
40. Would you find it very hard to break bad news to someone?
41. Would you enjoy fast driving?
42. Do you usually work quickly, without bothering to check?
43. Do you often change your interests?
44. Before making up your mind, do you consider all the advantages and disadvantages?
45. Can you get very interested in your friends’ problems?
46. Would you like to go pot-holing?
47. Would you be put off a job involving quite a bit of danger?
48. Do you prefer to ‘sleep on it’ before making decisions?
49. When people shout at you, do you shout back?
50. Do you feel sorry for very shy people?
51. Are you happy when you are with a cheerful group and sad when the others are glum?
52. Do you usually make up your mind quickly?
53. Can you imagine what it must be like to be very lonely?
54. Does it worry you when others are worrying and panicky?
APPENDIX D

DOMAIN-SPECIFIC RISK TAKING SCALE (DOSPERT)
Risk Taking Scale

For each of the following statements, please indicate the likelihood that you would engage in the described activity or behavior, if you were to find yourself in that situation.

For each of the following statements, please indicate your likelihood of engaging in each activity or behavior. Provide a rating from 1 to 5, using the following scale:

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<th>1</th>
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<th>5</th>
</tr>
</thead>
<tbody>
<tr>
<td>Very unlikely</td>
<td>Unlikely</td>
<td>Not sure</td>
<td>Likely</td>
<td>Very likely</td>
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</table>

1. Betting a day’s income at the horse races. (F) __________________________________
2. Investing 10% of your annual income in a moderate growth mutual fund. (F)  _____
3. Drinking heavily at a social function. (H/S) _____
4. Betting a day’s income at a high-stake poker game. (F) _____
5. Investing 5% of your annual income in a very speculative stock. (F) _____
6. Betting a day’s income on the outcome of a sporting event (e.g., baseball, soccer, or football). (F) _____
7. Investing 5% of your annual income in a dependable and conservative stock. (F) _____
8. Engaging in unprotected sex. (H/S) _____
9. Driving a car without wearing a seat belt. (H/S) _____
10. Investing 10% of your annual income in a new business venture. (F) _____
11. Riding a motorcycle without a helmet. (H/S) _____
12. Gambling a week’s income at a casino. (F) _____
13. Sunbathing without sunscreen. (H/S) _____
14. Walking home alone at night in an unsafe area of town. (H/S) _____
15. Eating high cholesterol foods. (H/S) _____
16. Driving while taking medication that may make you drowsy. (H/S) _____

Note. F = Financial and H/S = Health/Safety
Risk Perception Scale

People often see some risk in situations that contain uncertainty about what the outcome or consequences will be and for which there is the possibility of negative consequences. However, riskiness is a very personal and intuitive notion, and we are interested in your gut level assessment of how risky each situation or behavior is.

For each of the following statements, please indicate how risky you perceive each situation. Provide a rating from 1 to 5, using the following scale:

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<tbody>
<tr>
<td>Not at all</td>
<td>Moderately</td>
<td>Extremely risky</td>
<td></td>
<td></td>
</tr>
<tr>
<td>risky</td>
<td>risky</td>
<td></td>
<td></td>
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Expected Benefits Scale

For each of the following statements, please indicate the benefits you would obtain from each situation. Provide a rating from 1 to 5, using the following scale:

<table>
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<th>5</th>
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</thead>
<tbody>
<tr>
<td>No benefits</td>
<td>Moderate</td>
<td>Great benefits</td>
<td></td>
<td></td>
</tr>
<tr>
<td>at all</td>
<td>benefits</td>
<td></td>
<td></td>
<td></td>
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</tbody>
</table>
APPENDIX E

NUMERACY SCALE
General Numeracy Scale

1. Imagine that we rolled 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)? __________

2. In the BIG BUCKS LOTTERY, the chances of winning a $10.00 prize is 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 to BIG BUCKS? __________

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

Expanded Numeracy Scale

1. Which of the following numbers represents the biggest risk of getting a disease?
   ___ 1 in 100, ___ 1 in 1000, ___ 1 in 10

2. Which of the following numbers represents the biggest risk of getting a disease?
   ___ 1%, ___ 10%, ___ 5%

3. 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? __________

4. 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? __________

5. If the chance of getting a disease is 10%, how many people would be expected to get the disease:
   A: Out of 100? __________
   B: Out of 1000? __________

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

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

MARLOWE-CROWNE SOCIAL DESIRABILITY SCALE SHORT FORM C
Read each of the following items and decide whether the statement is *true* or *false* as it pertains to you personally and mark T or F beside the statement to indicate this.

_____ 1. I sometimes feel resentful when I don’t get my way.

_____ 2. On a few occasions, I have given up doing something because I thought too little of my abilities.

_____ 3. There have been times when I feel like rebelling against people in authority even though I knew they were right.

_____ 4. No matter who I’m talking to, I’m always a good listener.

_____ 5. I can remember “playing sick” to get out of something.

_____ 6. There have been occasions when I took advantage of someone.

_____ 7. I’m always willing to admit it when I make a mistake.

_____ 8. I sometimes try to get even, rather than forgive and forget.

_____ 9. I am always courteous, even to people who are disagreeable.

_____ 10. I have never been irked when people expressed ideas very different from my own.

_____ 11. There have been times when I was quite jealous of the good fortunes of others.

_____ 12. I am sometimes irritated by people who ask favors of me.

_____ 13. I have never deliberately said something that hurt someone’s feelings.
APPENDIX G

PILOT STUDY DECISION-MAKING SCENARIOS WITH LIKERT RATINGS
Below are 20 hypothetical scenarios that ask you to make a decision based on the information provided. Please read each hypothetical scenario carefully and select the option that you favor for each scenario. There are no right or wrong answers, so please do your best.

Financial Risky Decisions

Imagine that you have $6000 invested in the stock market. A downturn in the economy is occurring. You have two investment strategies that have been recommended to you by your trusted financial advisor to help preserve your investment.

Strategy A: If strategy A is followed, $2,000 of you investment will be saved and $4,000.00 will be lost.

Strategy B: If strategy B is followed, there is 30% chance that the entire $6000 will be saved, and a 70% chance that none of your investment will be saved.

Which of the two strategies (A or B) do you favor? _____

Not at all risky/ Highly risky/ Not representative of risk domain
Not representative of risk domain 1 2 3 4 5
Highly risky/ Representative of risk domain

Imagine that you won $1.1 million in the state lottery and have $50,000 in various debts (e.g. student loans, car loan, mortgage, credit card, etc.). What would you do with the money?

Option A: Invest all of the money into long-term savings plan.

Option B: Pay off all of your current debts and then spend the rest of the money however you choose.

Which of the two options (A or B) do you favor? ______

Not at all risky/ Highly risky/ Not representative of risk domain
Not representative of risk domain 1 2 3 4 5
Highly risky/ Representative of risk domain

Imagine that you won the Lottery for Life, which is a program that is designed to pay winners up to $3 million. You have two choices of how to receive the money.

Option A: Take the $3 million lump sum up front and pay a hefty state tax on this income.

Option B: Take the payment plan option, where you will receive $25,000 per month for the next ten years and pay state taxes on the annual earnings.
Imagine that you are looking to purchase a house and need to decide between two attractive options.

Option A: A well maintained house that is approximately 30 minutes away from your place of work and $20,000 under your budget.

Option B: A brand new house that is approximately 10 minutes away from your place of work and is $15,000 over your budget.

Imagine that your financial advisor informed you about a potentially lucrative investment in an up-and-coming internet technology business. The advisor tells you that this company’s stock has been steadily climbing and is projected to yield large gains on all investments; however, the stock market is unpredictable and you are not guaranteed to make a profit on your investment. The advisor asks if you would like to buy into the stock. Assume that you make $50,000 per year at your job. You are presented with two buy-in options.

Option A: Invest 5% of your annual income in this stock.

Option B: Invest $1000 in this stock.

Imagine that you are presented with an attractive all-inclusive 7-day trip to Fiji that costs $1,800.00 per person. You really want to go, but cannot afford to pay for the trip out of pocket. You have two options that would make this trip feasible.
Option A: Book the trip and all related expenses (e.g. souvenirs, day trips, transportation, etc.) on your credit card and pay off the trip and 20% monthly interest over the course of a year.

Option B: Take out a small loan from your bank and pay off the trip, related expenses, and 7% monthly interest over the course of a year.

Which of the two options (A or B) do you favor? _____

Not at all risky/Not representative of risk domain  1  2  3  4  5  Highly risky/Representative of risk domain

Imagine that you are looking to purchase a new car and come across two attractive options. Car A is a brand new top of the line model, while car B is also top of the line, but two years old and was returned to the dealership after a lease expired. Assume that you have budgeted a maximum of $600 in transportation costs per month. Which car would you purchase?

Car A: Costs $600 per month after your down payment.

Car B: Costs $450 per month after your down payment.

Which of the two cars (A or B) do you favor? _____

Not at all risky/Not representative of risk domain  1  2  3  4  5  Highly risky/Representative of risk domain

Imagine that you received $900.00 from your annual tax return and currently hold a balance of $275.00 on your credit card. Aside from the money that you owe on your credit card, you are debt-free. What would you do with the money?

Option A: Book a $1,200.00 trip to Europe for 10 days, which would require you to spend an additional $300 plus all related expenses.

Option B: Book a weekend getaway for $300.00, pay the $275.00 balance on your credit card, and invest the remaining $325.00 in a savings account.

Which of the two options (A or B) do you favor? _____

Not at all risky/Not representative of risk domain  1  2  3  4  5  Highly risky/Representative of risk domain
Imagine that you were looking to invest $5,000.00 in a mutual fund. Ideally, you would like to use the profit as part of a down payment on a planned large purchase in the future (i.e. a house, car, boat, etc.). Your financial advisor informs you that there are two options.

Option A: A slow growth mutual fund that is guaranteed to yield profit in the long-term (i.e. after one year).

Option B: A fast growth mutual fund that may yield profit initially (i.e. after one month) but is not guaranteed to yield long-term profit (i.e. after one year).

Which of the two options (A or B) do you favor? _____

Not at all risky/ Highly risky/ Not representative/ Representative of risk domain
Not representative of risk domain 1  2  3  4  5

Imagine that you are at a casino and have already won $500.00. You’re playing a game and are feeling lucky. What do you do on your next turn?

Option A: Go all in on your next bet in hopes of doubling your earnings.

Option B: Walk away now and keep the $500.00 that you’ve already made

Which of the two options (A or B) do you favor? _____

Not at all risky/ Highly risky/ Not representative/ Representative of risk domain
Not representative of risk domain 1  2  3  4  5

Health Risky Decisions

Imagine that the U.S. is preparing for the outbreak of a lethal viral strain of H1N1 swine flu, which is expected to kill 6 million people. In the Southern U.S., 250 cases have already been identified. Two alternative preventative vaccinations have been proposed.

Vaccine A: The current, standard vaccine yields a 60% chance that all people who receive this vaccination will become immune to the H1N1 flu. Comparatively, there is a 40% chance that all people who receive this vaccination will not be immune and will still be susceptible to contracting the H1N1 flu.

Vaccine B: A new vaccine has an 80-85% effectiveness rate of preventing the H1N1 in animals. It has not yet been tested on humans.

Which of the two programs (A or B) do you favor? _____
The National Cancer Institute has made two scientific breakthroughs that allow them to reverse a substantial portion of the cellular changes that lead to all types of cancer. This treatment has the potential to reduce the lethality of all forms of cancer; however, it cannot be guaranteed that people who develop cancer and receive this treatment will not die. The U.S. government is taking a nation-wide poll to determine which treatment the public wants to become standard treatment.

Treatment A: This is a new vaccination that has been tested in animals and yields a 55% effectiveness rate in treating cancerous cell growth. This vaccination is awaiting human testing.

Treatment B: This is a new vaccination that has been tested on animals and yields an 85% effectiveness rate in treating cancerous cell growth; however, it substantially increases the risk of having a heart attack and has not yet been tested on humans.

There are adequate resources to implement only one treatment program. Which of the two treatments (A or B) would you favor for national implementation? _____

Imagine that you have contracted a rare and lethal disease and are asked to pick a course of treatment. Two treatment options are available.

Treatment A: The current medical treatment yields a 40% success rate.

Treatment B: A new treatment yields a 65% success rate, but has only been tested on a small number (50) of adults in Europe and appeared to lower the participants’ immunity such that they were susceptible to other infections and illnesses for one year following treatment.

Which of the two treatments (A or B) do you favor? _____

Imagine that a major drug company will soon be releasing a new vaccine, which has been
approved by the Food and Drug Administration, to reduce the chances of contracting and spreading Sexually Transmitted Infections (STIs). This vaccine has been associated with slight reductions in libido across all sexes.

Vaccine A: Decline the vaccination, which may increase your chances of contracting an STI, but maintain your current libido.

Vaccine B: Receive the vaccination, which will significantly decrease your chances of contracting an STI, but may decrease your current libido.

Which of the two vaccines (A or B) do you favor? _____

| Not at all risky/ | 1 | 2 | 3 | 4 | 5 | Highly risky/ |
| Not representative of risk domain |  |  |  |  |  | Representative of risk domain |

Current research suggests that much of the meat and animal byproducts that make up a large proportion of the American diet are genetically modified, consist of antibiotics, and that these animals are highly susceptible to lethal strains of E-coli. Moreover, research suggests that beef is the most susceptible of all meats. Research has not yet determined the long-term effects of diets filled with meat and animal byproducts. There are two diet programs from which to choose.

Program A: A diet devoid of all beef products and byproducts.

Program B: Continue to consume meat and animal byproducts as a part of your regular diet.

Which of the two programs (A or B) do you favor? _____

| Not at all risky/ | 1 | 2 | 3 | 4 | 5 | Highly risky/ |
| Not representative of risk domain |  |  |  |  |  | Representative of risk domain |

The federal government and the Food and Drug Administration (FDA) are taking swift action to reduce the rates of obesity and health-related concerns that arise from a diet that is high in fats, cholesterol, salt, and sugar, which has been referred to as the “fast food and pre-processed diet”. The government and FDA have developed two programmed approaches to reduce the rates of obesity and health-related concerns amongst Americans.

Program A: Close all fast food chains across the country over the next 5 years and require that all remaining restaurants follow strict food preparation guidelines.

Program B: Require that all fast food chains follow strict food preparation guidelines and continue to allow Americans to choose their diet.
Which of the two programs (A or B) do you favor? _____

Not at all risky/ Highly risky/
Not representative  1  2  3  4  5  Representative of
of risk domain risk domain

Imagine that you arrive at the beach on a hot, sunny summer day and realize that you have forgotten your sunscreen at home, which is 15 minutes away. The weather network advised all people to wear sunscreen if they planned on being in the sun for longer than 20 minutes. What do you do?

Option A: Drive to the closest store, which is 10 minutes away and purchase some sunscreen.

Option B: Go to the beach without sunscreen.

Which of the two options (A or B) do you favor? _____

Not at all risky/ Highly risky/
Not representative  1  2  3  4  5  Representative of
of risk domain risk domain

Imagine that you are out at a social gathering with your close friend. Both of you have had several alcoholic beverages and your friend insists on driving home, noting that they are “Okay to drive”. What do you do?

Option A: Refuse to take a ride home from your friend and call a taxi. The taxi will charge you $25.00 to drive you home and you know that your friend does not have money.

Option B: Listen to your friend and accept the ride.

Which of the two options (A or B) do you favor? _____

Not at all risky/ Highly risky/
Not representative  1  2  3  4  5  Representative of
of risk domain risk domain

Imagine that you need $20.00 in the morning and forgot to take it out at the bank while you were running your errands during the day. You need to go to an ATM and take out cash before you go to bed, but do not have a car and there is no public transportation available. Your only option is to walk to the closest ATM. Which route do you take?
Route A: Consists of 5 blocks and takes approximately 10 minutes to reach the closest ATM, but goes through a bad part of town that is not well lit at night.

Route B: Consists of 10 blocks and takes approximately 20 minutes to reach the same ATM, but goes through the center of town, which is well lit and monitored at night.

Which of the two routes (A or B) do you favor? ____

Not at all risky/ Not representative of risk domain 1 2 3 4 5 Highly risky/ Representative of risk domain

Imagine that you get into your car to drive to work in the morning and realize that your seatbelt is broken. You try to fix it but are not successful. You cannot miss a day at work without losing pay and need the money. What do you do?

Option A: Call a friend to drive you to work, which would possibly make you late, resulting in a minimal daily pay reduction.

Option B: Drive your car to work without a seatbelt and arrive on time.

Which of the two options (A or B) do you favor? ____

Not at all risky/ Not representative of risk domain 1 2 3 4 5 Highly risky/ Representative of risk domain
APPENDIX H

DECISION-MAKING SCENARIOS
Below are 11 hypothetical scenarios that ask you to make a decision based on the information provided. Please read each hypothetical scenario carefully and select the option that you favor for each scenario. There are no right or wrong answers, so please do your best.

The National Cancer Institute has made two scientific breakthroughs that allow them to reverse a substantial portion of the cellular changes that lead to all types of cancer. This treatment has the potential to reduce the lethality of all forms of cancer; however, it cannot be guaranteed that people who develop cancer and receive this treatment will not die. The U.S. government is taking a nation-wide poll to determine which treatment the public wants to become standard treatment.

Treatment A: This is a new vaccination that has been tested in animals and yields a 55% effectiveness rate in treating cancerous cell growth. This vaccination is awaiting human testing.

Treatment B: This is a new vaccination that has been tested on animals and yields an 85% effectiveness rate in treating cancerous cell growth; however, it substantially increases the risk of having a heart attack and has not yet been tested on humans.

There are adequate resources to implement only one treatment program. Which of the two treatments (A or B) would you favor for national implementation? 

Imagine that you have $6000 invested in the stock market. A downturn in the economy is occurring. You have two investment strategies that have been recommended to you by your trusted financial advisor to help preserve your investment.

Strategy A: If strategy A is followed, $2,000 of you investment will be saved and $4,000.00 will be lost.

Strategy B: If strategy B is followed, there is 30% chance that the entire $6000 will be saved, and a 70% chance that none of your investment will be saved.

Which of the two strategies (A or B) do you favor? 

Imagine that the U.S. is preparing for the outbreak of a lethal viral strain of H1N1 swine flu, which is expected to kill 6 million people. In the Southern U.S., 250 cases have already been identified. Two alternative preventative vaccinations have been proposed.

Vaccine A: The current, standard vaccine yields a 60% chance that all people who receive this vaccination will become immune to the H1N1 flu. Comparatively, there is a 40% chance that all people who receive this vaccination will not be immune and will still be susceptible to contracting the H1N1 flu.
Vaccine B: A new vaccine has an 80-85% effectiveness rate of preventing the H1N1 in animals. It has not yet been tested on humans.

Which of the two programs (A or B) do you favor? _____

Imagine that you won the Lottery for Life, which is a program that is designed to pay winners up to $3 million. You have two choices of how to receive the money.

Option A: Take the $3 million lump sum up front and pay a hefty state tax on this income.

Option B: Take the payment plan option, where you will receive $25,000 per month for the next ten years and pay state taxes on the annual earnings.

Which of the two options (A or B) do you favor? _____

Imagine that you have contracted a rare and lethal disease and are asked to pick a course of treatment. Two treatment options are available.

Treatment A: The current medical treatment yields a 40% success rate.

Treatment B: A new treatment yields a 65% success rate, but has only been tested on a small number (50) of adults in Europe and appeared to lower the participants' immunity such that they were susceptible to other infections and illnesses for one year following treatment.

Which of the two treatments (A or B) do you favor? _____

Imagine that you are at a casino and have already won $500.00. You’re playing a game and are feeling lucky. What do you do on your next turn?

Option A: Go all in on your next bet in hopes of doubling your earnings.

Option B: Walk away now and keep the $500.00 that you’ve already made.

Which of the two options (A or B) do you favor? _____

Imagine that you arrive at the beach on a hot, sunny summer day and realize that you have forgotten your sunscreen at home, which is 15 minutes away. The weather network advised all people to wear sunscreen if they planned on being in the sun for longer than 20 minutes. What do you do?

Option A: Drive to the closest store, which is 10 minutes away and purchase some sunscreen.
Option B: Go to the beach without sunscreen.

Which of the two options (A or B) do you favor? _____

Imagine that you were looking to invest $5,000.00 in a mutual fund. Ideally, you would like to use the profit as part of a down payment on a planned large purchase in the future (i.e. a house, car, boat, etc.). Your financial advisor informs you that there are two options.

Option A: A slow growth mutual fund that is guaranteed to yield profit in the long-term (i.e. after one year).

Option B: A fast growth mutual fund that may yield profit initially (i.e. after one month) but is not guaranteed to yield long-term profit (i.e. after one year).

Which of the two options (A or B) do you favor? _____

Imagine that you are out at a social gathering with your close friend. Both of you have had several alcoholic beverages and your friend insists on driving home, noting that he/she are “Okay to drive”. What do you do?

Option A: Refuse to take a ride home from your friend and call a taxi. The taxi will charge you $25.00 to drive you home and you know that your friend does not have money.

Option B: Listen to your friend and accept the ride.

Which of the two options (A or B) do you favor? _____

Imagine that your financial advisor informed you about a potentially lucrative investment in an up-and-coming internet technology business. The advisor tells you that this company’s stock has been steadily climbing and is projected to yield large gains on all investments; however, the stock market is unpredictable and you are not guaranteed to make a profit on your investment. The advisor asks if you would like to buy into the stock. Assume that you make $50,000 per year at your job. You are presented with two buy-in options.

Option A: Invest 5% of your annual income in this stock.

Option B: Invest $1000 in this stock.

Which of the two options (A or B) do you favor? _____

Imagine that you need $20.00 in the morning and forgot to take it out at the bank while you were running your errands during the day. You need to go to an ATM and take out
cash before you go to bed, but do not have a car and there is no public transportation available. Your only option is to walk to the closest ATM. Which route do you take?

Route A: Consists of 5 blocks and takes approximately 10 minutes to reach the closest ATM, but goes through a bad part of town that is not well lit at night.

Route B: Consists of 10 blocks and takes approximately 20 minutes to reach the same ATM, but goes through the center of town, which is well lit and monitored at night.

Which of the two routes (A or B) do you favor? _____
"Welcome and thank you for participating in the study "Personal Factors, Domain Specificity, and Risky Decision-Making". My name is Rose Niles/ [say your name] and I am a research assistant of Rose Niles, the primary investigator of this study. In order to participate, you must be between the ages of 18-89 years and you must provide written informed consent. Please take a moment and read this consent form, as it contains important information about this study".

"You will notice that there are two identical consent forms in your survey packet, one labeled Participant Copy and one labeled Investigator Copy. If you would like to participate, please make an X in the box labeled Accept on both copies of this consent form. Please remove the Participant Copy and keep it with your personal records. If your instructor is offering extra course credit, the Participant Copy of the Informed Consent form may be used as proof of participation. If you do not wish to participate, please return your survey packet to me and you can leave”.

"Today you will be completing a survey packet and asked to do a number of things. Please answer every test item honestly and to the best of your ability. We will begin with two timed tests and then you will be given unlimited time to finish the remaining test items. Please take a moment to silence or turn off your cell phones before we begin. Please do not use your cell phone or other electronic devices, including calculators, to assist you on this test. Again, just do your best".
APPENDIX J

SHIPLEY-2 INSTRUCTIONS
Per the test administration guidelines, all participants will be introduced to the Shipley-2 via these instructions: “You will be taking two brief tests today. Please try as hard as you can on each one and pay attention to when I tell you to begin and to stop. Each of the tests has its own instructions. When I tell you to start, read the instructions carefully and then start working on the test” (Shipley et al., 2009, p.6).

Introduction to Vocabulary Test on the Shipley-2

Per the test administration guidelines, all participants will be introduced to the Vocabulary test of the Shipley-2 via these instructions: “This task is about word meanings. Ready? Read the instructions and begin” (Shipley et al., 2009, p. 6). After ten minutes have elapsed, participants will be told to put their pencils down and stop working.

Per the test administration guidelines, all participants will be introduced to the Block Design test of the Shipley-2 via these instructions: “The next task shows some block patterns to figure out. It is on two pages that face each other. You can do both pages without stopping. Open the form, read the instructions, and begin” (Shipley et al., 2009, p.6). After ten minutes have elapsed, the participants will be instructed to put their pencils down and stop working.
REFERENCES


