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Goal Framing of Health Related Behaviors: What Factors Contribute to the Persuasiveness of a Message?

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DISSERTATION
submitted to the Eberly College of Arts and Sciences
at the West Virginia University
in Partial Fulfillment of the Requirements for the degree of

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In
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Abstract

Goal Framing of Health Related Behaviors: What Factors Contribute to the Persuasiveness of a Message?

Sarah A. Stoner

There is evidence that the manner in which relevant information is framed can influence decisions that are based on that information. That is, information may be presented in a positive frame (i.e., describing benefits gained from engaging in behaviors) or in a negative frame (i.e., describing losses from not engaging in behaviors). The effect of information frame on older adults' decision to comply or not comply with health behavior recommendations is unclear due to a paucity of research. In an attempt to understand factors that influence older adult healthy behavior decision making, the current study examined variables that might predict whether positively or negatively framed information elicits greater compliance with health recommendations. Positively and negatively framed messages promoting skin cancer prevention and detection were distributed to older and younger adults. Participants rated their intentions to engage in prevention and detection behaviors. Intentions to engage in prevention behaviors was related to lower numeracy ability. Additionally, intentions to engage in prevention behaviors were stronger among older adults than younger adults. No significant difference was found across numeracy ability or age groups in intentions to engage in detection behaviors. Additionally, there were not significant differences in intentions to engage in prevention or detection behaviors when the efficacy level of these behaviors varied. History of engaging in prevention behaviors was related to intentions to engage in future prevention behaviors in the positive frame condition and in the negative frame condition. In conclusion, older adults reacted similarly to younger adults following exposure to framed messages, and endorsed stronger intentions than the younger adults to engage in prevention behaviors regardless of message frame. Additionally, positively-framed prevention messages were more persuasive than negatively-framed messages among people with a history of engaging in prevention behaviors. Recommendations for future research include examining variables associated with increased compliance among individuals with a weaker history of engaging in the recommended behaviors should be explored in future studies.

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Goal Framing of Health Related Behaviors: What Factors Contribute to the Persuasiveness of a Message?

When specific behaviors have a high chance of either preventing or detecting a health problem, people should engage in those behaviors if they wish to remain healthy. For example, people should use mouth wash if they want to prevent cavities, or get a mammogram if they want to detect breast cancer. While engaging in these activities may be unpleasant or time-consuming, these activities are beneficial to the individual's health. Despite the benefits of engaging in these activities, not all individuals engage in behaviors that prevent or detect health problems.

Several cognitive and social models and theories of health and behavior have been offered to explain differences in compliance rates with recommended health behaviors (e.g., health belief model, Janz & Becker, 1984; Rosenstock, 1974; protection motivation theory, Rogers, 1983; theory of reasoned action and planned behavior, Ajzen & Fishbein, 1980; Fishbein & Ajzen, 1975; see Armitage & Conner, 2000, for review). In addition to the factors that these theories suggest are related to whether individuals engage in health-promoting behaviors, there is growing evidence that how the facts are presented, or framed, may impact a person's decision to engage in a behavior.

Framing Effect

When making a decision in which there is a degree of risk, decision makers may become biased towards one option due to the framing of the information. This bias may lead to the framing effect, as originally illustrated by Tversky and Kahneman (1981). In this classic study, decision makers were given a dilemma in which an unusual disease would kill 600 people. Two options were presented in either a positive or negative frame:

Positive frame:

If Program A is adopted, 200 people will be saved.

If Program B is adopted, there is a 1/3 probability that 600 people will be saved, and 2/3 probability that no people will be saved.

Negative frame:

If Program C is adopted, 400 people will die.

If Program D is adopted, there is 1/3 probability that no one will die, and 2/3 probability that 600 people will die. (Tversky & Kahneman, 1981, p. 453).

Programs A and C are equivalent, as are Programs B and D. Nevertheless, Program A was preferred in the positive frame, and Program D was preferred in the negative frame. Participants were risk averse when the information was presented positively, yet risk seeking when the equivalent information was presented negatively. Despite the equivalent information, decisions differed across frames.

The tendency for risk preference to differ when options are presented in different frames has been found in numerous studies across varying domains, including finance and health decisions (see Moxey, O'Connell, & McGettigan, 2003 for review). From this research, three categories of framing have emerged: risky choice, attribute, and goal (Levin, Schneider, & Gaeth, 1998). Risky choice framing involves presenting options with varying degrees of risk in either a positive or negative frame, as in the Asian Disease problem described earlier (Tversky & Kahneman, 1981). Preference for seeking or avoiding risk may differ across frames. Attribute framing is different from risky choice framing; attribute framing involves describing a feature of an object or event in either a positive or negative frame. Perceived attractiveness or desirability of the targeted object may differ across frames. For example, meat described as 75% lean

(positive frame) was rated as more desirable than meat described as 25% fat (negative frame) in one study of attribute framing (Levin & Gaeth, 1988).

The third type of framing, goal framing, will be the focus of this study. Goal framing involves describing the outcomes of either engaging or not engaging in a targeted behavior. Positive frames emphasize the potential benefits of engaging in the behavior. Positive frames may also emphasize the negative consequences that could be avoided by engaging in the behavior. On the other hand, negative frames emphasize the potential benefits that are lost by not engaging in the behavior. Negative frames may also emphasize the negative consequences of failing to engage in the behavior (Levin et al., 1998). Negative frames differ from fear appeal messages in that fear appeal messages use emotion-laden messages to stress severity of a disease and one's vulnerability (cf. de Hoog, Stroebe, & DeWit, 2007). Both positive and negative frames contain logically equivalent information, and encourage individuals to engage in a behavior. However, the extent to which people engage or intend to engage in the behavior may differ across frames. For example, among people who did not regularly use their credit card, usage increased more among the individuals who learned about the disadvantages of not using credit cards (negative frame) as compared to those who learned about the advantages of using credit cards (positive frame; Ganzach & Karsahi, 1995). While both frames were intended to increase credit card usage, compliance differed across frames.

Theoretical Account for the Framing Effect

The effect of frame on eliciting different outcome behaviors is often explained through prospect theory (Kahneman & Tversky, 1979; Tversky & Kahneman, 1981). According to prospect theory, potential outcomes are weighted according to the probability that the outcome will occur. However, all outcomes are not weighted equally. Outcomes that are less likely to

occur are overweighted, while outcomes that are more likely to occur are underweighted. Additionally, potential outcomes are viewed as either gains or losses from a neutral point. This point is typically the current state of wealth or health (Kahneman & Tversky). Losses are perceived greater than gains (Tversky & Kahneman). That is, while gaining a certain amount of something will result in pleasure, losing the same amount of something will result in a greater amount of displeasure.

Generally, the least risky option is preferred over the riskier option in the positive frame (Tversky & Kahneman, 1981). This results in ensuring a gain (e.g., a certain gain of 200 survivors in the Asian Disease problem). However, the riskier option is often preferred over the least risky option in the negative frame. This results in increasing the likelihood of the smallest loss (e.g., the loss of no lives in the Asian Disease problem). The responses to the Asian Disease problem described earlier provide an example of this shift in risk preference across frames. Despite the presentation of equivalent information in both frames used in the Asian Disease problem, the risky option was avoided in the positive frame, whereas the risky option was selected in the negative frame.

Prospect theory provides a theoretical basis for understanding why targeted outcomes may vary across framed messages that present equivalent information. The theory also can be used to inform the design of informational messages to promote behaviors (Rothman, Bartels, Wlaschin, & Salovey, 2006).

Framing Effect and Health-Related Behaviors

Meyerowitz and Chaiken (1987) were among the first researchers to evaluate the persuasiveness of positively- verses negatively-framed messages in promoting a health-related detection behavior. They provided female college students with one of three similar brochures

which encouraged breast self-examinations (BSE) as a method for early detection of breast cancer. The brochures differed by frame; one version presented positively-framed messages, another presented negatively-framed messages, and the third contained unframed educational messages. A control group of females did not receive a brochure. While there were no immediate differences between groups in attitudes towards BSE performance, intention to perform BSE, and actual BSE performance, there were differences between groups at a later time. After 4 months, participants in the negatively-framed condition reported greater intentions than participants in the no-pamphlet and no-argument conditions, but not the positively-framed condition. Additionally, participants in the negatively-framed condition reported engaging in more BSE than participants in the other three conditions.

Since Meyerowitz and Chaiken's initial study of goal framing of a health behavior, numerous studies have examined the role of positively- or negatively-framed messages in promoting health-related behaviors in several domains. Obtaining a test for HIV (Apanovitch, McCarthy, & Salovey, 2003), utilization of mammograms (Banks, Salovey, Greener, & Rothman, 1995; Finney & Iannotti, 2002; Schneider, Salovey, Apanovitch, et al., 2001), screening for prostate cancer (Cherubini, Rumiati, Rossi, Nigro, & Calabro, 2005), adherence or intention to adhere to an exercise regimen (McCall & Ginis, 2004; Robberson & Rogers, 1988), flossing (Mann, Sherman, & Updegraff, 2004), use of mouthwash (Rothman, Martino, Bedell, Detweiler, & Salovey, 1999, study 2), and use of sunscreen (Block & Keller, 1995; Detweiler, Bedell, Salovey, Pronin, & Rothman, 1999; Rothman, Salovey, Antone, Keough, & Martin, 1993) are several of the health-related behaviors that have been promoted through positive and negative framing of information (for reviews, see Edwards, Elwyn, Covey, Matthews, & Pill, 2001; Levin et al., 1998; Moxey et al., 2003; Rothman & Salovey, 1997).

Differences in complying with health-related recommendations have been found across positive and negative frames in many studies, yet one frame is not consistently more persuasive than the other frame. Some studies have found that the positive frame is more persuasive than the negative (e.g., Rothman, et al., 1999; Detweiler et al., 1999). Other studies have found that the negative frame is more persuasive than the positive (e.g., Banks et al., 1995; Meyerowitz & Chaiken, 1987). Furthermore, some studies have found no differences in compliance across frames (e.g., Finney & Iannotti, 2002; Rivers, Salovey, Pizarro, Pizarro, & Schneider, 2005).

The inconsistent identification of a more persuasive frame may be partly due to the function of the goal-related health behavior (Rothman & Salovey, 1997). Some framing studies have examined goal-related behaviors that are intended to prevent a specific undesirable outcome from happening (e.g., Detweiler et al., 1999; McCall & Ginis, 2004; Robberson & Rogers, 1988). Other framing studies have examined goal-related behaviors that are intended to detect the presence of something undesirable (Finney & Iannotti, 2002; Lauver & Rubin, 1990; Williams, Clarke, & Borland, 2001). The different types of behaviors imply different probabilities for an aversive consequence (Rothman & Salovey). Engagement in prevention behaviors involves little, if any, immediate aversive consequence for the person exhibiting the behavior. Rather, prevention behaviors are intended to decrease potential risk of illness. For example, using sunscreen to prevent skin cancer poses no immediate risk of discovering cancer, and may decrease future risk of skin cancer. However, engagement in detection behaviors involves an immediate risk of discovering an illness, which may be an aversive consequence for some individuals. That is, a person who undergoes screening for skin cancer is at immediate risk of learning that he or she has cancer, and learning that one has cancer may be aversive. While detection behaviors may be intended to decrease future risk by discovering illnesses at an early,

potentially treatable stage, they nonetheless carry the immediate consequence of informing someone of a health problem.

Due to the differences in the risk of aversive consequences related to the function of a behavior, separate examinations of the framing effect for prevention behaviors and detection behaviors are warranted. Among the studies examining health-related detection behaviors, the negative frame has been more effective than the positive frame in eliciting intentions to engage in some of the targeted behaviors (skin cancer detection behaviors: Block & Keller, 1995; Rothman et al., 1993; detection of a hypothetical virus: Rothman et al., 1999; use of disclosing mouth rinse: Rothman et al., 1999), as well as eliciting actual engagement in the targeted behavior (mammogram utilization: Banks et al., 1995; Schneider, Salovey, Apanovitch et al., 2001; Papanicolaou testing: Rivers et al., 2005; use of disclosing mouth rinse: Rothman et al., 1999). However, in one study, the positive frame was more effective than the negative-frame in eliciting intentions from men to engage perform cancer detection behaviors (Rothman et al., 1993). A second study found the positive frame to be more effective than the negative frame in persuading women to seek HIV testing when they thought results would be negative (Apanovitch et al., 2003). Results from a study examining use of dental services were unclear in specifying whether the positive or negative frame was more persuasive, despite finding a difference in intentions across these frames (Arora, 2000).

Although the previously cited studies have found differences in intentions to engage or actual engagement in a health-related detection behavior, some studies examining a variety of behaviors (i.e., intentions to perform breast self-examinations: Meyerwitz & Chaiken, 1987; Williams, Clarke, & Borland, 2001; intentions to perform or actual performance of testicular self-examinations: Steffen, Sternberg, Teegarden, & Shepherd, 1994; mammography use: Finney

& Iannotti, 2002: performance of breast self-examinations: Lalor & Hailey, 1989; obtaining follow-up testing after abnormal Papanicolaou test results: Lauver & Rubin, 1990) have not found differences across frames. There are no notable differences in the methods used by these studies that would account for the inconsistent findings.

In contrast to studies examining detection behaviors, several of the prevention studies provide evidence that positively-framed information is more persuasive than negatively-framed information on eliciting intentions to engage in a prevention behavior (i.e., sunscreen use: Detweiler et al., 1999; exercise: Robberson & Rogers, 1988; mouth wash: Rothman et al., 1999). Positively-framed information has also been more persuasive in eliciting actual engagement in a prevention behavior (i.e., sunscreen use: Detweiler et al.; Rothman et al., 1993; flossing: Mann et al., 2004; mouth wash: Rothman et al.; tobacco cessation: Schneider, Salovey, Pallonen, et al., 2001). However, in some studies the negatively-framed information has been more persuasive than the positive-framed information on eliciting intentions to engage in the behavior (HPV prevention: Block & Keller, 1995; hormonal male contraception use: O'Connor, Ferguson, & O'Connor, 2005) or engagement in the behavior (flossing: Mann et al., 2004).

Similar to observations of the effect of framed messages on detection behaviors, no differences on intention to engage in a prevention behavior were found across frames in some studies promoting behaviors in a variety of domains (i.e., sunscreen use: Block & Keller; prevention of a hypothetical virus: Rothman et al., 1999; Pap test: Rivers et al., 2005; Rothman, et al., 1993). There were also no differences found across frames in engagement in the targeted behavior in some studies (i.e., exercise: McCall & Ginis, 2004; skin cancer prevention behaviors: Rothman et al., 1993). There are no notable differences in the methods used by these studies that would account for the inconsistent findings.

Based on the findings from previous studies, there appears to be a trend for the positive frame to be more persuasive than the negative frame when promoting prevention behaviors. In contrast, the negative frame tends to be more persuasive than the positive frame in promoting detection behaviors. However, as noted previously, there are several exceptions to these trends. Because of the inconsistent findings, sole consideration of the function of the health-promoting behavior is not adequate for accurately predicting which frame will elicit greater compliance with recommendations. As Schneider and colleagues (2001) have aptly stated, we need to know "under what conditions, for which behaviors, and for who are gain-framed or loss-framed messages most persuasive" (p. 680). Examination of individual differences and variables related to the framed message may help answer that question.

The Framing Effect and Individual Differences

Several researchers (i.e., Apanovitch, et al., 2003; Detweiler et al., 1999; Mann et al., 2004; O'Connor et al., 2005; Rothman et al., 1993/1999; Williams et al., 2001) have examined the role of individual differences regarding susceptibility to the framing effect. Mann et al. examined the role of message framing and two types of motivation orientation by distinguishing people who self-reported that they were motivated by incentives (approach motivation) from people who self-reported that they were motivated by threats or potential punishment (avoidance motivation), based on responses to a self-report measure of sensitivity to negative events, fun seeking, and responsiveness to rewards (BIS/BAS Scale; Carver & White, 1994). Mann and colleagues found that, over a seven day period, a positive frame was more effective than a negative frame in increasing flossing among participants with an approach motivation. That is, people who were motivated to seek rewards or incentives increased flossing behavior after reading a positively-framed message. In contrast, a negative frame was more effective than a

positive frame in increasing flossing among individuals with an avoidance motivation. That is, people who were motivated by avoiding threats or punishment increased flossing behavior after reading a negatively-framed message.

There is some evidence to suggest that males and females react differently to framed messages. Sex moderated the framing effect in a study that examined behaviors for either preventing or detecting skin cancer (Rothman et al., 1993). Among female participants, the positive frame elicited higher intentions to prevent skin cancer than the negative frame, yet the negative frame elicited higher intentions than the positive frame among male participants (Rothman et al., study 1). In a second experiment, more female participants requested samples of sunscreen with the recommended SPF level after reading a positively-framed message as compared to the women who read a negatively-framed message (Rothman et al., study 2). However, no similar difference across frames was observed among the male participants. Sex and attitude toward using a male hormonal contraception to prevent unplanned pregnancy were identified as moderators of the framing effect in a study by O'Connor, Ferguson, and O'Connor (2005, study 2). The positive frame was more effective in eliciting intentions than the negative frame among males who had a positive attitude towards the use of this contraceptive method. There were no differences in intentions between frames among males with negative attitudes towards the contraception, or among female participants.

A person's previous self-reported intentions to engage in a targeted behavior may also affect intentions to comply with framed messages. Detweiler and colleagues (1999) found no differences across frames in intentions to use sunscreen among beach visitors who reported previous intentions to use sunscreen, possibly due to their overall high initial intentions of using

sunscreen. However, the positive frame elicited higher intentions to use sunscreen than the negative frame among beach visitors who had not previously intended to use sunscreen.

Need for cognition, as obtained through self-report, was identified as an individual difference that impacted the effect of frame in one study (Rothman et al., 1999, study 1). Need for cognition refers to one's self-reported tendency to think extensively about statements (Cacioppo, Petty, & Kao, 1984). Among participants with a high need for cognition, a positively-framed message elicited greater intentions to detect a hypothetical virus than a negatively-framed message. However, no framing effect was found for participants with low need for cognition.

In summary, previous findings suggest that there are some individual difference variables that affect compliance with framed messages. There are other promising individual difference variables that have been shown to influence other types of framing, but not yet examined with goal framing. For example, some studies found relations between participant personality and susceptibility to the framing effect when making risky health decisions (Levin et al., 2002; Soane & Chimel, 2005). Impulsiveness, involvement in personal healthcare, and a tendency to feel anxious regarding one's personal health status are also related to decisions made in risky choice framing studies (Lauriola, Russo, Lucidi, Violani, & Levin, 2005).

Numeracy is another individual difference variable that has been studied in decision making and health studies (e.g., Donelle, Hoffman-Goetz, & Arocha, 2007; Lipkus, Samsa, & Rimer, 2001; Schwartz, Woloshin, Black, & Welch, 1997; Woloshin, Schwartz, Moncur, Gabriel, & Tosteson, 2001), but not within the goal framing literature. Numeracy refers to one's ability to understand and manipulate basic probabilities, ratios, and percentiles (Peters, Vastfjall, Slovic, Mertz, Mazzocco, & Dickert, 2006). There is evidence indicating that numeracy impacts health and medical decisions. As noted by Reyna and Brainer (2007) in a review of numeracy

studies, less numerate individuals tend to be at a disadvantage when making health and medical decisions due to their decreased understanding of risk and probabilities.

Numeracy skill has been assessed by administering three mathematical questions in many studies (e.g., Aggarwal, Speckman, Paasche-Orlow, Roloff, & Battaglia, 2007; Peters et al., 2006; Schwartz et al., 1997). One question requires familiarity with probability. People are asked to report how many times a coin would land heads-up when tossed 1000 times, or how many times a six-sided die would come up even when rolled 1000 times. A second question requires the transformation of a percentage to a proportion, and a third question requires the transformation of a proportion to a percentage. When assessed in this manner, the percentage of people who are able to answer these questions varies. For example, among community-dwelling middle-aged and older adults, 26% - 58% of participants were unable to answer more than one of the three questions correctly, 24% - 36% provided two correct answers, and 16% - 33% provided all three correct answers (Donelle et al., 2007; Lipkus et al., 2001; Schwartz et al., 1997; Woloshin et al., 2001). Correctly transforming proportions to percentages tends to be the hardest skill. Findings of poor numeracy ability from two of numeracy studies (Lipkus et al., Woloshin et al.) were notable in that the majority of participants had more than a high school education. This has led Reyna and Brainerd (2007) to conceptualize numeracy as a construct that differs from education. More recently, a numeracy measure containing more than three items has been developed by Lipkus, Samsa, and Rimer (2001). This measure expanded the three-item numeracy measure by adding seven probability, proportions, and percentages questions regarding health risk (e.g., “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,” p. 40). Lipkus and colleagues found that

participants continued to demonstrate difficulty in correctly answering questions pertaining to probabilities and percentages, as assessed using the expanded measure.

While numeracy has not yet been examined as a variable that may influence goal framing outcomes, there is evidence that numeracy influences decisions within attribute framing scenarios. In the only framing study examining numeracy as a variable that could influence framing, Peters and colleagues (2006) described a student's work as either 74% correct (positive frame) or 26% incorrect (negative frame). When asked to judge the quality of the student's work, a stronger framing effect occurred among participants with low numerate ability as compared to those with high numerate ability. That is, the difference in judgment between the two frames was greater for less numerate individuals than more numerate individuals (Peters et al, study 1). In light of the relation between numeracy and demonstration of the framing effect in studies of attribute framing, it is possible that numeracy may also influence the framing effect in studies of goal framing.

Age is another individual difference variable that may be useful to explore in order to determine who is susceptible to the framing effect. Age differences in decision making have not yet been explored in goal framing studies. However, age differences in the decision making process have been observed in many previous studies. For example, previous studies of decision making show that older adults spend more time making a decision than younger adults, and consider less information (Berg, Johnson, Meegan, & Strough, 2003; Johnson, 1993). Further, Löckenhoff and Cartsensen (2007/2008) found that older adults tend to review a greater number of positively framed statements than younger adults when making health decisions. In light of age differences in the incorporation of information into the decision making process, it is important to consider age as an individual difference variable that might be related to compliance

with framed messages. Several previous studies of goal framing included adults over age 65 as participants (Banks et al., 1995; Detweiler et al., 1999; Finney, & Iannotti, 2002; Schneider, Salovey, Apanovitch, et al., 2001; Williams et al., 2001). However, these studies did not examine adults over age 65 as a unique group. Therefore, these studies do not allow for conclusions to be made regarding the effect of frame on compliance with health recommendations among older adults.

There is evidence that older adults are susceptible to the effect of frame when making decisions involving risk (e.g., Kim et al., 2005; McKee, 2001; Rönnlund, Karlsson, Laggnäs, Larsson, & Lindström, 2005; Stoner, 2007; Woodhead, 2006). Ronnlund and colleagues (2005) found that older adults were as susceptible to the framing effect as younger adults in a study of risky decision making. That is, both older and younger adult participants expressed a difference in risk preference across positive and negative frames when faced with making risky decisions regarding personal survival, money, and public property. Several other studies have documented the framing effect among older adults who were faced with hypothetical risky decisions regarding cancer treatment and treatment for a fatal disease (McKee; Kim et al.; Stoner; Woodhead). In light of the effect of frame on decisions made by older adults within a risky-decision making context, it is possible that older adults may be susceptible to the effect of frame in goal framing situations.

Message Variability and the Framing Effect

Up to this point, researchers have provided evidence that differences among individuals and characteristics of the messages can account for some of the variability in the demonstration of the framing effect. However, very few studies have investigated interactions of the message frame and other message characteristics (i.e., Block & Keller, 1995; Krishnamurthy, Carter, &

Blair, 2001). In Block and Keller's study to promote the prevention of human papilloma virus (HPV), the efficacy of the recommendations was manipulated. That is, in the positive frame, participants were informed that adherence to the prevention recommendations would decrease their risk of contracting HPV by either 20% or 80%. In the negative frame, participants were informed that failure to adhere to the recommendations would increase their risk of contracting HPV by either 20% or 80%. When a lower efficacy rate was described, the negative frame was more persuasive than the positive frame for eliciting intentions to adhere to the prevention recommendations. However, there was no difference in intentions across positive and negative frames when the recommendations were described with the higher efficacy rate. While another goal framing study (Krishnamurthy et al.) manipulated the efficacy of a treatment, comparisons of compliance across frame and efficacy levels were not made.

The efficacy of a recommended behavior to prevent or detect an illness may alter the effect of frame by affecting the extent to which individuals process information (Block & Keller, 1995; Gleicher & Petty, 1992). Gleicher and Petty suggest that people avoid the extensive processing of messages that promote highly effective behaviors in order to reduce the chance of encountering evidence that the behavior is less effective than initially believed. In contrast, individuals are apt to process the information to a greater extent and seek more information when a behavior is not highly effective (Fredrickson, 1985; Gleicher & Petty, 1992; Block & Keller, 1995). In this search for additional information, various factors related to the message may influence an individual's decision (Block & Keller). For example, the message frame might then impact an individual's decision to comply. While the exact mechanism is not fully understood, Block and Keller provide preliminary evidence suggesting that the negative frame is more persuasive than the positive frame when efficacy rates are low.

In the literature examining the use of framed messages to elicit compliance with health recommendations, the efficacy level of health behaviors is typically ambiguous. That is, the outcomes of engagement in specific behaviors are typically described as a general increase or decrease in the risk of obtaining or detecting an illness. However, the magnitude of this increase is not typically reported. Some behaviors may be more effective than other behaviors at preventing or detecting an illness. Although Block & Keller (1995) demonstrated that efficacy level of recommendations may alter compliance with framed messages promoting a prevention behavior (preventing infection of HPV), efficacy level has not been examined in framed messages promoting detection behaviors. Since efficacy levels differ across types of behaviors and illnesses, research investigating the impact of framed messages in promoting behaviors with differing efficacy rates will promote a better understanding of the conditions under which one frame is more influential than another.

Statement of the Problem

Positively- and negatively-framed messages can be used to influence individuals to engage in targeted health behaviors (Edwards et al., 2001; Levin et al., 1998; Moxey et al., 2003; Rothman & Salovey, 1997). The direction of the framing effect differs across studies. Furthermore, not all studies have found an effect of frame on compliance with health recommendations (Finney & Iannotti, 2002; Rivers et al., 2005; Rothman et al., 1999; Williams et al., 2001).

The function of a goal-related health behavior may partially explain why one frame can be more persuasive than the other (Rothman & Salovey, 1997). The positive frame tends to be more persuasive than the negative frame for promoting <u>prevention</u> behaviors (e.g., Detweiler et al., 1999; Mann et al., 2004; Rothman et al., 1993/1999), and the negative frame tends to be

more persuasive than the positive frame for promoting detection behaviors (e.g., Banks et al., 1995; Block & Keller, 1995; Rothman et al., 1993). However, the function (i.e., prevention or detection) of the behavior does not completely account for differences across studies regarding which frame is more influential. Separate examination of compliance with framed messages for prevention and detection behaviors is warranted to understand the impact of framed messages on compliance with various behaviors.

Whether certain characteristics of a message interact with frame in eliciting intentions is unclear. One study (Block & Keller, 1995) suggests that the efficacy of a behavior changes the impact of framed messages. Block and Keller found that a negative frame is more persuasive than a positive frame when the prevention behavior had a low efficacy rate, and neither frame was more effective when the prevention behavior had a high efficacy rate. The relation of efficacy and detection behaviors has not been explored. Compliance with framed messages that promote a detection behavior may differ only when the behavior has a low efficacy rate, as found with the prevention behavior in Block and Keller's study. On the other hand, compliance with framed messages that promote a detection behavior may differ when the behavior has a high efficacy rate, in part due to the different function of detection behaviors and prevention behaviors.

Differences in the influence of message framing on compliance with recommendations may be related to individual difference variables. Sex, need for cognition, motivation orientation, and previous intentions to engage in a recommended behavior have been related to compliance with framed messages (Apanovitch, et al., 2003; Detweiler et al., 1999; Mann et al., 2004; O'Connor et al., 2005; Rothman et al., 1993/1999; Williams et al., 2001). There are additional individual difference variables that have had an effect on decisions in risk or attribute

framing studies, but have yet to be examined in goal framing studies. Numeracy ability has been shown to influence perceptions of framed messages in studies of attribute framing, but it is currently unclear whether numeracy ability influences compliance in studies of goal framing.

There is a paucity of studies examining message framing across the adult lifespan in the literature examining compliance with framed messages. Only five studies have included adults over 65 (Banks et al., 1995; Detweiler et al., 1999; Finney, & Iannotti, 2002; Schneider, Salovey, Apanovitch, et al., 2001; Williams et al., 2001), and no study examined adults over 65 as a unique group. Furthermore, no study has compared compliance with framed messages between older and younger adults. There may be age-related differences in how younger and older adults react to messages that promote health behaviors.

The purpose of the present study was to investigate variables that affect compliance with framed messages that promote behaviors that aid in the prevention or detection of skin cancer. This study addresses six questions. The first set of questions pertains to prevention behaviors, and the second set of questions pertains to detection behaviors.

The first question asks whether one's numeracy ability moderates the effect of frame on intentions to engage in prevention behaviors. Peters and colleagues (2006) found that individuals with low numeracy ability, but not individuals with high numeracy ability, showed the framing effect in an attribute framing scenario. Based on these findings, the hypothesis is that the interaction of message frame and numeracy ability will account for a significant portion of the variance in intentions to engage in prevention behaviors, thereby indicating that the relation between frame in intentions to engage in prevention behaviors is moderated by one's numeracy ability.

The second question asks whether intentions to engage in prevention behaviors vary by frame (positive verses negative) and age group (older adults verses younger adults). Previous studies (e.g., Detweiler et al., 1999; Mann et al., 2004; Robberson & Rogers, 1988; Rothman et al., 1993/1997; Schneider, Salovey, Pallonen, et al., 2001) found that the positive frame is more persuasive than the negative frame in promoting prevention behaviors. In light of those findings, the hypothesis is that the positive frame will elicit stronger intentions than the negative frame to engage in prevention behavior. Due to the paucity of research involving older adults, it is unclear whether the findings will differ by age group.

The third question asks whether the effect of frame on strength of intention varies by efficacy level and age group. Block and Keller (1995) found that the strength of intention did not differ when the behavior was highly effective, and did differ when the behavior was not highly effective. In light of their findings, the hypothesis is that the effects of frame on strength of intention will vary by efficacy level. It is unclear if the findings will also vary by age group, due to the paucity of research including older adults.

The fourth through sixth questions are similar to the first through third questions, but pertain to detection behaviors. The fourth question asks whether one's numeracy ability moderates the effect of frame on strength of intentions to engage in detection behaviors. Peters and colleagues (2006) found that individuals with low numeracy ability, but not individuals with high numeracy ability, showed the framing effect in an attribute framing scenario. Based on these findings, the hypothesis is that the interaction of message frame and numeracy ability will account for a significant portion of the variance in intentions to engage in detection behaviors, thereby indicating that the relation between frame in intentions to engage in detection behaviors is moderated by one's numeracy ability.

The fifth question asks whether intentions to engage in the detection behaviors vary by frame (positive verses negative) and age group (older adults verses younger adults). Previous studies (e.g., Banks et al., 1995; Block & Keller, 1995; Rivers et al., 2005; Rothman et al., 1993/1999; Schneider, Salovey, et al., 2001) have found that the negative frame is more persuasive than the positive frame in promoting detection behaviors. In light of those findings, the hypothesis is that the negative frame will elicit stronger intentions to engage in detection behavior. In light of the paucity of research involving older adults, it is unclear whether the findings will differ by age group.

The sixth question asks whether the effects of frame on strength of intention vary by efficacy level and age group. Block and Keller (1995) found that the strength of intention did not differ when the behavior was highly effective, and did differ when the behavior was not highly effective. In light of their findings, the hypothesis is that the effects of frame on strength of intention will vary by efficacy level. It is unclear if the findings will also vary by age group, due to the paucity of research including older adults.

Method

Participants

Sixty eight older adult women, over age 60, and 68 younger adult women, ages 18-30, who speak English, were recruited. The sample size was calculated using a power analysis based on findings from previous studies (Block & Keller, 1995; Detweiler, 1999; Rothman, 1993). The sample size was estimated to detect a medium effect size with a power of at least 0.70 for the planned analyses.

Males were excluded from this study for two reasons. First, previous researchers (e.g., Detweiler et al., 1999; Rothman et al., 1993) have found sex differences in the direction of the

framing effect for framed messages promoting skin cancer prevention and detection behaviors. Therefore, only one sex will be examined since the questions in this study are not investigating the role of sex. Second, in one study of sunscreen use (Rothman et al., 1993; study 2), a framing effect was found among female participants and not among male participants.

Older adults were recruited from the community (i.e., senior centers, assisted living facilities) in three counties in West Virginia (Harrison County, Marion County, Monongalia County) and two counties in Pennsylvania (Greene County, Washington County). Older adult participants were offered an opportunity to enter a raffle for $50. Younger adults, ages 18-30, were recruited from the local university. College students were recruited because previous goal-framing studies (e.g. Block & Keller, 1995; Lalor & Hailey, Mann et al., 2004; O'Connor et al., 2005; Rothman et al., 1993/1999) have examined use of framed messages on college students. The inclusion of college students in the current study allows for findings from this study to be compared with these previous findings. Young adult participants were offered extra credit for their participation, or an opportunity to enter a raffle for $50.

Design

This study included one dependent variable: intention to engage in the behavior. Two measures of behavior were used: intentions to engage in prevention behaviors, and intentions to engage in detection behaviors. A between subjects design with four between subject variables (frame, numeracy, efficacy level, and age group) was used. Frame has two levels: positive and negative. Numeracy was a continuous variable. Efficacy level has two levels: high efficacy and low efficacy. Age has two levels: older adults and younger adults. Participants were randomly assigned to frame and efficacy level conditions, with equal numbers of older and younger adults

assigned to each condition. Participants were not assigned to any condition on the basis of numeracy ability.

Materials

Instructions. Participants received instructions stating that they would read a message, and then be asked to answer questions (see Appendix A). The instructions also asked the participant to read the pages contained in the testing packet in the order presented.

Prevention and detection scenario. Four messages that described behaviors to prevent and detect skin cancer (see Appendices B-E) were presented to participants. These messages are modified versions of the materials used by Rothman and colleagues (1993). Two sections containing attribute framing statements, rather than goal framing statements were deleted from Rothman and colleague's original messages. Each message was divided into three sections: 1) What is skin cancer?, 2) How do I know if I have skin cancer?, and 3) Is there anything I can do to protect myself against skin cancer? The information will be presented in either a positive or a negative frame. The wording in the frames was different, but each framed message promoted the same behaviors. The efficacy of the prevention and detection behaviors was presented in either a high efficacy (80% increase or decrease of risk) or low efficacy (20% increase or decrease of risk) format. Therefore, one of the four messages were presented to each participant: positive frame with high efficacy (see Appendix B), positive frame with low efficacy (see Appendix C), negative frame with high efficacy (see Appendix D), and negative frame with low efficacy (see Appendix E).

Intentions questionnaire. Participants were asked to complete 7 questions about their likelihood of engaging in various skin cancer prevention behaviors, and 7 questions about their likelihood of engaging in various skin cancer detection behaviors (see Appendix F). Intentions

were rated using an 8-point Likert-type scale, ranging from 1 (not at all likely) to 8 (extremely likely). Several of these questions were previously used by Rothman and colleagues (1993). The questions pertaining to prevention behaviors were mixed with the questions pertaining to detection behavior. In order to prevent a response bias, the instructions for completing this measure asked participants to answer these questions honestly, and that there was no assumption that people will be consistent in answering these questions.

Risk perceptions questionnaire. Participants were asked to complete two questions that assessed their perception of the risk of skin cancer (see Appendix G). These questions were previously used by Rothman and colleagues (1993). Risk perception was rated using a 9-point Likert-type scale, ranging from 1 (not at all) to 9 (extremely).

Beliefs about skin cancer questionnaire. Three questions were asked to measure participant's beliefs about skin cancer (see Appendix H). These questions were previously used by Rothman and colleagues (1993). Risk perception was rated using a 9-point Likert-type scale, ranging from 1 (not at all) to 9 (extremely).

Numeracy measure. Participants were asked to complete the 11- item Numeracy Scale (Lipkus, Samsa, & Rimer, 2001; see Appendix I). This measure has been used in a previous study of the impact of attribute framing (Peters et al., 2006), and has demonstrated adequate internal consistency in three samples of adults ($\alpha = 0.74$, N = 124; $\alpha = 0.70$, N = 121; $\alpha = 0.75$, N = 218; Lipkus et al). Further, this measure has been demonstrated to assess a single construct, labeled global numeracy (Lipkus et al.).

Test of the information. Participants were asked to answer three multiple-choice questions regarding the material presented (see Appendix J).

Prior risky, prevention, and detection behaviors. Participants were asked to report their previous sun exposure, prevention, and detection behaviors by completing a survey developed by Glanz and colleagues (2008). Additional questions regarding use of tanning beds were added to this survey (see Appendix K).

Two subscales were created from this measure: history of engaging in skin cancer prevention behaviors, and history of engaging in skin cancer detection behaviors. History of engaging in skin cancer prevention behaviors was calculated using items four through nine, which ask participants to rate their engagement in various prevention behaviors. The mean score from these items was calculated to obtain a prevention history score, with higher numbers representing greater adherence to skin cancer prevention behaviors. Data on previous prevention behaviors were missing for 14 participants. These participants were excluded from this analysis, yielding a sample size of 122 participants. History of engaging in skin cancer detection behaviors was calculated using items 11 and 12, which asked participants to state whether they'd received a skin examination by a doctor, a partner, or performed a self-examination over the past year. Participants who responded "yes" to any of those questions (N=52) were categorized as having performed detection behaviors, while the participants who responded "no" to each of those questions (N=77) were categorized as not having performed detection behaviors.

Demographic questionnaire. A demographic questionnaire (see Appendix L) was distributed to each participant. The questionnaire was similar to those used by Mashat (2004), McKee (2001), Stoner (2007), and Woodhead (2006). The questionnaire contained questions regarding age, sex, ethnicity (race), marital status, years of education, and cancer experience. The four-item questionnaire regarding perceived health status from the Multilevel Assessment Instrument was also included (Lawton, Moss, Fulcomer, & Kleban, 1982).

Debriefing pamphlet. Following completion of the study materials, participants were told that the efficacy rates listed in the messages were inaccurate. They were debriefed and provided with a skin cancer brochure published by the American Cancer Society (2008). This brochure ensured that participants received accurate information regarding skin cancer.

Procedure

Participants were randomly assigned to a condition using a random number generator. Two lists were created: one for the older adult sample, and a second for the younger adult sample. Each list contained 17 sequences of four digits, so that 68 digits appeared on each list. Each number on the list represented which version of the message each participant received. The following digits were assigned to a condition as follows: 1) positive frame, high efficacy; 2) positive frame, low efficacy, 3) negative frame, high efficacy; 4) negative frame, low efficacy. Participants were distributed equally across conditions to avoid a systematic bias across sessions. Participants were assigned conditions in the order that they provided informed consent.

Participants were given a consent form and provided an opportunity to ask questions. Informed consent was obtained before continuing. All participants were given a packet containing the framed message. Page one was the participant instructions. Pages two through three contained the framed prevention or detection message with either high or low efficacy levels. Page four contained the intentions questionnaire. Page five contained the perceived risk and beliefs about skin cancer questionnaires. Pages six contained the numeracy measure. Page seven contained the multiple choice test of the information. Page eight through nine contained the prior risky, prevention, and detection behaviors questionnaire. Page ten through eleven contained the demographic questionnaire. After completing the packet, participants received a thank-you sheet where they had the option to sign up to be notified about future studies.

Participants were then given a brochure from the American Cancer Society, which contained information regarding skin cancer.

Results

Initial Analysis

Thirty four older adults and 34 younger adults read the positively-framed message; 34 older adults and 34 younger adults read the negatively-framed message. Demographic characteristics are presented in Tables 1 and 2 (see Appendix M). Performance on the test of information items is presented in Table 3 (see Appendix N). Means and standard deviations for the continuous variables of interest are presented in Table 4 (see Appendix O). Correlations among the continuous variables examined in the following analyses are presented in Table 5 (see Appendix P).

Hypothesis Testing

The first hypothesis was that the interaction of frame and numeracy ability would account for a significant portion of the variance in intentions to engage in prevention behaviors, thereby indicating that the relation between frame in intentions to engage in prevention behaviors is moderated by one's numeracy ability. Following the recommendations of Aiken and West (1991), as well as Fraizer, Tix, and Baron (2004) for analyzing moderator variables, a hierarchical multiple linear regression analysis was conducted. Frame was coded using unweighted effects coding (negative frame = -1, positive frame = 1; c.f., Fraizer et al., 2004; West, Aiken, & Krull, 1996). Numeracy was centered to reduce problems associated with multicolinearity and ease interpretation of results (Frazier et al., 2004). Frame and centered numeracy were entered on the first step to allow for the interaction term to be examined separately from the effect of frame and numeracy (Frazier et al., 2004; Judd et al., 1995). The

product term of the centered frame and numeracy was entered on the second step as an interaction (see Table 3).

Table 6. Effect of frame and numeracy ability on prevention behaviors

	B	*SE B*	β
Step 1			
Constant	3.66	0.12	
Frame	0.13	0.12	-.09
Numeracy (centered)	-0.16	0.03	-.38*
Step 2			
Constant	3.66	0.12	
Frame	0.13	0.12	-.09
Numeracy (centered)	-0.16	0.03	-.37*
Frame x Numeracy (centered) - interaction	-0.03	0.03	-.07

Note R^2 = .39 for Step 1; Δ R^2 = .02 for Step 2 (p = .39). * p < .05

A single degree of freedom F test was conducted to measure the stepwise change in variance accounted for by the interaction term (c.f., Frazier et al., 2004). The interaction of frame and numeracy in the second step of the model was not significant [$F(1, 128) = 0.76$, $p = 0.39$]. This indicates that numeracy did not moderate the relation between frame and intention to engage in prevention behaviors. There was a significant first-order conditional effect of numeracy (β = -.38, t = -4.65, $p < 0.001$) on intention. Lower numeracy ability was significantly related to higher intentions to engage in prevention behaviors. The first-order conditional effect of frame (β = -.09) was not significant.

The second hypothesis was that the positive frame would elicit stronger intentions to engage in prevention behaviors than the negative frame, but it was unclear if the findings would differ across age groups. The third hypothesis was that the effect of frame on strength of intention would vary by efficacy level, but it was unclear if the findings would also vary by age group. These two hypotheses were addressed using a 2 (frame: positive, negative) x 2 (efficacy

level: high, low) x 2 (age: older adults, younger adults) ANOVA (see Table 7 in Appendix Q). Intention to engage in the prevention behaviors was the dependent variable for this analysis. Different interactions were examined to address the second and third hypotheses. Levene's test for this model was significant, indicating that the assumption of homogeneity of variance across groups was violated. However, the ANOVA is a robust procedure and can withstand this violation with minimal effects (Howell, 2001). In light of this, no correction was made.

The second hypothesis was addressed by examining the interaction of frame by age group. The interaction of frame by age group was not significant [$F(1, 132) = 2.54$, $p = 0.11$]. The main effect of frame collapsed across age groups was also not significant [$F(1, 132) = 1.34$, $p = 0.25$]. There was a main effect of age, so that the intentions of older adults (M = 4.5, *SD* = 1.13) were greater than the intentions of younger adults (M = 2.85, *SD* = 1.18) when collapsed across frame [$F(1, 132) = 66.02$, $p < 0.001$]. These findings do not support the hypothesis that the positive frame would elicit stronger intentions to engage in prevention behaviors across age groups.

The third hypothesis was addressed by examining the three-way interaction between frame, efficacy level, and age group. The three-way interaction of frame, efficacy level, and age group was not significant [$F(1, 132) = 0.02$, $p = 0.88$]. Since the three-way interaction was not significant, the two-way interaction of frame by efficacy level was examined. This interaction was not significant [$F(1, 132) = 1.29$, $p = 0.26$]. These findings fail to support the third hypothesis that the effect of frame on strength of intention would vary by efficacy level.

The fourth hypothesis was the interaction of frame and numeracy ability would account for a significant portion of the variance in intentions to engage in detection behaviors, thereby indicating that the relation between frame in intentions to engage in detection behaviors is

moderated by one's numeracy ability. This hypothesis was addressed using the same procedure outlined for hypothesis one. A hierarchical multiple linear regression analysis was conducted. Frame was coded using unweighted effects coding (negative frame = -1, positive frame = 1; c.f., Fraizer et al., 2004; West, Aiken, & Krull, 1996). Numeracy was centered to reduce problems associated with multicolinearity and to ease interpretation of the model (Frazier et al., 2004). Frame and centered numeracy were entered on the first step, and their product term was entered on the second step as an interaction (see Table 8).

Table 8. Effect of frame and numeracy ability on detection behaviors

	B	*SE B*	β
Step 1			
Constant	5.42	0.11	
Frame	-0.13	0.11	-.11
Numeracy (centered)	0.02	0.03	.07
Step 2			
Constant	5.42	0.11	
Frame	-0.14	0.11	-.11
Numeracy (centered)	0.02	0.03	.07
Frame x Numeracy (centered) - interaction	0.01	0.03	.03

Note R^2 = .13 for Step 1; ΔR^2 = .02 for Step 2 (p = .73). * $p < .05$

A single degree of freedom *F* test was conducted to measure the stepwise change in variance accounted for by the interaction term (c.f., Frazier et al., 2004). The interaction of frame and numeracy in the second step of the model was not significant [$F(1, 128) = 0.12$, $p = 0.73$]. This indicates that numeracy did not moderate the relation between frame and intention to engage in detection behaviors. First-order conditional effects were not significant in this analysis.

The fifth hypothesis was that the negative frame would elicit stronger intentions to engage in skin cancer detection behaviors, but it was unclear if findings would differ across age groups. The sixth hypothesis was that the effects of frame on strength of intention would vary by

efficacy level, but it was unclear if the findings would vary by age group. The two hypotheses were addressed using a 2 (frame: positive, negative) x 2 (efficacy level: high, low) x 2 (age: older adults, younger adults) ANOVA (see Table 9 in Appendix R). Intention to engage in the skin cancer detection behaviors was the dependent variable for this analysis. Different interactions were examined to address the fifth and six hypotheses. Levene's test for this model was significant, indicating that the assumption of homogeneity of variance across groups was violated. However, the ANOVA is a robust procedure and can withstand this violation with minimal effects (Howell, 2001). In light of this, no correction was made.

The fifth hypothesis was addressed by examining the interaction of frame by age group. The interaction of frame by age group was not significant [$F(1, 132) = 0.06$, $p = 0.81$]. The main effect of frame collapsed across age groups was also not significant [$F(1, 132) = 1.64$, $p = 0.20$]. There was not a significant main effect of age when collapsed across frame [$F(1, 132) = 0.81$, $p = 0.37$]. These findings do not support the hypothesis that the negative frame would elicit stronger intentions to engage in detection behaviors across age groups.

The sixth hypothesis was addressed by examining the three-way interaction between frame, efficacy level, and age group. The three-way interaction of frame, efficacy level, and age group was not significant [$F(1, 132) = 2.43$, $p = 0.12$]. Since the three-way interaction was not significant, the two-way interaction frame by efficacy level was examined. This interaction was not significant [$F(1, 132) = 0.26$, $p = 0.61$]. The findings fail to support the sixth hypothesis.

Exploratory Questions

Two exploratory research questions were asked in order to determine how previous skin cancer prevention or detection behaviors might interact with frame in eliciting intentions to engage in future prevention or detection behaviors.

The first exploratory question asked whether an interaction of frame and one's history of engaging in prevention behaviors account for variance in predicting one's intentions to engage in future prevention behaviors. This question was addressed using the same procedure outlined for hypothesis one. A hierarchical multiple linear regression analysis was conducted. Frame was coded using unweighted effects coding (negative frame = -1, positive frame = 1; c.f., Frazier et al., 2004; West, Aiken, & Krull, 1996). History of engaging in prevention behaviors was centered to reduce problems associated with multicolinearity and ease interpretation of the model (Frazier et al., 2004). Frame and prevention history were entered on the first step, and their product term was entered on the second step as an interaction (see Table 10).

Table 10. Effect of frame and history of engaging in prevention behaviors on prevention intentions.

	B	*SE B*	β
Step 1			
Constant	3.61	0.08	
Frame	0.12	0.08	.09
History of prevention behaviors	0.27	0.02	.76*
Step 2			
Constant	3.61	0.08	
Frame	0.13	0.08	.09
History of prevention behaviors	0.26	0.02	.76*
Interaction of frame and history	0.04	0.02	.13*

Note $R^2 = .59$ for Step 1; $\Delta R^2 = .02$ for Step 2 ($p = .03$). * $p < .05$

A single degree of freedom *F* test was conducted to measure the stepwise change in variance accounted for by the interaction term (c.f., Frazier et al., 2004). The interaction of frame and history of prevention behaviors in the second step of the model significantly predicted intentions to engage in prevention behaviors, above and beyond the variance explained by frame and history alone [$F(1, 118) = 4.93\ 2$, $p = 0.03$]. To further explore the interaction, the predicted values of intentions following exposure to the positive or negative frame were plotted for high (1 *SD*) and low (-1 *SD*) values of history of prevention behaviors (c.f., Aiken & West, 1991; Fraizer

et al., 2004; see Figure 1). Follow-up tests revealed that history of engaging in prevention behaviors was related to intentions to engage in future prevention behaviors in the positive frame [R^2 = .67, F (1,60) = 119.3, p < .01, β = .82, t = 10.92, p < 0.01]. A weaker, but still significant, relation was found between history of engaging in prevention behaviors and intentions to engage in future prevention behaviors in the negative frame [R^2 = .50, F (1, 58) = 58.74, p < .01, β = .71, t = 7.66, p < 0.01].

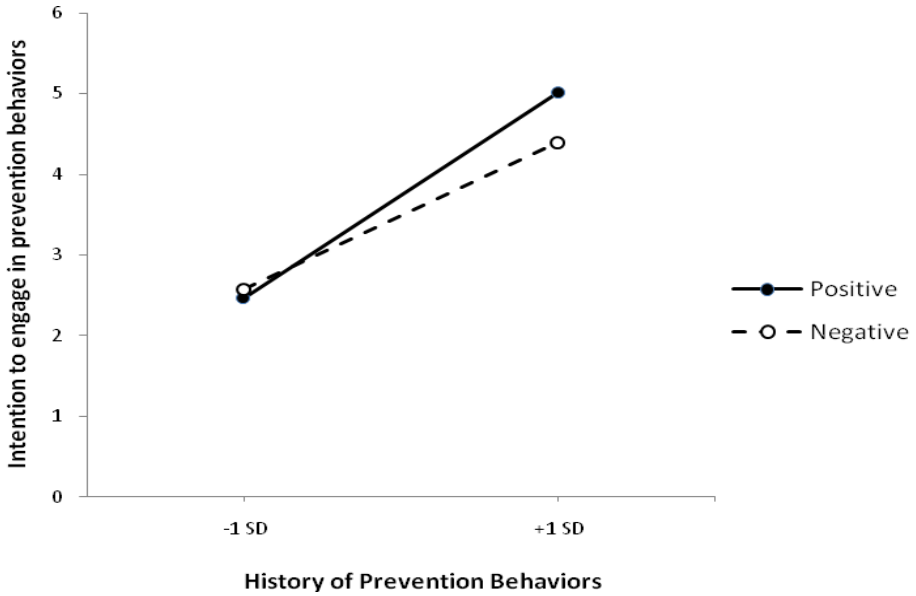

Figure 1. Plotted interaction of frame by history of prevention behaviors for high and low values.

The second exploratory question asked whether the effect of frame on one's intentions to engage in skin cancer detection behaviors differed according to one's history of engaging in skin cancer detection behavior. This question was addressed using a 2 (frame: positive, negative) by 2 (previous detection behavior: yes, no) ANOVA (see Table 11 in Appendix S). Data regarding previous detection behaviors were missing from seven participants, and they were excluded from this analysis. This resulted in a sample size of 129. The main effect of frame on intentions was not significant [F(1,125) = 2.99, p = 0.09]. There was a significant main effect of previous

detection behaviors on intentions to engage in future detection behaviors. Participants who had not previously engaged in skin cancer detection behaviors reported lower intentions to engage in future detection behaviors ($M = 5.14$, $SD = 1.12$) than participants who had previously engaged in detection behaviors [$M = 5.88$, $SD = 1.19$; $F(1,125) = 14.92$, $p < 0.01$]. There was not a significant interaction between previous detection behaviors and frame [$F(1,125) = 0.12$, $p = 0.73$]. That is, participants did not respond differently across frames based on their history of engaging in detection behaviors.

Discussion

This study examined the influence of message frame and several potential moderating variables in eliciting intentions to engage in skin cancer prevention and detection behaviors. Intentions to engage in skin cancer prevention or detection behaviors were not systematically affected by frame, and there was no evidence that one's numeracy ability, age, or efficacy level of the recommended behaviors moderated the relation between frame and intention to engage in either prevention or detection behaviors. There was evidence that age and numeracy ability independently predicted intentions to engage in skin cancer prevention, but not detection, behaviors. Additional analyses revealed that one's previous engagement in skin cancer prevention behaviors moderated the effect of frame on intentions to engage in prevention behaviors. However, one's previous detection behaviors did not moderate the effect of frame. The findings from this study will be discussed in additional detail below. Limitations of the current study and areas for future research will also be discussed.

Potential moderators of message frame and intention to engage in prevention behaviors.

Numeracy ability. Numeracy ability was examined as a potential moderator of frame and intention to engage in skin cancer prevention behaviors. In a hierarchical regression model,

numeracy ability accounted for a significant amount of variance in predicting intentions to engage in prevention behaviors but there was not a significant interaction between frame and numeracy ability. That is, lower numeracy ability was related to higher intentions to engage in prevention behaviors. However, the impact of numeracy ability on intentions to engage in prevention behaviors did not differ according to the frame in which the information was presented.

The current study did not support the findings of Peters et al. (2006), who examined numeracy ability as a moderator of message framing in a study examining attribute framing. Peters and colleagues found that differences across positive and negative frames in the judgment of a student's work quality was greater for less numerate individuals, as compared to more numerate individuals. Their finding suggested that individuals with lower numeracy ability might be more susceptible to the framing effect. The current study does not support this idea, as numeracy ability did not interact with frame to significantly predict one's intentions to engage in prevention behaviors.

Numeracy ability was found to be predictive of one's intentions to engage in the recommended prevention behaviors. Participants with lower numeracy ability reported greater intentions, in general, to engage in the prevention behaviors as compared to participants with higher numeracy ability. The finding that the lower numeracy ability was associated with better decisions (i.e., greater intention to comply with prevention recommendations) is inconsistent with several previous studies examining the relation of numeracy and decision making. For example, previous studies have found that individuals with greater numeracy ability make more accurate health-related judgments (e.g., Fagerlin, Ubel, Smith, & Zikmund-Fisher, 2007), and demonstrate better understanding of risks associated with health-related procedures (e.g.,

Schwartz et al., 1997). In a review of numeracy and health-related decision making, Reyna and Brainer (2007) suggested that individuals with lower numeracy ability tend to be at a disadvantage when making medical and health decisions due to decreased understanding of risk and probabilities. While Reyna and Brainer's statement might certainly be true when looking at decisions that involve complicated risk and probability statistics, the current study suggests that individuals with decreased numeracy are not at a disadvantage in making health decisions in some situations, such as situations involving simple calculations.

It should also be noted that numeracy ability was strongly correlated with age in the current study. Therefore, the relation between decreased numeracy and greater intention to engage in prevention behaviors may be due to age or cohort differences, rather than differences in one's numeracy ability.

Age. Differences in intentions to engage in prevention behaviors were not observed across frames when older and younger adults were examined separately. That is, this study did not find evidence that older adults react differently to framed goal messages than younger adults when these messages promote prevention behaviors. This finding cannot be directly compared to previous studies of goal framing, as previous studies have not examined older adults as a unique group. The related literature on risky framing provides some evidence that older adults make biased decisions as a function of the framing of information (Kim et al., 2005; McKee, 2001; Rönnlund, Karlsson, Laggnäs, Larsson, & Lindström, 2005; Stoner, 2007; Woodhead, 2006). However, in the current study, older and younger adults did not state different strengths of intention to engage in prevention behaviors as a function of the framing of information.

When intention to engage in prevention behaviors was examined according to age group, older adults expressed greater intentions to engage in prevention behaviors than younger adults.

This finding may be reflective of the higher rates of chronic health conditions, including different forms of cancer, among older adults (cf. Federal Interagency Forum on Aging-Related Statistics, 2008). It could be that older adults are more willing than younger adults to engage in prevention behaviors in order to maintain their current health status. The difference could also be contributable to historical differences in perceptions of sun tanning. Pale skin on women was considered attractive through the end of the 19th century and beginning of the 20th century (Albert & Ostheimer, 2002/2003a/2003b; van der Wyden, 1994). That is, tan skin was associated with outside labor and lower socioeconomic status. Pale skin was associated with engagement leisure activities and wealth. Sun tanning became popular in the 1920s and 1930s as the link between sun exposure, vitamin D, and increased health was being researched. Tan skin on women became associated with health and beauty during this time period. Harmful consequences of sun tanning gained public attention during the 1940s and 1950s. Despite risks of sun exposure, tan skin is still considered an indicator of health among adolescents and younger adults (Banerjee, Campo, & Greene, 2008; Broadstock, Borland, & Gason, 1992; Cafri, Thompson, & Jacobson, 2006; Knight, Kirincich, Farmer, & Hood, 2002; Robinson, Rigel, & Amonette, 1997). Therefore, it could be that the younger adults in this study are less willing to engage in skin cancer prevention behaviors that reduce skin tanning, as they view sun tans as indicators of health and beauty. It could also be that the older adults in this study were more willing to engage in these behaviors as they might place a greater emphasis on other indicators of health (e.g., absence of a chronic disease). Likewise, the older adults in this study might have perceived themselves to be at greater risk of skin cancer in light of a long history of sun exposure, and therefore more willing to engage in behaviors to reduce this risk.

Efficacy level. In the current study, efficacy level of the recommended prevention behavior did not moderate the relation between frame, age, and strength of intention to engage in skin cancer prevention behaviors. This finding is inconsistent with Block and Keller's (1995) study examining efficacy levels and compliance with human papilloma virus (HPV) prevention recommendations. Block and Keller noted that the negative frame elicited stronger intentions than the positive frame when HPV preventative behaviors were described using a low efficacy rate. In contrast, they noted that strength of intentions did not differ across frames when the preventative behaviors were described using a high efficacy rate. The current study did not find similar differences in the effect of frame on behaviors with varying efficacy rates. The inconsistency between studies may be due, in part, to some notable differences between the targeted disease in Block and Keller's study and the current study. Block and Keller promoted behaviors to prevent HPV among undergraduate college students. HPV was considered by the authors to be a highly salient among college students, in light of high prevalence rates. The participants in the current study may have considered skin cancer to be less prevalent, or as having less severe consequences than those participants who learned about HPV prevention behaviors. Another notable difference between HPV and skin cancer is the length of time that might pass between failure to engage in prevention behaviors and disease onset. HPV may be detected soon after one fails to engage in HPV prevention behaviors. In contrast, one might contract skin cancer years after failure to engage in skin cancer prevention behaviors. In light of the inconsistent findings from the current study and Block and Keller's study, it is possible that different variables moderate the effect of frame when the targeted disease differs.

Potential moderators of message frame and intention to engage in detection behaviors.

Numeracy ability. Numeracy ability was examined as a variable that might moderate the effect of message frame on intention to engage in skin cancer detection behaviors. This study found that numeracy ability did not account for a significant amount of variance in predicting intentions to engage in detection behaviors. Numeracy ability also did not moderate the relation between frame and intention to engage in detection behaviors.

The findings from this study regarding numeracy cannot be directly compared to previous research, as this study extended previous studies by examining numeracy as a potential moderator of goal framing. As noted above, a previous study (Peters et al., 2006) found that numeracy ability moderated the relation of frame and judgment in an attribute framing scenario. In light of that finding, it was expected that numeracy might moderate frame and intention to engage in detection behaviors in a goal-framing study. However, the current study did not find a relation between numeracy ability, frame, and strength of intention to engage in detection behaviors. That is, intentions to engage in skin cancer detection behaviors did not differ across frames according to one's numeracy ability. As this was the first study to examine the effect of numeracy in goal framing scenarios, it is unclear why numeracy did not impact intentions to engage in detection behaviors.

The current study allows for a comparison of the role of potential moderator variables of frame for both prevention and detection behaviors. Numeracy ability did not moderate the effect of frame on intention to engage in either prevention or detection behaviors. However, lower numeracy ability was predictive of stronger intentions to engage in skin cancer prevention behaviors, but not skin cancer detection behaviors. It is not clear why numeracy ability would be related to skin cancer prevention, but not detection, behaviors. There is evidence that numeracy ability is related to engagement in and understanding of other health behaviors (e.g.,

mammography screening: Aggarwal, Speckman, Paasche-Orlow, Roloff, & Battaglia, 2007, Schwartz, Woloshin, Black, Welch, 1997). It could be the case that differences in the complexity of presented information and one's familiarity with the targeted disease account for differences in findings related to numeracy ability. It should also be noted that age and numeracy ability were highly correlated in this study, so this finding may be attributable to age rather than numeracy ability.

Age. The effect of frame on intentions to engage in skin cancer detection behaviors was not moderated by age in the current study. That is, neither the younger nor older adults demonstrated differences in intentions to engage in detection behaviors across information frame. Additionally, as noted above, neither age group stated differences in intention to engage in prevention behavior across frame. Based on the results of the current study, one cannot conclude which age group is more susceptible to the effect of frame on intention to engage in recommended health behaviors as neither age group demonstrated the framing effect.

The results from the current study cannot be directly compared to previous goal-framing studies as there is a paucity of research examining goal framing among older adults. The risky-decision framing literature provides evidence that older adults are susceptible to becoming biased in their decisions based on the frame in which information is presented (Kim et al., 2005; McKee, 2001; Rönnlund, Karlsson, Laggnäs, Larsson, & Lindström, 2005; Stoner, 2007; Woodhead, 2006). However, the current study did not find evidence that the framing effect is moderated by age. It could be that older adults are not as susceptible to the effect of frame in the goal-framing context as in the risky-decision making context. Goal framing messages attempt to increase compliance with recommended behaviors. Risky-decision making messages require a person to choose between two options that pose different levels of risk (e.g., surgery verses

radiation treatment for cancer). The differences in the function of these messages (i.e., increase compliance; decide between two possible options) may account for the inconsistent findings regarding older adults' susceptibility to the framing effect. Another possibility is that older adults may be susceptible to the effect of frame when considering recommendations targeted towards preventing and detecting diseases other than skin cancer, such as diseases that pose more immediate consequences.

Efficacy level. Efficacy level of the recommended detection behavior was examined as a potential moderator of frame and intention to engage in detection behaviors. Strength of intentions to engage in detection behaviors did not differ according to efficacy level, and there was not a significant interaction of efficacy level with frame or age.

As stated above, efficacy level has been examined in relation to frame in eliciting intentions to engage in a recommended behavior in one previous study (Block & Keller, 1995). While Block and Keller found a relation between efficacy level and frame in eliciting intentions to engage in a prevention behavior, the current study did not find a similar relation for intentions to engage in either a prevention or detection behavior. That is, neither intentions to engage in prevention nor detection behaviors varied according to efficacy rate. As noted previously, the inconsistency between the current study's findings and the findings by Block and Keller may be due to differences in the targeted diseases (HPV verses skin cancer), as one's perception of prevalence, risk, and onset latency of various diseases may differ and be associated with reactions to framed messages.

Previous engagement in recommended behaviors as moderators of frame and intention.

Additional analyses examined one's previous engagement in targeted behaviors as a potential moderator of frame and future intentions. For prevention behaviors, one's previous

engagement in prevention behaviors was predictive of future intentions, and the strength of this prediction differed across frames. Among participants who viewed the positive frame, intentions to engage in prevention behaviors were greater among participants who had previously engaged in prevention behaviors. Among participants who viewed the negative frame, a somewhat weaker relation was found between intentions to engage in prevention behaviors and previous prevention behaviors. That is, the positive frame was more effective than the negative frame in eliciting intentions to engage in prevention behaviors among participants who reported higher rates of previous engagement in prevention behaviors. This finding is consistent with previous studies that have demonstrated that the positive frame is more effective than the negative frame in eliciting intentions to engage in prevention behaviors (Detweiler et al., 1999; Robberson & Rogers, 1988; Rothman, Martino, et al., 1999) and actual engagement in prevention behaviors (Detweiler et al.; Mann et al, 2004; Rothman, Martino, et al.; Rothman, Salovey, et al., 1993; Schneider, Salovey, Pallonen, et al., 2001). However, previous studies have not examined the role of previous engagement in the targeted behavior as a moderator of frame, so these results are not directly comparable to previous research. These results indicate that it is important to consider one's history of engaging, or not engaging, in the recommended prevention behaviors when evaluating the effect of frame on future intentions. For large scale prevention efforts where one's previous history of engaging in prevention behaviors cannot be assessed easily, these findings indicate that the positive frame should be utilized, as the positive frame is as effective as the negative frame among those who previously engaged in few prevention behaviors, and more effective than the negative frame among those who previously engaged in many prevention behaviors.

Previous engagement in skin cancer detection behaviors was related to intentions to engage in future detection behaviors, so that participants who had previously reported engaging in skin cancer detection behaviors reported greater intentions to engage in future skin cancer detection behaviors than participants with lower rates of previous detection behaviors. However, previous engagement in detection behaviors did not moderate the relation of frame and intention to engage in detection behaviors. This result was surprising, in light of the previous finding that history of prevention behaviors moderated the relation of frame and intention to engage in future prevention behaviors. The inconsistent findings may be due, in part, to the different function of prevention behaviors verses detection behaviors. Other researchers (i.e., Rothman & Salovey, 1997) have suggested that prevention behaviors lead to different consequences than detection behaviors. That is, prevention behaviors pose minimal short-term risk to the person engaging in these behaviors. In contrast, detection behaviors carry the short-term risk of discovering a potentially life-threatening disease. Therefore, inconsistent findings regarding the moderating role of previous behaviors on the relation of frame and future intentions may be, in part, attributable to differences in risks associated with engaging in prevention verses detection behaviors.

Limitations

Several limitations with the current study should be considered when interpreting the results. First, this study examined intentions to engage in recommended behaviors following exposure to framed messages, rather than actual engagement in recommended behaviors. Measuring intentions rather than behaviors can be beneficial in that intentions can be assessed at the time of exposure to framed messages. Measuring the recommended behaviors may require the passage of variable amounts of time, which may need to be particularly long to accurately

assess engagement in low-rate behaviors such as annual skin examinations. Additionally, participants may be reluctant to report failure to engage in recommended behaviors, in light of the social desirability to engage in recommended healthy behaviors. Measuring intentions rather than actual engagement in behaviors may allow for research to be conducted that would otherwise be unfeasible. However, measuring engagement in recommended behaviors as an indicator of compliance with framed messages would be beneficial, when plausible.

This study utilized a between-subject design regarding frame. That is, participants were exposed to either the positively or negatively framed message. This procedure minimized the likelihood that participants would become aware of the frame manipulation of the study, and therefore bias results. However, the between-subject design does not allow direct comparison of one's response to the positive verses negative frame. A within-subject design would allow one to directly compare differences in intentions between the positive and negative frame. The lack of the ability to make a direct comparison of the participants' responses to positively and negatively framed information could be viewed as a limitation.

Finally, the majority of the participants in the current study were Caucasians living in rural communities. The lack of racial and ethnic diversity in the current study could be viewed as a limitation. While the current sample is representative of the population from which participants were recruited, it is uncertain the extent to which the lack of diversity limits the generalizability of the current findings.

Conclusions

Previous studies have examined the role of frame in increasing compliance with health-related behaviors. The current study found little evidence of differences in compliance with

prevention or detection behaviors across frames, but did find evidence of other variables that may be associated with intentions to engage in recommended behaviors.

Previous engagement in prevention behaviors moderated the effect of frame on intentions to engage in prevention behaviors. That is, while participants who had previously engaged in prevention behaviors reported greater intentions to engage in future prevention behaviors, the positive frame elicited greater intentions than the negative frame among individuals who had previously engaged in higher rates of prevention behaviors. However, previous engagement in detection behaviors did not moderate the effect of frame in eliciting intentions to engage in future detection behaviors. These findings indicate that one's previous engagement in the targeted behavior should be considered when developing messages to increase engagement in a recommended health behavior. Positively framed messages appear more effective than negatively framed messages for people who previously engaged in the behaviors. However, manipulating other message characteristics may be necessary for more effectively promoting health behaviors among those who haven't previously engaged in the targeted behaviors.

Two variables were associated with differences in intentions to engage in prevention behaviors, but not detection behaviors. Decreased numeracy ability and older age were associated with increases in intention to engage in prevention behaviors. However, no similar relation was discovered with intention to engage in detection behaviors.

It should be noted that there were differences in findings between prevention behaviors and detection behaviors. Numeracy, age, and an interaction of previous behaviors and frame were related to intentions to engage in prevention behaviors. In contrast, numeracy, age, and an interaction of previous detection behaviors and frame were not related to intentions to engage in detection behaviors. That is, variables associated with intentions to engage in prevention

behaviors were not associated with intentions to engage in detection behaviors. This difference supports the importance of considering the function of the recommended behaviors when examining the impact of message frame and other variables associated with differences in compliance, as argued by other researchers (e.g., Rothman & Salovey, 1997).

Future Directions.

There are several areas for future research regarding the use of framed messages and compliance with health-related goal behaviors. First, the conditions under which one frame is more persuasive than another are not yet fully understood. As demonstrated in this study, previous findings that the impact of frame may differ by efficacy rates of the suggested behaviors or numeracy ability of participants were not supported in the current study. However, there was evidence that one's history of engaging in recommended behaviors is related to compliance across message frames. That is, this study found that participants with a history of engaging in skin cancer prevention behaviors rated intentions to engage in future skin cancer prevention behaviors differently across frames. However, participants with a history of engaging in fewer skin cancer prevention behaviors did not react differently across frames. Further study into the variables that are related to differences in compliance rates across frames is warranted, as these variables are not yet fully identified. In particular, identification of variables associated with increased compliance rates among individuals who have not previously engaged in the targeted behaviors is needed. Identification of these variables may be beneficial in developing targeted messages for people at risk for a disease or illness.

The relation of numeracy ability and goal framing messages could be further explored in a future study. The current study did not find numeracy ability to moderate the effect of frame. However, it should be noted that the current study included simple numeric statements. It is

possible that numeracy ability moderates the effect of frame when more complicated numerical information is presented. This could be examined in a future study by varying the amount and complexity of numerical information given within framed messages.

Finally, theoretical accounts for the effect of frame in goal-related health promotion messages could be examined in future studies. Many previous studies in both the goal framing literature and the risky-decision making literature have appealed to prospect theory (Kahneman & Tversky, 1979). However, this theory has yet to be empirically supported or refuted in the goal-framing literature. The current study did not attempt to validate or examine any theoretical account for the effect of frame on intentions to engage in behaviors. This could be accomplished in future studies. Prospect theory suggests that risk preference differs across frames (Kahneman & Tversky). That is, less risky options are preferred in the positive frame, while riskier options are preferred in the negative frame. Rothman and Salovey (1997) suggest that different levels of risk are associated with engagement, or failure to engage in, prevention and detection behaviors. A future study would need to assess one's perception of the risk involved with engaging in, or not engaging in, the recommended behaviors in order to empirically examine prospect theory.

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Appendix A

Participant Instructions

The following pages contain information about skin cancer and questions for you to answer. Please read the following pages in order. Once you have answered a question, do not return to it.

Appendix B

Positive Frame with High Efficacy Message

Note: Differences in text across messages are underlined.

Questions and Answers About Skin Cancer

What is skin cancer?
Skin cancer is the name given to a number of different diseases caused by abnormal growth of skin cells. Skin cancers are usually divided into two categories, melanoma and nonmelanoma cancers. Nonmelanoma is the more common type of skin cancer, and melanoma is the less common type of skin cancer. Nonmelanoma cancer is less likely to spread to other parts of the body, and melanoma cancer is more likely to spread to other parts of the body. Nonmelanoma cancers develop in the cells of the epidermis, which is the outermost layer of the skin. Melanoma develops in the melanocytes, which are cells that contain the skin's pigment, melanin.

How do I know if I have skin cancer?
Skin cancer usually appears as an unusual growth on the skin that is visible to the naked eye, but only a doctor can tell for sure whether an abnormality is cancerous. Therefore, it is very important that you notify your doctor about any abnormality on your skin that you cannot explain. There are some warning signs of which everyone should be aware. The most common warning signs are unusual growths on the skin or sores that don't heal. Nonmelanoma cancer can appear in a number of different forms. It may look like a small, smooth, shiny, pale or waxy lump, or as a firm red lump. The lump may bleed or develop a crust. This cancer may also appear as a flat red spot that is rough, dry, or scaly. Melanoma usually occurs as a change in a mole. A normal mole is an evenly colored brown or black spot on the skin, which can be flat or raised, round or oval, and is usually less than 6 millimeters in diameter (the size of a pencil eraser). Warning signs of melanoma include asymmetry of the color, and diameter larger than 6 millimeters. If you discover any of these symptoms, you should contact your physician immediately.

Is there anything I can do to protect myself against skin cancer?
There are two important things to remember when you think about skin cancer. First, you must remember that the main cause of skin cancer is ultraviolet radiation from the sun. <u>Second, you must be aware that although skin cancer can occur at any age, and remembering the care of your skin during your youth will decrease your risk of developing skin cancer later in life. You can decrease your chance of possibly getting skin cancer by not exposing your skin to the sun without protection, especially at times when the effects are most serious, between 10 a.m. and 3 p.m. If you do not allow your skin to burn by protecting it with sunscreen or clothing, you have a lower chance of getting skin cancer at some point in your life. The higher the Sun Protection Factor (SPF) of a sunscreen lotion, the more it will protect you from the sun's ultraviolet rays. Sunscreens with an SPF of 15 or above are most effective. It is very important that you perform behaviors that put you at a lesser risk for contracting skin cancer. By following steps to protect your skin, your risk of developing skin cancer will decrease by 80%.</u>

It is also suggested that you pay attention to changes in your skin. If you make a small effort to familiarize yourself with the normal appearance of your skin, you will make it possible for yourself to detect changes in your skin that may be warning signs of cancer. If you remember to check your skin occasionally for the skin cancer warning signs, you will know if you have skin cancer, and you can cause yourself less harm by not allowing it to spread. If you follow steps to detect signs of skin cancer, your chance of discovering skin cancer at an early, treatable stage will increase by 80%. It is up to you to bring any unusual skin condition to your doctor's attention.

Appendix C

Positive Frame with Low Efficacy Message

Note: Differences in text across messages are underlined.

Questions and Answers About Skin Cancer

What is skin cancer?
Skin cancer is the name given to a number of different diseases caused by abnormal growth of skin cells. Skin cancers are usually divided into two categories, melanoma and nonmelanoma cancers. Nonmelanoma is the more common type of skin cancer, and melanoma is the less common type of skin cancer. Nonmelanoma cancer is less likely to spread to other parts of the body, and melanoma cancer is more likely to spread to other parts of the body. Nonmelanoma cancers develop in the cells of the epidermis, which is the outermost layer of the skin. Melanoma develops in the melanocytes, which are cells that contain the skin's pigment, melanin.

How do I know if I have skin cancer?
Skin cancer usually appears as an unusual growth on the skin that is visible to the naked eye, but only a doctor can tell for sure whether an abnormality is cancerous. Therefore, it is very important that you notify your doctor about any abnormality on your skin that you cannot explain. There are some warning signs of which everyone should be aware. The most common warning signs are unusual growths on the skin or sores that don't heal. Nonmelanoma cancer can appear in a number of different forms. It may look like a small, smooth, shiny, pale or waxy lump, or as a firm red lump. The lump may bleed or develop a crust. This cancer may also appear as a flat red spot that is rough, dry, or scaly. Melanoma usually occurs as a change in a mole. A normal mole is an evenly colored brown or black spot on the skin, which can be flat or raised, round or oval, and is usually less than 6 millimeters in diameter (the size of a pencil eraser). Warning signs of melanoma include asymmetry of the color, and diameter larger than 6 millimeters. If you discover any of these symptoms, you should contact your physician immediately.

Is there anything I can do to protect myself against skin cancer?
There are two important things to remember when you think about skin cancer. First, you must remember that the main cause of skin cancer is ultraviolet radiation from the sun. <u>Second, you must be aware that skin cancer can occur at any age, and remembering the care of your skin during your youth will decrease your risk of developing skin cancer later in life. You can decrease your chance of possibly getting skin cancer by not exposing your skin to the sun without protection, especially at times when the effects are most serious, between 10 a.m. and 3 p.m. If you do not allow your skin to burn by protecting it with sunscreen or clothing, you have a lower chance of getting skin cancer at some point in your life. The higher the Sun Protection Factor (SPF) of a sunscreen lotion, the more it will protect you from the sun's ultraviolet rays. Sunscreens with an SPF of 15 or above are most effective. It is very important that you perform behaviors that put you at a lesser risk for contracting skin cancer. By following steps to protect your skin, your risk of developing skin cancer will decrease by 20%.</u>

It is also suggested that you pay attention to changes in your skin. If you make a small effort to familiarize yourself with the normal appearance of your skin, you will make it possible for yourself to detect changes in your skin that may be warning signs of cancer. If you remember to check your skin occasionally for the skin cancer warning signs, you will know if you have skin cancer, and you can cause yourself less harm by not allowing it to spread. If you follow steps to detect signs of skin cancer, your chance of discovering skin cancer at an early, treatable stage will increase by 20%. It is up to you to bring any unusual skin condition to your doctor's attention.

Appendix D

Negative Frame with High Efficacy Message

Note: Differences in text across messages are underlined.

Questions and Answers About Skin Cancer

What is skin cancer?
Skin cancer is the name given to a number of different diseases caused by abnormal growth of skin cells. Skin cancers are usually divided into two categories, melanoma and nonmelanoma cancers. Nonmelanoma is the more common type of skin cancer, and melanoma is the less common type of skin cancer. Nonmelanoma cancer is less likely to spread to other parts of the body, and melanoma cancer is more likely to spread to other parts of the body. Nonmelanoma cancers develop in the cells of the epidermis, which is the outermost layer of the skin. Melanoma develops in the melanocytes, which are cells that contain the skin's pigment, melanin.

How do I know if I have skin cancer?
Skin cancer usually appears as an unusual growth on the skin that is visible to the naked eye, but only a doctor can tell for sure whether an abnormality is cancerous. Therefore, it is very important that you notify your doctor about any abnormality on your skin that you cannot explain. There are some warning signs of which everyone should be aware. The most common warning signs are unusual growths on the skin or sores that don't heal. Nonmelanoma cancer can appear in a number of different forms. It may look like a small, smooth, shiny, pale or waxy lump, or as a firm red lump. The lump may bleed or develop a crust. This cancer may also appear as a flat red spot that is rough, dry, or scaly. Melanoma usually occurs as a change in a mole. A normal mole is an evenly colored brown or black spot on the skin, which can be flat or raised, round or oval, and is usually less than 6 millimeters in diameter (the size of a pencil eraser). Warning signs of melanoma include asymmetry of the color, and diameter larger than 6 millimeters. If you discover any of these symptoms, you should contact your physician immediately.

Is there anything I can do to protect myself against skin cancer?
There are two important things to remember when you think about skin cancer. First, you must remember that the main cause of skin cancer is ultraviolet radiation from the sun. <u>Second, you must be aware that skin cancer can occur at any age, and ignoring the care of your skin during your youth will increase your risk of developing skin cancer later in life. You can increase your chances of possibly getting skin cancer by exposing your skin to the sun without protection, especially at times when the effects are most serious, between 10 a.m. and 3 p.m. If you allow your skin to burn, by not protecting it with sunscreen or clothing, you have a higher chance of getting skin cancer at some point in your life. The lower the Sun Protection Factor (SPF) of a sunscreen lotion, the less it will protect you from the sun's ultraviolet rays. Sunscreens with an SPF of 15 or above are the most effective. It is very important that you avoid behaviors that put you at a greater risk for contracting skin cancer. By not following steps to protect your skin, your risk of developing skin cancer will increase by 80%.</u>

It is also suggested that you pay attention to changes on your skin. If you don't make a small effort to familiarize yourself with the normal appearance of your skin, you will make it more difficult for yourself to detect changes in your skin that may be warning signs of cancer. If you neglect to check your skin occasionally for the skin cancer warning signs, you might have skin cancer without knowing, and you can cause yourself great harm by allowing it to spread. If you do not follow steps to detect signs of skin cancer, your chance of discovering skin cancer at an early, treatable stage will decrease by 80%. It is up to you to bring any unusual skin conditions to your doctor's attention.

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Appendix E

Negative Frame with Low Efficacy Message

Note: Differences in text across messages are underlined.

Questions and Answers About Skin Cancer

What is skin cancer?
Skin cancer is the name given to a number of different diseases caused by abnormal growth of skin cells. Skin cancers are usually divided into two categories, melanoma and nonmelanoma cancers. Nonmelanoma is the more common type of skin cancer, and melanoma is the less common type of skin cancer. Nonmelanoma cancer is less likely to spread to other parts of the body, and melanoma cancer is more likely to spread to other parts of the body. Nonmelanoma cancers develop in the cells of the epidermis, which is the outermost layer of the skin. Melanoma develops in the melanocytes, which are cells that contain the skin's pigment, melanin.

How do I know if I have skin cancer?
Skin cancer usually appears as an unusual growth on the skin that is visible to the naked eye, but only a doctor can tell for sure whether an abnormality is cancerous. Therefore, it is very important that you notify your doctor about any abnormality on your skin that you cannot explain. There are some warning signs of which everyone should be aware. The most common warning signs are unusual growths on the skin or sores that don't heal. Nonmelanoma cancer can appear in a number of different forms. It may look like a small, smooth, shiny, pale or waxy lump, or as a firm red lump. The lump may bleed or develop a crust. This cancer may also appear as a flat red spot that is rough, dry, or scaly. Melanoma usually occurs as a change in a mole. A normal mole is an evenly colored brown or black spot on the skin, which can be flat or raised, round or oval, and is usually less than 6 millimeters in diameter (the size of a pencil eraser). Warning signs of melanoma include asymmetry of the color, and diameter larger than 6 millimeters. If you discover any of these symptoms, you should contact your physician immediately.

Is there anything I can do to protect myself against skin cancer?
There are two important things to remember when you think about skin cancer. First, you must remember that the main cause of skin cancer is ultraviolet radiation from the sun. <u>Second, you must be aware that skin cancer can occur at any age, and ignoring the care of your skin during your youth will increase your risk of developing skin cancer later in life. You can increase your chances of possibly getting skin cancer by exposing your skin to the sun without protection, especially at times when the effects are most serious, between 10 a.m. and 3 p.m. If you allow your skin to burn, by not protecting it with sunscreen or clothing, you have a higher chance of getting skin cancer at some point in your life. The lower the Sun Protection Factor (SPF) of a sunscreen lotion, the less it will protect you from the sun's ultraviolet rays. Sunscreens with an SPF of 15 or above are the most effective. It is very important that you avoid behaviors that put you at a greater risk for contracting skin cancer. By not following steps to protect your skin, your risk of developing skin cancer will increase by 20%.</u>

It is also suggested that you pay attention to changes on your skin. If you don't make a small effort to familiarize yourself with the normal appearance of your skin, you will make it more difficult for yourself to detect changes in your skin that may be warning signs of cancer. If you neglect to check your skin occasionally for the skin cancer warning signs, you might have skin cancer without knowing, and you can cause yourself great harm by allowing it to spread. If you do not follow steps to detect signs of skin cancer, your chance of discovering skin cancer at an early, treatable stage will decrease by 20%. It is up to you to bring any unusual skin conditions to your doctor's attention.

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Appendix F

Intentions Questionnaire

The following questions are about your feelings about doing different things. Please answer these questions as honestly as possible. We are not assuming that you will be consistent with your answers.

In order to answer the following items, please use the following scale:

1	2	3	4	5	6	7
Very Unlikely						Very Likely

Question	Your Rating
1. How likely is it that you will avoid the sun between 10:00 a.m. and 3:00 p.m.?	
2. How likely is it that you will ignore a sore that won't heal quickly?	
3. How interested would you be in making an appointment to get a skin cancer examination at your doctor's office?	
4. How likely is it that you will wear a wide-brim hat when in the sun?	
5. How likely is it that you will familiarize yourself with the normal appearance of your skin?	
6. How likely is it that you will learn how to check your own skin for the development of skin cancer?	
7. How likely is it that you will cover your arms and legs when in the sun?	
8. How likely is it that you will spend the day in the sun in order to get a tan?	
9. How likely is it that you will use sunscreen on a cloudy day?	
10. How likely is it that you will incorporate examining your skin into your usual health routine?	

11. How likely is it that you will talk with your doctor about your skin?	
12. How likely is it that you will go outside without using sunscreen?	
13. How likely is it that you will schedule a doctor's appointment if you notice an asymmetrical mole?	
14. How likely is it that you will use sunscreen next time you are out in the sun?	

***Numbers 1, 4, 7, 8, 9, 12, and 14 are prevention behaviors.
Numbers 2, 3, 5, 6, 10, 11, and 13 are detection behaviors.

Appendix G

Risk Perceptions Questionnaire

In order to answer the following items, please use the following scale:

1	2	3	4	5	6	7	8	9
Not at all								**Extremely**

Question	**Your Rating**
1. How likely do you think it is that you will develop skin cancer?	
2. How likely to you think it is that a typical person will develop skin cancer?	

Appendix H

Beliefs About Skin Cancer Questionnaire

In order to answer the following items, please use the following scale:

1	2	3	4	5	6	7	8	9
Not at all								**Extremely**

Question	**Your Rating**
1. Are you concerned about developing skin cancer?	
2. How dangerous do you think it is to get a sunburn?	
3. Do you feel skin cancer is a serious health problem?	

Appendix I

11-item Numeracy Scale (Lipkus, Samsa, & Rimer, 2001)

Please complete the following questions:

Question	**Answer**
1. Imagine that we roll a fair, six-sided die 1,000 times. Out of 1,000 roles, 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?	
4. Which of the following numbers represents the biggest risk of getting a disease?	___ 1 in 100 ___ 1 in 1000 ___ 1 in 10
5. Which of the following numbers represents the biggest risk of getting a disease?	___ 1% ___ 10% ___ 5%
6. If Person A's risk of getting a disease is 1% in ten years, and person B's risk is double that of A's, what is B's risk?	
7. If Person A's risk 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?	
8. 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?	
9. 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.	
10. 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 J

Test of the information

Please answer the following questions:

1. What disease was discussed in the message you read?
    a. Breast cancer
    b. Skin cancer
    c. Prostate cancer
    d. Heart failure

2. According to the message, if you follow the recommendations, your chance of getting skin cancer will:
    a. Increase by 20%
    b. Increase by 80%
    c. Decrease by 20%
    d. Decrease by 80%

3. According to the authors, which of the following is a sign of skin cancer?
    a. An evenly-colored brown or black mole
    b. Muscle tenderness
    c. A sore that heals quickly
    d. Unusual growth on skin

Appendix K

Prior risky, prevention, and detection behaviors (Glanz et al., 2008)

For each question listed, please select the one answer that is the best response to the question.

1. In the summer, on average, how many hours are you outside per day between 10 am and 4 pm...on WEEKDAYS (Monday-Friday)?

____ 30 minutes or less
____ 31 minutes to 1 hour
____ 1 to 2 hours
____ 2 to 3 hours
____ 3 to 4 hours
____ 4 to 5 hours
____ 5 to 6 hours

2. In the summer, on average, how many hours are you outside per day between 10 am and 4 pm...on WEEKEND DAYS (Saturday & Sunday)?

____ 30 minutes or less
____ 31 minutes to 1 hour
____ 1 to 2 hours
____ 2 to 3 hours
____ 3 to 4 hours
____ 4 to 5 hours
____ 5 to 6 hours

3. In the past 12 months, how many times did you have a red OR painful sunburn that lasted a day or more?

____ 0____ 1____ 2 ____ 3____ 4 ____ 5 or more

For the following questions, think about what you do when you are outside during the summer on a warm sunny day.

4. How often do you wear **SUNSCREEN**?	Never	Rarely	Sometimes	Often	Always
5. How often do you wear a **SHIRT WITH SLEEVES that cover your shoulders**?	Never	Rarely	Sometimes	Often	Always
6. How often do you wear a **HAT**?	Never	Rarely	Sometimes	Often	Always
7. How often do you stay in the **SHADE or UNDER AN UMBRELLA**?	Never	Rarely	Sometimes	Often	Always

8. How often do you wear **SUNGLASSES**?	Never	Rarely	Sometimes	Often	Always
9. How often do you spend time in the sun in order to get a tan?	Never	Rarely	Sometimes	Often	Always

10. What is the color of your untanned skin?

____ Very fair
____ Fair
____ Olive
____ Light brown
____ Dark brown
____ Very dark

11. Have you EVER had your skin checked for skin cancer from head to toe by a health professional?

____ No
____ Yes. What is the month and year when you last had your skin checked from head to toe? Month: ____ Year: ____

12. In the last 12 months, have you or a partner examined your entire body, including your back, for skin cancer?

____ No
____ Yes. How many times? ____

13. Have you ever used a tanning bed or booth with tanning lamps?

____ No
____ Yes:

If yes, how many times in your entire life have you used a tanning bed or booth with tanning lamps? _____ times.

How many times in the last 12 months have you used a tanning bed or booth? _____ times.

How old were you the first time you used a tanning bed or booth? _____ years old.

Appendix L

Demographic Questionnaire

1. Age: _____ Gender: (circle one) Male Female

2. Years of Education: _____

3. Marital Status: (circle one)
   Single Married Separated Divorced Widowed

4. If married/separated/divorced/widowed:
   Number of Years Married to current/most recent spouse: _____
   Number of Marriages: _____

5. Ethnicity/race: (circle one)

Caucasian (White)
African American (Black)
Asian American
Hispanic
Pacific Islander
Native American (American Indian/Alaskan Native)
Other: _____

6. What is your current occupation or the occupation you pursued for the majority of your adult life? _____

7. Have you ever been diagnosed with a chronic illness, that is, a disease that is ongoing or long-lasting (e.g., heart disease, diabetes, arthritis)?
   Yes_____ No_____

8. How long has it been since you were examined by a doctor? _____

9. How would you rate your overall health at the present time?
   (1) *Excellent*
   (2) *Good*
   (3) *Fair*
   (4) *Poor*

10. Is your health now better, about the same, or not as good as it was three years ago?:
    (1) *Better*
    (2) *About the Same*
    (3) *Not as Good*

11. Do your health problems stand in the way of your doing the things you want to do?
    (1) *Not at All*
    (2) *A Little*
    (3) *A Great Deal*

12. Would you say your health is better, about the same, or not as good as most people your age?:

(1) *Better*
(2) *The Same*
(3) *Not as Good*.

13. Do you smoke? Yes _____ No _____

If yes, how many years have you smoked? _____

14. Have you ever been diagnosed with any type of cancer? Yes ____ No ____

If yes, what type of cancer? _____

15. Has someone close to you ever been diagnosed with any type of cancer? Yes ____ No ____

If yes, what type of cancer? _____

Please indicate your relationship to this person: _____

16. Have you ever discussed the experience of cancer with someone who had cancer?
Yes _____ No _____

If so, please rate how involved you were in this person's life during their experience with cancer:

1---------2----------3----------4----------5
not at all involved very involved

17. Have you ever discussed the treatment of cancer with someone who had cancer?
Yes _____ No _____

If so, please rate how involved you were in this person's life during their treatment of cancer:

1---------2----------3----------4----------5
not at all involved very involved

Appendix M

Table 1. Descriptive information for younger and older adults.

	Younger Adults (N = 68)	Older Adults (N = 68)
Age (*SD*)	19.93 (2.42)	75.95 (8.08)
Education (*SD*)	14.35 (1.63)	12.06 (2.30)

Table 2. Descriptive information for participants in the positive and negative frame conditions.

	Positive Frame (N=68)	Negative Frame (N=68)
Education (*SD*)	13.30 (2.05)	13.20 (2.53)
Ethnicity		
Caucasian	65	63
African American	0	2
Asian American	0	1
Hispanic	0	1
Native American	1	1
Middle Eastern	1	0
Multiple ethnicity	1	0
Diagnosed with cancer at some point	18	13
Diagnosed with skin cancer at some point	8	7
Knew someone diagnosed with skin cancer	8	12

*With the exception of education, all numbers represent frequencies.

Appendix N

Table 3. Percentage of participants who responded correctly to each test of information item.

	Positive Frame (percent of participants correct) N = 64	Negative Frame (percent of participants correct) N = 68
What disease was discussed in the message you read?	98.5	95.6
According to the message, if you follow the recommendations, your chance of getting skin cancer will _____	70.8	20.6
According to the authors, which of the following is a sign of skin cancer?	87.7	76.5

Appendix O

Table 4. Descriptive information for continuous variables examined in regressions.

Variable	M	*SD*	Range
Intention to engage in prevention behaviors	3.65	1.42	1-7
Intentions to engage in detection behaviors	5.42	1.22	1-7
Numeracy ability	5.60	3.41	1-11
History of prevention behaviors	12.86	4.15	1-24

Appendix P

Table 5. Correlations among dependent and independent variables.

Variable	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.
1. Intention to engage in prevention behaviors	--	0.21*[a]	.11[c]	-.38*[a]	.01[c]	.73*[c]	0.76*[a]	.31*[c]	-.03[a]	.31*[a]
2. Intention to engage in detection behaviors		--	0.14[c]	.07[a]	0.04[c]	.09[c]	0.28*[a]	.38*[c]	.31*[a]	.30*[a]
3. Frame			--	.02[c]	.00[b]	.00[b]	-.04[c]	-.13[b]	-.01[c]	-.16[c]
4. Numeracy ability (centered)				--	-.13[c]	-.94*[c]	-0.23*[a]	.02[c]	0.05[a]	-.08[a]
5. Efficacy level					--	.00[b]	0.02[c]	-.12[b]	.13[c]	.05[c]
6. Age group						--	.50*[c]	-.11[b]	.05[c]	.12[c]
7. History of prevention behaviors (centered)							--	.28*[c]	-.05[a]	.27*[a]
8. History of detection behaviors								--	.21[c]	.19[c]
9. Risk perceptions									--	.28*[a]
10. Beliefs about skin cancer										--

a = Pearson product moment b = phi c = biserial * $p < 0.05$

Appendix Q

Table 7. Summary table of 2 (frame) x 2 (age group) x 2 (efficacy level) ANOVA on intentions to engage in prevention behaviors.

Source	Type III Sum of Squares	df	Mean Square	F	Significance
Intercept	1771.52	1	1771.52	1319.26	.00
Frame	1.79	1	1.79	1.79	.25
Efficacy	.004	1	.004	.00	.96
Age group	88.65	1	88.65	66.02	.00
Frame * efficacy	1.73	1	1.73	1.29	.26
Frame * age group	3.41	1	3.41	2.54	.11
Efficacy * age group	.95	1	.95	.71	.40
Frame * age group * efficacy	.03	1	.03	.02	.88
Error	166.51	124	1.34		
Total	2021.16	132			
Corrected total	264.26	131			

Dependent variable: Intentions to engage in prevention behaviors

Appendix R

Table 9. Summary table of 2 (frame) x 2 (age group) x 2 (efficacy level) ANOVA on intentions to engage in detection behaviors.

Source	Type III Sum of Squares	df	Mean Square	F	Significance
Intercept	3878.89	1	3878.89	2589.31	.00
Frame	2.46	1	2.46	1.64	.20
Efficacy	.28	1	.28	.19	.67
Age group	1.22	1	1.22	.81	.37
Frame * efficacy	.39	1	.39	.26	.61
Frame * age group	.08	1	.08	.06	.81
Efficacy * age group	.42	1	.42	.28	.60
Frame * age group * efficacy	3.63	1	3.63	2.43	.12
Error	185.76	124	1.50		
Total	4071.71	132			
Corrected total	194.15	131			

Dependent variable: Intentions to engage in detection behaviors

Appendix S

Table 11. Summary table of 2 (frame) x 2 (detection history) ANOVA on intentions to engage in detection behaviors.

Source	Type III Sum of Squares	df	Mean Square	F	Significance
Intercept	3677.66	1	3677.66	2827.86	.00
History of detection behaviors	19.41	1	19.41	14.92	.00
Frame	3.90	1	3.90	2.99	.09
History * Frame	.16	1	.16	.12	.73
Error	162.56	125	1.30		
Total	3994.49	129			
Corrected total	183.63	128			

Dependent variable: Intentions to engage in detection behaviors

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