

MESSAGE FRAMING EFFECTS IN NUTRITION EDUCATION

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Introduction

This paper reviews nutrition education research on the effectiveness of message framing in persuading people to comply with recommendations. First, we will define message framing and discuss its basis in prospect theory, a subset of decision theory. Then, we will relate prospect theory to health and nutrition education theory. Finally, we will discuss the state of evidence concerning the effectiveness of message framing in nutrition education and identify research needs to further our understanding of whether and how message frame may affect nutrition attitudes, intentions, and behaviors.

What is Message Framing?

In decision theory, the term “frame” refers to the perspective, in terms of expected losses or gains, a choice is presented to a decision maker. In the context of this paper, message framing refers to presenting a persuasive message in terms of expected gains or losses associated with an advocated behavior. In general, a *gain-framed* message presents beneficial outcomes or the absence of negative outcomes related to performing the behavior advocated in the message. Conversely, a *loss-framed* message presents negative outcomes or the absence of positive outcomes associated with not performing the advocated behavior (Broemer, 2002). For example, consider presenting someone with a choice about whether to drink lots of soda. One way of loss-framing a message is to say, “If you drink a lot of soda, you are likely to have tooth decay.” The corollary gain-framed message would be, “If you limit your soda drinking, you are more likely to avoid tooth decay.” In the example, the choice facing the decision maker is how much soda to consume. In the context of nutrition education, the advocated behavior is limiting soda intake. An advocated behavior can be about not doing something risky, such as not consuming too much fat, or about doing something healthy, such as consuming lots of vegetables. It is important not to get hung up on whether the advocated behavior involves limiting or doing more of a dietary behavior—the important thing in framing is how the outcome is presented. In the soda example, the loss-frame is created by presenting a negative outcome (tooth decay) of not performing the behavior (e.g., drinking lots of soda), and the gain frame is created by presenting a positive outcome, avoiding tooth decay, of performing the behavior (i.e., limiting soda intake).

While related, a message’s frame is different from its affective appeal that is the type of emotion, positive or negative, the message intends to elicit (Monahan, 1995; Hale and Dillard, 1995.) Table 1 compares message frame to affective appeal.

Table 1: Comparison of Message Framing and Affective Appeal

Frame	Framed Message	Affect	Affective Appeal
Gain	If you eat at least 2 cups of fruit and vegetables per day, your risk of colon cancer is reduced by X percent.	Positive	Be smart! Eat at least 2 cups of fruits and vegetables daily.
Loss	If you do not eat a minimum of 2 cups of fruits and vegetable per day, your risk of colon cancer is increased by X percent.	Negative	Don’t be a fool. Don’t eat fewer than 2 cups of fruits and vegetables daily.

While the gain (loss) framed message can also be classified as having a positive (negative) affective appeal, it includes the persuasive element of probability or risk of obtaining or not obtaining outcomes associated with the advocated behavior. A message’s frame may impact the hearer’s perceptions and decisions in a way that its affective appeal cannot because framing brings into play how people evaluate risk to make decisions.

We know very little about the impact of affective appeal on these outcomes. Some qualitative surveillance indicates that consumers prefer to hear positive messages about nutrition, however, these studies do not test the impact of negative versus positive messages on attitudes, intentions or behaviors (Borra et al., 2001; Schwartz and Borra, 1997).

This paper reviews research that investigates the impact that message frame has on perception of risk and how that perception impacts nutrition attitudes, intentions and behavior. The literature reviewed covers the impact of nutrition messages on changing dietary behaviors including the importance of increasing fruit and vegetable intake, folic acid and flavonoid (anti-oxidant) intake, breakfast eating and reducing fat intake. None of the studies covers other areas of nutrition such as shopping behaviors or weight control.

Decision Theory

Before we delve into the impact of message framing, we need to understand how people make decisions. Perceived benefit and threat, gain and loss, and certainty and risk from performing or not performing a given action are central to decision making. Prospect theory incorporates the aspect of individual perception of risk into our understanding of how people make decisions. This section will discuss how perception, including how a message is framed in a person’s mind, impacts decision-making preferences. Figure 1 defines terms used in decision theory.

Classical decision theory, known as expected utility theory, holds that the expected value of a prospect is a linear function of risk and utility. Under this theory, when faced with a choice between two or more prospects, the decision-maker will always choose the prospect with the highest expected value (Tversky and Fox, 1995).

Figure 1. Decision Theory Terms

<p>Prospect: A potential outcome with a probability of occurring.</p> <p>Risk: The known probability of an outcome.</p> <p>Certainty: A 0% or 100% probability of an outcome occurring.</p> <p>Expected Value: The absolute value of a potential outcome (e.g., \$100) multiplied by the probability (e.g., 20%) of it occurring yields an expected value of \$20.</p> <p>Utility: The subjective value an individual places on a potential outcome.</p> <p>Expected Utility Theory: Holds that when faced with alternative prospects, people always prefer the prospect that yields the highest expected value.</p> <p>Prospect Theory: Holds that people do not always choose the prospect that yields the highest expected value because they:</p> <ul style="list-style-type: none">• are sensitive to message frame, choosing differently than expected utility would predict depending on how a message is framed;• are loss averse, tending to place a higher subjective value (utility) on losses than on equivalent gains, preferring avoiding losses to gains of equivalent absolute value;• are more likely to deviate from expected preferences when the probability of a prospect is closer to certainty (0% or 100%);• prefer to bet on uncertain prospects when betting in an area of personal competence; and,• are risk seeking, preferring the prospect with a lower expected value when offered a small probability of obtaining a large prize.

Kahneman and Tversky's (1979) Prospect theory challenges Expected Utility Theory. They hypothesized that decision-makers do not always react with perfect rationality to prospects of loss and gain in the presence of risk because individual perception impacts the decision. In experiments to observe decision-making behavior, they found that quite often actual behavior violates the predictions of expected utility theory. They found that subjects tended to place a higher subjective value on losses than on equivalent gains. That is, losses were more threatening than gains were appealing. In certain situations, they also found that subjects were risk-seeking when expected utility theory predicts they would have been risk-averse. Figure 2 demonstrates the prospect theory value function developed by Tversky and Kahneman as a result of their findings. The function is curved, not linear as expected utility theory would predict. Note that for each of the prospects (P1 and P2), the absolute value of the objective outcome is the same, 400 lives. However, the absolute subjective value people place on each outcome is markedly higher for lives lost than gained.

An important implication of these findings is that the way a choice between prospects is framed in a person's mind, in terms of loss or gain, can affect their preference for those prospects. Kahneman and Tversky (1979) tested this implication and found that subjects systematically

preferred to accept risk when prospects were presented in terms of costs [i.e., loss-frame] and to avoid risk when those same prospects were presented in beneficial terms [i.e., gain-frame]. Table 2 shows that, under a gain frame, people would prefer a certain gain of \$50 to a 60% chance of winning \$100 while, under a loss frame, a 60% chance of losing \$100 beats a certain loss of \$50. Notice that in alternative frames, each prospect carries the same numeric value but that preference for the prospect reverses. The italicized prospects are the preferred prospects for each frame.

Figure 2: Prospect Theory Value Function

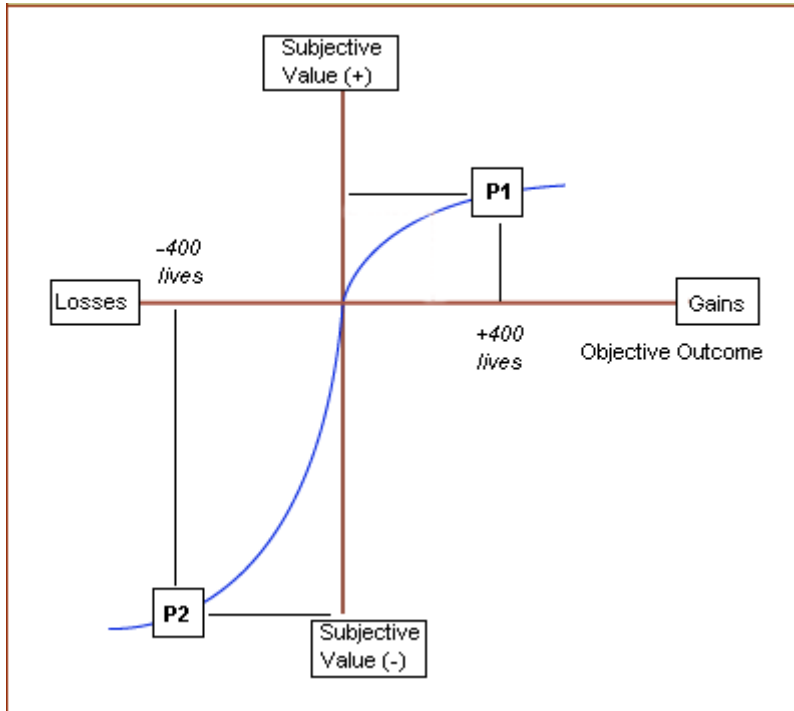


Table 2: Example of Framing Effects

Frame	Prospect 1			Prospect 2		
	Risk of Gain/Loss	Amount of Gain/Loss	Expected Value	Risk of Gain/Loss	Amount of Gain/Loss	Expected Value
Gain	60%	+\$100	+\$60	<i>100%</i>	+\$50	+\$50
Loss	60%	-\$100	-\$60	100%	-\$50	-\$50

The reversal of preference demonstrated in Table 2 represents a change in the decision-maker's subjective valuation of the prospects resulting from how the choice is framed in their mind. Tversky and Kahneman's work shows that people are not always purely rational in developing preferences. They suggest that preferences are conditioned by mediating factors such as an individual's perception or evaluation of a prospect which is subject to many biases such as the heuristic processes (i.e., intuitive, subjective rules of thumb) by which a person evaluates information concerning a prospect, the context in which the prospect arises, and how the prospect is elicited (Tversky and Kahneman, 1992). With respect to heuristic processing, individuals simplify and assimilate information concerning a prospect using different rules of

thumb which in turn will bias how they perceive the risk involved in the prospect. For example, some people strongly hold onto long-held beliefs when they are challenged with information that contradicts those beliefs. These people will process the information differently and arrive at a different perception of a prospect's risk than those who are quicker to adjust their beliefs. With respect to context, a person's perception of their personal risk upon being exposed to a message depends upon their life experience with the content of the message. For example, someone who has personal experience with colon cancer when exposed to a message about the link between colon cancer and diet will process the prospect differently than someone who has no such experience. With respect to how a prospect is elicited, a person's perception of the message may be biased by how and when they receive the message. For example, receiving the message from a doctor during a colon examination is likely to affect a person's judgment differently than exposure to the same message on a bus ride to home from work.

Relating Prospect Theory to Nutrition Education

Prospect theory helps us to understand how personal perception of risks and outcomes affects rational choice. Perception is mediated by many factors such as how a message is framed in a person's mind, how much a person knows about a topic, how big the potential gain is, or how certain an outcome appears to be (Tversky and Kahneman, 1992). Understanding how mediating factors, such as message frame, affect perception is key to developing effective methods to influence health and nutrition choices. Message frame may be an important factor in how people perceive risks related to nutrition choices.

The impact of personal perception on decisions as described in prospect theory fits nicely into a set of nutrition and health education theories known as behavioral change theories.¹ Behavioral change theories posit that individual health or nutrition beliefs, attitudes, and intentions impact one's behavioral decisions. Expectancy value models are a subset of behavioral change theories that focus on the impact of perceptions of risk on attitudes toward and intentions to perform an advocated health or nutrition behavior (Contento et al., 1995). In expectancy value models, the term "expected value" takes on a new meaning closer to the concept of utility used in decision theory. Expected value in this new context refers to the subjective value of a prospect based on an individual's perceptions of the associated risk. Expectancy value models intersect with prospect theory in that they focus on how people perceive risks to evaluate a prospect, such as improved health, resulting from performing an advocated health behavior. Intentions to perform, or actual performance of, the behavior are conditioned by the expected value an individual assigns to the prospect.

Expectancy value models include the health belief model, the theory of reasoned action and the theory of planned behavior. The concepts of perceived risk and expected value fit into each of the models although the terms used may vary. The health belief model emphasizes the concept of risk as it predicts that perceived threat motivates action and perceived benefit points to preferred action. In the theory of reasoned action and the theory of planned behavior, beliefs about risk and expected value are included in the concept of attitude. The theory of reasoned

¹ Most of the articles reviewed here include references to Prospect theory (Broemer, 2002; Brug et al., 2003; Rothman and Salovey, 1997; Rothman et al., 1999; Van Assema et al., 2001). While only two include explicit references to any Behavioral Change Theory (BCT) (Brug et al., 2003; Van Assema et al., 2001), the connection to BCT is clear in the discussion of their findings.

action posits that attitude predicts intention which in turn predicts behavior. The theory of planned behavior differs only in that it holds that self-efficacy, or the belief that one can perform the advocated behavior, mediates between intention and behavior (Booth-Butterfield and Reger, 2004; Contento, 1995; Brug et al., 2003).

Evidence of Framing Effects in Health Education Messaging

The literature on framing effects in nutrition education messaging applies much of what has been learned from a larger body of work on framing effects in health education messaging. The following discussion of Rothman and Salovey (1997) and Rothman et al. (1999) on message framing in the context of health education provides a backdrop for our later review of the nutrition education evidence.

In a comprehensive literature review of framing effects in health education messaging, Rothman and Salovey (1997) demonstrate that framing sometimes results in effects inconsistent with those that would be expected based on prospect theory; but, they do not repudiate prospect theory. They note that the inconsistencies may result from lack of specificity in health messages tested. In order to develop prospect theory, Tversky and Kahneman (1979, 1992) offered subjects choices between options with *specific numeric* risks that would yield *explicit numeric* outcomes. But, health messages like “Using sunscreen lowers your chance of getting skin cancer” tend to advocate a behavior associated with a general probability of an unquantified outcome (Rothman and Salovey, 1997). They suggest that researchers have less experimental control when exposing subjects to framed messages that lack specificity.

To account for the inconsistent results, they proposed that an additional layer of mediating factors conditions how people respond to message frame. For example, mediating factors such as personal situation, attitudes, knowledge of, interest in, experience with, beliefs about, and cognitive involvement in processing a health issue may influence how message frame affects health decisions. As they reviewed the seemingly inconsistent research, they found patterns. They found that a significant number of studies showed a preference for a loss frame when the advocated behavior was a detection behavior or a preference for a gain frame when the advocated behavior was preventative. This review led them to propose that a gain frame would be more effective than a loss frame when related to disease prevention and a loss frame more effective than a gain frame when related to disease detection behaviors. They place a caveat on the expectation that a gain frame is more likely to influence recuperative behavior (i.e., disease treatment) decisions because the evidence only suggests a preference in hypothetical treatment decisions.

Rothman et al. (1999) went on to directly test the hypothesis in Rothman and Salovey (1997). They tested frame conditions in the context of advocated disease detection (screening) and prevention behaviors in two experiments. The first experiment tested frame effects on 176 (72 men, 95 women, and 9 unknown gender) undergraduate participants’ willingness to detect an unfamiliar disease through a laboratory test or prevent it through inoculation. The disease was hypothetical to ensure that no one had heard of it before. Subjects were randomly assigned to one of four groups: prevention/gain-frame; prevention/loss-frame; detection/gain-frame; and, detection/loss-frame. Subjects were assessed on intentions to perform the advocated behavior, how they rated the risk on a scale of 1 to 7, and on the need for cognition (i.e., how inclined they were to think about the messages). Need for cognition was assessed because the researchers

were concerned about the impact of cognitive elaboration, which is depth of message processing, since messages were about a completely unfamiliar disease. The authors predicted that subjects receiving the loss-framed detection message (e.g., “Failing to detect the virus may undermine effective treatment ...”) would be more likely to intend to do the lab test than those getting the gain-framed detection message (e.g., “Detection makes effective treatment possible...”). They also predicted that subjects receiving the gain-framed prevention message (e.g., “Prevention ensures you of your health...”) would be more likely to intend to be inoculated than those getting the loss-framed prevention message (e.g., “Failing to prevent the virus may undermine your health...”). In addition, they predicted that the pattern would only hold among those with a high need for cognition. Both of the framing effect predictions described above held, although the framing effect was not statistically significant for the prevention messages. In addition, as predicted, only those with a high need for cognition were affected by the frame. The authors do not report whether the subjects’ demographic characteristics moderated the impact of message frame.

Experiment two tested frame effects on 120 (89 women, 31 men) undergraduate participants’ willingness to use a plaque-detecting mouth rinse or a plaque-fighting rinse to detect or prevent gum disease, respectively. The sample was again divided into 4 groups as in the previous experiment. Subjects were given a loss or gain-framed pamphlet on either the detective or a preventive behavior. After reading the pamphlet, subjects were assessed on cognitive elaboration using a thought listing task in which subjects recorded thoughts they had while reading the pamphlet; emotional reactions to the pamphlet; perceptions of risk and severity of gum disease; attitudes toward the advocated behaviors; behavioral intentions; and, overall evaluation of the pamphlet. The evaluation of the pamphlet was done to ensure that quality of the pamphlets was similar except in frame.

The authors first tested for moderating effects of demographic characteristics and dental history on the impact of message frame and found none. As a result, further analyses were conducted without stratification over demographic characteristics or dental history. Then, subjects were evaluated based on their attitudes toward and intentions of buying each type of mouth rinse, and whether they actually obtained either type of mouth rinse. They found that subjects receiving loss-framed pamphlets perceived a higher risk for gum-disease, had more negative thoughts about their dental health, and had more favorable attitudes towards the behaviors (both detection and prevention) than those receiving the gain-framed pamphlets. Framing effects for behavioral intentions were measured by intention to purchase the advocated product (disclosing or plaque-fighting rinse). Subjects exposed to the gain-framed pamphlet about the preventive plaque-fighting rinse were expected to report stronger intentions to buy, use and pay more for the rinse than those exposed to the loss-framed pamphlet. Subjects exposed to the loss-framed pamphlet about the disclosing rinse were expected to report stronger intentions to buy, use and pay more for the rinse than those exposed to the gain-framed pamphlet. The subjects demonstrated the expected frame advantages. Finally, actual behavior was tested by giving subjects a postcard they could mail in for a free sample of the rinse they had read about. As expected, those exposed to loss-framed messages more often requested the plaque-disclosing rinse than the gain-framed group and vice-versa for the preventive plaque-fighting rinse.

Evidence in Nutrition Education Messaging

Very little evidence exists in nutrition education research to support framing effects on perceptions, attitudes, intentions, or behavior. We found only five experiments on framing effects in the nutrition education literature and, of those, only one looked at a framing effect on behavior. The remainder tested framing effect on attitudes and intentions.

The first of the articles (Brug et al., 2003) reviewed here discusses three experiments that tested the hypothesis that a gain-frame is more persuasive in preventive scenarios, as was tested in Rothman et al. (1999). The next two studies (Tykocinski et al., 1994, and Broemer, 2002) investigate whether certain psychological characteristics mediate framing effects on message persuasiveness. Only Tykocinski et al. tested framing effects on behavior.

Prevention Situations

Based on Rothman and Salovey (1997) and Rothman et al. (1999), Brug et al. (2003) summarized the results of three studies hypothesizing that a gain-frame would positively impact attitudes and intentions towards preventive dietary behaviors more than a loss-frame. None of the studies dealt with framing effects on actual behaviors or intentions to perform detection behaviors. All of the studies were performed in the Netherlands. In each study, the authors tested frame effects by randomly assigning subjects to a gain or loss frame group. Participants completed a survey measuring attitudes toward and intention to change dietary behaviors. In addition, the authors asked questions that would allow them to further test the framing effects mediated by personal characteristics of the participants. For example, framing effects were tested between groups for which the advocated behavior was relevant or not relevant, novel or known, and practiced to some degree or not.

1. Study one, also published separately (Van Assema et al. 2001), posited that gain-frames would be more effective than loss-frames in encouraging preventive behaviors such as a low-fat diet and eating fruits and vegetables. A sample of 148 adults (75% female, aged 21-79) recruited from adult education centers in the Netherlands randomly received one of four framed messages, a gain- or loss-framed message on fruits and vegetables or on fat. Table 3 shows examples of the messages. Subjects were asked questions about mediating factors including personal relevance, self-reported intake, and self-reported intensity of reading the educational material. Eighty-eight percent of the subjects reported that they read the materials intensely, 11% said the information was novel, 87% said it was highly credible, 29% reported high fat intake and 20% reported low fruit and vegetable intake. No framing effects were found in any of the conditions. The authors do not report any mediating effects of demographic characteristics on frame impact. The authors suggest the hypothesis was not supported because the information was not novel and a large majority reported appropriate levels of fat and fruit and vegetable intake. They reasoned that the data indicated that the sample did not perceive a need to change behavior.
2. Since the participants in study one found the fat and fruit and vegetable messages familiar, study two tested framing effects on less familiar preventive behaviors and risks and attempted to more strongly persuade subjects that their intake was

inadequate. Subjects were randomly assigned to receive a booklet with either loss- or gain-framed messages related to flavonoids (anti-oxidants found especially in fruits and vegetables) and their role in disease prevention. Unlike the messages in study one, the messages advocated a very specific behavior associated with explicit risks. Loss-framed messages included statements like “people who eat less than 50 mg of flavonoids per day have a 50% higher cardiovascular disease risk.” Gain-framed messages included statements like “people who eat more than 50 mg of flavonoids per day have a 50% lower cardiovascular disease risk.” The sample included 149 Dutch University students, 80% of whom were female, aged 17 to 32 (mean=20). Subjects were asked a number of questions about potential mediating factors including impressions of the booklet and their own behavior. A little more than half (55%) reported that they were motivated to read the booklet, though 96% reported that they read it carefully. Most (95%) reported that the information was new to them, 55% rated it as credible, 52% rated it as important, and 43% rated the arguments as strong. Self-reported flavonoid intake was low for 42% of the subjects. No framing effects were found, nor did any of the above potential mediating factors interact with message frame to impact intentions or attitudes.

3. Study three tested framing effects of messages about preventing birth defects by using folic acid supplementation before and during pregnancy. The sample included 92 female students, aged 18-29 (mean=20), all of whom reported that they wanted to have children in the future and 97% of whom reported the topic was important. The researchers first administered a survey purportedly designed to measure folic acid intake to all subjects. They created high and low relevance groups by telling the women that they had adequate (low relevance) or low (high relevance) intakes based on manipulated intake survey results. Then the women were randomly assigned to one of four groups in a 2 (gain v. loss frame) X 2 (low v. high relevance) design. Gain-framed messages included statements like, “If your intake of folic acid is at least 8 mg per day, your risk [of having] a child without a neural tube disorder is 50% higher.” Loss-framed messages included statements like, “If your intake of folic acid is below 8 mg per day, your risk of having a child with a neural tube disorder is 50% higher.” After reading the brochure, 15% rated their fear level as high. There were no differences between the conditions on fear level or importance. The high personal relevance condition was significantly associated with a higher mean intention score, but not with attitude scores. However, the study found no framing effects and no interaction between frame and mediating factors.

Table 3: Examples of Messages Used in Study 1

	Gain-Framed	Loss-Framed
Fat	People who eat a low-fat diet have less chance of getting cardiovascular diseases.	People who eat too much fat have more chance of getting cardiovascular diseases.
Fruits and Vegetables	People who eat ample fruits and vegetables have less chance of getting cancer.	People who eat few fruits and vegetables have more chance of getting cancer.

These studies failed to support the hypothesis of Rothman et al. (1999). Brug et al. (2003) are fairly negative about the prospects of message framing to impact dietary attitudes, intentions, and behavior since no studies at the time of publication had supported any main framing effects on motivation. No new studies, to our knowledge, have been published since Brug et al. (2003). However, Broemer (2002) and Tykocinski et al. (1994), as discussed next, found that message frame mediated by certain psychological characteristics did have an effect.

Psychological Mediating Factors

In the examples to follow, researchers tested whether psychological traits condition how people respond to message frames. They looked at ambivalence towards an advocated behavior (Broemer, 2002) and self-discrepancy, when a person's self-perception conflicts with their ideals for themselves or what they believe others want them to be (Tykocinski et al., 1994). Both of these studies directly tested attitudes and intentions and Tykocinski et al. (1994) also included behavior.

Tykocinski et al. (1994) tested the impact of the mediating factor of self-discrepancy on gain- or loss-framed messages about eating breakfast. Self-discrepancy theory holds that emotional vulnerabilities arising from a discrepancy between self-beliefs produce psychological discomfort. The type of discomfort depends on the type of discrepancy. Two discrepancies are investigated in Tykocinski et al.

Actual:ought (A:O) discrepancy is associated with anxiety. It arises when a person's concept of their own attributes is different from what they believe others think they should possess. To avoid negative consequences, a person with an A:O discrepancy is motivated to meet other's expectations of them. In earlier work, Higgins and Tykocinski (1992) found that A:O discrepant subjects were more attentive to stories that reflected negative outcomes than positive outcomes. Tykocinski et al. (1994) hypothesize that, although A:O discrepant subjects are more attentive to negative outcomes, a loss-framed message which describes negative outcomes would also produce anxiety and cause them to reject the message. They further posited that a gain-framed message is less likely to activate their emotional vulnerability to anxiety and would be more effective with them.

Actual:ideal (A:I) discrepancy is associated with low-self esteem. It arises when a person's concept of their own attributes is different from their ideal for themselves. A:I discrepant persons are motivated to meet their ideals to get the positive outcome they believe is associated with the ideal. Higgins and Tykocinski (1992) found that A:I discrepant subjects were more attentive to stories that reflected positive outcomes than negative outcomes. Tykocinski et al. (1994) hypothesize that, although A:I discrepant subjects are more attentive to positive outcomes, a gain-framed message which describes positive outcomes would activate a sense of low-self esteem and cause them to reject the message. They further posited that a loss-framed message is less likely to activate their emotional vulnerability to low-self esteem and would be more effective with them.

To test these proposed framing effects, Tykocinski et al. (1994) grouped a small sample of 39 by self-discrepancy type as determined by a questionnaire and exposed them to gain or loss frame conditions. Of 23 A:I subjects, 11 were exposed to loss-frame and 12 to gain-framed messages. The 16 A:O subjects were evenly split between frame conditions. The researchers obscured the

true purpose of the study to boost the validity of the results. The messages advocated eating breakfast. The study supported the hypothesized framing effects, that A:I subjects would be more responsive to a loss-framed message and A:O subjects to a gain-framed message, with respect to intentions to eat and feelings about eating breakfast. The effect was maintained for A:O subjects for eating behavior as measured by a mail in survey sent 2 weeks after the laboratory testing.

Broemer (2002) reports the results of 3 studies supporting the hypothesis that the attitudes and intentions of highly ambivalent subjects are more persuaded by loss- than gain-frames as a result of negativity bias (an increased sensitivity to negative information) involved in ambivalence. One of these studies looked at messages about eating a low fat diet. The loss-framed message read, "Not adopting a low-fat diet increases your risk of developing a serious heart disease." The gain-framed message read, "Adopting a low-fat diet reduces your risk of developing a serious heart disease." Eighty male university students completed a health attitudes survey which enabled the researchers to place them in high and low ambivalence groups. Then they were randomly assigned to receive loss or gain framed messages. After reading the messages, they were asked about their attitudes and intentions toward the advocated behavior. Broemer found a significant framing effect among highly ambivalent subjects. As expected they were more influenced by a loss frame. Broemer also found that lower ambivalence subjects were slightly, but not significantly, more likely to respond to a gain-framed message as expected. One caveat noted by the author is that the sample included only males, for whom heart disease is perceived to be more relevant. This study may also be limited in its generalizability because young males tend to exhibit more risk-taking health behaviors than young females as indicated by adolescent health literature (Duberstein Lindberg et al., 2000.)

These studies are interesting for their look into how psychological characteristics mediate message frame evaluation. However, their conclusions may not be particularly useful in practice (Brug et al., 2003) if nutrition educators are not able to determine psychological characteristics of the target group or person in order to select the most effective message frame. This caveat is particularly salient with respect to group nutrition education. However, interactive computer message tailoring may have potential for assessing individual psychological characteristics that mediate framing effects to produce messages with the appropriate frame for an individual. But first, more research is needed to strengthen support for hypotheses concerning frame mediating effects of psychological characteristics. Then, research on whether targeted message framing based on computer generated psychological assessments would have the expected effects.

Conclusions

None of the reviewed articles pertaining to nutrition education provide evidence of main frame effects; however, they do show some support for framing effects mediated by psychological traits. Framing effects were found in the two articles that interacted frame with the psychological mediators of ambivalence and self-discrepancy. Considering the small sample sizes, prominence of convenience sampling, sampling among heterogeneous populations such as those in the Dutch studies (Brug et al., 2003), lack of sampling among low-income populations and the lack of impact on behavior, the evidence is fairly weak. Not enough evidence, weak or strong, exists to draw definite conclusions.

Why does it appear that framing techniques used for health related prevention behaviors show preferences between loss and gain frames while they seem to have little or no influence when used to promote dietary behaviors? Rothman and Salovey's (1997) observation that the situation to which a health message applies (i.e., prevention or detection) appears to have no relevance for nutrition education messaging. What's the difference?

Are risks and outcomes in nutrition messages too vague? Rothman and Salovey (1997) argue that health related decisions are made in a more complex environment than the explicit and simplistic risk scenario (e.g., 50% chance of winning \$1000) in which decisions are tested in Kahneman and Tversky (1979). This argument could be extended to the complex arena of nutrition education. A message such as "Eating fruits and vegetables lowers your risk of colon cancer" is fairly vague. The message begs complex questions like what kind of fruits and vegetables, how many of each kind, and how long duration of eating them is associated with what level of risk? Rothman and Salovey's point makes sense. Surely more explicit messages would make the impact of a message frame more predictable (e.g., "Eating 1/2 cup leafy green and 1/2 cup of dark orange vegetables, 1 banana, 1 orange, and 1 apple every day will reduce your risk of colon cancer by 50% if colon cancer is hereditary in your family.") But, explicitness of risk does not appear to be an operative factor in Brug et al. (2003) and Rothman et al. (1999). In their second experiment, Brug et al. (2003) do test messages with explicit risks (e.g., "people who eat more than 50 mg of flavonoids per day have a 50% lower cardiovascular disease risk"), but do not yield framing effects. Meanwhile, Rothman et al. (1999) found framing effects for prevention messages without giving explicit probabilities (e.g., "People who use mouth rinse daily are taking advantage of a safe and effective way to reduce plaque accumulation.")

What about complexity of the behaviors and outcomes themselves? We know that the relationship between diet and health status is very complex, making clear probabilistic statements of risk and benefit of performing an advocated behavior very difficult. Preventive (and recuperative) dietary behaviors can be very complex in and of themselves, requiring long-term commitments to a lifestyle change. Lifestyle changes on the order of eating a low-fat diet and 2 to 2.5 cups of vegetables daily are certainly more complex, time-consuming, and psychologically difficult to adopt than some preventive health behaviors for which framing effects have been demonstrated. The latter include getting an inoculation, wearing sunscreen when outdoors or performing a regular breast self-examination. Rothman and Salovey (1997) argue that as a result of the complexity and difficulty of changing health behaviors, mediating factors, beyond prevention or detection situations are likely to have an impact on decision making. One could easily extend that argument to diet-related decisions, which are often extremely complex. And in the case of nutrition, based on the work of Brug et al. (2003) it appears we must look beyond prevention and detection situation to other mediating factors.

What other factors could make the difference? Our five studies looked at several mediating factors including personal issue relevance, ambivalence, self-discrepancy, and fear; perceived message credibility, novelty, strength and importance; and, self-reported intake and intensity of message reading. Only ambivalence and self-discrepancy were shown to mediate a frame effect, and they did so in only one experiment each. Clearly, there are no patterns of significance in the research reviewed. So where do we go from here? If prospect theory's proposition that people tend to select options that limit risk over those that emphasize gains can be applied to dietary decisions, then we need to look for mediating factors that would blunt or heighten aversion to continuing a risky dietary behavior. Mediating factors that effect risk perception for poor dietary

behaviors, like not eating enough vegetables, may be very different than those that affect risk perception of other unsafe health behaviors like drug use or smoking.

This literature also raises the question of whether other nutrition related behaviors (such as weight loss practices or physical activity) are more likely to be affected by message framing than changing complex eating habits. Some diet related detection behaviors, such as cholesterol or blood sugar testing, are fairly straightforward. None of these types of behaviors were tested by the reviewed nutrition education research. Detection behaviors may be a good place to look for framing effects in nutrition education settings.

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