

## Original Research

# Reconsidering Prospect Theory in Health Communication: Interplay of Certainty with Different Types of Framing

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## ABSTRACT

While framing studies in health communication research are grounded in prospect theory, there are deviations from the original prospect theory in three major areas: (1) the conceptualization of risk as susceptibility/severity rather than certainty, (2) the presentation of outcomes of different events in gain- and loss-framed messages rather than different aspects of the same outcome, and (3) the use of participants' ratings as outcome variables instead of participants' choice of one option over the other. To understand the implications of these discrepancies, two randomized experiments were conducted within the context of obesity policy support. In experiment 1, participants were asked to rate their support for policies. With a framing approach consistent with prospect theory (called *prospect-theory framing* in this study), participants' ratings were marginally significant but in a consistent pattern with prospect theory; however, no effect was found with the framing approach described in health communication literature (called *persuasion framing* in this study). In Study 2, participants were asked to choose one policy for obesity over the other, revealing a result aligning with the prospect theory predictions. These findings underscore the influence of both framing conceptualization and outcome measurement on observed framing effects.

## KEYWORDS

prospect theory, framing, certainty, risk

Prospect theory (Kahneman & Tversky, 1979; Tversky & Kahneman, 1981) argues that people's preference toward probability information (certain vs. uncertain) can differ depending on whether the outcome is presented in a loss or gain frame. That is, people prefer a certain option over an uncertain option when a message is gain-framed, yet the opposite pattern is true when a message is loss-framed. In a scenario, an unusual disease outbreak is expected to kill 600 people (Tversky & Kahneman, 1981). The majority of study participants chose a program expected to save 200 people (certain/

gain) over a program with a 1/3 probability of saving 600 people and a 2/3 probability of saving no one (uncertain/gain); they preferred a program with a 1/3 probability of no one dying and a 2/3 probability of 600 people dying (uncertain/loss) to a program that is expected to result in 400 people dying (certain/loss). Based on these results, prospect theory concludes that people tend to avoid uncertainty, or risk, when a message is gain-framed and take uncertainty when a message is loss-framed.

Researchers have translated the principle of prospect theory into health communication: a gain-framed message is more effective than a loss-framed message when a risky outcome is not expected and vice versa when a risky outcome is expected (Rothman & Salovey, 1997). Thus, gain frames are effective for disease prevention behaviors which do not result in negative consequences (a relatively low risk) and loss frames are effective for disease detection behaviors, which accompany a risk of facing undesirable outcomes, such as the diagnosis of a disease (a relatively high risk). Meta-analytic studies, however, have not found strong effects to support this conclusion (O'Keefe & Jensen, 2006, 2007, 2009).

The limited framing effects in meta-analytic studies might be due to the discrepancies between prospect theory and framing research in health communication literature. Notably, health communication research conceptualizes risk differently and employs a different outcome measurement and framing approaches from those of prospect theory. To resolve these discrepancies, the current study tests prospect theory in the context of an obesity policy, reconsidering the conceptualization of risk, framing, and outcome measurement in two randomized experiments.

### THREE MAJOR DISCREPANCIES IN FRAMING RESEARCH

There are three major areas in which framing studies in health communication literature deviate from the original theory: conceptualization of risk, conceptualization of gain/loss frames, and outcome measurement. Table 1 summarizes the discrepancies.

#### Conceptualization of Risk: Certainty vs. Susceptibility and Severity

In defining risk, prospect theory considers certainty. For example, in the scenario of an unusual disease outbreak above (Tversky & Kahneman, 1981), when the expected outcome of the program was presented with a certain number of people who will be influenced by the chosen program (certain), it is considered as risk reverse; however, when the occurrence of the consequence is presented with a probability that an outcome can happen (uncertain), it is considered as risk-seeking. Based on this definition, risk can be found in both positive (e.g., saving people) and negative (e.g., losing people) situations.

However, as some researchers have pointed out (Harrington & Kerr, 2017; Levin, Schneider, & Gaeth, 1998; Van't Riet et al., 2016), health communication research does not consider certainty of expected outcome as a risk; rather, they define risk as a combination of susceptibility and severity of a negative outcome (Janz & Becker, 1984; Weinstein, 2000). That is, an event is considered riskier when it is expected to bring a more severe outcome and when the expected negative outcome is more likely to happen.

So far, however, only a few studies in health communication research have followed prospect theory in defining risk (Harrington & Kerr, 2017) even though certainty is the key variable that changes individuals' decision making in prospect theory. The current study defines risk as certainty,

**Table 1.** Framing Research in Prospect Theory and Health Communication

|   | Prospect Theory  | Health Communication   |
|---|--|--|
| <b>Risk</b>                             |  |  |
| Conceptualization                       | Level of certainty<br><br>Low risk (certain): a specific impact of an event; the impact is presented with a specific number. e.g., 600 people will be saved  | Susceptibility and severity<br><br>Low risk: a negative outcome is unlikely to happen. e.g., the HPV vaccine can prevent cervical cancer and it is not likely to result in a negative outcome. Thus, it is low in risk |
| Operationalization                      | High risk (uncertain): probabilities that an outcome is likely to happen when an event happens. e.g., 1/3 probability of saving 600 people and a 2/3 probability of saving no one                                      | High risk: a negative outcome is likely to happen. e.g., A Pap test can detect cervical cancer which is a negative consequence. Thus, a Pap test is riskier than receiving the HPV vaccine.                            |
| Current study                           | We follow the definition of risk in prospect theory and manipulate the certainty.  |  |
| <b>Framing Approach (gain vs. loss)</b> |  |  |
| Consequences of an event                | Gain and loss frames explain the consequences of a same event in either gain or loss terms.  | Gain frame focuses on the <i>benefits</i> that people can get when they adopt an advocated action.<br><br>Loss frame focuses on the <i>costs</i> that people can face when an advocated action is <i>not</i> adopted.  |
| Message goals                           | Messages are designed to compare how people make a decision differently depending on the frame (not designed for persuasion).  | Both gain and loss frame messages are designed to <i>persuade</i> people to adopt an advocated action in a message.  |
| Current study                           | It is called in <i>prospect-theory framing</i> as it follows prospect theory<br><br>This study includes both prospect-theory and persuasion frames in experiments and tests the effects of these two different frames. | It is called in <i>persuasion framing</i> as it follows health communication literature that aims persuasion.  |
| <b>Outcome measurement</b>              |  |  |
| What is asked in research               | Both high- and low-risk options are provided in either gain or loss frame, and participants are asked to choose one.   | Each participant receives only one option (either gain or loss frame) and the effect of the option is asked.   |
| What is compared in data analysis       | Whether participants' choice between high- and low-risk options is different in gain and loss frames are tested.   | The effects of gain and loss frames are compared.  |
| Current study                           | Study 2 follows the outcome measurement of prospect theory.  | Study 1 follows the outcome measurement of framing research in health communication.   |

following prospect theory (Kahneman & Tversky, 1979; Tversky & Kahneman, 1981), to test if the principle stated in the original prospect theory can be applied to health communication.

### Framing Approaches: Different Conceptualization of Gain and Loss Frames

In formulating gain and loss frames, prospect theory presents the same consequences of the same events in either gain or loss terms. For

example, in the disease example given earlier, both gain and loss frames present the same consequence (expected survival rate is 1/3); however, the gain message emphasizes the expected gain (i.e., 1/3 of people will survive) and the loss message focuses on the expected loss (i.e., 2/3 of people will die).

In stating uncertain options, both gain and loss frames in prospect theory show positive and negative aspects. For example, in the gain frame, the uncertain option presents the probability of everyone being saved (positive aspect) and the probability of no one being saved (negative aspect). Similarly, in the loss frame, the uncertain option presents the chance that everyone is lost (negative aspect) and the chance that no one is lost (positive aspect).

However, framing studies in health communication define gain and loss frames differently than does prospect theory. Researchers (Nan, 2007a; O’Keefe & Jensen, 2007, 2009; Rothman & Salovey, 1997; Wilson et al., 1988) state that gain- and loss-framed messages can be positioned in a 2 X 2 matrix: whether the outcome is desirable or undesirable and whether it is obtained or avoided. In gain messages, *complying* with an advocated action can help *attain a desirable* outcome or *avoid an undesirable* outcome (result in a *positive* outcome); in loss messages, *not complying* with an advocated action can lead to *avoid a desirable* outcome or *attain an undesirable* outcome (cause a *negative* outcome).

Here, the characteristics of gain and loss framing in prospect theory differ from those in health communication in two significant ways. First, gain- and loss-framed messages in health communication depict the consequences of *different* events (e.g., receiving a donated organ vs. not receiving a donated organ), whereas those in prospect theory show the consequences of the *same* event (e.g., receiving a donated organ). For example, in Cohen (2010), a gain frame would say, “If James receives a donated organ in time, he will survive,” and a loss frame would say, “If James

*does not receive* a donated organ in time, he will die.” In prospect theory (Kahneman & Tversky, 1979; Tversky & Kahneman, 1981), on the other hand, a gain frame would say, “If James *receives* a donated organ in time, he will have XX% chance of survival” and a loss frame would say, “If James *receives* a donated organ in time, he will have XX% chance of dying.” However, it is worth noting that Harrington and Kerr (2017) strictly adhered to the principles of prospect theory.

Second, in prospect theory, both gain- and loss-framed messages present both positive and negative consequences in different terms, particularly in the uncertain option. For example, a gain frame states that “a program has a 1/3 probability of saving 600 people and a 2/3 probability of saving no one” whereas a loss frame states that “a program has a 1/3 probability of no one dying and a 2/3 probability of 600 people dying.” In contrast, in health communication, the gain-framed messages show only positive consequences (e.g., a program will increase survival rate) and the loss-framed messages show only negative consequences (e.g., a program will reduce survival rate).

In this study, we include two types of framing to test how they interact with certainty differently. We call the gain and loss frames in prospect theory as *prospect-theory framing*; the frames in health communication as *persuasion framing*.

### **Outcome Measurement: Option Selection vs. Message Evaluation**

Lastly, framing studies in health communication employ a different outcome measurement from prospect theory. Prospect theory provides participants with certain and uncertain options in either a gain- or loss-framed message, and then participants are asked to choose either the certain or uncertain option. It is to test whether people choose the certain or uncertain option differently depending on whether the message is framed as a gain or loss. The expected effects are that people

prefer a certain (vs. uncertain) option in a gain frame, whereas people prefer an uncertain (vs. certain) option in a loss frame. The results are largely consistent across different contexts (Levin et al., 1998).

Framing studies within health communication aim to determine whether a gain or loss frame is more persuasive under what conditions (e.g., de Graaf et al., 2015; Nan et al., 2016; Shen & Kollar, 2015). In most of these studies, participants are presented with either a gain- or loss-framed message and asked to rate its effectiveness. Then, the persuasive effects of the gain and loss frames are compared to ascertain which message is more effective. However, only a limited number of framing studies in health communication have employed the outcome measurement framework of the prospect theory (e.g., Harrington & Kerr, 2017).

Collectively, we attempt to close the gaps between the original prospect theory and its application in health communication. In Study 1, we follow the outcome measurement of framing research in health communication. Specifically, participants in Study 1 are given one policy option and asked to rate the policy as a function of certainty and different framing approaches (prospect-theory vs. persuasion framing) to test which option is more persuasive in increasing public support for obesity policies. Study 2, on the other hand, adopts the outcome measurement of the original prospect theory by presenting two policy options that vary by the level of uncertainty and, after asking participants to choose one, compares if participants' choice differs between prospect-theory and persuasion framing.

## CONTEXT OF THIS STUDY: OBESITY POLICIES

Currently, more than two-thirds of adults in the United States are either overweight or obese (Fryar et al., 2020). Obesity is caused by and can

be addressed at both individual and societal levels (Hillier-Brown et al., 2014; Sallis & Glanz, 2006; Story et al., 2008). On an individual level, obesity may be caused by individuals' unhealthy diets and lack of physical activity. On a societal level, an increase in the obesity rate of a community can be caused by low accessibility to affordable healthy food and exercise facilities. In such cases, policies targeted at lowering obesity rates can call for lower-priced healthy foods and an increase in accessibility to affordable exercise facilities. Thus, some studies in health communication examine how to lead individuals to engage in weight-loss behaviors (Hwang et al., 2011; Knobloch-Westerwick & Sarge, 2015) and some examine how to increase public support for obesity policies (Kim & Lee, 2018) as persuasive outcomes. Although enacting policies to reduce obesity is a societal-level solution, individual-level support for those policies is required to establish those policies. The present study aims to better understand the efficacy of message framing at promoting individuals' support for obesity policies while disentangling some of the discrepancies in the literature on the study of framing effects.

With the topic of obesity policy, we designed two separate studies to test how different outcome measures can influence the framing effect. Study 1 follows the outcome measurement of framing research in health communication, presenting one policy option to each participant and asking them to rate the policy to test which option is more persuasive. Study 2 employs the outcome measurement of the original prospect theory, showing participants two policy options and asking them to choose one option over the other. This research was approved by the Institutional Review Board (IRB) at the University of Utah.

## STUDY 1

With the definition of risk in prospect theory, in Studies 1 and 2, message conditions included

different levels of certainty information (certain vs. uncertain) in both gain and loss frames. As gain and loss frames are defined differently in prospect theory and health communication, Studies 1 and 2 include both prospect theory and persuasion framing.

Study 1 follows the outcome measurement with which health communication literature typically tests framed messages; thus, participants are exposed to only one message. Along with our main persuasion outcome, policy support, we also test the effects on perceived argument strength, which has been found to correlate with actual persuasiveness (Zhao et al., 2011). Although perceived argument strength is not equal to actual persuasiveness of a message (O’Keefe, 2020), examining both policy support and perceived argument strength can help address the reliability of framing effects hypothesized in this study.

Prospect theory shows a clear prediction that in the gain frame, individuals prefer a certain option to an uncertain option and in the loss frame, an uncertain option is preferred. Based on prospect theory, this study predicts that in the prospect-theory/gain frame, the certain condition would be more positively evaluated than the uncertain condition and vice versa in the prospect-theory/loss frame. H1 tests if this pattern is found on both policy support and perceived argument strength.

H1. In the prospect-theory/gain frame, participants in the certain condition (a) support the policy more and (b) rate the message as stronger than those in the uncertain condition.

H2. In the prospect-theory/loss frame, participants in the uncertain condition (a) support the policy more and (b) rate the message as stronger than those in the certain condition.

Although framing studies in health communication, which use persuasion framing, have suggested

several moderators of framing effects, little is known about how certainty interacts with the gain and loss frames in persuasion framing. Thus, it remains as a research question.

RQ1. In the persuasion frame, how would certainty interact with gain-loss framing in influencing participants’ (a) policy support and (b) perceived argument strength?

## Method

### *Participants and procedure*

A randomized experiment was conducted with a between-subject design with 7 conditions. The study design was a 2 (frame approaches: prospect-theory vs. persuasion frame) X 2 (certainty: certain vs. uncertain) X 2 (gain vs. loss frame), but since the certain/gain conditions in prospect-theory and persuasion frames were the same (see the “Stimuli messages” section for a detailed explanation), 7 conditions were created for Study 1.

A total of 235 participants were recruited via Amazon Mechanical Turk (M-Turk) in exchange for \$.50. The participants of this study had a high approved rate (> 95%) from previous participations in M-turk and they had participated in more than 100 studies in M-turk. Participants’ ages ranged from 18 to 70 ( $M = 41.17$ ,  $SD = 12.84$ ) and about half of the participants were female (52.8%). A majority of the participants were non-Hispanic White (71.4%), followed by Hispanic (10.7%), non-Hispanic Black (10.7%), Asian (5.6%), and others (1.7%).

After submitting an informed consent, participants read brief information about the prevalence of obesity and the importance of obesity policies. They were then randomly assigned to one of the 7 conditions and read a short message about an obesity policy for the condition. Next, they answered how much they would support the policy and how strong

the message is to support the policy. Lastly, participants were asked their demographic information and political ideology.

### *Stimuli messages*

Seven condition messages were developed. The message was about a policy to reduce the price of low-fat items, which is a suggested way to address obesity in the US (Chan & Woo, 2010; Frank et al., 2004; Jeffery, 2001). The impact of the policy in terms of probability estimates was informed by policy reports (Chan & Woo, 2010; Frank et al., 2004; Jeffery, 2001) and modified to fit the purpose of this study. The probability estimates of policy implications were the same across conditions; however, each condition differed according to the frames and certainty level employed in the condition.

According to the prospect theory's (Tversky & Kahneman, 1981) frame conditions, both gain and loss conditions showed the same consequence of the proposed policy; however, gain conditions used gain terms and loss conditions used loss terms. In the persuasion frame conditions, the gain conditions presented positive outcomes of establishing the proposed policy; the loss conditions showed negative outcomes of not establishing the proposed policy.

The certain conditions stated the exact number of people who would benefit by establishing the proposed policy (certain/gain frame for both prospect-theory and persuasion frame condition), who would not benefit by establishing the proposed policy (prospect-theory/certain/loss frame condition), or who would not benefit by not establishing the proposed policy (persuasion/certain/loss frame). Here, prospect-theory/certain/gain and persuasion/certain/gain frames are the same in that both talk about the exact number of people who can get benefits due to the policy being established.

The uncertain conditions of the prospect-theory frame showed the probability information that all people and no one would benefit by establishing

the proposed policy (prospect-theory/uncertain/gain frame condition), or all people and no one would lose out by establishing the proposed policy (prospect-theory/uncertain/loss frame condition). The uncertain conditions of persuasion frame condition presented the probability information that all people would benefit by establishing the proposed policy (persuasion/uncertain/gain frame condition), or all people would lose out by not establishing the proposed policy (persuasion/uncertain/loss frame). See Appendix A for stimuli.

No separate manipulation checks were performed because framing and certainty manipulation are considered intrinsic message features (O'Keefe, 2003) and, in the broader literature on prospect theory, manipulation checks are uncommon because its theoretical prediction hinges on biases and heuristics (Tversky & Kahneman, 1981), which lose their impact when individuals become aware of them.

### *Measures*

Participants answered questions about policy support, perceived argument strength and their political ideology. To assess *policy support*, participants reported the extent to which they supported the policy after a message exposure, "Remove tax and provide a subsidy to reduce low-fat item prices by 25%" on a 5-point scale (1 = *Strongly Oppose*; 5 = *Strongly Support*) ( $M = 3.74$ ,  $SD = 1.10$ ).

To measure *perceived argument strength*, participants evaluated the message on 5 items. They were asked to rate the degree to which the message (1) gives a reason for, (2) helps them feel confident about, and (3) puts thoughts in their mind about supporting the policy, (4) helps others support the policy, and (5) puts thoughts in their mind about not supporting the policy (reversed code) in a random order on 5-point scales (1 = *Strongly Disagree*; 5 = *Strongly Agree*) (Zhao et al., 2011). Participants' answers were averaged (*Cronbach's Alpha* = .86,

$M = 3.63, SD = 0.85$ ).

At the same time, previous studies that examine message effects in obesity policies have shown differential message processing depending on political predispositions (Lee & Kim, 2017). To statistically control this potential effect, participants' *political ideology* was measured on a 7-point scale (1 = *Very Liberal*; 7 = *Very Conservative*). To simplify the analyses, we made this variable a binary; participants who answered 1 through 3 were coded as "Liberals" (50.6%); those who answered 4 through 7 were coded as "Moderates / Conservatives" (49.4%).

### *Analytic approach*

First, the success of random assignment was checked by comparing participant profiles across conditions. A series of analysis of variance (ANOVA) and chi-square tests was used to see if there is any significant difference by participants' age, gender, and political ideology among message conditions. The results showed that there was no difference,  $ps > .45$ . Thus, the randomization was deemed successful.

To test the hypotheses and research question, ANCOVAs were conducted, having certainty and gain-loss framing as factors and individuals' political ideology as a covariate, for policy support (H1a, H2a, RQ1a) and perceived argument strength (H1b, H2b, RQ1b) separately. Since the interaction between gain-loss framing and certainty was predicted separately in the prospect-theory and persuasion frame conditions, the ANCOVAs were conducted in the prospect-theory frame condition (H1, H2) and in the persuasion frame condition (RQ1) separately. As the message for the certain/gain frame condition was created for both prospect-theory and persuasion frames, the condition was included for both analyses.

## **Results**

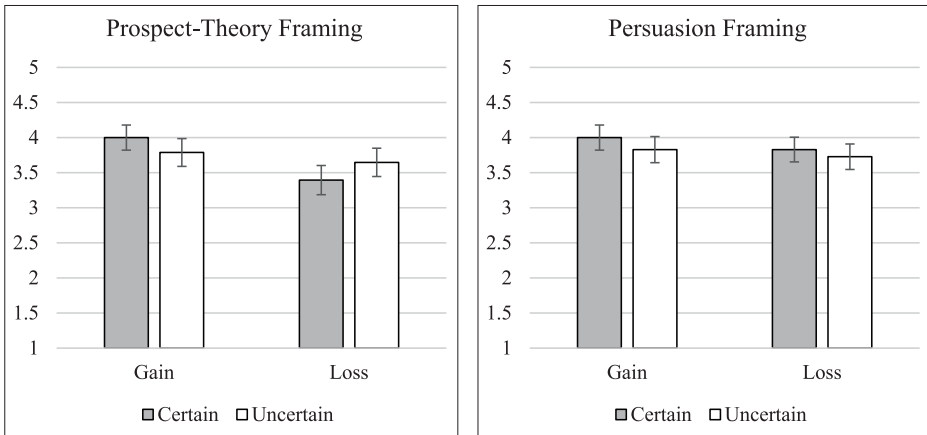
### *Policy support in the prospect-theory frame condition (H1a, H2a)*

First, the effects of certainty and gain-loss framing on policy support, while individuals' political ideology was controlled, was examined focusing on the prospect-theory frame condition. An ANCOVA revealed a significant main effect of gain-loss framing,  $F(1, 127) = 7.04, p = .009$ , partial eta squared = .052 (gain:  $M = 3.89, SD = 1.08$ ; loss:  $M = 3.52, SD = 1.19$ ), a nonsignificant main effect of certainty,  $F(1, 127) = 0.12, p = .728$ , (certain:  $M = 3.69, SD = 1.14$ ; uncertain:  $M = 3.72, SD = 1.15$ ), and a marginally significant two-way interaction,  $F(1, 127) = 2.81, p = .096$ , partial eta squared = .022. Further analyses indicated that as predicted by prospect theory, in the gain condition, participants in the certain condition ( $M = 4.00, SD = 1.02$ ) supported the policy more than those in the uncertain condition ( $M = 3.79, SD = 1.14$ ); however the difference did not reach the significance level,  $F(1, 62) = 1.92, p = .171$ . Similarly, as predicted by prospect theory, in the loss condition, those in the uncertain condition ( $M = 3.65, SD = 1.18$ ) supported the policy more than those in the certain condition ( $M = 3.39, SD = 1.20$ ); but, again, the difference did not reach the significance level,  $F(1, 64) = 0.83, p = .366$ . Therefore, although the pattern was consistent as predicted, H1a and H2a were not supported.

### *Policy support in the persuasion frame condition (RQ1a)*

Next, the interaction between certainty and gain-loss framing on policy support was examined focusing on the persuasion frame condition. An ANCOVA revealed no main or interaction effect: the main effect of certainty,  $F(1, 130) = 0.89, p = .347$  (certain:  $M = 3.91, SD = 1.03$ ; uncertain:  $M = 3.78, SD = 1.06$ ), and gain-loss frame,  $F(1, 130) = 0.50, p = .482$  (gain:  $M = 3.91, SD = 1.06$ ; loss:  $M = 3.78, SD = 1.03$ ), and the interaction



**Figure 1.** Policy Support by Condition

Note. Standard errors are represented in the figure by the error bars attached to each column. The certain-gain condition is identical for both prospect-theory and persuasion frame conditions.

between certainty and gain-loss frame,  $F(1, 130) = 0.12, p = .735$ .

Figure 1 presents the results on policy support by condition.

#### *Perceived argument strength in the prospect-theory frame condition (H1b, H2b)*

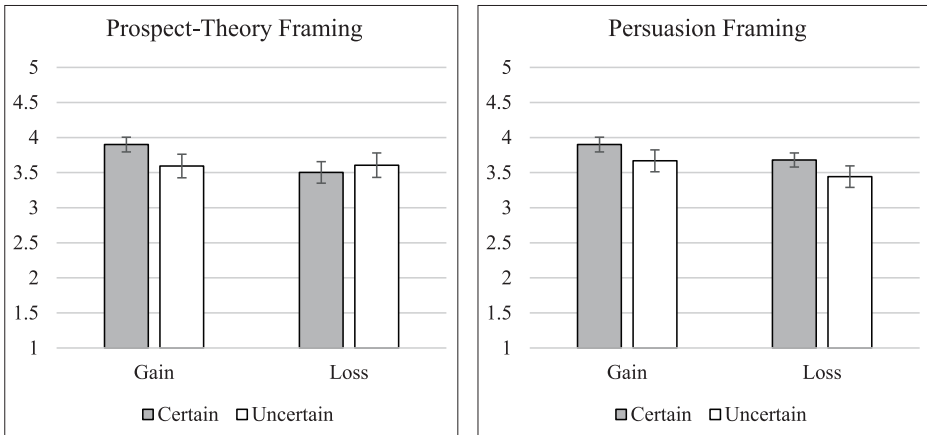
An ANCOVA, having the perceived argument strength as the dependent variable, was conducted for the prospect-theory frame condition. The ANCOVA revealed a marginally significant main effect of gain-loss framing,  $F(1, 127) = 3.15, p = .078$ , partial eta squared = .024 (gain:  $M = 3.74, SD = 0.81$ ; loss:  $M = 3.56, SD = 0.95$ ), a nonsignificant main effect of certainty,  $F(1, 127) = 1.09, p = .299$  (certain:  $M = 3.70, SD = 0.77$ ; uncertain:  $M = 3.60, SD = .98$ ), and a marginally significant interaction between certainty and gain-loss framing,  $F(1, 127) = 2.89, p = .092$ , partial eta squared = .022. Again, as predicted by prospect theory, in the gain condition, participants in the certain condition ( $M = 3.90, SD = 0.59$ ) supported the policy more than those in the uncertain condition ( $M$

$= 3.59, SD = 0.97$ ); however, the difference did not reach the significance level,  $F(1, 62) = 3.43, p = .069$ . In the same way, in the loss condition, those in the uncertain condition ( $M = 3.61, SD = 1.01$ ) supported the policy more than those in the certain condition ( $M = 3.50, SD = 0.88$ ); however, the difference again did not reach the significance level,  $F(1, 64) = .19, p = .665$ . Therefore, although the pattern was consistent, H1b and H2b were not supported.

#### *Perceived argument strength in the persuasion frame condition (RQ1b)*

Lastly, the interaction between certainty and gain-loss framing on policy support was examined in the persuasion frame condition. An ANCOVA revealed a significant main effect of certainty,  $F(1, 130) = 4.04, p = .046$ , partial eta squared = .03 (certain:  $M = 3.79, SD = 0.60$ ; uncertain:  $M = 3.56, SD = 0.91$ ), a nonsignificant main effect of gain-loss framing,  $F(1, 130) = 2.70, p = .103$  (gain:  $M = 3.78, SD = 0.79$ ; loss:  $M = 3.56, SD = 0.75$ ), and a nonsignificant interaction between certainty and gain-loss framing,  $F(1, 130) = 0.02$ ,

**Figure 2.** Perceived Argument Strength by Condition



Note. Standard errors are represented in the figure by the error bars attached to each column. The certain-gain condition is identical for both prospect-theory and persuasion frame conditions.

$p = .880$ .

Figure 2 reports the results on perceived argument strength by condition.

## Discussion

The results of Study 1 show a consistent pattern as predicted by prospect theory. Specifically, in the prospect-theory frame, participants in the gain frame rated higher on policy support and perceived argument strength when the message was presented in a certain form rather than an uncertain form; the opposite pattern held in the loss frame. However, these results did not reach the significance level. No interaction was found in the persuasion frame.

This limited impact might be due to the difference in outcome measurement between prospect theory and health communication research. To test this possibility, Study 2 asks participants to choose between a certain and uncertain option, following the outcome measurement of prospect theory.

## STUDY 2

Study 2 aims to examine whether different framing approaches produce different outcomes when investigated under the outcome measurement of prospect theory (i.e., option selection). Although the outcome measurement of prospect theory has been tested in various contexts (for a review, see Levin et al. (1998)), it has not been tested in the context of obesity policy. Thus, this study aims to examine whether the findings of prospect theory are replicated in the context of obesity policy. Study 2, replicating the prediction of prospect theory, first tests if participants are more likely to choose an obesity policy in a certain option over the uncertain option when the policies are presented in the prospect-theory/gain frame compared to when the same policies are presented in the prospect-theory/loss frame.

H3. Compared to those in the prospect-theory/loss frame, participants in the prospect-theory/gain frame would prefer the certain option to the uncertain option.

On the other hand, because persuasion framing has not been tested with the outcome measurement of prospect theory, this is left as a research question.

RQ2. Compared to those in the persuasion/loss frame, would participants in the persuasion/gain frame condition prefer the uncertain or certain option?

## Method

### *Participants and procedure*

A randomized experiment was conducted with a 2 (frame approaches: prospect-theory vs. persuasion frame) X 2 (gain vs. loss frame) X 2 (two sets of policies) design. The frame approaches and gain-loss frame were between-subject factors and randomized. To improve the generalizability of our findings, two obesity policy sets were shown and it was a within-subject factor. A total of 136 participants were recruited via Amazon Mechanical Turk (M-Turk) as in Study 1. Participants' ages ranged from 20 to 72 ( $M = 38.92$ ,  $SD = 13.20$ ). About half of the participants were female (54.4%). A majority of the participants were non-Hispanic White (80.1%), followed by Hispanic (6.6%), non-Hispanic Black (5.9%), Asian (4.4%), and others (2.9%).

As in Study 1, after submitting an informed consent, participants read brief information about the prevalence of obesity and the importance of obesity policies. They were then randomly assigned to one of the four message conditions that combine 2 (frame approaches: prospect-theory vs. persuasion frame) X 2 (gain vs. loss frame). Participants read two sets of policies written in both certain and uncertain options and responded with which policy between the two they would support more after each set. Lastly, participants were asked their demographic information and political ideology.

### *Stimuli messages*

In each condition, participants were asked to read two sets of policies in a random order. Each policy set consisted of two policy options: Policy A, written with certainty, and Policy B, written with uncertainty. Consistent with Study 1, the certain option (Policy A) included the exact number of those who would benefit or lose out as an outcome of the policy, whereas the uncertain option (Policy B) showed the probability information of the expected outcomes of selecting the policy option. Participants were presented with two sets of policies to increase generalizability, each set containing two options. After showing the two options, participants were asked to choose one. See Appendix B for stimuli.

### *Measures*

After reading each set of policies, participants were asked which policy they would support more between Policy A and Policy B. Political ideology was asked as in Study 1. 50.0% of participants identified as Republicans/Independents and 50.0% as Democrats.

### *Randomization check*

We first checked the success of random assignment by comparing participant profiles across conditions. Using a series of ANOVA and chi-square tests, we found no difference by participants' age, gender, and political ideology among message conditions ( $ps > .31$ ). Thus, we deemed that the randomization was successful.

## Results

H3 and RQ2 ask if participants' choices in two policy sets are dependent on the frames. First, to test if participants' answers are varied in the two sets of policies, a random intercept logistic regression model was conducted by using *xtnlogit* in STATA. The model treats participants' choices in two sets of policies as Level-1 variables nested within subject, a Level-2

variable. The model assumes that the subject is a random effect; the main effect and the interaction of two manipulations (the prospect-theory vs. persuasion frame; gain vs. loss frame), political predispositions, and the policy set as fixed effects. The results showed no effect of the policy set,  $B = -0.48, SE = .35, p = .18$ , while the interaction between the two framing manipulations was significant,  $B = -3.47, SE = 1.19, p = .004$ .

To answer H3, the random intercept logistic regression was tested only among the prospect-theory frame. Supporting H3, participants in the gain condition chose the certain option more than the uncertain option compared to those in the loss condition,  $B = 3.16, SE = 1.07, p = .003$ , while no effect of policy set was found,  $B = -1.09, SE = 0.57, p = .057$ .

To answer RQ2, the same regression was run focusing on the persuasion frame. In the persuasion frame, participants' choices between the certain and uncertain options were not varied between the gain and loss conditions,  $B = -0.46, SE = 0.75, p = .538$ , and, again, no effect of policy set was found ( $p = 1.00$ ).

Table 2 reports participants' choices by conditions.

## Discussion

Study 2 compared different conceptualizations of framing within the outcome measurement of prospect theory (i.e., option selection). The results of Study 2 replicate prospect theory, showing that individuals prefer the certain option to the uncertain option when the expected outcome is presented in the gain frame compared to when the same outcome is presented in the loss frame. As in Study 1, however, no effect was found in the persuasion frame condition, suggesting that different heuristics may be involved in decision making for the persuasion frame than what was theorized by prospect theory.

## GENERAL DISCUSSION

This study aimed to resolve the discrepancies in framing studies between prospect theory and health communication. Although previous studies have criticized these discrepancies, only a few studies have attempted to empirically disentangle them, albeit partially (Harrington & Kerr, 2017;

**Table 2.** Policy Choice by Condition

|                      | Certain    | Uncertain  | Total     |
|----------------------|------------|------------|-----------|
| Prospect-Theory/Gain |            |            |           |
| Policy Set 1         | 31 (88.6%) | 4 (11.4%)  | 35 (100%) |
| Policy Set 2         | 28 (80.0%) | 7 (20.0%)  | 35 (100%) |
| Prospect-Theory/Loss |            |            |           |
| Policy Set 1         | 19 (55.9%) | 15 (44.1%) | 34 (100%) |
| Policy Set 2         | 14 (41.2%) | 20 (58.8%) | 34 (100%) |
| Persuasion/Gain      |            |            |           |
| Policy Set 1         | 21 (60.0%) | 14 (40.0%) | 35 (100%) |
| Policy Set 2         | 19 (54.3%) | 16 (45.7%) | 35 (100%) |
| Persuasion/Loss      |            |            |           |
| Policy Set 1         | 19 (57.6%) | 14 (42.4%) | 33 (100%) |
| Policy Set 2         | 21 (63.6%) | 12 (36.4%) | 33 (100%) |

Note. Percent of participants in each condition is presented in parentheses.

Levin et al., 1998). For instance, Harrington and Kerr (2017) conceptualized risk in terms of risks and utilized the outcome measurement used in prospect theory; however, they did not examine how different conceptualizations of framing may interact with different outcome measurements. To address the discrepancies all together in one study, this study examined how certainty information interplays with different framing approaches and outcome measurements in the context of obesity policies.

The results overall were consistent with prospect theory. The certain option was more effective than the uncertain option in a gain frame and vice versa in a loss frame in Study 1, although the difference did not reach the significance level. Following the outcome measurement of prospect theory, in the prospect-theory frame condition of Study 2, the certain policy option was significantly more often preferred over the uncertain policy option in the gain frame compared to in the loss frame, whereas there was no framing effect in the persuasion frame condition. These results indicate that the persuasion frame, which typically has been adopted in health communication, does not produce message effects as predicted by prospect theory. The current study sheds some light on potential reasons for the null or weak framing effects in health communication research compared to the original framing studies testing prospect theory.

### **Conceptualizing Risk in Framing Research**

We adopted the original conceptualization of risk (i.e., certainty of expected outcome) from prospect theory and replicated the predicted patterns in the context of an obesity policy. Besides certainty, several different conceptualizations of risk have been used in framing studies in health communication. One common approach is the type of behavior, where a study conceptualizes detection behavior as

involving high risk and prevention behavior as involving low risk; however, meta-analyses did not show the predicted framing effect (O'Keefe & Jensen, 2006, 2007, 2009). Another approach is to conceptualize risk as perceived susceptibility of experiencing a negative consequence. In several studies using this conceptualization, the predicted framing effect is observed (Ferguson & Gallagher, 2007; Gallagher et al., 2011; Nan et al., 2016). For example, a gain-framed message to be more persuasive than a loss-framed message for those who perceive their children to have a high chance of contracting human papillomavirus (HPV) and the opposite pattern was observed for those who perceive their children to have a low chance of contracting HPV (Nan et al., 2016). Combining these past studies and the results of the current study, the strength of the framing effect may depend on how risk is conceptualized in a study. To observe the framing effect proposed by prospect theory, the concept of risk needs to reflect the notion of uncertainty or probability rather than addressing a potential negative event (or severity) without considering the chance of occurrence.

At the same time, it should be noted that framing studies in health communication research typically focus on the comparison between gain and loss frames rather than the effect of certainty within different frames. Considering its persuasion purpose, gain and loss frames in health communication research may be more likely to convey certain outcomes than uncertain outcomes. The results of this study suggest that uncertain messages may be useful for persuasion purposes as well, such as when a message needs to be presented in a loss frame.

### **Conceptualizing Gain and Loss Frame**

In testing the interaction between gain-loss framing and certainty, two types of framing approaches were compared, one in prospect theory and the other in health communication

literature. Findings from Study 1 and Study 2 consistently show that the prediction of prospect theory applies only to the former, whereas the level of certainty does not change the effects of the latter regardless of outcome measurement. One possibility is that the underlying heuristics that produce framing effects as predicted by prospect theory is relevant to the message that describes the outcomes of an action (“if a policy is implemented”), but not when it presents the outcomes of an inaction (“if a policy is not implemented”). That is, the potential value of (avoiding) losses is influenced by certainty information only when some kind of change is assumed by taking an action.

The lack of a gain-loss framing effect in the persuasion frame condition of the current study raises an important question on whether prospect theory is an appropriate framework for studying message frames in health communication. Typical framing studies in health communication have adopted the persuasion frame, addressing negative outcomes of not adopting a recommended action, and made predictions based on prospect theory. However, several recent studies have suggested different theoretical frameworks, such as Construal Level Theory, for understanding framing effects in health communication research (Nan, 2007b). For example, a gain frame was associated with a higher level of construals, whereas a loss frame was associated with a lower level of construals. These differences in construal level are likely to produce different framing effects. Future work should further examine the potential for different heuristics or mechanisms at play and identify a useful theoretical framework, beyond prospect theory, for studying framing in health communication.

### **Implications Based on Different Outcome Measurements**

The current study further advances our understanding of boundary conditions for the framing effects by

employing two different outcome measurements. Participants in Study 1 were given one option and asked to evaluate that option whereas participants in Study 2 were given two options, the certain and uncertain options, and asked to choose one. The two outcome measurements vary greatly by the presentation of options and the nature of outcome. Participants in Study 2 were allowed to compare between certain and uncertain options when making a policy decision, whereas Study 1 participants did not have the opportunity to compare as they were randomly assigned to evaluate only one option. Although the pattern was consistent, Study 1 did not show a significant result. Our findings indicate that the framing effect occurs more prominently when individuals can compare the possible options in making policy decisions; in fact, parallel literature on the general evaluation theory (Hsee & Zhang, 2010) supports this finding. Specifically, studies have shown that comparing between two options makes it easier for individuals to evaluate a hard-to-evaluate attribute (e.g., probability, prevalence) than when evaluating one single option in isolation (Zikmund-Fisher et al., 2004). Because numerical attributes, like certainty, are relatively hard to evaluate for lay people, its effect might have been more pronounced when the options were jointly presented (Study 2) rather than being separately evaluated (Study 1).

### **Study Limitations and Future Study Directions**

Regarding study limitations, two generalizability issues need to be addressed. First, this study examined framing effects within a single context. While Study 2 incorporates two policies to increase generalizability, the findings may be specific to the domain of obesity policies. Prospect theory suggests that individuals’ decision-making is sensitive to probabilities, such as the likelihood of an event significantly impacting the decision-making process. However, we did not explore this aspect in

the current study, as we aimed to provide accurate probability information regarding the consequences of the obesity policy—we calculated this information based on previous research and did not explore varied probability information. The second generalizability issue has to do with the persuasion frame manipulation. Health communication researchers (Nan, 2007a; O’Keefe & Jensen, 2007, 2009; Rothman & Salovey, 1997; Wilson et al., 1988) state that persuasion frame messages can be positioned in a 2 X 2 matrix, detailing whether an outcome is desirable or undesirable and whether the outcome is to be attained or avoided. In this study, a gain-framed message presented a desirable outcome to be attained and a loss-framed message showed a desirable outcome to be avoided. However, a gain-framed message can also communicate an undesirable outcome to be avoided and a loss-framed message can communicate an undesirable outcome to be attained. It would thus be interesting to investigate whether or not a consistent pattern is found with differently operationalized persuasion frame messages.

Another limitation lies in the use of a single measure of policy support because it is susceptible to measurement errors. Although we attempted to complement this weakness with the additional assessment of perceived argument strength, future work should include multiple measures that assess policy support.

In the methodology, it is important to consider the sample size. We had a relatively small sample size, with 235 participants in Study 1 and 136 participants in Study 2. Previous framing research has indicated relatively small effect sizes (O’Keefe & Jensen, 2006); thus, the lack of significant effects, despite observing the predicted pattern, could be attributed to the small sample sizes. A post-hoc power analysis conducted using G\*Power (Faul et al., 2009) suggests this possibility, showing that the power is lower than .70. A future study could investigate this

possibility with a large sample size.

Lastly, by adhering closely to the wording and stimulus of prospect theory to evaluate their efficacy in the health communication context, there may have been a reduction in the readability of the stimulus messages. Future studies should explore whether this potential reduction in readability affects participants’ processing of the messages.

## Conclusion

Derived from prospect theory, health communication researchers have examined the persuasive efficacy of gain- and loss-framed messages for various types of contexts; however, they have created several discrepancies with prospect theory. It appears that it is important to carefully adopt different conceptualizations of risk and gain-loss and employ a different outcome measurement, as this can influence individuals’ decision-making.

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## Appendix A.

### Stimuli for Study 1

After all participants read “In the United States, about 78.6 million adults are obese,” they read one of the following messages:

**Prospect-theory/certain/gain frame & persuasion/certain/gain frame** ( $n = 32$ ): If the price of low-fat items (e.g., fruit and salad) is reduced by 25%, 30.7 million obese adults will overcome obesity.

**Prospect-theory/certain/loss frame** ( $n = 33$ ): If the price of low-fat items (e.g., fruit and salad) is reduced by 25%, 47.9 million obese adults will remain obese.

**Prospect-theory/uncertain/gain frame** ( $n = 33$ ): If the price of low-fat items (e.g., fruit and salad) is reduced by 25%, there is a 39% chance that all obese adults will overcome obesity and a 61% chance that no obese adults will overcome obesity.

**Prospect-theory/uncertain/loss frame** ( $n = 34$ ): If the price of low-fat items (e.g., fruit and salad) is reduced by 25%, there is a 39% chance that no obese adults will remain obese and a 61% chance that all obese adults will remain obese.

**Persuasion/certain/loss frame** ( $n = 35$ ): If the price of low-fat items (e.g., fruit and salad) is not reduced by 25%, the opportunity for 30.7 million obese adults to overcome obesity will be lost.

**Persuasion/uncertain/gain frame** ( $n = 35$ ): If the price of low-fat items (e.g., fruit and salad) is reduced by 25%, there is a 39% chance that all obese adults will overcome obesity.

**Persuasion/uncertain/loss frame** ( $n = 33$ ): If the price of low-fat items (e.g., fruit and salad) is not reduced by 25%, the 39% chance for all obese adults to overcome obesity will be lost.

## Appendix B.

### Stimuli for Study 2

After all participants read “In the United States, about 78.6 million adults are obese,” they read one of the following messages:

#### ***Prospect-theory/gain frame condition (n = 35).***

##### Policy set 1

- Certain: If Policy A is established, 30.7 million obese adults will overcome obesity.
- Uncertain: If Policy B is established, there is a 39% chance that all obese adults will overcome obesity and a 61% chance that no obese adults will overcome obesity.

##### Policy set 2

- Certain: If Policy A is established, 18.9 million obese adults will overcome obesity.
- Uncertain: If Policy B is established, there is a 24% chance that all obese adults will overcome obesity and a 76% chance that no obese adults will overcome obesity.

#### ***Prospect-theory/loss frame condition (n = 34).***

##### Policy set 1

- Certain: If Policy A is established, 47.9 million obese adults will remain obese.
- Uncertain: If Policy B is established, there is a 39% chance that no obese adults will remain obese and a 61% chance that all obese adults will remain obese.

##### Policy set 2

- Certain: If Policy A is established, 59.7 million obese adults will remain obese.
- Uncertain: If Policy B is established, there is a 24% chance that all obese adults will remain obese and a 76% chance that no obese adults will remain obese.

#### ***Persuasion/gain frame condition (n = 35).***

##### Policy set 1

- Certain: If Policy A is established, 30.7 million obese adults will overcome obesity.
- Uncertain: If Policy B is established, there is a 39% chance that all obese adults will overcome obesity.

##### Policy set 2

- Certain: If Policy A is established, 18.9 million obese adults will overcome obesity.
- Uncertain: If Policy B is established, there is a 24% chance that all obese adults will overcome obesity.

#### ***Persuasion/loss frame condition (n = 32).***

##### Policy set 1

- Certain: If Policy A is not established, the opportunity for 30.7 million obese adults to overcome obesity will be lost.
- Uncertain: If Policy B is not established, the 39% chance that all obese adults will overcome obesity will be lost.

##### Policy set 2

- Certain: If Policy A is not established, the opportunity for 18.9 million obese adults to overcome obesity will be lost.
- Uncertain: If Policy B is not established, the 24% chance that all obese adults will overcome obesity will be lost.

NOTE. As in Study 1, the certain options in both the prospect-theory/gain and persuasion/gain conditions are identical.