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Acceptability of the H1N1 Vaccine Among Older Adults: The Interplay of Message Framing and Perceived Vaccine Safety and Efficacy

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This study examines the relative effectiveness of using gain- versus loss-framed messages to promote H1N1 vaccination among older adults, focusing on the moderating roles of perceived vaccine safety and efficacy. An experiment was conducted with older adults recruited from senior centers in the state of Maryland. Results show that older adults who perceived low vaccine efficacy developed greater intentions to receive the vaccine when presented with a loss-framed message (versus a gain-framed message). For those who perceived high vaccine efficacy, message framing did not make a difference in postexposure intentions. Evidence regarding the interaction between message framing and perceived vaccine safety is limited. Theoretical and practical implications of the findings are discussed.

A vibrant area of health communication research has been concerned with the relative effectiveness of gain- versus loss-framed health messages. By definition, a gain-framed message focuses on the advantages of adopting a recommended action (e.g., "by applying sunscreen, you will decrease your chance of getting skin cancer"), whereas a loss-framed message emphasizes the disadvantages of not performing the advocated behavior (e.g., "by not applying sunscreen, you will increase your chance of getting skin cancer"). A significant body of literature has examined the relative persuasiveness of gain- versus loss-framed messages (for reviews, see O'Keefe & Jensen, 2006; Rothman, Bartels, Wlaschin, & Salovey, 2006; Rothman & Salovey, 1997). Collectively, empirical evidence shows only marginal main effects of gain versus loss framing (O'Keefe & Jensen, 2006), pointing to the need to identify potential moderators of the relation between framing and message effectiveness.

The research reported here investigates message framing effects in the context of communicating about the H1N1 vaccine among older adults, with specific focus on the moderating roles of perceived vaccine safety and efficacy. In the spring of 2009, the H1N1 influenza virus began to spread across the United States and around the world. A year later, an estimated 61 million people had been infected with the virus. From April 2009 to April 2010, approximately 274,000 people were hospitalized and 12,470 people lost their lives due to complications related to H1N1 (Centers for Disease Control and Prevention [CDC], 2010a). Response to the H1N1 flu pandemic included the development of a vaccine. Despite the potential deadly effects of the virus, less than a quarter of American adults received the H1N1 vaccine between October 2009 and May 2010 (CDC, 2010b).

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Although the threat of the H1N1 flu has dissipated since May 2010, CDC officials warn the spread of the virus may come to model that of seasonal influenza, continuing to infect the population for years to come (CDC, 2010c). Vaccination against H1N1 is continually available yet infrequently received by those in the population most susceptible to flu-related complications such as older adults. According to the CDC, less than 30% of people older than 65 received the H1N1 vaccine during the last flu season (CDC, 2010b). Improving acceptability of the H1N1 vaccine among older adults thus constitutes an important objective for public health promotion. Given the unfamiliarity of the H1N1 virus and the vaccine, communication may be particularly instrumental in encouraging older adults to receive the vaccine.

The current research seeks to address these issues: (1) Will gain- or loss-framed messages related to H1N1 vaccination be more persuasive for older adults? (2) Will perceived vaccine safety have a moderating effect on the relative persuasiveness of gain- versus loss-framed messages about the H1N1 vaccine? (3) Will perceived vaccine efficacy have a moderating effect on the relative persuasiveness of gain- versus loss-framed H1N1 vaccination messages?

CONCEPTUAL BACKGROUND

According to prospect theory (Kanhneman & Tversky, 1979; Tversky & Kahneman, 1981), the simple shifting of presenting action outcomes in terms of gains or losses can result in differential preferences for particular courses of action, subsequently influencing behavioral decisions. Specifically, prospect theory posits that people are willing to take risks when they are presented with the losses or costs of the action, but are opposed to risk or are risk-averse when they are presented with factually equivalent gains or benefits of the action. Message framing researchers have developed a heuristic based on this premise, asserting that loss-framed messages are more persuasive when a situation or course of action is perceived as risky, and gain-framed messages are more persuasive when a situation or course of action is perceived as rather safe or harmless (Rothman et al., 2006; Rothman & Salovey, 1997).

Conceptual definitions of risk vary. Some have defined risk as the probability that a certain outcome may occur. This definition of risk is usually used to address situations in which people must choose between a certain outcome and an uncertain outcome (Rothman et al., 2006). Tversky and Kahneman's (1981) study asking people to choose between two plans in the face of an epidemic has been used as a standard example of this definition of risk. In Tversky and Kahneman's study, participants were asked to imagine a disease that would kill 600 people and to choose a solution based on either plan A or plan B. Plan A offered a certain outcome with less risk. Plan B provided an uncertain outcome involving more risk. When the plans were gain-framed ("if Program A is adopted, 200 people will be saved"; "if Program B is adopted, there is one-third probability that 600 people will be saved and two-thirds probability that no people will be saved"), more participants chose the certain, less risky plan A. However, when the plans were loss-framed ("if Program A is adopted, 400 people will die"; "if Program B is adopted, there is one-third probability that nobody will die and two-thirds probability that 600 people will die"), more participants chose the risky plan B (Tversky & Kahneman, 1981).

Rothman and colleagues (Rothman et al., 2006; Rothman & Salovey, 1997) posit that health promotion messages rarely provide two options, but rather refer to engaging or not engaging in a certain behavior. They also argue that in the health communication domain risk may be seen as the extent to which the behavior will lead to an unpleasant outcome. With this understanding, risk is thought of less in terms of the probability of the occurrence and more in terms of individuals' perception of the extent of unpleasant outcomes. Subsequently, the relative riskiness of an action under consideration may depend on whether the act is meant to detect or prevent a health issue. Detection behaviors involve actions such as performing breast self-examination (Meyerowitz & Chaiken, 1987) or getting a mammogram (Cox & Cox, 2001) or a colonoscopy (Rothman et al., 2006). When engaging in these behaviors, one runs the risk of being informed they possess an illness or symptoms of an illness (Rothman et al., 2006). Following prospect theory, loss-framed messages would be more effective for promoting detection behaviors if these behaviors are seen as risky or engender the perception of an unpleasant outcome. In contrast, prevention behaviors or actions taken to prevent illness or maintain a healthy status, such as wearing a condom or putting on sunscreen, are not associated with unpleasant outcomes and are perceived as less risky and safer options than detection behaviors. Gain-framed messages should then be more persuasive for promoting prevention behaviors.

Although these predictions by Rothman and colleagues received empirical support in several studies (e.g., Banks, Salovey, Greener, Rothman, & Moyer et al., 1995; Cox & Cox, 2001; Rothman, Martino, Bedell, Detweiler, & Salovey, 1999), meta-analytic research (O'Keefe & Jensen, 2006; 2007; 2009) revealed mixed results. O'Keefe and Jensen (2006) found that gain-framed appeals are more persuasive than loss-framed appeals for encouraging disease prevention behaviors, whereas gain- and loss-framed appeals do not differ significantly in persuasiveness for encouraging disease detection behaviors. The difference in the persuasiveness of gain- and loss-framed messages for promoting prevention behaviors is small and appears to reflect a relatively large effect for messages advocating dental hygiene behaviors (O'Keefe & Jensen, 2007). In a more recent meta-analysis, O'Keefe and Jensen (2009) found that

loss-framed appeals are slightly more persuasive than gain-framed appeals for promoting detection behaviors and the difference appears to be driven by a small advantage of loss-framed appeals for advocating breast cancer detection behaviors. One possible explanation for the mixed results is that perhaps not all detection behaviors are risky. Similarly, it is possible that not all prevention behaviors are without risk.

By definition, vaccination is a primarily preventive behavior meant to avert the effects of disease. Accordingly, gain-framed messages should be more effective when attempting to persuade people to get vaccinated if the prevention-detection framework proposed by Rothman and colleagues is adopted. However, recent studies specifically testing messages about vaccination have found loss-framed messages to be more persuasive whenever a framing effect is detected (Abhyankar, O'Connor, & Lawton, 2008; Ferguson & Gallagher, 2007; Gerend & Shepherd, 2007; Gerend, Shepherd, & Monday 2008; Nan, in press). Abhyankar et al. (2008), for example, found that exposure to loss-framed messages increased behavioral intention to obtain the MMR (measles, mumps, and rubella) vaccine. Additionally, Ferguson and Gallagher (2007) reported that people who were presented with a loss-framed message were more likely to be motivated to receive a flu vaccine when perceived procedural risk associated with vaccination (e.g., vaccines have side effects) was high.

Why do these results run counter to the prevention–detection framework? Perhaps vaccination differs from other prevention behaviors in terms of relative risk. Eating vegetables and wearing a bicycle helmet are behaviors likely perceived as safe, harmless, and absent of unpleasant outcomes. Although vaccination carries the benefit of preventing disease, the medical community also warns of possible side effects, perhaps making the choice to get vaccinated risky. Some of these side effects may be perceived as more probable and serious than they actually are. In fact, a significant portion of the general public is concerned about vaccine safety, harboring misperceptions of severe side effects (Ball, Evans, & Bostrom, 1998; Freed, Clark, Butchart, Singer, & Davis, 2010), even though serious adverse problems resulting from vaccination are extremely rare. Additionally, not knowing how effective a vaccine is at averting disease could increase perceived riskiness of receiving the vaccine. For these reasons, vaccination may be construed as a risky choice rather than a safe course of action. As a result, loss-framed messages are expected to be more persuasive than gain-framed messages in promoting this behavior.

Although the best indicator of message persuasiveness is whether or not the advocated action is actually adopted, often data on actual behavior are difficult to obtain. The theory of reasoned action postulates that the best predictor of actual behavior is one's behavioral intention, which in turn is strongly influenced by attitude toward performing the behavior (Fishbein & Ajzen, 1975). Considering that attitudes and behavioral intentions are important precursors of actual behaviors, we operationalize message persuasiveness in terms of attitudes toward H1N1 vaccination and intentions to receive the vaccine. Specifically, we propose the following hypotheses.

H1a: Older adults will express more favorable attitudes toward H1N1 vaccination after exposure to a loss-framed message than after exposure to a gain-framed message.

H1b: Older adults will express greater intentions to receive the H1N1 vaccine after exposure to a loss-framed message than after exposure to a gain-framed message.

Prospect theory suggests that two preexisting beliefs, namely, perceived vaccine safety and efficacy, may serve as moderators of message framing effects. In other words, the relative persuasiveness of gain- versus loss-framed vaccination messages may depend upon how safe and effective people perceive vaccination to be. When a vaccine is perceived to have side effects or other negative consequences, receiving the vaccine will likely be construed as a risky course of action. To the extent that safety concerns are reduced, getting the vaccine will likely be considered as a relatively less risky behavior. The persuasive advantage of loss-framed messages in promoting vaccination, therefore, should be stronger when a message recipient's perceived vaccine safety is low compared to when it is high. This statement is supported by the results of Ferguson and Gallagher's (2007) study on the flu vaccine, as the presentation of loss framed messages resulted in greater intentions to receive the vaccine for people who perceived a high procedural risk. On the other hand, gain and loss frames were equally persuasive for people who perceived low procedural risk.

Similarly, perceived vaccine efficacy or how effective a vaccine is perceived to be may also moderate the relative effectiveness of gain versus loss frames. People who are uncertain that getting the vaccine will prevent the disease may see being vaccinated as a risky behavior because they cannot be confident that they will be protected (Rothman et al., 2006). In other words, getting vaccinated may be construed as an unpleasant course of action if one knows that the vaccine does not effectively protect against the disease. On the other hand, getting vaccinated may be perceived as more pleasant, and thus less risky, if one is certain that the vaccine is effective.

Difference in perceived vaccine efficacy may also influence a person's construal of outcome certainty of vaccination. With low efficacy, getting vaccinated may be seen as risky because it leads to uncertain outcomes (i.e., if I get vaccinated, I may or may not contract the disease). With high efficacy, vaccination may be seen as less risky because it leads to certain outcomes (i.e., if I get vaccinated, I will not contract the disease). Given this account, examining the moderating role of perceived vaccine efficacy allows us to preliminarily assess how riskiness might be best defined, as outcome uncertainty or outcome pleasantness.

In either account, prospect theory suggests that the persuasive advantage of loss-framed messages in promoting vaccination should be stronger when a message recipient's perceived vaccine efficacy is low compared to when it is high. This effect was demonstrated in a study manipulating perceived effectiveness of a hypothetical new vaccine to combat the West Nile virus (Bartels, Elo, & Rothman, 2004; also see Bartels, Kelly, & Rothman, 2010, for a similar study). One group of participants were told that the vaccine would be effective for 6 out of 10 people, while participants in another group were told that the vaccine would be effective for 9 out of 10 people. Participants were then presented with either a gain- or a loss-framed message. Perceived effectiveness of the vaccine moderated the relative persuasiveness of message frames such that those assigned to the high-efficacy group were more likely to express interest after reading the gain-framed message, whereas those assigned to the low efficacy-group expressed more interest in the vaccine after reading the loss-framed message.

With the rationale and evidence presented above, we propose the following hypotheses.

H2a: Message framing will interact with perceived vaccine safety such that a loss-framed message (versus a gain-framed message) will lead to more favorable attitudes toward H1N1 vaccination when perceived vaccine safety is low and this effect will be attenuated when perceived vaccine safety is high.

H2b: Message framing will interact with perceived vaccine safety such that a loss-framed message (versus a gain-framed message) will lead to greater intentions to receive the H1N1 vaccine when perceived vaccine safety is low and this effect will be attenuated when perceived vaccine safety is high.

H3a: Message framing will interact with perceived vaccine efficacy such that a loss-framed message (versus a gain-framed message) will lead to more favorable attitudes toward H1N1 vaccination when perceived vaccine efficacy is low and this effect will be attenuated when perceived vaccine efficacy is high.

H3b: Message framing will interact with perceived vaccine efficacy such that a loss-framed message (versus a gain-framed message) will lead to greater intentions to receive the H1N1 vaccine when perceived vaccine efficacy is low and this effect will be attenuated when perceived vaccine efficacy is high.

METHOD

Participants

A convenience sample of 222 older adults participated in this study between November 2010 and March 2011. Participants were recruited from senior centers in Maryland through standard recruitment techniques (e.g., flyers posted in the facility, word of mouth). We excluded participants who were younger than 50 and/or those with missing data ($n = 36$). Whether or not the participants had received the H1N1 vaccine in the past 12 months is likely to have a strong influence on their attitudes and intentions toward receiving the vaccine again in the future. To control for any unknown impact of previous H1N1 vaccination behavior on the predicted interaction between message framing and vaccine beliefs, we excluded participants who had received the H1N1 vaccine in the past 12 months ($n = 98$). Our final working sample consists of 88 older adults. Of these participants, 59.1% were women; 69% were White/Caucasian, 18.4% were Black/African American, and 12.6% were Asian. More than half (56.8%) of the participants were older than 70 years; 14.8% aged between 65 and 70 (including 65); 10.2% aged between 60 and 65 (including 60); 12.5% aged between 55 and 60 (including 55); 5.6% aged between 50 and 55 (including 50).

Design and Procedure

Data collection for this study took place in 10 senior centers in Maryland. The study protocol had been approved by the institutional review board of the University of Maryland before data collection was initiated. A graduate research assistant visited the senior centers and explained the study to potential participants. Interested older adults were asked to first read the informed consent form and indicate their agreement to participate in the study. Once informed consent was obtained, each participant was randomly assigned to one of two experimental conditions (gain versus loss). All participants first completed a short survey about their demographic background, awareness of the H1N1 flu virus and the H1N1 vaccine, and flu vaccination record in the past 12 months. Next, all participants were presented with a short message from the Centers for Disease Control and Prevention (CDC) that explains briefly the definition of influenza (the flu), health problems caused by it, and the availability of the 2010–2011 seasonal influenza vaccine that includes vaccines against the regular flu as well as the H1N1 flu. All information was adapted from published content on the official website of CDC. Participants were instructed to read this message "carefully before turning to the next page." Participants then responded to 12 questions that measured beliefs about the H1N1 flu virus and vaccine, including perceived susceptibility to and severity of the H1N1 flu virus and perceived safety and efficacy of the H1N1 vaccine. Next, participants were presented with a health message concerning H1N1 vaccination that was either gain-framed or loss-framed (see description below). After reading the message, participants responded to six questions that measured attitudes toward H1N1 vaccination and intentions to receive the vaccine in the current flu season. The entire study took approximately 20 minutes to complete.

H1N1 Vaccination Messages

The gain-framed and loss-framed H1N1 vaccination messages were made to look like health pamphlets people usually see in clinics or doctors' offices. The messages were headlined by "Why you should get the H1N1 flu vaccine," with a number of reasons listed beneath the headline. The gain-framed message focused on the benefits of receiving the H1N1 flu vaccine (e.g., "If you decide to get the vaccine, you may decrease your chance of contracting the potentially deadly H1N1 flu virus"). The loss-framed message emphasized the costs of not receiving the H1N1 flu vaccine (e.g., "If you decide not to get the vaccine, you may increase your chance of contracting the potentially deadly H1N1 flu virus"). The manipulation of message framing followed the procedure and content used in previous studies (e.g., Block & Keller, 1995; Gerend & Shepherd, 2007; Nan, in press). The health messages used in the experiment are available from the lead author upon request.

Key Measures

Descriptive statistics for key measures are summarized and reported in Table 1.

Perceived vaccine safety. Perceived vaccine safety was measured by a three-item scale adapted from Brabin, Roberts, Farzaneh, and Kitchener (2006). Participants were asked to indicate their level of agreement with three statements on response scales of 1 (*strongly disagree*) to 5 (*strongly agree*): (1) I worry about the short term side effects of the H1N1 vaccine; (2) I worry that the H1N1 vaccine might negatively affect my body; and (3) I worry that the H1N1 vaccine might have unknown long term side effects. The scores were averaged to form an index for perceived vaccine safety (Cronbach's $\alpha = .96$, $M = 2.88$, $SD = 1.33$). Higher scores indicate greater safety concerns.

Perceived vaccine efficacy. Perceived vaccine efficacy was assessed using three items adapted from Witte's Risk Behavior Diagnosis Scale (RBDS) (Witte, Meyer, & Martell, 2001). Participants were asked to indicate their level of agreement with three statements on response scales of 1 (*strongly disagree*) to 5 (*strongly agree*): (1) I believe the H1N1 flu vaccine is effective in preventing the H1N1 flu; (2) I believe if I get the H1N1 vaccine, I will be less likely to get the H1N1 flu; (3) I believe the H1N1 vaccine works in preventing the H1N1 flu. The scores were averaged to form an index for perceived vaccine efficacy (Cronbach's $\alpha = .81$, $M = 3.81$, $SD = .91$). Higher scores indicate greater perceived efficacy of the vaccine.[1]

TABLE 1
Descriptive Statistics for Key Measures

	Minimum	*Maximum*	*Mean*	*SD*
Perceived vaccine safety	1.00	5.00	2.88	1.33
Perceived vaccine efficacy	1.00	5.00	3.81	0.91
Perceived susceptibility	1.00	5.00	2.82	1.02
Perceived severity	1.00	5.00	3.30	1.09
Attitudes	1.00	5.00	3.57	0.96
Intentions	1.00	5.00	2.89	1.11

Attitudes toward H1N1 vaccination. Attitudes toward H1N1 vaccination were assessed by a measure adapted from Abhyankar et al. (2008). Participants rated "getting the H1N1 flu vaccine" on a scale consisting of three 1–5 semantic differential items (bad/good, harmful/beneficial, foolish/wise). The scores were averaged to form an index for attitudes toward H1N1 vaccination (Cronbach's $\alpha = .96$, $M = 3.57$, $SD = .96$). Higher scores indicate more favorable attitudes.

Intentions to receive the H1N1 vaccine. Intentions were assessed by a scale adapted from previous research (Rothman et al., 1999). The following questions were asked: (1) how likely would you be to get the H1N1 flu vaccine sometime soon for the 2010–2011 flu season; (2) if you were faced with the decision of whether to get the H1N1 flu vaccine today, how likely is it that you would choose to get the vaccine for the 2010–2011 flu season; and (3) how likely would you be to get the H1N1 flu vaccine in the future for the 2010–2011 flu season? Participants responded to the questions on 1–5 scales anchored by "*extremely unlikely*" (1) and "*extremely likely*" (5). A "*Not Applicable; I have received the vaccine*" option was also provided. An index for intentions to get the H1N1 vaccine was formed by averaging the three items (Cronbach's $\alpha = .89$, $M = 2.89$, $SD = 1.11$). Higher scores indicate greater intentions to receive the vaccine.

Control variables. A number of demographic, behavioral, and psychographic factors were assessed as control variables. Demographic variables included age, gender, and race (see the Participants section earlier). Participants were also asked to disclose whether they had ever received a regular flu vaccine or shot in the past 12 months (60.2% yes, 39.8% no). Psychographic factors examined were health beliefs that, according to the health belief model (Rosenstock, 1974), could have a significant impact on one's attitudes and intentions toward the vaccine. Two health beliefs were examined: perceived susceptibility to the H1N1 flu virus and perceived severity of the H1N1 flu. Perceived susceptibility is the belief that a person is at risk of experiencing a particular negative health outcome. Individuals who believe that they are not susceptible to a

[1]To assess the validity of measurement dimensionality, we submitted the six items measuring the key predictors—perceived vaccine safety and perceived vaccine efficacy—to a confirmative factor analysis (CFA), specifying a two-factor structure. Results indicated an adequate fit of the measurement model, as shown by the absolute and relative fit indices ($\chi^2 = 11.891$, $p = .156$, RMSEA = .075, CFI = .990, IFI = .990).

disease will be less likely to act on a desired preventative behavior. Perceived severity is the belief that severe consequences will occur as a result of not enacting the desired behavior to prevent the health problem. Intentions to adopt a health behavior will be weakened if one perceives the consequences of not preventing the health problem to be insignificant. In the current study, perceived susceptibility to the H1N1 flu virus and perceived severity of the H1N1 flu were measured with scales adapted from previous research (Brabin, Roberts, Farzaneh, & Kitchener, 2006; Witte, Meyer, & Martell, 2001). To assess perceived susceptibility, we used the following statements: (1) It is likely that I will contract the H1N1 flu virus; (2) I am at risk for getting the H1N1 flu virus; and (3) it is possible that I will get the H1N1 flu virus (Cronbach's $\alpha = .79$, $M = 2.82$, $SD = 1.02$). Perceived severity was measured by three items: (1) I believe that the H1N1 flu will result in severe health problems; (2) I believe that the H1N1 flu has serious negative consequences; and (3) I believe that the H1N1 flu is extremely harmful (Cronbach's $\alpha = .81$, $M = 3.30$, $SD = 1.09$). Responses to the above items were indicated on 1–5 Likert scales with "*strongly disagree*" (1) and "*strongly agree*" (5) as endpoints. Items measuring each construct were averaged to form an index for that variable. Higher scores indicate greater perceived susceptibility to the H1N1 virus and greater perceived severity of the H1N1 flu.

RESULTS

To test the hypotheses, two hierarchical multiple regression analyses were conducted, with attitudes toward H1N1 vaccination and intentions to receive the vaccine as dependent variables. The regression models had a similar four-block structure. The first block contained demographic and behavioral control variables, including age, gender, dummy-coded race factors (Black and Asian), and whether or not one has received a regular flu shot in the past 12 months. The second block included two health beliefs as the predictors, namely, perceived susceptibility to the H1N1 flu virus and perceived severity of the H1N1 flu. The predictors of main interest to this research—perceived vaccine safety, perceived vaccine efficacy, and message framing—were entered into the third block. The final and fourth block contained two two-way interaction terms—framing by perceived vaccine safety and framing by perceived vaccine efficacy. Each interaction term was the product of the two component variables. To reduce multicollinearity between the interaction term and its components, the component variables were centered and the interaction terms were calculated based on the centered scores. Diagnostic analysis revealed no multicollinearity or normality problems in the regression models.

Results of the regression analyses are summarized in Table 2 (zero-order correlation data are available from the lead author upon request). Overall, the regression model explained a good amount of variance in the dependent variables, with 17.9% of variance explained for attitudes toward H1N1 vaccination ($p = .007$) and 19.1% of variance explained for intentions to vaccinate ($p = .007$). The association between age and intention approached significance ($\beta = .210$, $p = .086$). The positive sign of the regression coefficient indicated that participants who were older tended to have higher intentions to receive the H1N1 vaccine. No other significant effects emerged for the control variables.

Among the main predictors, perceived vaccine efficacy emerged as a significant predictor of attitudes toward H1N1 vaccination ($\beta = .285$, $p = .026$). The data suggested that higher perceived vaccine efficacy was associated with more favorable attitudes. The main effects of message framing were not significant. Thus H1s, which predicted that the loss-framed message would result in more favorable attitudes (H1a) and greater intentions (H1b), were not supported.

H2s predicted that message framing would interact with perceived vaccine safety such that a loss-framed message (versus a gain-framed message) would lead to more favorable attitudes toward H1N1 vaccination (H2a) and greater intentions to receive the vaccine (H2b) when perceived vaccine safety is low and this effect would be attenuated when perceived vaccine safety is high. No interaction between framing and perceived vaccine safety was found for attitudes toward H1N1 vaccination. H2a was not supported. There was, however, an interaction between framing and perceived vaccine safety that approached significance for intentions to receive the vaccine ($\beta = –.191$, $p = .097$).

H3s predicted that message framing would interact with perceived vaccine efficacy such that a loss-framed message (versus a gain-framed message) would lead to more favorable attitudes toward H1N1 vaccination (H3a) and greater intentions to receive the vaccine (H3b) when perceived vaccine efficacy is low and this effect would be attenuated when perceived vaccine efficacy is high. There was an interaction between framing and perceived vaccine efficacy that approached significance for attitudes toward H1N1 vaccination ($\beta = –.199$, $p = .085$). Additionally, the interaction between framing and perceived vaccine efficacy for intentions to receive the vaccine was statistically significant ($\beta = –.281$, $p = .024$).

The three interactions detected were further probed to see if the patterns were consistent with the predictions of H2b, H3a, and H3b. To probe the nature of the first interaction, the relation between framing and intentions to receive the vaccine was estimated at two values of perceived vaccine safety, one standard deviation below the mean and one standard deviation above the mean, with all other variables in the original regression analysis held constant (see Aiken & West, 1991). The statistical procedure was performed with Hayes and Matthes's (2009) SPSS macro. Results showed that when perceived vaccine safety was low the loss-framed message was associated with greater intentions ($b = .548$).

TABLE 2
Predictors of Attitudes and Intentions Toward H1N1 Vaccination

	Attitudes	*p-value*	*Intentions*	*p-value*
Age	−.156	.194	.210ˆ	.086
Gender	−.037	.736	−.106	.344
Race (Black)	−.115	.336	−.151	.229
Race (Asian)	.092	.399	.147	.189
Received a regular flu shot in the past 12 months	−.125	.270	−.088	.450
ΔR^2	.150[a]	.021	.120ˆ	.081
Perceived susceptibility	−.020	.870	.077	.572
Perceived severity	−.057	.638	−.007	.962
ΔR^2	.001	.946	.012	.595
Perceived vaccine safety (PVS)	−.205	.118	−.189	.159
Perceived vaccine efficacy (PVE)	.285[a]	.026	.203	.140
Message framing	−.061	.583	.070	.542
ΔR^2	.110[a]	.015	.111[a]	.022
Framing × PVS	.023	.835	−.191ˆ	.097
Framing × PVE	−.199ˆ	.085	−.281[a]	.024
ΔR^2	.034	.177	.069[a]	.039
Total R^2	.295[b]	.007	.312[b]	.007
Adjusted R^2	.179[b]	.007	.191[b]	.007

Note. Numbers are standardized regression coefficients. Gender: female = 1, male = 2; Race (Black): Black = 1, other = 0; Race (Asian): Asian = 1, other = 0. Received a regular flu shot: yes = 1, no = 2. Perceived susceptibility: higher scores indicate higher perceived susceptibility; Perceived severity: higher scores indicate higher perceived severity. Perceived vaccine safety: higher scores indicate higher concerns for safety. Perceived vaccine efficacy: higher scores indicate higher perceived efficacy. Framing: gain = 1, loss = 2; Time orientation: higher scores indicate more future-mindedness and lower scores indicate more present-mindedness. Significance indicated by ˆ$p < .10$, [a]$p <= .05$, [b]$p < .01$, [c]p.

However this difference failed to reach statistical significance ($p = .127$). When perceived vaccine safety was high, there was some indication that the gain-framed message was associated with greater intentions ($b = –.310$). This difference likewise did not reach statistical significance ($p = .392$). Taken together, however, this pattern of interaction may be seen as consistent with H2b, although the results did not reach statistical significance.

The interactive effect of framing and perceived vaccine efficacy on attitudes toward H1N1 vaccination was also probed for specific patterns with a similar procedure. The relation between framing and attitudes toward H1N1 vaccination was estimated at two values of perceived vaccine efficacy, that is, one standard deviation below the mean and one standard deviation above the mean, with all other variables in the original regression analysis held constant. Results showed that when perceived vaccine efficacy was low the loss-framed message was associated with more favorable attitudes ($b = .273$). However, this difference failed to reach statistical significance ($p = .353$). When perceived vaccine efficacy was high, there was some indication that the gain-framed message was associated with more favorable attitudes ($b = –.492$). This difference similarly did not reach statistical significance ($p = .123$). Overall, however, the pattern of interaction showed consistency with H3a, although the results were not statistically significant.

Finally, the interactive effect of framing and perceived vaccine efficacy on intentions to receive the vaccine was probed for specific patterns with the same procedure. The relation between framing and intentions to receive the H1N1 vaccine was estimated at two values of perceived vaccine efficacy, that is, one standard deviation below the mean and one standard deviation above the mean, with all other variables in the original regression analysis held constant. The results showed that when perceived vaccine efficacy was low the loss-framed message was significantly more effective than the gain-framed message in inducing intentions to vaccinate ($b = .819$, $p = .022$). In comparison, when perceived vaccine efficacy was high, there was some indication that the gain-framed message was more effective ($b = –.415$). This difference, however, did not reach statistical significance ($p = .277$). This pattern of interaction is consistent with H3b (see Figure 1). H3b is supported.

DISCUSSION

This research sought to determine the relative effectiveness of using gain- versus loss-framed messages to promote H1N1 vaccination among older adults and how framing effects might be moderated by perceived vaccine safety and efficacy. Understanding how message features such as framing interact with older adults' preexisting vaccine beliefs to influence message persuasive outcomes is critical for developing targeted messages to improve H1N1 vaccination acceptability within this vulnerable population.

One of the key findings of this study is that the persuasive advantage of the loss-framed message was strengthened

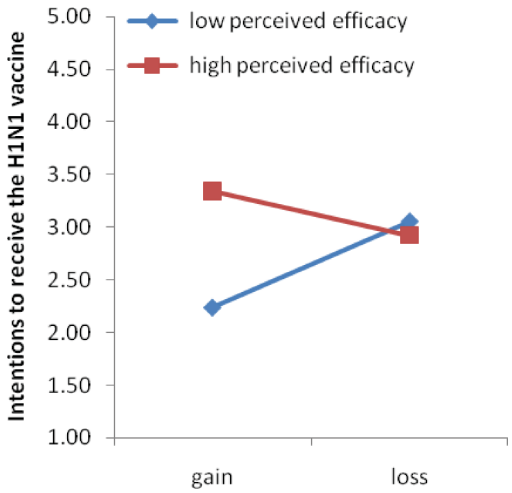

FIGURE 1 Interaction of framing and perceived vaccine efficacy (color figure available online).

among older adults who perceived low vaccine efficacy, but attenuated among those who perceived high vaccine efficacy. In fact, for older adults who believed the H1N1 vaccine was effective, framing had no appreciable impact on either attitudes toward H1N1 vaccination or intentions to receive the vaccine. In contrast, framing effects were observed among participants who had low confidence in the vaccine's effectiveness, with the loss-framed message leading to somewhat more favorable attitudes and significantly greater intentions. These results suggest that when communicating about the H1N1 vaccine to older adults, emphasis should be on matching individuals who hold low perceived vaccine efficacy with loss-framed messages. When communicating to those who perceive high vaccine efficacy, using either frame would be equally beneficial.

This finding is also informative at a theoretical level. It supports the hypothesis that the perceived risky implication of a health behavior moderates message framing effects. As mentioned earlier, riskiness in the realm of health communication is often conceptualized as the extent to which the behavior will lead to an unpleasant outcome (Rothman et al., 2006; Rothman & Salovey, 1997). This definition of riskiness, however, departs from the notion of uncertainty about outcomes stipulated in prospect theory. The disconnection between the two definitions of riskiness may raise concerns about the appropriateness of using prospect theory as the basis for understanding message framing effects in the context of persuasive communication (see O'Keefe, in press, for a detailed discussion). Other plausible explanations suggested in the literature for the differential effects of gain- versus loss-framed messages have included negativity bias (Taylor, 1991) and loss aversion (Kahneman & Tversky, 1979), both predicting that loss-framed messages will be more persuasive than gain-framed messages. A recent meta-analysis (O'Keefe, 2011) found that the mean effect of framing across 219 studies was not significantly different from zero, disaffirming an overall persuasive advantage for loss-framed messages. Our finding that the persuasive advantage of the loss-framed message only showed when perceived vaccine efficacy was low may be seen as suggesting that negativity bias or loss aversion is only evident under certain circumstances, possibly characterized by increased depth of information processing. Block and Keller (1995) demonstrate in two studies that low perceived efficacy of a recommended health behavior motivates more in-depth processing of the health message and, as a result, renders the loss-framed message more persuasive than the gain-framed message.

It should be noted that our study and the work of Block and Keller (1995) focus on what may be termed perceived response efficacy, i.e., perceived effectiveness of a recommended health behavior. Van 't Riet and colleagues (Van 't Riet, Ruiter, Smerecnik, & De Vries, 2010a; Van 't Riet, Ruiter, Werrij, & De Vries, 2010b; Van 't Riet, Ruiter, Werrij, & De Vries, 2008) demonstrate that another type of efficacy belief—perceived self-efficacy, i.e., belief that one is capable of performing a health behavior to avert a health threat—also interacts with message framing to influence persuasive outcomes. They found that, compared to gain-framed messages, loss-framed messages more effectively decrease salt intake (Van 't Riet et al, 2010a), increase motivations to quit smoking (Van 't Riet et al., 2010b), and enhance intentions to perform skin self-examination for cancer (Van 't Riet et al., 2008), but only when people have high self-efficacy; when self-efficacy is low, both frames are equally persuasive. These findings are consistent with theories such as Protection Motivation Theory (Rogers, 1983) and the Extended Parallel Process Model (Witte, 1992; 1994). Collectively, extant research appears to show that efficacy beliefs are important moderators of message framing effects and that different types of efficacy beliefs may interact with message framing differently.

Other findings of this study revealed that framing had no main effects on attitudes or intentions and that the moderating effects of perceived vaccine safety were only shown marginally for intentions. Given the presence of one significant moderating variable (i.e., perceived vaccine efficacy), it is perhaps not surprising that the main effects were attenuated. It is unclear as to why the predicted interaction between framing and perceived vaccine safety did not emerge more clearly. One possibility is that the effect size of such an interaction is fairly small and the current study did not have sufficient statistical power to detect the interaction. It is also possible, of course, that such an interaction simply does not exist and cannot be substantiated even with a large enough sample size. Notably, perceived vaccine efficacy had the expected positive effects on attitudes, but not on behavioral intentions. This finding suggests that attitudinal responses and behavior responses toward vaccination may be based upon different beliefs and therefore warrant being examined separately. Finally, as might be expected, people who were

older had somewhat greater intentions to receive the vaccine, possibly due to their perceived vulnerability to flu-related complications.

Descriptive statistics also provided useful insights. Participants in this study generally held positive attitudes toward H1N1 vaccination, although their intentions to receive the vaccine were somewhat lower. Concerns for H1N1 vaccine safety were evident but may still be considered low. Perceived vaccine effectiveness was generally high. Low safety concerns and high perceived vaccine efficacy observed in this case are consistent with the conventional medical model, which holds that patients are essentially passive recipients in the medical encounter (Brody, 1980). Older adults, having been more heavily influenced by the conventional model than their younger counterparts, are more likely to exhibit greater "perpetuating passivity" (Makoul, 1998), that is, having great reliance on medical professionals for health information and decision making (Xie, 2009). Older adults, generally speaking, might be more used to getting advice from medical professionals about receiving vaccination and have a longer history of receiving vaccination throughout their life course. This life experience might have helped older adults lower perceived risk associated with flu vaccines and enhance perceived efficacy. Notably, perceived susceptibility to the H1N1 virus was somewhat low and perceived severity of the H1N1 flu was only moderate. However, neither perceived susceptibility nor perceived severity was found to have any significant impact on H1N1 vaccination acceptability.

The current research has limitations that need to be acknowledged. First, in this study, attitudes toward H1N1 vaccination and intentions to get the vaccine were measured immediately after message exposure. The extent to which short-term message effects can translate into long-term impact is not clear. Also, attitudes and behavioral intentions are important, but not perfect, predictors of actual behavior. How framing and vaccine-related beliefs might influence H1N1 vaccine uptake needs to be ascertained in future research. Second, some measures employed in this study, though high in internal consistency, may be seen as having unusual wording and lacking evidence of construct validity. For example, perceived vaccine safety was measured by three items, all of which mentioned *worry* about safety. Future research may seek to validate a better constructed measure of perceived vaccine safety and use it to test the proposed hypotheses. Third, this study employed print materials to convey H1N1 information. The extent to which the results could be generalized to other message formats (e.g., video) is unknown and clearly an important area for future research. Fourth, this study recruited older adults from senior centers and presumably this group of individuals might differ from those who don't frequent senior centers in important characteristics that might influence health behaviors (e.g., having better social support, more interpersonal communication about health issues). Demographically, the study sample overrepresented women (59.1%) and underrepresented Hispanics (0%). Thus the extent to which our findings may be generalized to a more representative sample of older adults needs to be determined in future studies. Finally, this study's ability to detect significant results may have been lowered by the relatively small sample size. Given resources, future research may seek to reexamine the hypotheses posed here with a larger sample of older adults.

In conclusion, more research is needed to identify moderators of the relative effectiveness of gain- versus loss-framed health messages, particularly in the context of vaccine risk communication. Future research is also called for to identify effective communication strategies for improving acceptability of flu vaccines among older adults as they are more vulnerable to flu-related complications. Such research is especially important for relatively new flu vaccine products such as the H1N1 vaccine since initial uptake of new vaccines is likely to be low, jeopardizing herd immunity. The current study suggests that H1N1 vaccination messages targeted to older adults need to be carefully framed and should take into account individuals' preexisting beliefs about the vaccine such as perceived effectiveness in order to achieve maximum persuasiveness. A future challenge for health communication researchers and professionals is to use perceived vaccine efficacy as an audience segmentation variable to craft targeted H1N1 messages. Translational research is needed to develop specific strategies to disseminate and implement the intervention. One strategy, for example, might involve using a diagnostic tool (e.g., a prescreening questionnaire) to evaluate an individual's beliefs in vaccine effectiveness and, accordingly, provide the right health materials. As the Baby Boomers continue to enter retirement, the U.S. population is on average growing older. By 2030, there will be twice as many people over age 65 as there are today (Population Resource Center, 2011). Improving vaccine risk communication among older adults thus will continue to be a priority for public health promotion.

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