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ORIGINAL ARTICLE

When Different Message Frames Motivate Different Routes to the Same Health Outcome

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Abstract
Background Message framing is an effective strategy for promoting health behavior.
Purpose We examined the relative effectiveness of framed messages that simultaneously promoted two different health behaviors—eating a calcium-rich diet and taking calcium supplements—for preventing osteoporosis. Because those behaviors are associated with different perceptions of risk, we predicted that gain- and loss-framed messages would have opposite effects.
Methods In two experiments, participants (N_1=69; N_2=219) were randomly assigned to a gain- or loss-framed message presenting two osteoporosis prevention behaviors.
Results A gain-framed advantage was observed for dietary calcium consumption, but the opposite—a loss-framed advantage—was observed for use of calcium supplements. Message frame interacted with baseline calcium consumption behavior for some outcomes.
Conclusions Both gain- and loss-framed messages increased osteoporosis prevention behavior, but their relative effectiveness depended on the type of behavior. Framed messages can have opposite effects on different behaviors used to achieve a common health goal.

Keywords Message framing · Calcium consumption · Osteoporosis prevention · Adolescent and young adult women

Many positive health outcomes can be achieved through multiple means. To reduce hypertension, for example, one could exercise regularly and eat a healthy diet or one could take blood pressure medication. To prevent skin cancer, one could avoid the sun during peak hours or one could wear sunscreen and protective clothing. In bettering their health, people are often faced with different routes to achieving the very same outcome. When designing persuasive health communications, it is therefore important to consider not only the health outcome being sought but also the routes that may be taken to achieve that outcome.

One promising strategy for promoting health behavior is message framing. Message framing is a theoretically grounded health communication strategy aimed at motivating behavior change through presentation of equivalent appeals framed in terms of gains or losses [1–3]. A gain-framed message emphasizes the benefits of engaging in the behavior ("Drinking plenty of water can help keep you hydrated."), whereas a loss-framed message emphasizes the costs of not engaging in the behavior ("Not drinking plenty of water can prevent you from staying hydrated."). It is important to note that the content presented in gain- and loss-framed messages is identical; only the frame of the message differs. Thus, the goal of message framing research is to understand how subtle alterations in the frame of a message affect health behavior.

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Virtually all studies involving message framing have used messages designed to promote particular health behaviors (e.g., mammography to detect breast cancer [4]; flossing to prevent gum disease [5]; vaccination to prevent an infection [6]). To our knowledge, no studies have investigated how message frames might be used to promote multiple behaviors aimed at achieving the same outcome. For example, if a couple is trying to prevent pregnancy, they have multiple options for doing so (e.g., using condoms, taking oral contraceptives, using an intrauterine device, etc.). Little is known about how gain- and loss-framed messages may operate when people have different options for achieving the same health goal. Here, we suggest that a framed message that is highly effective at promoting one type of behavior may be significantly less effective for another behavior, even if those behaviors are aimed at achieving the very same health outcome.

The context for the current research was osteoporosis prevention, and the two health behaviors examined were consuming a calcium-rich diet and taking calcium supplements. Both behaviors contribute to strong healthy bones, which can prevent osteoporosis, a disease characterized by weak and brittle bones that can easily fracture. Nevertheless, we propose that these behaviors also differ from one another in their associated perceptions of risk, which could affect the relative effectiveness of framed messages.

Message Framing and Health Behavior

Meta-analyses suggest that gain- versus loss-framed messages exert small but reliable effects on health behavior, though framing effects tend to be more consistent for some health behaviors (e.g., dental hygiene, physical activity, breast cancer detection) than others (e.g., vaccination, safe sex) [7–9]. Several frameworks have been proposed to explain gain-loss framing effects [1, 5, 10, 11]. One factor some of these frameworks share in common is the idea that framing effects depend on perceptions of risk. Those perceptions arise from a variety of sources including the health behavior advocated in the framed message [1, 4, 12–14], the outcome prevented by the health behavior [15–17], individual differences such as motivational orientation [5, 18, 19] or previous experiences that could affect risk perceptions relevant to the health behavior [6], and situational cues in the environment [20, 21]. As a whole, this body of research suggests that whereas gain-framed messages are maximally effective under conditions of perceived safety and certainty, loss-framed messages perform better under conditions of perceived risk and uncertainty (cf. [22]).

The role of risk perception in determining the relative effectiveness of gain- versus loss-framed messages originated from ideas proposed by Rothman and Salovey [1]. Drawing on prospect theory [23], Rothman and Salovey argued that because people are relatively open to taking risks when faced with losses, a loss-framed appeal should be most effective in promoting behaviors thought to involve potential risk or uncertainty (e.g., being screened for breast cancer). On the other hand, because people tend to avoid risks in the face of potential gains, gain-framed appeals should be most effective in promoting behaviors associated with safety and certainty (e.g., dental flossing). Thus, there is reason to think that risk perceptions play a key role in determining message framing effects.

If different health behaviors aimed at achieving the same health outcome are differentially associated with perceptions of risk, gain- versus loss-framed messages may have different effects on those behaviors, despite the fact that those behaviors promote the very same outcome. To see how this might work, imagine a patient newly diagnosed with hypertension who is presented with the treatment options of lifestyle modification and blood pressure medication. How she reacts to a framed message about those options could be influenced by her perceptions of risk *for the two behaviors*. She might, for instance, view eating a healthy diet and exercising as relatively safe because they are common behaviors associated with health more generally. In contrast, she may view taking medication as riskier because it is relatively less familiar and may seem less "natural" than eating a healthy diet and exercising. Based on these divergent risk perceptions, one might expect her to be more persuaded to engage in lifestyle modification if presented with a gain-framed appeal but more persuaded to take medication if presented with a loss-framed appeal.

The current work focuses on differences in the way people on average perceive more versus less risk associated with different health behaviors aimed at achieving the same health goal [1]. This approach can be contrasted with previous research that has focused on how *individual differences* in perceptions of risk (i.e., how much risk an individual personally associates with a health behavior or a health outcome) influence message-framing effects [15–17]. The assumption in the current investigation is that differences in the way people generally view risks associated with health behaviors help explain the differential effects of gain- versus loss-framed messages. In sum, the present research tested the hypothesis that when different behaviors that produce the same health goal are associated with differential perceptions of risk, gain- and loss-framed messages will exert opposite effects on those behaviors.

The Present Research

The health outcome addressed in the current research was osteoporosis, a disease that is particularly common among elderly women [24]. Sufficient calcium intake is critical for preventing or delaying the onset of osteoporosis and is

especially important during the first three decades of life when bone mass is accumulating [25]. As women are at significantly higher risk for osteoporosis than men [24], our messages targeted women. Indeed, many college-aged women do not meet the recommended dietary allowance for calcium [26], which is 1300 mg per day for 14- to 18-year-olds and 1000 mg per day for 19- to 50-year-olds [27].

We examined the relative effects of gain- and loss-framed messages for increasing two osteoporosis prevention behaviors: eating a calcium-rich diet and taking calcium supplements. Examples of calcium-rich foods include dairy products, dark green leafy vegetables, and calcium-fortified foods (e.g., orange juice) [25]. Although dieticians recommend that people get most of their calcium through food and beverages, calcium supplements are a useful option for individuals with dietary restrictions (e.g., lactose intolerance) and those who may not consume sufficient calcium through food intake [28].

To inform this research, we conducted a pilot study that examined women's perceptions of dietary calcium consumption and calcium supplement use. We assessed risk perceptions of the two behaviors in an independent study rather than in the primary experiments, as the process of explicitly measuring women's perceptions of risk might inadvertently influence their thoughts about the two behaviors (i.e., prompt them to think about risk when they might not have otherwise). We hypothesized that "eating a calcium-rich diet" versus "taking calcium supplements" would vary in terms of how familiar and natural they are perceived to be, in turn affecting women's perceptions of the relative safety versus riskiness of the two behaviors. Because eating is a relatively more common behavior than taking supplements, we expected eating calcium-rich foods to be viewed (on average) as more familiar and natural and thus be construed as relatively safe. In contrast, because taking supplements is likely to be relatively less common than eating, we predicted that taking calcium supplements would be viewed (on average) as less familiar and natural and thus be construed as relatively riskier.

The primary research consisted of two experiments in which participants were randomly assigned to read a gain- or loss-framed pamphlet promoting calcium consumption through dietary calcium intake and calcium supplement use, such that all participants read about both preventive behaviors. Although eating a calcium-rich diet and taking calcium supplements both lead to strong healthy bones, we hypothesized that the relative effectiveness of gain- versus loss-framed messages would depend on the health behavior in question. We predicted that a gain-framed message would be more effective than a loss-framed message in promoting dietary calcium intake. In contrast, we hypothesized that a loss-framed message would be more effective than a gain-framed message in promoting calcium supplement use. The novelty of this work lies in the fact that, although both behaviors are aimed at preventing osteoporosis, gain- and loss-framed messages may have opposite effects on promoting the two behaviors.

Pilot Study

Twenty female students (mean age=21.6 years; SD=3.1) completed the pilot survey. Participants rated their level of agreement (1=*disagree strongly* to 7=*agree strongly*) with five items assessing the perceived familiarity, safety, and naturalness of eating a calcium-rich diet (defined as eating foods that are high in calcium) and taking calcium supplements. Whether participants answered questions about supplements or diet first was counterbalanced, but the order of the five items was the same for each behavior. Participants completed two perceived familiarity items ("Taking calcium supplements/eating a calcium-rich diet is familiar to me; Taking calcium supplements/eating a calcium-rich diet feels strange to me." [Reversed]), followed by two items assessing the perceived safety of each behavior ("I think it is safe to take calcium supplements/eat a calcium-rich diet." "I think it is risky to take calcium supplements/eat a calcium-rich diet." [Reversed]). The final item assessed perceived naturalness ("Taking calcium supplements/eating a calcium-rich diet feels natural to me.") After reverse-scoring relevant items, we created composites of the perceived familiarity and perceived safety items for each health behavior.

We conducted a repeated measures analysis of variance to examine relative differences in participants' perceptions of eating a calcium-rich diet and taking calcium supplements. Whether participants answered questions about supplements or diet first resulted in no significant differences. Participants viewed eating a calcium-rich diet (M=5.70; SD=0.87) as substantially more natural than taking calcium supplements (M=2.65; SD=1.31), $F(1, 19)=58.0$, $p<.001$, partial $\eta^2=.75$. Participants also viewed eating a calcium-rich diet (M=5.70; SD=1.32) as significantly more familiar than taking calcium supplements (M=3.80; SD=1.86), $F(1, 19)=11.75$, $p=.003$, partial $\eta^2=.38$. Finally, eating a calcium-rich diet (M=6.25; SD=0.82) was viewed as considerably safer than taking calcium supplements (M=4.93; SD=1.37), $F(1, 19)=14.95$, $p=.001$, partial $\eta^2=.44$. Each of these results reflected a very large effect.

Results demonstrate that people on average tend to perceive eating a calcium-rich diet as relatively more natural, familiar, and safe than taking a calcium supplement. Findings provide support for the notion that people's risk perceptions of behaviors aimed at achieving the same health outcome can in fact differ from one another. One minor limitation of the pilot study is that asking participants to rate the familiarity of the behavior directly before rating its safety may have cued individuals to respond to the safety questions with familiarity in

mind. Next, we describe results from two experiments that tested the hypothesis that gain- and loss-framed messages would operate differently when promoting dietary calcium consumption versus supplement use.

Study 1

Method

Participants

Female undergraduate students (N=69) recruited from a large public university in the southeastern USA participated for course credit. Mean age was 19 years (SD=1.1). Eighty-one percent self-identified as white or Caucasian. The remaining participants were black/African American (13 %); Asian/Asian American (1 %); multiracial (1 %); and race unknown or not reported (3 %). Twenty percent were Hispanic/Latina. Most students (59 %) were in their first year of college. Mean dietary calcium intake at baseline was 1500 mg/day (SD=740) and 25 % (n=17) of participants reported taking a calcium supplement in the past month.

Procedure and Materials

A trained research assistant guided each participant through the experiment individually. After providing informed consent, participants completed a survey assessing a variety of health practices including baseline dietary calcium intake and calcium supplement use. Participants were then randomly assigned to read a gain- (n=33) or loss-framed (n=36) pamphlet promoting calcium consumption. Afterward, participants completed another brief survey that assessed their evaluations of the pamphlet, a framing manipulation check, dietary calcium consumption and supplement use intentions, and demographics. Before dismissal, participants received a copy of the pamphlet and were offered free calcium supplements (more detail on this below). The study was approved by the University Human Subjects Committee.

Framed messages promoting calcium consumption were developed using content from the National Institutes of Health (NIH) [25]. Pamphlets were similar to those used in a previous study [18] and contained information about osteoporosis (its definition, prevalence, symptoms, consequences, and risk factors) and discussed two behaviors for preventing the disease (dietary calcium intake and calcium supplement use). The gain-framed pamphlet focused on the benefits of consuming sufficient calcium (e.g., "What are the *benefits* of getting enough calcium? Getting enough calcium promotes strong bone growth. Adequate calcium intake decreases your chances of getting osteoporosis later in life. Eating calcium-rich foods can prevent painful fractures and spinal deformities like humpback and stooped posture."), whereas the loss-framed pamphlet focused on the costs of not consuming sufficient calcium (e.g., "What are the *risks* of not getting enough calcium? Not getting enough calcium causes poor bone growth. Inadequate calcium intake increases your chances of getting osteoporosis later in life. Not eating calcium-rich foods can lead to painful fractures and spinal deformities like humpback and stooped posture."). Participants were provided with the following information about calcium supplements, which was also framed accordingly: "What about calcium supplements? Although food is the best source of calcium, calcium supplements are an option for women who cannot get enough calcium through their diet. Calcium supplements come in pill form and soft chews in a variety of flavors (Viactiv™ calcium chews). If you take/don't take a calcium supplement you may be more/less likely to reach your daily calcium requirement." Full text of the pamphlets is provided in the Electronic Supplementary Material.

Measures

Baseline Calcium Consumption We used the 25-item Short Calcium Questionnaire [29] to assess dietary calcium consumption at baseline. The Short Calcium Questionnaire has been shown to be a reliable method for estimating dietary calcium intake [29]. For each food/beverage item listed (e.g., milk, any kind, including on cereal, in beverages, etc.—1 cup), participants entered the number of servings eaten in a typical week. A reference serving size was included for each food/beverage item. We calculated a daily dietary calcium intake score (mg/day) for each participant. An adjustment factor of 200 mg/day was added to each participant's score to reflect the contribution of calcium from foods eaten but not listed on the questionnaire. We used the following item to assess calcium supplement use at baseline: "Have you taken calcium supplements or pills in the last month?" (yes/no).

Manipulation Check and Pamphlet Evaluations To assess the effectiveness of the framing manipulation, participants rated the pamphlet's relative emphasis on the *risks of not getting enough calcium* [1] versus the *benefits of getting enough calcium* [7], with the middle of the scale labeled *equal focus on risks and benefits* [4]. Participants also rated the extent to which the pamphlet was informative, convincing, interesting, important, and educational (1=*disagree strongly* to 7=*agree strongly*).

Intentions to Consume Dietary Calcium We used four items to assess intentions to consume dietary calcium: "I plan/intend to eat calcium-rich foods regularly over the next month"; "I plan/intend to drink calcium-rich beverages over the next month" (1=*disagree strongly* to 7=*agree strongly*). Items were combined to create a composite (α=.92).

Intentions to Take Calcium Supplements We used two items to assess intentions to take a calcium supplement: "I plan/intend to take a calcium supplement regularly over the next month" (1=*disagree strongly* to 7=*agree strongly*). Items were combined to create a composite (α=.97).

Number of Calcium Chews Taken We used a behavioral measure to assess participants' interest in taking calcium supplements. Before dismissal, the experimenter offered the participant free calcium supplements (i.e., individually wrapped, caramel-flavored Viactiv® calcium chews) by saying the following: "Thank you for participating in the study today. Your responses will help us learn more about the most effective ways to provide health information to students. Here is a credit slip and a copy of the handout you read earlier. I also wanted to let you know that we're handing out free calcium supplements. I put a container of them on the table. Please feel free to take some on your way out." Afterward, the experimenter walked into the adjoining storage room to give participants privacy and reduce experimenter demand. After the participant left, the experimenter recorded the number of calcium chews that had been taken.

Statistical Analyses

We used *t* tests and chi-square analyses to compare participants in the gain- versus loss-framed condition on baseline dietary calcium intake and calcium supplement use. *T* tests were also used to examine pamphlet evaluations and the framing manipulation check for participants in the gain- versus loss-framed condition. As participants' intentions to consume calcium were expected to depend on their baseline intake, we used multivariate regression to assess the effects of message frame, baseline dietary calcium intake, baseline calcium supplement use, and all higher-order interactions (centered) on intentions to consume dietary calcium, intentions to use calcium supplements, and number of chews taken. Interactions were probed at 1 standard deviation above and below the mean (Aiken & West, 1991). One participant was excluded from the analysis predicting number of chews taken because she was an extreme outlier on number of chews taken (>4.5 SD above the mean).

Results

Preliminary Analyses

Participants in the gain- (M=1474, SD=706) and loss-framed conditions (M=1523, SD=778) reported equivalent levels of baseline dietary calcium intake, $t(67)=0.27$, $p=.786$. Further, no differences in baseline calcium supplement use were observed for participants in the gain- (24 %) versus loss-framed conditions (25 %), $\chi^2(1, N=69)=0.01$, $p=.942$. Relative to participants in the loss-framed condition (M=2.39, SD=1.18), participants in the gain-framed condition (M=3.27, SD=1.21) rated the pamphlet as more focused on the benefits of getting enough calcium than on the costs of not getting enough calcium, $t(67)=3.08$, $p=.003$, indicating that the manipulation was successful. Participants in the gain- and loss-framed conditions viewed the pamphlet as equally informative, convincing, interesting, and important, but participants in the gain-framed condition rated the pamphlet as more educational (M=6.94, SD=0.24) than did participants in the loss-framed condition (M=6.42, SD=1.44), $t(67)=2.06$, $p=.044$.

Intentions to Consume Dietary Calcium

When predicting intentions to consume dietary calcium over the next month, the main effect of frame was trending toward significance, $\beta=-.19$, $p=.091$, partial $r=.22$, and the main effect of baseline dietary calcium intake was statistically significant, $\beta=.39$, $p=.001$, partial $r=.40$. Importantly, these effects were qualified by a significant interaction between message frame and baseline dietary calcium intake, $\beta=.24$, $p=.039$, partial $r=.26$ (see Fig. 1). Although there was no effect of frame among participants with relatively high dietary calcium intake at baseline (i.e., 1 SD above the mean), $\beta=.04$, $p=.778$, partial $r=.04$, among participants with relatively low baseline dietary calcium intake (i.e., 1 SD below the mean), exposure to the gain-framed message led to greater intentions than did exposure to the loss-framed message, $\beta=-.43$, $p=.008$, partial $r=-.33$. No other effects were observed.

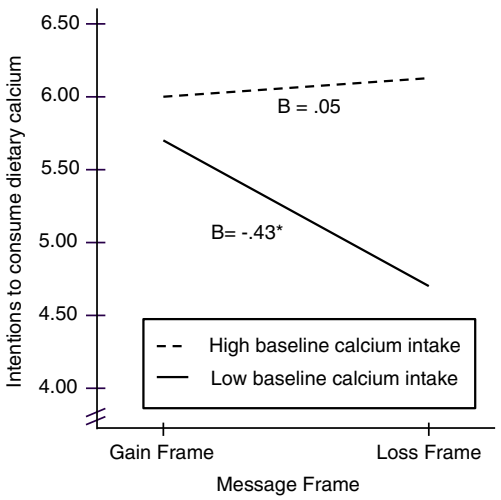

Fig. 1 Effects of message frame and dietary calcium intake at baseline on intentions to consume dietary calcium over the next month (study 1). Among women with relatively low baseline dietary calcium intake, exposure to the gain-framed message led to higher intentions to consume dietary calcium than did exposure to the loss-framed message. No effect of message frame was observed among women with relatively high baseline dietary calcium intake. Standardized regression coefficients are reported. *$p<.05$

Intentions to Take Calcium Supplements

When predicting intentions to take calcium supplements over the next month, we observed a significant main effect of baseline dietary calcium intake, β=.32, p=.004, partial r=.36, and baseline supplement use, β=.44, p<.001, partial r=.47. More importantly, the main effect of frame was trending toward significance, β=.18, p=.082, partial r=.21, such that participants who were exposed to the loss-framed message reported greater intentions to take calcium supplements (M=4.96; SD=1.97) than did participants who were exposed to a gain-framed message (M=4.18; SD=1.94). This framing effect was in the *opposite* direction from that observed for dietary intake. No other effects were observed.

Number of Calcium Chews Taken

Across conditions, participants took an average of 2.25 chews (SD=2.32); however, the number of chews taken varied by frame and baseline dietary calcium intake. We observed a significant interaction between message frame and baseline dietary calcium intake, β=−.31, p=.011, partial r=−.31 (see Fig. 2). Although there was no effect of frame among participants with relatively high baseline dietary calcium intake, β=−.21, p=.215, partial r=−.16, among participants with relatively low baseline dietary calcium intake, exposure to the loss frame led participants to take a larger number of chews than did exposure to the gain frame, β=.40, p=.021, partial r=.29. This framing effect was in the same direction as calcium supplement intentions, but opposite in direction from dietary calcium intentions. No other effects were observed.

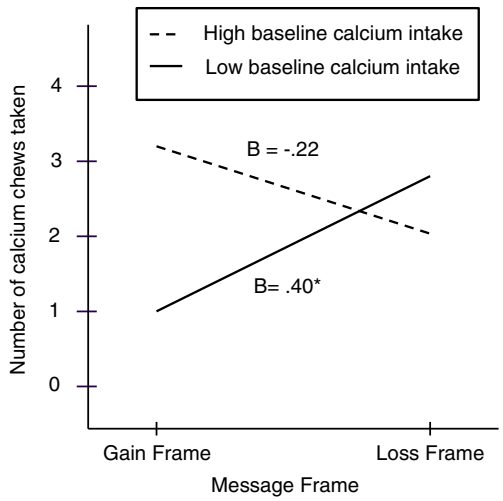

Fig. 2 Effects of message frame and dietary calcium intake at baseline on number of calcium chews taken (study 1). Among women with relatively low baseline dietary calcium intake, exposure to the loss-framed message led participants to take a larger number of chews than did exposure to the gain-framed message. No effect of message frame was observed among women with relatively high baseline dietary calcium intake. Standardized regression coefficients are reported. *p<.05

Discussion

Study 1 provides preliminary evidence that gain- versus loss-framed messages operate differently for different health behaviors aimed at accomplishing the same health goal. The general pattern of results suggested a gain frame advantage for dietary calcium consumption but a loss frame advantage for calcium supplement use. Women exposed to a gain-framed (vs. loss-framed) message reported higher intentions to consume a calcium-rich diet, although this effect was only found among women who were consuming relatively low levels of dietary calcium at baseline. In contrast, women exposed to a loss-framed (vs. gain-framed) message reported slightly higher intentions to take calcium supplements over the next month and took significantly more calcium chews before leaving the lab, although again the latter effect was only found among women consuming relatively low levels of dietary calcium at baseline.

Study 2

The goal of study 2 was to replicate findings from study 1 with a larger sample and to assess effects of the framing intervention on calcium-related behavior over time. The procedure was identical to study 1 except that participants also completed a follow-up assessment 2 weeks after exposure to the framed message.

Method

Participants

Female undergraduates (N=219) from the same university as study 1 participated for course credit. The sample size was reduced to N=213 after excluding participants who did not provide consent for their data to be used upon learning that the research assistant counted how many chews were taken after the lab session. Mean age was 19 years (SD=1.6). Eighty-one percent of participants self-identified as white or Caucasian. The remaining participants were black/African American (10 %); Asian/Asian American (3 %); American Indian or Alaska Native (1 %); multiracial (4 %); and race unknown or not reported (1 %). Twenty-six percent were Hispanic/Latina. Most students (58 %) were in their first year of college. Of the 219 participants who completed the baseline assessment, only three participants (1.4 %) failed to complete the 2-week follow-up. Mean dietary calcium intake at baseline was 941 mg/day (SD=408), and 10 % (n=21) of participants reported taking a calcium supplement in the past 2 weeks. Notably, baseline calcium intake was considerably lower in this sample, compared with study 1.

Procedure and Materials

The procedure for study 2 was almost identical to that of study 1. After providing informed consent, participants completed a survey assessing baseline dietary calcium intake and supplement use and were then randomly assigned to read a gain- (n=104) versus loss-framed (n=109) pamphlet about calcium consumption. The pamphlets were nearly identical to those used in study 1, although we made slight revisions to place additional emphasis on calcium supplement use and included several images (e.g., of a woman's spine with and without osteoporosis; a container of calcium chews) to complement information presented in the text. Images were *identical* in the gain- and loss-framed pamphlets. After reading the pamphlet, participants completed another brief survey. Before dismissal, participants were offered free calcium supplements; however, instead of leaving the container on the table, the experimenter placed it directly on the desk where the participant was seated. Approximately 2 weeks later, participants completed a brief online follow-up survey. The study was approved by the University Human Subjects Committee.

Measures

We used the same measures as study 1 to assess baseline dietary calcium intake (mg/day using the Short Calcium Questionnaire) and baseline supplement use (yes/no), although both included a 2-week time frame to be consistent with the 2-week follow-up period (i.e., "Have you taken a calcium supplement (pill, chews, gummies) in the past 2 weeks?"). At follow-up, participants completed the Short Calcium Questionnaire again and indicated whether they ingested a calcium supplement over the past 2 weeks (yes/no).[1] We also assessed whether participants purchased calcium supplements over the past 2 weeks: "I've purchased some kind of calcium supplement since session one of this experiment" (1=*disagree strongly* to 6=*agree strongly*). As in study 1, the 200-mg/day adjustment factor was added to dietary calcium intake at baseline and follow-up.

Statistical Analyses

The analysis strategy for study 2 was similar to study 1. We used t tests and chi-square analyses to compare participants in the gain- versus loss-framed condition on baseline dietary calcium intake, calcium supplement use, pamphlet evaluations, and the framing manipulation check. We used multivariate regression to assess the effects of message frame on number of chews taken, dietary calcium consumption at follow-up, and purchase of calcium supplements since the baseline session. Relevant covariates (e.g., baseline dietary intake) and interaction terms for effects observed in study 1 were also included. Two and three participants were excluded from the analyses predicting number of chews taken/calcium supplement purchasing behavior at follow-up and dietary calcium intake at follow-up, respectively, because they were extreme outliers (>4.5 SD above the mean) on those measures.

Results

Preliminary Analyses

Participants in the gain- (M=950, SD=398) and loss-framed conditions (M=1004, SD=640) reported equivalent levels of baseline dietary calcium intake, $t(211)=0.73$, $p=.467$. No differences in baseline calcium supplement use were observed for participants in the gain- (9 %) versus loss-framed condition (11 %), $\chi^2(1, N=212)=0.31$, $p=.650$. Relative to participants in the loss-framed condition (M=2.11, SD=1.07), participants in the gain-framed condition (M=3.49, SD=1.49) rated the pamphlet as more focused on the benefits of getting enough calcium than on the costs of not getting enough calcium, $t(210)=7.75$, $p<.001$. Across conditions, participants viewed the pamphlet as equally informative, convincing, interesting, important, and educational.

Dietary Calcium Intake at Follow-up

Dietary calcium intake at follow-up (mg/day) was predicted from message frame, dietary calcium intake at baseline, and the interaction between frame and baseline dietary calcium intake. We observed a significant effect of baseline intake such that participants who consumed more dietary calcium at baseline reported higher dietary intake at follow-up, $\beta=.57$, $p<.001$, partial $r=.54$. More important, we observed a significant frame by baseline intake interaction, $\beta=-.17$, $p=.008$, partial $r=.19$ (see Fig. 3). Although there was no effect of frame among participants with relatively low baseline dietary calcium intake, $\beta=.14$, $p=.113$, partial $r=.11$, among participants with relatively high baseline dietary calcium intake, exposure to the gain-framed message led to greater dietary calcium intake at follow-up than did exposure to the loss-framed message, $\beta=-.20$, $p=.020$, partial $r=.16$.

Number of Calcium Chews Taken

Number of calcium chews taken was predicted from message frame, baseline supplement use, baseline dietary

[1] After data collection was complete, we realized that we failed to ask participants to exclude supplements (chews) they received from the lab when answering this question and thus it was not an appropriate measure because it did not differentiate between chews ingested at the lab and supplements eaten during the 2-week follow-up period. Findings from a logistic regression analysis revealed no difference in supplement use at follow-up among women in the gain- versus loss-framed condition.

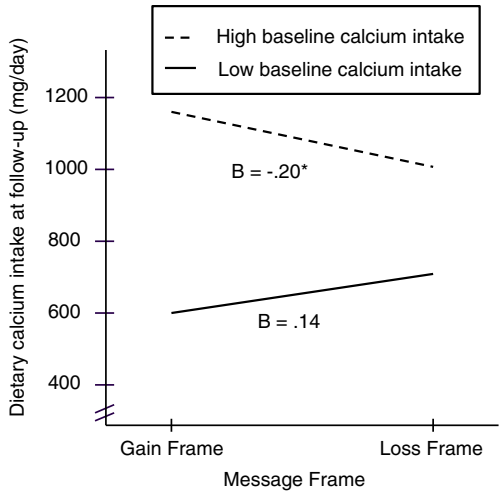

Fig. 3 Effects of message frame and dietary calcium intake at baseline on dietary calcium intake at follow-up (study 2). Among women with relatively high baseline dietary calcium intake, exposure to the gain-framed message led participants to consume more dietary calcium over the 2-week follow-up than did exposure to the loss-framed message. No effect of message frame was observed among women with relatively low baseline dietary calcium intake. Standardized regression coefficients are reported. *$p<.05$

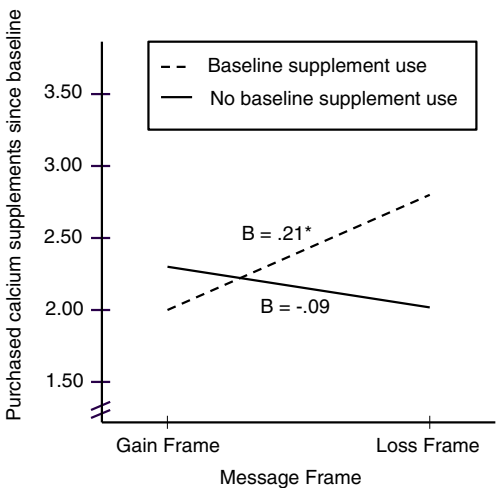

Fig. 4 Effects of message frame and baseline supplement use on calcium supplement purchasing behavior at follow-up (study 2). Among women who used supplements at baseline, exposure to the loss-framed message led to greater purchasing of calcium supplements than did exposure to the gain-framed message. No effect of message frame was observed among participants who did not use supplements at baseline. Standardized regression coefficients are reported. *$p<.05$

calcium intake, and the interaction between frame and baseline dietary calcium intake. We observed only a main effect of frame, β=.13, p=.054, partial r=.13, such that participants exposed to the loss frame took a larger number of chews (M=4.66, SD=3.98) than did participants exposed to the gain frame (M=3.76, SD=3.41). No other effects were observed. Thus, the direction of the framing effect for chews taken was opposite that for dietary calcium intake at follow-up.

Calcium Supplement Purchasing Behavior at Follow-up

Calcium supplement purchasing behavior at follow-up was predicted from message frame, calcium supplement use at baseline, and the interaction between frame and baseline supplement use. Neither main effect of frame nor baseline supplement use was significant; however, we observed a significant frame by baseline supplement use interaction, β=.15, p=.030, partial r=.15 (see Fig. 4). Follow-up analyses revealed no differences in calcium supplement purchasing behavior among participants in the gain- and loss-framed conditions who had not used supplements at baseline, β=−.09, p=.343, partial r=.07. However, among participants who had previously used supplements, exposure to the loss-framed message led to greater purchasing of calcium supplements than did exposure to the gain-framed message, β=.21, p=.032, partial r=.15. Thus, the direction of the framing effect was the same as that observed for chews taken from the lab.

Discussion

Study 2 replicated key findings from study 1 and extended findings to calcium-related behavior 2 weeks after the intervention. As in study 1, a gain frame advantage was observed for dietary calcium intake. Women who read the gain-framed message (relative to the loss-framed message) consumed significantly more dietary calcium at follow-up, although this effect was only observed for women with relatively high calcium intake at baseline. In contrast, women exposed to the loss-framed message (relative to the gain-framed message) helped themselves to more calcium chews before leaving the lab and were more likely to purchase calcium supplements relative to women in the gain-framed condition; this latter effect, however, was limited to those women using calcium supplements at baseline.

One inconsistency across the two studies pertains to the moderating effect of baseline dietary intake. In study 1, framing effects emerged among women with relatively low levels of baseline calcium intake, whereas in study 2, framing effects emerged for women with relatively high levels of baseline intake. This inconsistency may reflect the very different distributions (and mean levels) for baseline dietary calcium intake across the two studies. Mean intake was substantially higher in study 1 (1500 mg/day) than in study 2 (941 mg/day), and therefore the locations within the distribution tested in the two studies (i.e., 1 SD above and below the mean) were not equivalent. Thus, we conducted two additional analyses with the data from study 1 to assess whether the effect of frame was observed at the same level at which it was observed in study 2 (approximately 1350 mg/day). Analyses were

conducted for the two outcome variables for which a frame by baseline intake interaction was observed: intentions to consume dietary calcium and number of chews taken. The interaction for intentions to consume a calcium-rich diet was observed at the same level at which it was observed for study 2, β=−.24, p=.036, partial r=−.26, providing evidence for consistency across the two studies. On the measure of calcium chews taken, although the interaction in study 1 did not emerge at exactly the same level as it did in study 2 (1349 mg/day), it did emerge at a slightly lower level (1049 mg/day), β=.28, p=.050, partial r=.24.

These findings suggest that the two studies were largely consistent in terms of the moderating effects of baseline calcium intake, with framing effects observed at similar levels of baseline dietary intake across the two studies. Women toward the middle of the overall distribution (those in the lower portion of the distribution in study 1 and those in the upper portion of the distribution in study 2) were generally more responsive to the messages. Framing effects were not observed among women who were at either extreme of the continuum, that is, women consuming especially high or low levels of dietary calcium at baseline. Women who were already consuming high amounts of calcium do not have much need to change their behavior, so it is not surprising that minimal effects were observed for those women. Conversely, women who were consuming very low levels of calcium may require a more powerful intervention before they become motivated to increase their calcium intake. Additional studies are needed to more clearly identify the range of the distribution at which framing effects are strongest.

General Discussion

Identical health outcomes often can be achieved via different routes. Findings from the present research suggest that different routes may be motivated by different persuasive communications, particularly when those routes are associated with different risk perceptions. When designing framed health appeals, it is therefore important to consider the different health behaviors people can adopt in attempting to reach the distal health goal. The health messages in the current studies encouraged women to consume sufficient calcium to promote strong bone mass during young adulthood, with the ultimate goal of preventing osteoporosis later in life. Both gain- and loss-framed messages increased osteoporosis prevention behavior, although their relative effectiveness depended on the type of health behavior intended to increase calcium consumption (i.e., eating a calcium-rich diet or taking calcium supplements). Findings suggested a gain-framed advantage for dietary calcium consumption but a loss-framed advantage for use of calcium supplements. This research makes a novel contribution to the literature by demonstrating that gain- versus loss-framed message frames can have opposite effects in promoting different health behaviors intended to prevent the same health outcome.

Findings from the pilot study confirmed that women generally view taking supplements as less familiar and more unnatural than eating high calcium foods. Moreover, women view the two behaviors differently in terms of their overall judgments of risk: taking calcium supplements was viewed as entailing significantly more risk than eating a calcium-rich diet. Although direct evidence for the moderating effect of risk perceptions in these studies was not provided, findings are consistent with the hypothesis that divergent risk perceptions underlie the differential effects of gain- versus loss-framed messages. Nevertheless, it is unclear which aspect of risk (e.g., the extent to which the behavior is viewed as unfamiliar or unnatural or perhaps more general perceptions of the riskiness of engaging in the behavior) is centrally responsible for the current findings. Moreover, it is possible that some other difference between the two behaviors was responsible for the observed pattern of findings.

Although the current findings should be replicated for different health behaviors and outcomes, they have important implications for both theory and practice. From a theoretical standpoint, findings support the notion that risk perceptions of the recommended behavior have an important impact on the relative success of gain- versus loss-framed appeals [1, 2, 11]. Recall that several different forms of risk perceptions have been found to moderate framing effects: risk perceptions associated with performing the health behavior described in the message; risk perceptions to the health outcome prevented or reduced by the recommended behavior; individual differences in sensitivity to threat cues; and even certain emotional states such as fear [5, 6, 13, 15–21]. Although some research has begun to examine different operationalizations of risk to identify which risk-related beliefs are most important in guiding gain-loss framing effects (e.g., 15), more systematic work in this area is needed to further pinpoint this process.

Findings also highlight the importance of carefully distinguishing between desired health outcomes and the health behaviors used to achieve those outcomes. Whereas health outcomes reflect relatively distal goals (e.g., avoiding osteoporosis), health behaviors (e.g., eating calcium-rich foods; taking supplements) provide relatively more proximate pathways intended to reach those goals. Many theories such as those pertaining to construal level or psychological distance [30] suggest important differences in the way people conceptualize events and behaviors that are relatively proximate versus distal. Consequently, theories that emphasize health behavior change would benefit from attending to the difference between ultimate health goals and proximate health behavior

change pathways. The success of health interventions, for example, may depend on how well-tailored an intervention's focus is to the psychological immediacy of the behavior or outcome featured in the intervention.

The current findings have interesting practical implications for promoting health outcomes that can be achieved via different behaviors. In particular, in promoting positive long-term health outcomes that can be reached via multiple pathways, behavior change professionals should be cognizant of which pathway or pathways an individual is most likely to take. Moreover, which pathway an individual is likely to adopt can be influenced by many factors (e.g., perceived norms, which behavior is easier to enact or is more strongly recommended by physicians, individual differences), and these factors should also be taken into consideration. The implications of our findings are potentially complex, given that sometimes people may be inclined to adopt a blend of different behaviors in trying to achieve their health goals. For example, if a woman was interested in boosting her calcium intake by both taking supplements and eating more calcium-rich foods, generating an ideal behavior change message presents an interesting challenge.

Limitations of the present research provide important directions for future research. First, we tested our hypotheses in the context of osteoporosis prevention. It will be important for future research to examine other health outcomes for which multiple health behaviors can be used to achieve the same goal (e.g., pregnancy prevention; smoking cessation; weight loss). Second, we focused on only two health behaviors that can prevent osteoporosis: consuming a calcium-rich diet and taking calcium supplements. Other behaviors can increase bone mass such as engaging in weight-bearing exercise or strength training [25], yet these behaviors were not emphasized in the messages. Further, dieticians generally prefer that individuals acquire most of their calcium through food and beverages, as opposed to taking supplements. Future studies would benefit from integrating a more direct focus on contexts in which one behavior pathway is viewed as more beneficial than another in promoting a positive health outcome. Third, it is unclear whether the behaviors' perceived familiarity or how natural they were perceived to be served as a more important determinant of perceived risk. Future studies should attempt to identify which elements of perceived risk are most important in driving framing effects. It may also be useful to consider factors that influence people's general preferences for engaging in one preventive behavior over another (e.g., whether a prescription or clinic visit is necessary; the degree of effort required to carry out the behavior), as these factors may also affect risk perceptions. Fourth, like the majority of gain-loss framing studies, we did not include a control group, which precludes the ability to quantify the direction of the observed effects. Finally, the follow-up period in study 2 was limited to 2 weeks. Although some framing studies have demonstrated effects up to 6 or even 12 months [4, 12], whether the observed effects persisted beyond 2 weeks is unknown.

In closing, findings from the current paper provide an important contribution to the literature by investigating gain-loss framing effects for health outcomes that can be achieved through different health behaviors. Both gain- and loss-framed messages increased osteoporosis prevention behavior, but their relative effectiveness depended on the specific behavior, with a gain frame advantage observed for consuming a calcium-rich diet and a loss frame advantage observed for using calcium supplements. The very same message that was successful at promoting one behavior was considerably less successful in promoting another behavior, even though both behaviors were aimed at achieving the very same health outcome. Findings contribute to the growing body of research suggesting that subtle differences in the way health information is framed can have important effects on people's motivation and behavior.

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Compliance with Ethical Standards

Authors' Statement of Conflict of Interest and Adherence to Ethical Standards Authors Gerend and Shepherd declare that they have no conflict of interest. All procedures, including the informed consent process, were conducted in accordance with the ethical standards of the responsible committee on human experimentation (institutional or national) and with the Helsinki Declaration of 1975, as revised in 2000. This article does not contain any studies with animals performed by any of the authors. Informed consent was obtained from all individual participants included in the study.

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