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Altering Message Frame and Time Orientation to Promote Change in Health Behavior

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Abstract

The way in which healthcare professionals communicate risk to their patients is a key component of an individual's health outcomes. Message framing is an extensive field of psychology that has branched from economic applications into the domain of health messaging. While there have been a variety of findings in message framing research, there have been mixed results regarding what framing is most effective. In an attempt to strengthen the effects of message frame, we look at inducing future oriented thinking. Changing future health depends on action taken in the present, and requires a good deal of future thinking. We attempted to induce people to overcome cognitive barriers that might affect decision making regarding the future, thereby changing the decisions they would make in the present. Combining these two ideas, we presented participants with gain vs. loss framed messages, and induced them to think about the present vs. the future, in an attempt to optimize health messaging to produce the best health outcomes. The message presented regarded a growing health risk, chronic knee pain, which often onset later in life. Even though many may overlook this issue, behaviors in the present can drastically change outcomes for knee health. We found a pattern of means suggesting negative frame was more effective than positive frame, but upon analysis no significant effect of message frame or time orientation. Again, there was a pattern suggesting an interaction between the variables, but we found no significant interaction between the two. We therefore cannot definitively conclude from our study that time orientation can play a significant role in improving health messages, but further study could take a more in depth approach to studying the possible interaction.

Altering Message Frame and Time Orientation to Promote Change in Health Behavior

According to the Centers for Medicare & Medicaid Services (CMS), the national health expenditure in the United States in 2015 accounted for 17.8% of the nation's Gross Domestic Product. Another report predicted even further growth into the future, with healthcare projected to account for 19.9% of GDP by 2025. Despite this massive amount of spending, US health outcomes consistently rank lower than countries that spend less on healthcare. Psychological research into the way in which health messages are communicated to patients, and whether or not these messages impact their behaviors, could be an essential tool to better the outcomes of health for our population.

Health risk communication is a well-developed field of study. One topic often studied in attempts to convey health information and elicit change is message framing. The concept of psychological message framing was first presented and highlighted in psychological decision-making to support the idea that people do not always follow a rational decision-making model. People make decisions and form preferences based on how a problem or message is presented (Tversky & Kahneman, 1981). When identical problems are framed in different ways, people will make different choices.

An impact of message framing has been found in varying problems and situations. For example, Tversky and Kahneman (1981) found that when presented with the exact same public health issue, framed in terms of lives saved versus lives lost, people will choose different options. When the public health message was worded as lives saved, respondents chose the risk averse option (e.g., they chose to definitely save 200 out of 600 lives instead of take a chance in which the number saved could be more, but was uncertain). In the negative frame, when the option was worded as people dying, respondents chose the risk seeking option (e.g., they chose

to have a chance of saving more people instead of definitely saving 200). People prefer risk seeking options when they are presented with losses, and prefer risk averse options when considering gains (Kahneman & Tversky, 1979).

Framing and Health Behaviors

This area of psychological research has since been applied in the health domain. Results have been mixed and different approaches have been investigated. In one scenario, negative framing was more persuasive than positive framing in inducing more positive attitudes about breast self-examination (Meyerowitz & Chaiken, 1987). In an attempt to change attitudes and intentions to exercise, it was found that positive framing appealing to self-esteem related reasons to exercise was most effective in inducing changes in behavior (Robberson & Rogers, 1988). Maheswaran and Meyers-Levy (1990) found support for the hypothesis that people in high involvement conditions, who believe an issue to be particularly relevant to themselves, favor negatively framed messages, and those in low involvement conditions favor positively framed messages. This suggests that if someone knows or thinks an issue is something that relates to them, they will favor a message that is negatively framed, whereas people who do not know much about an issue or do not feel it is relevant to them may favor positively framed information.

In a series of studies involving skin cancer, the influence of message framing was investigated to discover how differing target behavior types could be influencing an individual's health related decision-making (Rothman, Salovey, Antone, Keough, & Martin, 1993; Rothman & Salovey, 1997). The researchers anticipated that the type of behavior in question (e.g., detection vs. prevention) would impact the effectiveness of positive versus negative message framing. They hypothesized that negatively framed information should promote detection

behaviors (e.g., breast self-exams) and positively framed information should promote prevention behaviors (e.g., sunscreen use, dental hygiene) based on the idea that detection behaviors might be considered risk-seeking (Meyerowitz & Chaiken, 1987) and prevention behaviors that would mitigate risk might be considered risk-averse.

Participants were given positively or negatively framed information regarding skin cancer, affective reactions were measured, and following the experiment participants were able to send in a postcard to receive information and/or sunscreen samples. They reacted with more negative and less positive affect when exposed to the negative frame as compared to the positive frame (Rothman et al., 1993). The frame had no influence on interest in the pamphlets, however, which contradicted the prediction regarding prevention behaviors and a previous study that supported the prediction that gain-frame messages should be more effective.

Recent studies in message framing have focused on congruency with a personality type to invoke the strongest message effectiveness (Sherman, Mann, & Updegraff, 2006; Updegraff, Sherman, Luyster, & Mann, 2007). These studies have provided evidence that behavioral motivation types and congruency can alter how effective a message is to an individual, regardless of message quality. While an interesting field of study, it would be impractical to apply in a routine way on an individualized basis, like in a primary care or specialist physician setting, because it would require time to determine individual personality type and effort on the physician's part to always specifically tailor the health message accordingly. For this reason, we believed it would be a more effective tool to focus on target behavior type, to produce a broader approach to effective framing.

Barriers to Future Thinking

Changes in ingrained health behaviors or willingness to begin new behaviors would imply that someone is either 1) experiencing a current health issue and therefore presently forced to change how they handle their personal health or 2) thinking about how their current habits might affect their future health. People will not change their behaviors until they are thinking actively about how their behaviors could benefit their future. Unfortunately, there are many findings in human behaviors across many domains, in lab studies and real-world scenarios that provide evidence that human beings have large difficulty thinking about their future.

Cognitive myopia, otherwise referred to as shortsightedness, prevents people from seeing future gains or benefits because of the present cost of producing behaviors that would lead to these benefits (Weber & Johnson, 2016). This failure occurs as a product of limited attentional and processing capacity in humans, who as a result attend to immediate goals and constraints before distant ones (Weber & Johnson, 2016). This effect might account for the suboptimal decision making habits that humans engage in that do not correspond to behavioral decision models outlining optimal decision making. Similarly, people engage in excessive discounting, in which they place much less weight on future benefits when compared to present benefits that can be obtained immediately. This idea of discounting has been studied across economic, environmental, and health domains. It is often the trend that people forego future benefits due to the present cost of producing those future benefits (Hardisty & Weber, 2009). In the health domain, this is particularly relevant. The question of how to get people to change their current behaviors, which are likely ingrained and would be a burden to alter, is becoming increasingly important. What could be done, for example, to convince someone to eat healthier now, foregoing the benefits of enjoyable, less healthy food, in exchange for better health in the future?

Prospection and Decision Making

Inducing future-oriented thought might help provide a solution as to how we overcome cognitive myopia and move past excessive discounting to get people thinking about the future. Recent studies have supported this thought, showing that actively inducing prospection can change how people think and make decisions about the future. Most of the research involving future oriented thinking had been done in the financial domain, regarding investing for the future. It has been determined that when induced to think about the future, people will favor low-risk investments to high risk ones (Monroe, Ainsworth, Vohs, & Baumeister, 2017). By inducing people to think about their future self in vivid ways, e.g. actively encouraging prospection, their future self becomes more realistic to imagine and they make financial savings choices more willingly now that will benefit them later (Hershfield, 2011). When future thinking was induced through goal and general cues, those participants who were told to think about future financial goals, rather than generally about their financial future, made better financial decisions (O'Donnell, Daniel, & Epstein, 2017). This suggests that not only does prospection lead to better decision making, but that actively thinking about future aims for oneself can further benefit their decision making.

This difference in decision making has been suggested to be associated with activation of brain areas involving prospection, meaning there is a measurable change in how people's brains are being activated when they are induced to think about their future (Ersner-Hershfield, Wimmer, & Knutson, 2009; O'Donnell et al., 2017). People who feel more future self-continuity, or similarity to their future selves, show similar activation in imaging the brain in the areas involved with self-thought when thinking about their present self and future self (Ersner-Hershfield et al., 2009). When someone thought of their future self as if they were a different

person, the activation patterns in these areas were not similar. Those who showed the biggest activation differences when thinking about present vs. future showed the steepest delay discounting (Ersner-Hershfield et al., 2009). This indicates that people who viewed their future self, more vividly and more alike to their present self, experienced brain activation patterns that allowed them to think more beneficially for their future.

In another fMRI study, it was again shown that a modulation of decision making networks and prospection networks was linked to reduction in delay discounting. The rate of reduction was related to anterior cingulate cortex (ACC) signals and neural coupling between the ACC and hippocampus, suggesting that these brain regions are related to engagement in future-oriented behaviors (Peters & Buchel, 2010). In summary, these studies support that actively inducing prospection can change how the brain is activated by inducing prospection networks, which can then lead to beneficial financial decision making.

Generalizing Future Induction to the Health Domain

If we apply this idea of future induction to health behaviors, this suggests that inducing a person to think about their future health, rather than their current state of health, in a vivid way that requires them to picture their future self might result in more low risk behaviors and produce more favorable outcomes in the future as a result of increased willingness to act in healthy ways now.

The behavior of interest in my study was knee health, in an attempt to promote knee exercising to reduce risk of future debilitating chronic pain. The question investigated was whether or not message frame and time orientation have an effect on intent and action towards behavioral change regarding knee health behaviors. Chronic knee pain affects about 25% of US adults such that knee functioning is impaired, according to the American Physical Therapy

Association's Move Forward Guide (2011). This is a growing problem that could be lessened through preventative exercising. It is also of particular interest to our study because it is an issue for which young people likely feel very low levels of involvement. We wanted to explore if there is a way to induce change in this population, despite the fact that they feel little worry about this issue, considering it is likely a non-issue in their present state and might only become an issue far into their future.

We hypothesized that getting people to think carefully about their future selves and lives can be an important tool in encouraging preventative health behaviors. Further, we thought it would reduce the impact of framing by enhancing positive health behaviors, regardless of framing. To test this, we presented participants with gain and loss framed message regarding knee health. Following this message presentation, we induced them into a time orientation by asking them to think carefully regarding their capacity for mobility currently or 25 years into the future, and write about some topics regarding knee health in these time frames. Finally, they completed ratings of intention to participate in knee exercising and had the opportunity to trade in a ticket for an exercise band that helped us to indicate which participants were actually acting to change their behaviors.

We predicted that gain framed messages would have more effect on intent and action to change knee health behaviors than loss framed messages. We also predicted that future orientation will have more effect on intent and action to change behavior than present orientation. We based the first prediction on the findings of Robberson & Rogers (1988) and Rothman et al. (1993) that prevention behaviors may be more inducible through gain-framed messages. Knee health may not be of high issue involvement to the participants in our study, who are young and may not experience any pain in the present, which may further suggest a

preference for gain framed messages (Maheswaran & Meyers-Levy, 1990). We based the second prediction on the findings of Monroe et al. (2017), from which we know that inducing someone to think prospectively about their future creates more risk-averse behaviors. Finally, we predicted an interaction between message framing and time orientation in which the difference in message frame effects are less prominent in the future orientation than the present orientation because thinking about oneself in the future should promote positive behaviors, regardless of frame.

Method

Participants

Sixty-five participants were recruited through posted flyers. Flyers were placed around campus buildings, on campus internet sites, and sent out through the Arts & Sciences weekly update. Participants signed up via an appointment calendar and were sent reminder emails regarding their participation time and location. Both Lehigh undergraduate and graduate students were recruited for participation. Forty-one participants signed up for a time slot using the appointment calendar link found on the posted advertisements. Twenty additional participants were recruited in the Fairchild-Martindale library café. The same advertisement was placed on a table, and students walking through the café of the library were able to participate on the spot, if they chose to do so. This same method was employed in the University Center, and 4 participants were recruited at this location. All participants were English proficient and able to provide consent.

Design

The study used a 2 x 2 factorial design that was completely between subjects. The first independent variable was message frame, with two levels: gain frame and loss frame. The second

independent variable was time orientation, also with two levels: present orientation and future orientation. The dependent variables were the rating of intention scale and the behavioral measure of intention.

Participants were placed into one of four conditions: negative frame/present time orientation, negative frame/future time orientation, positive frame/present time orientation, positive frame/future time orientation. These conditions differed based on the framing of the information presented and the time frame to which the participants were oriented. Participants were assigned to each group on a rotating basis. I conducted a between-subjects analysis of variance, an independent samples t-test, and a chi-square test on the data.

Materials

The four surveys used were different for each of the four conditions, described above in the design section. The information in the message presentation was taken from the American Physical Therapy Association's Move Forward Guide (2011). Participants received the following messages, created based on a vignette strategy employed from Rothman et al. (1993) for the presentation of health messages.

Negative-Frame:

The prevalence of knee pain has increased over the past 20 years. Among American adults, approximately 25% have experienced knee pain affecting the function of the knee. Knee pain can cause functional difficulty in walking, rising from a chair, climbing stairs, playing sports, balance, coordination, and loss of control over the knee. Knee health can be lost through failure to perform preventative exercising and health behaviors.

Positive-Frame:

The prevalence of knee pain has increased over the past 20 years. However, among American adults, approximately 75% maintain sustained function of the knee. Absence of knee pain allows for the normal function in walking, rising from a chair, climbing stairs, playing sports, balance, coordination, and sustained control over the knee. Knee health can be maintained through preventative exercising and health behaviors.

Following the presentation of the respective message, the surveys induced participants to think about their mobility in either the present or the future. To do this, they were told to think either ‘currently’ or ‘25 years from now’. They were asked to answer a series of questions regarding how things are going in respect to their state of mobility in the specified time frame. They were asked to write about themselves in relation to the prompts provided, which included things like walking and exercising on a daily basis. They were given space under each of the 7 prompts to write however much they felt comfortable sharing about their capabilities or the capabilities they could foresee having in 25 years in regards to the specific topic of that prompt. All of the exact prompts can be found in Appendix A. This strategy was adapted from the investigation of Monroe et al. (2017), from their procedure of writing sentences to induce prospective thinking. The questions asked were consistent across the time orientations, and the difference was only the time period they were thinking of.

All participants, regardless of condition, then completed four measures through a rating of intention scale. Ratings of intention have been used in many message frame studies as a measure of effectiveness of messages (Robberson & Rogers, 1988; Rothman et al., 1993; Sherman et al., 2006; Updegraff et al., 2007; Arora, Stoner, & Arora, 2006). The rating prompts

corresponded to framing condition, with language consistent with gain (e.g., exercise to maintain mobility) and loss (e.g., exercise to prevent loss of mobility) frames. Using a 5-point scale, participants were asked to make four value and intent judgments regarding their mobility capabilities and intent to change their current behaviors regarding knee health. These Likert scales can be found in Appendix B. Finally, they were informed of the chance to receive an exercise band that could help them to improve knee health, providing a behavioral measure similar to those employed in Rothman et al. (1993) and Sherman et al. (2006) to measure effectiveness of each communication technique. The information that was presented regarding this band was as follows:

Professional non-latex resistance bands have been shown to be effective in strengthening muscles to prevent knee injury. They are used to improve functional living and can reduce knee pain. They are portable and can be used in the comfort of a user's own home. Following completion of this session, you will receive a ticket. If you wish, you can exchange this ticket down the hall at Room 380 for your own resistance band.

Participants who chose to receive the band were also provided the link to a video that provided instructional information on how to use the band. Resistance bands are a known method for knee strengthening exercises, which have been supported as a means to reduce physically debilitating knee pain (Focht, 2006).

Procedure

Participants entered the lab and were informed that they were participating in a study regarding knee health. They provided consent via an online survey, completely separated from the four condition surveys and the rest of collected data. Participants were placed in a condition on a rotating basis beginning with the positive/present condition and finishing with the

negative/future condition. The cycle was then restarted. Each condition was color coordinated with the ticket received at the end of the survey process. Participants recruited from the Fairchild-Martindale Library café as well as the Lehigh University Center followed the exact same procedure for consent and survey distribution. An equal number of participants per condition were recorded in both of these locations to avoid any possible data discrepancies based on location.

Students completed the survey given to them based on the condition in which they were placed. The outline of the survey and specific questions that were asked can be found in the Materials section above. The survey was completed in a 5 to 10 minute period by all participants. Following the completion of the survey, participants received their \$5 compensation, signed a receipt of compensation form, and were then given their color-coded ticket. They were informed during the survey of where to exchange this ticket for their resistance band. The research aide responsible for this exchange was placed in a room 20 to 25 seconds walk from the location in which the survey was taken, and this was held across all three locations in which participants took the study. This person was strategically placed to ensure participants seeking the band had to go out of their way to a certain extent, but not exert an extreme effort to exchange.

All data, as previously mentioned, was separated from names of participants and consent forms. We used Qualtrics to administer the surveys, and data was stored safely in a password protected computer, inside a locked Lehigh University Psychology Department laboratory. The tickets that were traded were collected on a regular basis and stored safely to protect the findings of the study.

Results

The responses to questions asked in each condition that were intended to induct participants into the time orientations were first examined. We scanned all responses to ensure they were in line with the proper time orientation and followed the prompts (i.e. showed enough thought to ensure they were actually becoming oriented to a time frame). Three participants across two of the conditions were omitted for failure to follow the prompt. Data from the rest of the sixty-two participants were analyzed further.

Participants were asked to rate their agreement with four measures using a 5-point Likert scale and their responses were recorded as a numeric value, with 1 = Disagree Strongly and 5 = Agree Strongly. We calculated the mean of the participants' responses for each measure. From these, we obtained means for the four conditions. We also calculated the marginal means for each measure. A table of means for each of the four measures is presented in Tables 1-4. We ran a two-way between subject's ANOVA on the data for each measure. Tables 5-7 provide the F-values for all variables across the four measures.

If our hypothesis is correct, there should be a main effect of message frame: the intentions of participants in the gain-frame message conditions should indicate a higher level of willingness to change behaviors than those in the loss-frame message conditions. The pattern of means across four measures did not support our prediction, as the marginal means for negative frame were consistently higher than those for positive frame. The difference between these means was not significant (Table 5) for measures 1, 2, and 3, but was significant for measure 4 $F(1, 58) = 6.90, p = .011$. From this, we can conclude that our hypothesis that gain-frame messages would be more effective than loss-framed messages in encouraging preventative knee health behavioral change was not supported by the findings of the study.

Table 1: I value my ability to walk, move up and down stairs, and exercise on a daily basis.

Message Frame			
	Positive Framing	Negative Framing	<i>Marginal Mean</i>
Orientation			
Present	4.81	4.64	4.73
Future	4.56	4.88	4.72
<i>Marginal Mean</i>	4.69	4.77	

Table 2: I should participate in knee pain prevention/knee health maintenance exercises for the sake of maintaining my capacity for mobility.

Message Frame			
	Positive Framing	Negative Framing	<i>Marginal Mean</i>
Orientation			
Present	4.25	4.07	4.17
Future	4.13	4.50	4.31
<i>Marginal Mean</i>	4.19	4.30	

Table 3: I am willing to put time into participation in exercises that will prevent chronic knee pain/maintain knee health in my future.

		Message Frame		
		Positive Framing	Negative Framing	<i>Marginal Mean</i>
Orientation				
	Present	3.94	3.93	3.93
	Future	3.56	4.31	3.94
	<i>Marginal Mean</i>	3.75	4.13	

Table 4: I intend to start exercising to prevent chronic knee pain/maintain knee health in my future.

		Message Frame		
		Positive Framing	Negative Framing	<i>Marginal Mean</i>
Orientation				
	Present	3.44	3.71	3.57
	Future	3.19	4.25	3.72
	<i>Marginal Mean</i>	3.31	4.00	

We also predicted a main effect for time orientation: future orientation induction should have led to higher intentions to change behavior than present orientation induction. The pattern of marginal means does not support any consistent effect of time-orientation, as the marginal means were similar across all four measures. The differences between means across all four measures were not significant (Table 6). Our hypothesis regarding the main effect of time orientation was not supported by the findings of our study.

We predicted there would be an interaction between time orientation and message frame, in which the difference between gain and loss frame messages' effects would be reduced by the effects of time orientation. More specifically, we expected a smaller difference between message frame effects in the future-orientation condition than the present-orientation condition. The pattern of means suggested an interaction, but not the one we had anticipated. Instead, the effects of message frame depended on time orientation. In the present time orientation, positive frame led to higher intention ratings than negative frame. In the future time orientation, negative frame led to higher intention ratings than positive frame. Despite this pattern, there was no significant interaction between time orientation and message frame found in any of the four measures (Table 7). Our hypothesis was therefore not supported.

Because the time orientation was such an important part of our study and we noticed a pattern of means in comparing the four conditions in which the positive future condition consistently led to lower ratings of intention, we ran t-tests to compare the difference in means between future time orientation and present time orientation within the positive conditions and negative conditions individually for each measure. However, no significant effects were found. The results of the t-test can be found in Tables 8a and 8b.

Table 5: F-values for message frame

Message Frame			
	df	F	Significance (p value)
Measure 1			
Frame	1	.156	.694
Error	58		
Measure 2			
Frame	1	.229	.634
Error	58		
Measure 3			
Frame	1	2.604	.112
Error	58		
Measure 4			
Frame	1	6.900	.011
Error	58		

Table 6: F-values for time orientation

Time Orientation			
	df	F	Significance (p value)
Measure 1			
Time	1	.002	.961
Error	58		
Measure 2			
Time	1	.548	.462
Error	58		
Measure 3			
Time	1	.000	.985
Error	58		
Measure 4			
Time	1	.314	.577
Error	58		

Table 7: F-values for time interaction

Interaction			
	df	F	Significance (p value)
Measure 1			
Time*Frame	1	1.775	.188
Error	58		
Measure 2			
Time*Frame	1	1.822	.182
Error	58		
Measure 3			
Time*Frame	1	2.731	.104
Error	58		
Measure 4			
Time*Frame	1	2.375	.129
Error	58		

Finally, we predicted the experimental conditions would affect participants' willingness to exchange a provided ticket for an exercise band, indicating that they were willing and intending to change their knee health behaviors in a tangible way. We predicted that people in the positive conditions as well as the future conditions would trade their ticket for an exercise band more than people in negative and present conditions, respectively. The data for traded tickets can be found in Table 9. There was a fairly even distribution across conditions regarding tickets traded. We ran a chi-square analysis on the action induced (number of tickets traded) by condition, and no significant relationship was found between tickets traded and condition $X^2(3, 36) = .222, p = .974$. Our hypothesis that more people would trade tickets if they were in the positive and future conditions was not supported.

In all, the data do not support our hypothesis that positive framing and future orientation will induce more intent and behavior change than negative framing and present orientation. Further, our prediction that the effect of message frame will be lessened by future orientation was not supported as there was no significant interaction between message frame and time orientation.

Table 8a: t-test results comparing positive future and positive present conditions

	Positive Framing T-Test		
	F	t	Significance
Measure 1	1.936	.858	.398
Measure 2	.000	.425	.674
Measure 3	2.681	1.081	.288
Measure 4	.019	.681	.501

Table 8b: t-test results comparing negative future and negative present conditions

	Negative Framing T-Test		
	F	t	Significance
Measure 1	6.472	-1.121	.272
Measure 2	.372	-1.506	.143
Measure 3	.174	-1.295	.206
Measure 4	3.500	-1.523	.139

Table 9: tickets traded

Location	Behavioral Measure of Intention			
	Positive/Present	Positive/Future	Negative/Present	Negative/Future
FML	6	7	7	6
UC	0	0	0	1
Lab	2	3	2	2
<i>Total:</i>	8	10	9	9

Discussion

In measures one, two and three, we found no significant effect of message frame or time orientation. In measure four, when participants were asked rate their actual intention to change their behaviors regarding their knee health, we did find a significant main effect of message frame in which negative message framing corresponded to higher intent to change knee health behaviors than positive framing. There was still no significant effect of time orientation. No significant interaction was supported by our data. This being said, there were patterns in our data that suggested to us things about message frame and time orientation that we had not expected.

Prevention Behavior and Message Framing

First, we had expected that positive message framing would be more effective in changing attitudes and intents regarding knee health behaviors than negative framing. This was based on a body of literature that had found significant effects of message frame on people's attitudes regarding prevention and detection health behaviors (Meyerowitz & Chaiken, 1987; Rothman et al., 1993; Rothman & Salovey, 1997). However, we found no significant main effect of message frame in three out of four measures, and found only a significant main effect that negative framing was more impactful in the fourth measure.

When analyzing the findings of a large body of studies on message frame and target behavior type, O'Keefe & Jensen (2007) found that overall, there was a much more limited difference found (i.e., the effect was weak) between gain and loss frame for prevention and detection behaviors than was suggested by the results of Rothman et al. (1993) and Rothman & Salovey (1997), although still significant. Under more careful review, when one behavior type was eliminated from the body of data, O'Keefe and Jensen (2007) found this eliminated the significant effect on gain versus loss frame. This is important to consider, especially in our study

with limited statistical power, because if the effect was weak in a study with more participants, it is not surprising that it could be eliminated in a study with fewer participants and less statistical power.

It is also possible there is some other form of influence that is causing the differences in reception of message type. For example, congruency has been studied as a relevant aspect of effectiveness of message frame type in inducing health behavior changes (Updegraff et al., 2007). Congruency is the idea that the most effective message frame for a given participant is the one in line with their behavioral motivation type. We did not take this into effect in our study. However, it is possible that more participants with corresponding behavioral motivation types (i.e., approach/avoidance) were randomly placed in the negative conditions, which could explain the effect found in the fourth measure in which negative message frame conditions are inducing more intent to change than the positive message frame conditions. Similarly, it is possible that some participants felt more connected to the issue of knee health, and as a result the message frame did not create as strong of an effect on their intentions. Because we could not conclude that there were strong effects of message frame, we cannot draw any concrete conclusions from these findings about which frame is more effective in inducing higher intent to engage in prevention behaviors generally, or knee exercising specifically.

Future Thinking about Health

We predicted there would be a main effect of time orientation, in which participants in the future time orientation conditions would intend to change their behaviors more and actually behave more beneficially (i.e., trade their tickets for bands) than participants in the present conditions. We predicted this because, as an issue that may not affect them as much at their current age, knee health may become a more important issue to them as they think about their

future. We thought by inducing them to think specifically about their knee health in the future through targeted prompts, it would make the issue more important to them personally and as a result get them to want to change and to actually change their behaviors more readily.

In studies on future orientation, it has been supported that future orientation in general leads to better future decision making, but more specifically that goal or relevant future cues are more effective in promoting financial saving and in reducing delay discounting than general cues (O'Donnell et al., 2017). In presenting a health message that discusses possible future mobility issues, as well as asking people to think about their own mobility, we had hoped to make the issue of knee health more relevant to each individual participant. However, the lack of significant difference in time orientation results would suggest that most participants did not feel this issue would be any more relevant to them in the future than it is now, and they were unable to imagine a future self who would benefit from acting now. A future study might use a more detailed method of induction, ensuring each prompt and answer would be more relevant by asking participants to recall or prospect on more specific instances that recently have or will happen in their future that are directly related to their own knee health (O'Donnell et al., 2017).

We thought that being placed in the future condition would, through the process of actively imagining future knee activities and mobility, create a more vivid future self for the participants. Hershfield (2011) reports that the more connected one feels to this future self, that is, the more continuity they feel with their future self, the more willing they might be to make beneficial decisions for this future self despite what may be an easier and more accessible current gain. However, this would have meant that our participants would have gone out of their way to trade their ticket for a band more frequently as a result of being placed in the future time orientation, because thinking of their future self should have made them want to act more beneficially for

their future. It is possible that our measures to induce time orientation did not get people to think vividly enough about their future selves, and this could also have contributed to the lack of significant difference in intentions and behaviors between future and present time oriented participants. If they were still thinking about their current selves differently than their future selves (i.e. as two different people rather than a continuation of themselves) it is not surprising based on previous findings that they would be less likely to act in ways or report intentions that would be more beneficial to their futures (Ersner-Hershfield et al., 2009). Still, because of the lack of significant effect of time orientation, we cannot draw any definitive conclusions about the generalizability of this method of future induction to produce more beneficial behaviors in the health domain.

Influence of Time Orientation on Framing Effects

Finally, we had predicted that there would be an interaction between time orientation and message frame. We had expected that the effect of time orientation would have made someone's future more vivid, and therefore would diminish the effects of message frame, which has been found to diminish with other, stronger acting effects in past studies (Arora et al., 2006). We did find a pattern of means suggesting an interaction, but it was not this interaction that we had expected. Instead, we found that the effect of message frame depended on time orientation. The pattern suggested that people thinking presently respond more strongly to a positive rather than a negative message, and people thinking about the future respond more to a negative message rather than a positive message. Even though we had expected future orientation to produce stronger intents to change, regardless of frame, the interaction between frame and orientation is clearly producing a different outcome in which thinking positively about the future does not

induce the highest intent ratings, but instead leads to less reported willingness to participate in preventative behaviors.

Thinking presently, people preferred the message frames we had anticipated. In three out of four measures, they responded more strongly to the positively framed messages than the negatively framed messages regarding their feelings about knee health behaviors. The question then becomes: why might people thinking about their future prefer a negatively framed message? It is possible that thinking about the future in a negative way induces something in people that makes them more motivated to want to change how they are acting now. Very similarly, thinking positively about the future might create an image of a healthy future self, which would not really induce any immediate desire to change how things are going. The purpose of inducing future thought is to get people thinking about their future self in a way that makes them want to change behaviors now, because it creates a more tangible benefit for the future. If we somehow led people to picture a future self that was perfectly healthy and capable of all the exercises and activities that we had been prompting participants to think about, we could have inadvertently pushed them to believe there was no need to change at all. On the other hand, leading them to picture a future self that was incapable of very basic movements and activities could have been a reason for which they would be more willing to change their behaviors.

Can We Change Behaviors?

We had expected to see an effect of message frame in our ‘tickets traded’ data, in which more tickets would be traded by participants in the future orientation conditions. We did not see any pattern or significant effect in this respect. Across all experimental conditions, an even or close to even number of tickets were traded, suggesting that no condition promoted actual behavior change more strongly than another. This would suggest that even if intent ratings were

different, and created patterns suggesting there may be an advantage to a certain message or a certain interaction, actual behaviors were not influenced by frame or time orientation. As a result, it is not possible for us to conclude anything more about whether framing or time orientation induction can increase positive preventative health behaviors in a majority of people.

To summarize, we really cannot make any strong conclusions about the frame of a message or the time period that will optimize a health risk message. It would likely be best in the future to place less weight on the fact that the target behavior type was a preventative behavior, and instead account for behavioral motivation congruency as a within subject's measure to see if there is a stronger effect of message frame and interaction under those conditions. Even though we intentionally left this factor out, as it seems impractical to employ on a largescale basis, it has been shown to be a more successful method in inducing intention to change behaviors (Sherman et al., 2006; Updegraff et al., 2007). We were unable to conclude that a broader approach could be effective, so there could be benefit in including a more personality specific method.

In the future, the measures intended to induce time orientation would need to be recreated to ensure a more in-depth processing of potential future self, especially in relation to knee health. If the goal was to make the issue important to participants, especially those in the future condition, our results suggest we failed to do this and would need to change our approach to include more specific self-related issues and instances. Further, we might in the future need to account for past history with knee injury, as it is likely possible that participants who had experienced knee pain or significant injury would already be thinking about their knee health in a more personal way than other participants might be.

Because we could not draw any conclusions or see any patterns regarding actual behaviors induced by these forms of communicating risk, we cannot generalize this strategy to suggest a

way to change behavior, but instead only suggest a way in which we may get people to think differently about their future health. To truly be able to draw more definitive conclusions about the potential applicability of inducing future thought and using message framing in health risk communication, we would need to look further into the pattern of interaction we saw here in our study, and determine if there is any significance to the fact that future thinkers respond more strongly to negative messages as opposed to positive messages.

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APPENDIX A

1. Your ability to walk to and from locations of relative short distance
2. Your ability to walk to and from locations of relative long distance
3. Your ability to walk up and down stairs
4. The pain involved with these actions daily: walking, sitting and getting up, going up and down stairs
5. Your exercise routine, regarding types, frequency, and ability to sustain exercise for a period of time
6. Your ability to walk a beach or hike for 3 or more miles
7. Your ability to shop for groceries for an hour each week

APPENDIX B

Positive Frame:

	1: Disagree Strongly	2: Disagree Moderately	3: Neutral	4: Agree Moderately	5: Agree Strongly
I value my ability to walk, move up and downstairs, and exercise on a daily basis	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I should participate in knee health exercises for the sake of maintaining my capacity for mobility	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I am willing to put time into participation in exercises that will maintain knee health in my future	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I intend to start exercising to maintain knee health	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Negative Frame:

	1: Disagree Strongly	2: Disagree Moderately	3: Neutral	4: Agree Moderately	5: Agree Strongly
I value my ability to walk, move up and downstairs, and exercise on a daily basis	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I should participate in knee pain prevention exercises for the sake of preventing mobility loss	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I am willing to put time into participation in exercises that will prevent chronic knee pain in my future	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I intend to start exercising to prevent chronic knee pain in my future	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>