Framing effect debiasing in medical decision making

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Abstract

Objective
Numerous studies have demonstrated the robustness of the framing effect in a variety of contexts. The present study investigated the effects of a debiasing procedure designed to prevent the framing effect for young adults who made decisions based on hypothetical medical decision-making vignettes.

Methods
The debiasing technique involved participants listing advantages and disadvantages of each treatment prior to making a choice. One hundred and two undergraduate students read a set of three medical treatment vignettes that presented information in terms of different outcome probabilities under either debiasing or control conditions.

Results
The framing effect was demonstrated by the control group in two of the three vignettes. The debiasing group successfully avoided the framing effect for both of these vignettes.

Conclusion
These results further support previous findings of the framing effect as well as an effective debiasing technique. This study improved upon previous framing debiasing studies by including a control group and personal medical scenarios, as well as demonstrating debiasing in a framing condition in which the framing effect was demonstrated without a debiasing procedure.

Practice implications
The findings suggest a relatively simple manipulation may circumvent the use of decision-making heuristics in patients.

Keywords
Framing effect, Decision bias, Debiasing intervention, Medical decision making, Treatment choice

Disciplines
Gerontology

Comments
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Framing effect debiasing in medical decision making

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1. Introduction

There is considerable evidence that we often make irrational or biased decisions [1,2] and that several factors can contribute to such decisions. One of these factors is the way in which the decision options are framed [3]. There is a significant body of research demonstrating that people often make decisions based on how the expected outcome is framed [4]. This phenomenon, termed the framing effect, was first characterized in the prospect theory [5]. The framing effect has been the object of numerous studies conducted in a variety of contexts [6,7], including, for example, financial decisions [8], taxes [9], and medical decisions [10].

The framing effect in medical decision making is particularly troubling, as it often reveals that decisions regarding life-threatening diseases can be influenced by the way in which the medical information is framed [11]. That is, different medical decisions are made on the basis of the same medical information. Several studies have examined the framing effect in the context of medical decision making [10,12–18]. The results of these studies suggest that the framing effect can be reliably produced in the context of medical decision making, although the conditions under which this effect has been demonstrated varies from study to study. The failure to use the same scenarios and outcome probability formats across studies tends to preclude conclusions regarding the maximal conditions for the demonstration of framing.

Demonstrations of the framing effect with medical decisions cast doubt on whether patients are making rational or optimal decisions. The fact that individuals make different decisions based on varied presentation of the same information (e.g., outcome probabilities, survival versus mortality) suggests at least biased, if not non-optimal, decision making [10]. If we are to encourage unbiased optimal decision making, we must find methods for reducing decisional biases such as the framing...
effect. Unfortunately, the simple technique of informing people of a particular bias (e.g., framing effect) and then imploring them not to be influenced by the bias has proven “absolutely worthless” ([19], p. 326).

Some researchers [12,20–22] have utilized other methods for circumventing the framing effect, including having individuals provide rationales for their decisions. This approach hypothetically forces individuals to consider carefully all the alternatives and reduces the likelihood of the use of heuristics (i.e., learned cognitive “shortcuts”) in the decision-making process. In other words, providing a rationale for decisions should, theoretically, result in participants making their decisions on the basis of the concrete aspects of decision situations as presented rather than relying on prior experience or heuristics [23].

The effect of requesting that participants provide a rationale after making a decision has been examined previously in the context of seven decision problems, including the original Asian disease problem and six similar problems [20]. Using a within-subjects design, this research varied the degree of the risk and whether a decision rationale was requested. Both factors influenced the size of the framing effect. The framing effect was found only when a rationale was not requested. Unfortunately, the absence of a control condition with comparable activities and cognitive demands, along with the confounds associated with each participant experiencing all of the conditions, precludes definitive conclusions regarding the effects of the independent variables.

Siek and Yates [21], in a partial replication of the above study [20], utilized a between-subjects design with the classic Asian disease problem to avoid possible confounds associated with a within-subjects design. The results of this partial replication were consistent with those of the previous study. Participants exposed to a survival frame (i.e., the likelihood of surviving a certain procedure) chose the less risky option more often than those exposed to a mortality frame (i.e., the likelihood of dying from the same procedure). This study also demonstrated the effectiveness of a debiasing effect in which participants provided rationales for their decisions following their choices. It is noteworthy that there was no alternative task for the control participants in this study, raising the question of whether it was the consideration of alternatives that resulted in the debiasing or the extra time the participants took in making a decision.

Takemura [22] obtained a similar debiasing effect of the decision justification requirement with college students using a between-groups design and the classic Asian disease problem. The participants received a low or high elaboration (i.e., degree of required decision justification) instruction. Participants in the low elaboration condition demonstrated the framing effect, whereas those in the high elaboration condition did not. Although this study utilized a control group, the low-elaboration group was instructed only to choose an option without completing an alternative task, which again leaves open the possibility that the extra time that the high-elaboration group had in making a decision resulted in a decreased framing effect. In addition, this study did not use a personal medical problem, making the decision much less personally relevant.

Though the debiasing studies described above were effective in demonstrating the effects of a debiasing procedure, all of them employed the Asian disease problem. The use of this classic problem is commendable, as it permits one to compare results across studies. However, this problem scenario is considerably less relevant for the investigation of how people make personal decisions, such as choosing medical treatments. In fact, findings using the Asian disease problem are often contrary to findings related to medical scenarios (i.e., participants viewing the Asian disease problem tend to be more risky in negatively framed problems, whereas participants viewing medical scenarios tend to be more risky in positively framed problems). Kim et al. [12] addressed this void in the literature in part by studying debiasing using two scenarios, a “fatal disease” scenario [24] and a cancer scenario [10], with younger and older adults. The findings indicated that the framing effect was demonstrated in the older adult population, but not with younger adults. The framing effect was avoided for both scenarios requesting that participants provide rationales for their decisions. As with the previously described studies [20,21], Kim and colleagues employed no suitable control for the cognitive activities or the passage of time that were associated with the debiasing procedures. In addition, no framing effect was demonstrated within the group without the debiasing procedure, thus making the argument that the debiasing procedure was successful, difficult to support. Overall, the initial absence of the framing effect and the absence of a control group preclude firm conclusions regarding the efficacy of their debiasing procedure.

In summary, previous studies of framing using medical scenarios have consistently demonstrated the strength of the framing effect; however, the framing format with which the effect has been demonstrated has varied across studies. Attempts to avoid the framing effect have been effective, but virtually all of these studies have used scenarios that did not involve personal medical decisions. In the case that personal medical decision scenarios were used [12], methodological shortcomings precluded firm conclusions. In addition, many studies have used repeated-measures designs, which may not be relevant in “real-world” medical decision making (i.e., patients are likely presented with information in one format, not multiple formats). Finally, many of the studies have not employed a control group, thus making the interpretation of the efficacy of the debiasing technique difficult. The current study was designed to address these potential methodological shortcomings in debiasing research by: (a) employing a control group that engaged in a cognitive task that lasted approximately the same amount of time as the debiasing procedure, (b) using a between-subjects design, and (c) using a personal medical decision scenario.

The present study examined the effects of a debiasing procedure on three different medical decisions involving cancer treatments. Participants in the control and experimental conditions were presented with three medical decision-making
2. Methods

2.1. Participants

A sample of 107 undergraduate students was recruited from psychology courses and offered extra course credit for participation. Two selection criteria were employed: (a) participants could not have personal experience with making cancer-related treatment decisions and (b) participants were between the ages of 18 and 25. Of the sample, eighty (74%) of the participants were women, and eighty-nine (83%) were White. Participants were randomly assigned to the control group or the experimental group. Five participants’ data were eliminated due to incomplete responses (n = 3) or falling outside of the eligible age range (n = 2) resulting in a final sample size of 102 participants (M = 19.77 years, S.D. = 1.46).

2.2. Materials

2.2.1. Demographic questionnaire

A demographic questionnaire elicited information, including age, sex, and whether the participant had ever known someone close who had had cancer.

2.2.2. Vignettes

The bases for decisions included a set of three vignettes containing information about treatments for lung cancer [16,18]. Each vignette consisted of an imaginary scenario depicting a diagnosis of cancer followed by two treatment options, surgery or radiation. The outcomes of each treatment option were framed as either the probability of surviving (survival frame) or the probability of dying (mortality frame) following each treatment. Treatment outcomes were presented in three different ways. In the cumulative probability format, the cumulative number of people who have died/survived up to a certain time period was noted. For example, participants were told that, ”of 100 patients having surgery, 90 patients live until the end of treatment, 78 patients live through treatment but less than 1 year, 44 patients live for 1–5 years, and 10 patients live longer than 5 years.” Finally, for the life expectancy format, participants were told the long-term survival rate of patients. For example, participants were told that, “of 100 patients having surgery, 90% of the patients live through treatment. The patients who survive surgery have an average life expectancy of 6.8 years” (see Appendix A for vignette introduction and example mortality frames for each treatment outcome format).

2.2.3. Decision-making questionnaires

In addition to the vignettes, the experimental group was given a debiasing questionnaire containing five questions. The five questions were identical for each vignette, thus each participant received 15 questions (5 questions × 3 vignettes). The questions required the participant to list the advantages and disadvantages of each treatment, and the information that was most relevant in making his or her treatment choice. The purpose of this questionnaire was similar to that used in previous research [20], in which a rationale was requested to avoid the framing effect. To control for testing duration and cognitive effort, the control group received a questionnaire containing information related to stress, dental hygiene, and physical fitness. More specifically, the questions addressed the participant’s status with regard to each topic and his or her willingness to make changes to improve in these areas. The questionnaire contained no information related to any of the vignettes that could have potentially affected the control group’s treatment choice. Questionnaires were completed between the presentation of the vignettes and elicitation of treatment choices. There was no appreciable difference between the control group and experimental group in the amount of time spent on the questionnaires.

2.3. Procedure

Participants were randomly assigned to the control group (n = 54) or the experimental group (n = 48). Next, participants were presented with the written consent form, three vignettes (along with the debiasing questionnaire for the experimental group and a control questionnaire for the control group), and the demographic questionnaire. The materials were presented to participants in a university classroom in groups of 5–10. Written instructions were included with each packet of materials.

Participants were instructed to: (a) read the background information on the first page; (b) read the first vignette, with outcome information stated in terms of cumulative probability (CP), interval probability (IP), or life expectancy (LE); (c) answer the questions (control or debiasing); and (d) choose a treatment. They were instructed to repeat this same procedure with the second and third vignettes. The presentation order for the three vignettes was counterbalanced, with the six orders matched with participants on a random basis, with between 12 and 20 participants receiving each presentation order. Analyses
revealed no order effects so this variable was not included in any further analyses.

3. Results

A series of chi-square analyses were performed to determine if a framing effect was present. It should be noted that debiasing could only be tested when the control group displayed a significant framing effect. A nonsignificant difference between the control and experimental group would indicate that a debiasing technique was not needed. If the framing effect was present (i.e., there was a significant Frame × Condition chi-square value), a follow-up logistic regression was performed to determine if the intervention had the desired effect.

The first hypothesis was that in the control condition, the proportion of participants in the survival wording condition who selected surgery would differ from the proportion of participants in the mortality wording condition who selected surgery in at least one vignette. That is, participants who were given the same outcome information, but framed differently, would make different decisions. To assess the effect of frame on treatment choice for the control group, three chi-square analyses were run for the three vignettes in the control condition. Significant chi-square values indicate the presence of a framing effect. A significant framing effect was obtained for treatment choice with the CP vignette, \( \chi^2 (1, n = 54) = 20.53, p < .01 \), as well as the IP vignette, \( \chi^2 (1, n = 54) = 13.35, p < .01 \). In contrast, no significant effect was obtained for the LE vignette, \( \chi^2 (1, n = 54) = 0.43, p > .05 \). Thus, the efficacy of the debiasing technique could only be tested in the CP and IP vignette.

The second hypothesis was that in the experimental group, the framing of the information (survival or mortality) would not be significantly related to the likelihood of selecting surgery or radiation in the vignettes (i.e., the framing effect would not be present). To assess the effects of the intervention, two logistic regressions were performed (see Table 1). The first step in the regression included age and gender as control variables, the second step entered frame (mortality versus survival) and condition (control versus experimental), and the third step included the Frame × Condition interaction. A significant Frame × Condition interaction would indicate a successful debiasing intervention.

Overall, the results indicated that the debiasing intervention was successful. For the CP vignette, the odds ratio for selecting surgery (risky choice) in the control group was 0.30 (95% CI, 0.17–0.54) for the mortality frame, and 7.64 (95% CI, 2.01–29.01) for the survival frame. In other words, control participants were more likely to select the risky choice in the survival frame and less likely to select the risky choice in the mortality frame. In the experimental group, the odds ratio for selecting surgery (risky choice) in the control group was 0.60 (95% CI, 0.34–1.08) for the mortality frame, and 1.69 (95% CI, 0.90–3.18) for the survival frame. The 95% confidence intervals included 1.0 in the experimental group, indicating successful debiasing.

Similar results were found for the IP vignette. The odds ratio for selecting surgery (risky choice) in the control group was 0.38 (95% CI, 0.22–0.66) for the mortality frame, and 3.78 (95% CI, 1.51–9.46) for the survival frame. Here again, control participants were more likely to select the risky choice in the survival frame and less likely to select the risky choice in the mortality frame. In the experimental group, the odds ratio for selecting surgery (risky choice) in the control group was 0.72 (95% CI, 0.41–1.26) for the mortality frame, and 1.41 (95% CI, 0.77–2.57) for the survival frame. Again, in the experimental group, the 95% confidence intervals included 1.0, indicating successful debiasing.

4. Discussion and conclusion

4.1. Discussion

The overall goal of this study was to investigate whether the use of a debiasing strategy would prevent a framing effect in a hypothetical medical treatment situation. This required two steps: (a) the demonstration of a framing effect and (b) the avoidance of this effect following a debiasing intervention.

The finding of a framing effect for the medical scenario stated in CP and IP formats in the control group is consistent with previous research [16,18,20]. The reliable presence of a
framing effect with CP and IP formats may be due to the relatively higher amount of cognitive processing that is needed to comprehend information presented in terms of probabilities [25]. In other words, the information in the cumulative probability vignette, and perhaps the IP vignette, may be less straightforward compared to the life-expectancy information. However, additional research examining the actual decision-making process when participants are provided with different outcome probabilities is needed. For example, a “think out loud” study could investigate what information is most salient and useful to participants during the decision-making.

As hypothesized, the framing effect was avoided in the experimental condition in the two vignettes for which the framing effect was present in the control group (i.e., the CP and IP vignettes). This finding is consistent with previous research that suggests that elaboration reduces the framing effect [22] and is particularly interesting given the robust framing effect obtained for cumulative probability outcomes in previous research [16,18,19]. According to prospect theory [5], the elaboration component of the decision making process might have changed the frame of the vignette and the overall construal of the problem for individuals who were “forced” to consider the information more deeply [26].

There were several limitations of note in this study. The sample population consisted almost entirely of young, White college undergraduates who reported themselves in good (47.1%) or excellent (38.5%) health. Young adults may think less about serious health issues than older individuals, and so the topic may seem distant and not likely to be a “real-life” situation for them, and may thus be perceived as less relevant. Certain decision biases are reduced or eliminated when the problem is made to be more personally relevant [1]. Although some previous research found that there was no difference in framing effects on the medical scenarios between university students and older adults [16], the effect of age on debiasing of those framing biases has not been thoroughly explored. Despite the potentially limited generalizability of this study, the homogeneity of this college-aged sample controlled for a number of possible confounds (e.g., health problems, cognitive ability) that might otherwise influence the presence of the framing effect. The current results provide a foundation for future research that can determine how a relatively simple manipulation might preclude the framing effect in more diverse samples.

In addition, only two of the three vignettes could be used to demonstrate the efficacy of the debiasing technique in the present study because the framing effect was not obtained for the third vignette. Thus, the efficacy of the debiasing technique remains unclear when outcomes are presented in ways other than cumulative or interval probabilities. Future research should address the mechanisms and decision processes that underlie the decisions participants make under different conditions (e.g., when information is presented in terms of life expectancy).

A third potential limitation was the relatively small number of participants in each presentation order, resulting in limited power to detect an order effect. However, based on preliminary analyses and pilot research it is unlikely that the order of presentation had any significant influence on decision outcomes.

Finally, the decisions that were made by the participants were hypothetical and thus had no “real” consequences. Evaluating the efficacy of the debiasing technique in applied settings would provide additional evidence that forced elaboration helps people avoid the framing effect in actual medical decisions.

4.2. Conclusion

The results of this study suggest that a relatively simple manipulation can lead to the avoidance of the framing effect. The design of this study addressed potential weaknesses in previous research by using a between-subject design, an active control group, and a personally relevant medical decision scenario. Taken together, these design components strengthen the conclusion that elaboration and justification can pre-empt the framing effect in a medical decision making scenario. The results of this study could be applied to “real-life” medical decision making by utilizing rational techniques to eliminate framing and other biases in medical treatment decisions. As both physicians and patients have been shown to succumb to biases when making medical decisions [27], it is important that new techniques be applied to current decision making procedures to ensure that rational treatment choices are made. The findings of this study may be expanded upon and applied so that more careful thought is put into seemingly objective statistics and predictions.

4.3. Practice implications

The results of this study have direct implications in healthcare settings. The results suggest that the relatively simple manipulation may circumvent the use of heuristics that might ordinarily be used for making such decisions. Additionally, by leading patients to consider all of the relevant information of a problem, the patient will likely make more informed decisions. By asking patients to consider the consequences of treatments they may feel more involved in the decision-making process, which may lead to better outcomes, including satisfaction and treatment compliance [28,29]. Finally, given that the framing effect was not demonstrated in the life-expectancy vignette, it may be beneficial to train care providers to communicate outcome information in terms of life-expectancy rather than cumulative or interval probabilities.

I confirm all personal identifiers have been removed or disguised so the persons described are not identifiable and cannot be identified through the details of the story.

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