Replication and extension of framing effects to compliance with health behaviors during pandemics

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ARTICLE INFO

Keywords:
- Covid-19
- Swine flu
- Framing
- Replication
- Health behavior

ABSTRACT

Outbreaks of infectious diseases represent a significant challenge for health authorities around the world. Public cooperation and compliance with health recommendations constitute critical steps to stop the spread of such diseases. But how should these recommendations be framed to achieve the most desirable outcomes? Across two experiments, we show that the classic Asian Disease Problem (Tversky and Kahneman, 1981) is replicable, regardless of disease type (real vs. hypothetical). Thus, people are less (vs. more) willing to take risks when information is positively (negatively) framed, irrespective of disease type, although they are generally more risk-averse in real pandemics. Furthermore, people high (vs. low) in emotionality are more willing to comply with preventive health behaviors when information is framed positively (vs. negatively), but only in the case of a real disease. These findings provide a range of insights into the design and management of health recommendations aimed at promoting public health.

1. Introduction

The outbreak of infectious diseases, such as the recent case of the coronavirus (Covid-19), provides a significant challenge to authorities and health services worldwide. Cooperation from the public, such as compliance with specific health recommendations (e.g., self-isolation, improved hygiene) is often essential to slow or even stop the spread of infectious diseases. The framing of public messages encouraging preventive health behaviors is a major factor determining how the public will respond (Rothman and Salovey, 1997). Given that such messages often convey mortality or survival rates, applying framing theory and the classic ‘Asian Disease Problem’ (Tversky and Kahneman, 1981) to contemporary health policy decisions is opportune.

The present research aimed to investigate whether the Asian Disease Problem, which exposed participants to a scenario about an outbreak of a hypothetical disease, also applies to real pandemic outbreaks; that is, Covid-19 and the swine flu, A(H1N1). The Asian Disease Problem suggests that when survival is communicated (positive framing), people tend to choose an option with a certain outcome (risk-averse decision). In contrast, when mortality is communicated (negative framing), people tend to choose an option with an uncertain outcome (risk-seeking decision). Besides trying to replicate these findings during or in close connection to two widely publicized pandemics, where concepts such as viruses and infectious diseases should be highly salient in people’s minds, a second main objective of the current work was to examine whether positive versus negative framing may influence public compliance with a set of preventive health behaviors that require certain personal sacrifices, such as personal isolation, wearing mask, and improving personal hygiene. Specifically, we investigated whether such acts of compliance would be contingent on (1) the described disease, as being hypothetical (i.e., the Asian Disease Problem) or real (i.e., Covid-19), and (2) individual differences in people’s trait emotionality.

Across two experimental studies, we provide empirical evidence that the Asian Disease Problem is replicable, regardless of whether the disease is hypothetical or represents a real pandemic (the swine flu in Study 1 and Covid-19 in Study 2). Thus, people are less (more) willing to take risks when information is positively (negatively) framed, irrespective of disease type, although they are generally more risk-averse in the case of real pandemic outbreaks. Furthermore, people high (vs. low) in emotionality are more prone to comply with preventive health behaviors when information is framed positively (vs. negatively), but

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https://doi.org/10.1016/j.ssci.2020.105065
Received 6 October 2020; Accepted 20 October 2020
Available online 30 October 2020
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only in the case of a real (vs. hypothetical) disease. These results provide a range of insights into the design and management of health recommendations aimed at promoting public health. More precisely, our findings indicate that individuals are more inclined to act on disease-related information if such information is clearly communicated as “real” rather than hypothetical, suggesting that decision-makers and health authorities need to communicate public health recommendations vividly. Moreover, considering individuals’ emotionality when designing the specific framing strategy (positive vs. negative) of such messages will increase the public’s willingness to comply with preventive health behaviors. It may thus be used to effectively mitigate the spread of pandemic outbreaks and other infectious diseases.

2. Conceptual framework

2.1. Framing and the Asian Disease Problem

Meta-analytic work on framing effects for risky choice problems has revealed a reliable tendency of individuals to become more risk-averse when information is framed positively in terms of gains, and more risk-seeking when information is framed negatively in terms of losses (Kühberger, 1998). The strength of such framing effects seems to be contingent on aspects such as the particular experimental design (e.g., Asian Disease vs. Clinical Reasoning), the response mode (i.e., choices vs. ratings or judgments), and the risk domain (e.g., business vs. social), but the Asian Disease Problem shows the strongest mean effect, with a Cohen’s $d$ of approximately $d = 0.60$, representing a medium-sized effect. In the classic Asian Disease Problem, participants make a binary choice between one alternative that offers a certain outcome and one alternative that offers a risky outcome, with the frames being manipulated by modifying the saliency of reference points. Participants are offered identical outcomes, but these outcomes are framed in two distinct ways: as gains (promoting risk-averse behavior) or as losses (facilitating risk-seeking behavior). Although framing effects are widely variable (e.g., Fagley and Miller, 1990; Isaac and Poor, 2016; Miller and Fagley, 1991; Schneider, 1992; Tangari and Smith, 2012; Wadhwa et al., 2019), they have still been demonstrated for both hypothetical and real choices (Kühberger et al., 2002), and particularly so in the original Asian Disease design (Kühberger, 1998). Therefore, we hypothesize:

H1: Positive (vs. negative) framing decreases people’s propensity to make risk-seeking (vs. risk-averse) decisions, regardless of disease type (real vs. hypothetical).

2.2. Framing and intentions to comply with health behaviors

Compliance with health behaviors is likely to depend, to a large extent, on the type of behavior in question. Detection behaviors are performed in order to identify a health problem (e.g., health screening to detect a potentially cancerous tumor), whereas preventive behaviors can impede the onset of a health condition (e.g., vaccination to prevent flu) (Rothman and Salovey, 1997). Loss frames (which encourage risk-seeking) are generally more effective for promoting detection behaviors (perceived to be riskier). In contrast, gain frames (which emphasize certainty) are generally more effective for promoting prevention behaviors (perceived to be safer) (O’Connor et al., 2005). Although preventive behaviors aimed at limiting the spread of a pandemic (e.g., wearing a face mask, washing one’s hands, social distancing) should generally be more effective if communicated using gain-frames, increases in intended health behaviors have been observed after exposure to both gain-framed and loss-framed information, with some studies reporting no framing effects (for a review, see Rothman and Salovey, 1997; see also the meta-analysis by Kühberger, 1998). Such mixed results indicate that framing effects are contextually sensitive (Otterbring et al., 2020; Van Bavel et al., 2016).

When making risk-related decisions (e.g., whether to wear a face mask during the pandemic), humans have to make tradeoffs between relying solely on rational, yet slow information processing, and more intuitive, affect-based decision-making strategies (Slovic et al., 2004). Numerous studies have shown that affect plays a pivotal role in risk-related decision-making (Finucane et al., 2000; Peters and Slovic, 1996; Slovic et al., 2007) and, in some instances, even facilitates more rational choices (Slovic et al., 2004). Slovic et al. (1991) investigated whether vivid imagery related to nuclear waste would make people support or oppose the deposition of nuclear waste in a proposed area, contingent upon their first affective association with these radioactive materials. These authors found that the vast majority of people whose first associations with nuclear waste elicited negative affect were opposed such plans, whereas only half of those whose first images elicited positive affect would veto this idea. The Covid-19 pandemic—due to its salience and implications for life and death—triggers strong affective reactions. However, people differ in the susceptibility to affect-laden cues; hence, the framing of information related to viruses and infectious diseases may be contingent on individual differences in trait emotionality.

According to the HEXACO personality inventory, emotionality reflects low emotional stability and includes elements of both physical and psychological harm avoidance. Individuals high in emotionality exhibit increased levels of neuroticism and anxiety, usually associated with heightened risk perceptions and less risk-taking (Maner et al., 2007; Weller and Tikir, 2011). Furthermore, according to affect-as-information theory, individuals often decide based on the feelings triggered by specific situations (Pham, 2004; Pham and Lee, 2019). Feelings of anxiety and worry are interpreted as cues that the environment is uncertain and unpredictable. As a result, anxious individuals prefer safer options, which usually provide them with a sense of control and safety (Raghunathan et al., 2006). Against this background, and given that gain-frames emphasize certainty and loss-frames emphasize risk-taking, we expect that individuals high in trait emotionality will have higher intentions to comply with recommended preventive health behaviors when exposed to a gain-frame (vs. loss-frame). Prior literature also suggests that individuals low in emotionality (e.g., in extreme cases, individuals with alexithymia) do not necessarily incorporate emotional information into decision-making. Therefore, they show less susceptibility to the framing effect (Shah et al., 2016). Simultaneously, individuals high in need for cognition and those who process information more systematically tend to respond better to loss frames, since negatively-valenced information has greater weight when processed systematically (Maheswaran and Meyers-Levy, 1990; Rothman and Salovey, 1997). Given such findings, we expect loss frames to be more effective than gain frames among individuals low in trait emotionality.

However, emotions are more likely to be triggered in real situations than in imagined scenarios or simulated environments. For example, individuals exposed to virtual environments have difficulties getting immersed as the experience does not feel “real enough” for them. This means that the fears or emotions that would normally be triggered by a real event often cannot be triggered by a simulated one (Scorzari and Gambirini, 2011; Walshe et al., 2005). The current situation provides us with a unique opportunity to explore whether people do, indeed, experience a real threat (Covid-19) more intensely than a hypothetical one (the Asian Disease). We propose that the effect of framing on compliance with preventive health behaviors will be moderated by disease type and trait emotionality. Therefore, we hypothesize:

H2: In a real (vs. hypothetical) disease, the effect of framing on people’s subsequent intentions to comply with preventive health behaviors is moderated by trait emotionality, such that individuals high (vs. low) in trait emotionality are more inclined to comply with preventive health behaviors under conditions of positive (vs. negative) framing.

3. Study 1

The primary purpose of Study 1 was to test H1, and thus examine the replicability of the general framing effect, regardless of disease type.
To examine our replication hypothesis, we conducted a simple moderation analysis (PROCESS Model 1; Hayes, 2013), with framing (positive = 0, negative = 1) as the predictor, disease (Asian disease = 0, Swine flu = 1) as the moderator, and participants’ choice of program (risk averse = 0, risk seeking = 1) as the outcome variable. Supporting a framing account, and consistent with H1, we found a statistically significant effect of framing on participants’ choice of program (β = 1.52, Z = 4.80, p < 0.001), such that a larger proportion of participants chose the risky program under conditions of negative (78.0%) compared to positive framing (44.0%). The effect of disease was non-significant (β = −0.40, Z = −1.25, p = 0.210), just as the interaction effect (β = −0.15, Z = −0.23, p = 0.819).

Mirroring the results from the above analysis, a Pearson’s chi-square analysis on 2 (framing: positive, negative) × 2 (choice: risk-averse, risk-seeking) crosstabs found a significant association between framing and choice of program, χ² (1, N = 200) = 24.30, p < 0.001, V = 0.35. Chi-square analyses for the hypothetical and real disease separately showed comparable results. Thus, for the original Asian Disease Problem, there was a significant association between framing and choice of program, χ² (1, N = 100) = 12.70, p < 0.001, V = 0.36. For this hypothetical disease, the proportion of participants who selected the risky program was larger under conditions of negative (82.0%) compared to positive framing (48.0%). Similarly, for the real disease of swine flu, there was also a significant association between framing and choice of program, χ² (1, N = 100) = 11.79, p = 0.001, V = 0.34, with a larger proportion of participants choosing the risky program under conditions of negative (74.0%) compared to positive framing (40.0%).

In sum, Study 1 provides strong evidence for the framing effect, regardless of whether the disease described in the decision-making problem is hypothetical or real. In both cases, negative framing switched participants’ choice preferences more towards the risky option that could potentially save more lives, despite that this option also involved a risk of an even more significant number of deaths.

4. Study 2

Study 2 aimed to test H1-H2 and included 800 participants from the online panel Prolific (51.7% female; M_age = 30.18 years, SD = 10.44) using the same 2 (framing: positive, negative) × 2 (disease: hypothetical, real) between-subjects design as the one utilized in Study 1. The only major difference was the type of real disease involved in the decision-making problem (i.e., Covid-19). Since the study was conducted in the middle of the Covid-19 pandemic (April 2020), we wanted to examine if there would be a differential effect on participants’ choices when the real disease was an even more publicized event at the time of data collection, virtually present on the front pages of all major newspapers worldwide. In order to control for potential familiarity aspects, participants also replied to two binary yes/no questions asking whether they (1) were familiar with Daniel Kahneman, and (2) had read the book “Thinking: Fast and Slow.”

Given that we also aimed to examine whether participants’ emotional identity would play a role in determining the impact of framing on subsequent responses regarding compliance with preventive health behaviors (H2), we also included measures of participants’ emotional identity. We used the ten emotionality items from the HEXACO personality model (Ashton and Lee, 2009) and created an emotionality index by averaging these items (α = 0.81). We then created a sum score reflecting participants’ willingness to comply with preventive health behaviors by summarizing their ratings on three items (i.e., social distancing, wearing a face mask, and washing their hands frequently), which were rated on a 5-point scale (1 = not at all willing; 5 = very willing). A total of 15 participants failed an attention check asking them to state the middle option on a 5-point scale from 1 to 5 and were therefore discarded from the analyses. Moreover, we removed 19 participants who replied to the entire survey in 4 min or less and 24 participants who did not choose a program in the framing problem. Taken together, and considering that one participant was excluded due to several of the above-stated criteria, our final sample consisted of 743 participants (51.1% female; M_age = 30.10 years, SD = 10.36). Including these participants in the analyses (i.e.,
e., all except those with missing values) did not change the nature and significance of our results.

4.1. Results and discussion

4.1.1. Framing effects on decision-making

Similar to Study 1, we conducted a simple moderation analysis (PROCESS Model 1; Hayes, 2013), with framing (positive = 0, negative = 1) as the predictor, disease (Asian Disease = 0, Covid-19 = 1) as the moderator, and participants’ choice of program (risk-averse = 0, risk-seeking = 1) as the outcome variable. In further support of a framing account (H1), and mirroring the main finding from Study 1, this analysis revealed a statistically significant effect of framing on participants’ choice of program ($b = 1.82, Z = 11.13, p < 0.001$), such that a larger proportion of participants chose the risky program under conditions of negative (68.8%) compared to positive framing (26.6%). The effect of disease was non-significant ($b = -0.27, Z = -1.63, p = 0.103$), just as the interaction effect ($b = 0.26, Z = 0.79, p = 0.432$). Participants’ familiarity with Daniel Kahneman or the book “Thinking: Fast and Slow” were unrelated to their choices in the framing problem (both ps > 0.23) and none of these variables, when treated as covariates (one by one or together), changed the nature and significance of these results.

Mirroring the results from the above analysis, a Pearson’s chi-square analysis on 2 (framing: positive, negative) × 2 (choice: risk-averse, risk-seeking) crosstabs found a significant association between framing and choice of program, $\chi^2 (1, N = 743) = 132.34, p < 0.001, V = 0.42$. Chi-square analyses for the hypothetical and real disease separately showed comparable results. Thus, for the original Asian Disease Problem, there was again a significant association between framing and choice of program, $\chi^2 (1, N = 362) = 57.27, p < 0.001, V = 0.40$. For this hypothetical disease, the proportion of participants who selected the risky program was larger under conditions of negative (70.3%) compared to positive framing (30.6%). Similarly, for the real disease of Covid-19, there was also a significant association between framing and choice of program, $\chi^2 (1, N = 381) = 76.03, p < 0.001, V = 0.45$, with a larger proportion of participants yet again choosing the risky program under conditions of negative (67.4%) compared to positive framing (22.9%).

4.1.2. Emotionality and framing effects on intentions to comply with health behaviors

For the second part of our study, we conducted a regression analysis on willingness to comply with preventive health behaviors as a function of framing (positive = 0, negative = 1) emotionality (continuous), disease (Asian Disease = 0, Covid-19 = 1), and their two- and three-way interactions (PROCESS Model 3; Hayes, 2013). We found statistically significant positive main effects of emotionality ($b = 0.16, t = 5.17, p < 0.001$) and disease ($b = 0.80, t = 2.00, p = 0.046$) on participants’ willingness to comply. This means that participants high in emotionality and those who were exposed to the Covid-19 condition were more willing to comply with health behaviors than participants low in emotionality and those who were exposed to the hypothetical disease. Central to our theorizing (H2), the three-way interaction between framing, emotionality, and disease emerged ($b = -0.27, t = -2.20, p = 0.028$). All other effects were non-significant (ps > 0.65).

To better understand the nature of the three-way interaction, we split the analysis by disease and conducted two separate regression models, one for the Covid-19 condition and one for the Asian Disease condition (PROCESS Model 1; Hayes, 2013). We found statistically significant positive effects of emotionality on willingness to comply in both conditions ($b = 0.14, t = 3.70, p < 0.001$ for the Covid-19 condition, and $b = 0.17, t = 3.64, p < 0.001$ for the Asian Disease condition). However, there was a significant two-way interaction between framing and emotionality only in the Covid-19 condition ($b = -0.20, t = -2.65, p = 0.009$), but not in the Asian Disease condition ($b = 0.06, t = 0.66, p = 0.508$). The main effect of framing was statistically non-significant in
both conditions (both \( p > 0.65 \)).

In the Covid-19 condition, a floodlight analysis (Spiller et al., 2013) showed a significant positive effect of negative framing on willingness to comply (\( p < 0.05 \)) among participants low in emotionality (emotionality < 2.19, \( b = 0.19, SE = 0.10 \)) and a negative effect (\( p < 0.05 \)) among participants high in emotionality (emotionality > 3.79, \( b = -0.13, SE = 0.07 \)). For positive framing, the reverse pattern of results applied (i.e., positive framing negatively influenced compliance with health behaviors among participants low in emotionality, but positively influenced compliance with such behaviors among participants high in emotionality). Fig. 1 depicts the results with the dependent variable averaged across the three preventive health behaviors.

As such, our findings indicate that the more emotional, the more willing a person is to comply with preventive health behaviors. Moreover, people reading the initial decision-making problem about a real disease (i.e., Covid-19) are more willing to comply with such actions than people reading about a hypothetical disease. However, framing interacts with disease and emotionality, such that emotional (vs. non-emotional) people reading about a real disease are more willing to comply with these actions if the information is framed positively (vs. negatively), whereas such interactive effects do not apply for people reading about a hypothetical disease, regardless of their emotionality.

5. General discussion

Replicating the classical Asian Disease Problem (Tversky and Kahneman, 1981), the present research adds to the growing body of evidence indicating that that the effectiveness of message framing applies not only to hypothetical diseases but also to real pandemics (in our case, the coronavirus and the swine flu). For both outbreaks, negative framing shifts participants’ choice preferences more towards risky options that can potentially save more lives, despite that such options may also involve the risk of an even more significant number of deaths.

Our findings further outline the conditions under which gain frames and loss frames are more effective in promoting preventive health behaviors during a pandemic outbreak. Typically, gain-framed messages are more effective in promoting preventive health behaviors, which alleviate the risk of a health problem. However, earlier research in this area has yielded mixed results, suggesting that additional moderators might be at play (Rothman and Salovey, 1997). Building on the previous literature highlighting the importance of affect in risk-related decision-making (e.g., Finucane et al., 2000; Peters and Slovic, 1996; Slovic et al., 1991), our findings indicate that the effectiveness of gain or loss frames depends on an individual’s level of emotionality, with individuals exhibiting high levels of emotionality preferring safer options and, in this way, maintaining a sense of control over the outcomes. In the case of preventive health behaviors, the safe option is to perform health behavior, an alternative that preserves one’s health status (Rothman and Salovey, 1997). Supporting this notion, our findings indicate that individuals exhibiting high levels of emotionality are more likely to comply with preventive health behaviors if the message is gain-framed. Conversely, albeit generally less inclined to comply with such behaviors, individuals low in emotionality are more inclined to be persuaded by loss frames. Therefore, our results support earlier conceptualizations, which have linked more systematic processing of information with a loss-frame advantage.

At a general level, our findings demonstrate that the information presented in health recommendations is likely to be contingent on an individual’s personality traits. The key to this discussion is that the effects presented above were only observed in the real disease condition and not in the hypothetical one. This effect can be compared to the “vividness effect,” where events that stand out are more likely to impact decision-making. For example, health messages are more persuasive when vivid communication material is used (Block and Keller, 1997). In the present context, this means that if a disease outbreak feels “real enough,” individuals will be more likely to react to and act on it.

The results reported herein provide practitioners with important insights into the design and management of health recommendations in the case of pandemic outbreaks and other infectious diseases. Specifically, our results suggest that gain frames may enhance persuasion outcomes for preventive health behaviors if used to target highly emotional persons. The reverse holds true for persons who exhibit low levels of emotionality, as they are more likely to act based on loss frames. If targeted communication based on consumers’ personality traits was an unfeasible endeavor years ago, the digitization of information has now made a wealth of data easily accessible (Nøjd et al., 2020). Thus, when data management rules, privacy legislations, and consumer consent aspects allow, text entries from online reviews, Google searches, social media posts, and web forums offer unique opportunities to profile individuals and target them accordingly in order to create tailor-made communication campaigns that can promote public health.

Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Acknowledgements

This project was supported by a grant awarded to the first author by the Aarhus University Research Foundation (Aarhus Universitets Forskningsfond; AUFF). The authors are grateful to Marcus Båck Hjorth for help with data collection in Study 1.

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