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In COVID-19 health messaging, loss framing increases anxiety with little-to-no concomitant benefits: Experimental evidence from 84 countries.

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Abstract

The COVID-19 pandemic highlights a critical need to communicate health information effectively to the global public. Given that subtle differences in information framing can have potent effects on behavior, behavioral science research highlights a pressing question: Is it more effective to frame COVID-19 health messages in terms of potential losses (e.g., "If you do not practice these steps, you can endanger yourself and others") or potential gains (e.g., "If you practice these steps, you can protect yourself and others")? Collecting data in 48 languages from 15,929 participants in 84 countries, we experimentally tested the effects of message framing on COVID-19-related judgments, intentions, and feelings. Loss- (vs. gain-) framed messages increased self-reported anxiety among participants cross-nationally without improving policy attitudes, behavioral intentions, or information seeking relevant to pandemic risks. These results were consistent across 84 countries, three variations of the message framing wording, and 560 data processing and analytic choices. Thus, results provide an empirical answer to a global communication question and highlight the emotional toll of loss-framed messages. Critically, this work demonstrates the importance of considering unintended affective consequences when evaluating nudge-style interventions.

Keywords: Message framing, Anxiety, Nudges, COVID-19

Declarations

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Conflicts of interest/competing interests

We have no conflicts of interests/competing interests to report.

Availability of data and material

Data and materials are available here: https://osf.io/m6q8f/

Code availability

Code is available here: https://osf.io/m6q8f/

Authors' contributions

Due to the large-scale nature of the collaboration (over 500 co-authors), we have listed for now only the names of the lead team members in our submission. All other authors are provisionally listed as the "Psychological Science Accelerator."

Ethics approval

All participating research groups either obtained approval from their host institution's ethics committee, explicitly indicated that their institution did not require approval to conduct this type of experiment, or explicitly indicated that the experiment was covered by a preexisting ethics approval.

Consent to participate

All participants provided informed consent.

Introduction

Eradicating the COVID-19 pandemic hinges in part on effectively communicating health messages to the global public. One critical question is how to frame such messages, given widespread evidence from psychology and related fields that the way in which information is framed can have potent effects on behavior, even when the core information is essentially the same across distinct frames (for reviews, see Gallagher & Updegraff, 2012; Rothman, Desmarais, & Lenne, 2020). Indeed, in their widely-cited review recommending social and behavioral science applications for reducing the spread of COVID-19, Van Bavel and colleagues (2020) highlighted this very question: "Research is needed to determine whether a more positive [vs. negative] frame could educate the public and relieve negative emotions while increasing public health behaviors" (p. 462). More generally, Sunstein and Thaler (2003, p. 1182) have long argued that "In order to be effective, any effort to inform people must be rooted in an understanding of how people actually think. Presentation makes a great deal of difference: The behavioral consequences of otherwise identical pieces of information depend on how they are framed." In their view, framing constitutes a potentially powerful nudge–i.e., a way of altering people's behavior in a predictable way without changing the underlying incentives (Thaler & Sunstein, 2009; see also de Bruin & Bostrom, 2012; Downs, 2014).

In the case of COVID-19 health messaging, communicators could emphasize either (a) the benefits of compliance (i.e., *gain framing*) or (b) the costs of non-compliance (i.e., *loss framing*) with recommended actions. For example, as depicted in Figure 1, the United States Centers for Disease Control and Prevention (CDC) website (perhaps unintentionally) framed messages in terms of gains, asking the public to: "Wear a mask. Save lives" (CDC, 2021).

However, an alternative loss framing might have said: "If you do not wear a mask, lives may be lost."

Given the ability of news media, national and international health organizations, and political leaders to reach wide audiences, message framing effects could save a substantial number of lives with limited implementation costs. With this possibility in mind, we conducted an experiment to test the effect of loss- versus gain- framing of COVID-19-related public health messages on behavioral intentions, policy attitudes, and information seeking among participants in 84 countries during the pandemic. Moreover, we sought to assess the potential benefit of changes on those outcomes against the potential emotional costs that loss (vs. gain) framing might elicit.[1] Specifically, we examined whether loss (versus gain) framing would increase participants' anxiety.

Anxiety, "an emotion characterized by feelings of tension, worried thoughts, and physical changes like increased blood pressure" (American Psychological Association, 2021), may take the form of a temporary state, a chronic trait-like tendency, or a clinical disorder.[2] Anxiety has been linked with leading causes of human morbidity and mortality. For example, heightened anxiety is linked to increased risk of cardiovascular disease mortality and morbidity (e.g., heart disease, stroke, and heart failure; Levine Glenn et al., 2021). It has also been linked to increased stress hormone secretion, which, when chronic, diminishes immune function and complicates

[1] Although behavioral decision researchers studying loss vs. gain framing have traditionally examined emotional states to understand their influence on behaviors and attitudes (for reviews, see Lerner, Li, Valdesolo, & Kassam, 2015; Dorison, Klusowski, Han, & Lerner, 2020), they have tended to omit emotion as a outcome in nudge-style interventions (i.e., interventions that encourage desirable behavior without restricting choice or introducing economic incentives; Thaler & Sunstein, 2009). For counter-examples, see Allcott & Kessler, 2019; Loewenstein & O'Donoghue, 2006; Zlatev & Rogers, 2020.

[2] Anxiety disorders are ranked as the sixth largest contributor to non-fatal health loss globally and appear in the top 10 causes of years of healthy life lost in all WHO Regions (World Health Organization, 2021). We chose anxiety not only because it was a focal emotional state heightened by the pandemic (Aknin et al., 2021), but also because of its association with negative downstream consequences for coping and for overall health.

individuals' ability to cope with stress (for review, Taylor, 2021). Moreover, the effect of anxiety on stress hormone secretion may worsen with age (ó Hartaigh et al., 2012; Otte et al., 2005), potentially putting elderly individuals who already face heightened risks from COVID-19 in an even more vulnerable position. While the anxiety triggered by exposure to public health messages is likely mild compared to the levels associated with a clinical disorder, any potential behavioral benefit from message framing must still be weighed against a potential emotional cost (intended or otherwise).

Given the global nature of the pandemic, it is critical to assess the generalizability of framing effects on a global scale. Traditionally, psychological research on human behavior includes sample populations in western, educated, industrialized, rich, and democratic societies (i.e., WEIRD societies; Henrich, Heine, & Norenzayan, 2010a, 2010b). However, extrapolating from studies conducted in only a single location may miss meaningful cross-regional variation in effects. Consequently, this can lead to incomplete--and even potentially detrimental--policy recommendations. Thus, rather than assume generalization from a single population, research that aims to inform global policy recommendations during COVID-19 should incorporate a global sample (c.f., Bauer, 2019).

Method

We launched a global participant recruitment effort between April and September 2020, collecting data in 48 languages from 15,929 participants in 84 countries.[3] Participants were recruited by (1) research groups affiliated with the Psychological Science Accelerator (PSA; Moshontz et al., 2018) and (2) semi-representative research panels. The present experiment was bundled with another experiment, both of which participants completed in randomized order

[3] For country classification, we relied on standard's promoted by the International Organization for Standardization. Nevertheless, we acknowledge the presence of ongoing territory disputes that are not reflected in these standards.

after completing a pre-study survey that included demographic questions. The other experiment and pre-study survey findings will be reported elsewhere.

In the present experiment, participants were randomly assigned to read COVID-19 health recommendations adapted from World Health Organization (WHO) advisories (e.g., social distancing, mask wearing) that were framed in terms of losses (e.g., "if you do not practice these four steps, you can endanger yourself and others") or gains (e.g., "if you practice these four steps, you can protect yourself and others").

To ensure that any observed effects arose from meaningful conceptual differences (as opposed to particular wording; see Wells & Windschitl, 1999), we also examined three variations of the framed messages: neutral, self-focused, or health-focused (described below). Thus, participants were randomly assigned to one of six between-subjects experimental conditions that varied both the framing and wording/version of the COVID-19 health recommendation.

Following the message framing manipulation, we measured four outcome variables: (1) behavioral intentions to follow guidelines to prevent COVID-19 transmission, (2) attitudes toward COVID-19 prevention policies, (3) whether participants chose to seek more information about COVID-19, and (4) subjective anxiety.

Psychological Science Accelerator (PSA) COVID-19 Rapid Project

We conducted the present experiment as part of a larger PSA COVID-19 Rapid Project, which involved one pre-study general survey and three experiments related to COVID-19 (Forscher, Paris, Primbs, & Coles, 2020). The study and the experiments were presented online through the formR survey platform (Arslan, Walther, & Tata, 2020). The present experiment was bundled with another experiment, both of which participants completed in randomized order

after completing the pre-study general survey that included questions about beliefs and behaviors related to COVID-19. The third experiment was conducted separately. The pre-study general survey and the other two experiments will be reported elsewhere (e.g., Wang et al., 2021).

Participants

Sample size was primarily determined by the availability of resources amongst members of the PSA. Nevertheless, results from an a-priori power simulation estimating power as a function of number of countries, number of participants per country, intraclass correlations, effect sizes, and between-country variability in effect sizes can be found at https://osf.io/m6q8f/. After excluding participants who (a) had corrupted data due to technical difficulties, (b) did not provide responses to our outcomes of interest, or (c) did not indicate their country of origin, we were left with data from 15,929 participants (59% female, 36% male, 4% non-response, < 1% other; M_{age} = 33.70 , SD_{age} = 14.45), who lived in 84 different countries and completed the survey in a total of 48 languages. Participants were recruited either through semi-representative research panels (n = 5,555) or by PSA research groups (n = 10,374; see Forscher, Paris, Primbs, & Coles, 2020 for more details on sampling and translations).

Procedure

Independent variables. Participants were randomly assigned to view loss- or gain-framed versions of four recommendations related to COVID-19 adapted from the WHO. These recommendations related to: (1) staying home (unless absolutely necessary), (2) avoiding all shops other than necessary ones (such as for food), (3) wearing a mouth and nose covering in public at all times, and (4) completely isolating if exposed to COVID-19. All participants viewed four similarly-worded recommendations—but were randomly assigned to view either a loss- or gain-framed message. To examine whether our conclusions generalize across multiple variants of

framed messages, we created three distinct versions of each frame: neutral, self-focused, and health-focused. (See Wells & Windschitl, 1999, for more information on the importance of this stimulus sampling approach.) Thus, the experiment took the form of a 2 (Framing: gain, loss) x 3 (Version: neutral, self-focused, health-focused) between-subjects factorial design, featuring the following messages:

- *Gain/neutral*: "There is so much to gain. If you practice these four steps, you can protect yourself and others."
- *Gain/self-focused*: "You have so much to gain. You can protect yourself and others if you practice these four steps."
- *Gain/health-focused*: "There is so much to gain. Practicing these four steps can help you stay healthy and protect the health of others."
- *Loss/neutral*: "There is so much to lose. If you do not practice these four steps, you can endanger yourself and others."
- *Loss/self-focused*: "You have so much to lose. You can endanger yourself and others if you do not practice these four steps."
- *Loss/health-focused*: "There is so much to lose. You can get sick and endanger the health of others if you do not practice these four steps."

The four recommendations and dependent variables were displayed for all participants, with the message frame and version type varied by condition. The manipulated message appeared at the top of the pages displaying each recommendation and instructions when completing the outcome variables.

Manipulation check. At the end of the survey, participants completed a manipulation check. We asked participants which of the following phrases, if any, they recalled reading during

the survey: (a) There is so much to gain. You can stay healthy and protect others by...; (b) There is so much to lose. You can avoid losing your health and avoid endangering others by..."; or (c) neither. Exact wording varied to match the precise wording across the six conditions.

Dependent variables. After reading the four recommendations (with message framing varied by condition), participants completed three self-report questionnaires: behavioral intentions to follow guidelines to prevent COVID-19 transmission, attitudes toward COVID-19 prevention policies, and self-reported anxiety (described below). Afterwards, participants completed a behavioral measure, wherein they indicated whether they would be interested in learning more information about safe practices regarding COVID-19 (and were thus directed to the WHO website). While the questions themselves were identical across conditions, participants received different instructions depending on their randomly-assigned condition. For example, for the behavioral intention questionnaire, participants in the gain/neutral condition saw: "Stay healthy and protect others. There is so much to gain. We are interested in how you yourself will respond in the coming week in order to stay healthy and protect others." Participants in the loss/neutral condition saw: "Avoid losing your health and avoid endangering others. We are interested in how you yourself will respond in the coming week in order to avoid losing your health and avoid endangering others." The presentation order of the dependent variables was held constant for all participants.

For the outcome variables, we created ad-hoc face-valid measures and relied on exploratory analyses to assess internal consistency and convergent validity (see *Results* and *Supplementary Information (SI)*). Participants first indicated their intentions to engage in a variety of COVID-19 preventative behaviors (adapted from WHO recommendations at the time of survey launch). Specifically, participants indicated how likely they were to: (1) stay at home at

all times unless absolutely necessary, (2) avoid all shops other than necessary ones (such as for food), (3) wear a mouth and nose covering (such as a mask) in public at all times, and (4) completely isolate themselves if they think they have been exposed to COVID-19. The four questions were presented in a randomized order and all responses were on a 7-point Likert scale (1 = Extremely unlikely to 7 = Extremely likely).

Of note, we observed an unexpected J-shaped distribution in behavioral intentions—wherein a large majority of participants indicated very strong intentions to engage in protective behaviors (M = 6.47, SD = 0.91 on a 7-point scale). In the *SI*, we discuss potential explanations for, and additional analyses regarding, the restriction of range. Despite the restriction of range (and thus smaller-than-expected variation in the measure), behavioral intentions were still correlated with other variables in the convergent validity analyses (rs from .04 - .35; described in *Results* below). Furthermore, we did not observe a restriction of range in the other continuous outcomes: attitudes about policies that empower individuals (M = 3.46, SD = 1.93 on a 7-point scale), attitudes about policies that extend government power (M = 5.67, SD = 1.31 on a 7-point scale), and anxiety (M = 2.44, SD = 1.17 on a 5-point scale). Concerns about restrictions of range also were not applicable to the measure of information seeking (25% no, 75% yes).

After responding to the behavioral intention items, participants reported their attitudes toward five statements regarding COVID-19 prevention policies. The policy attitude items focused on trade-offs between individual rights and collective security. Two statements emphasized individual rights and autonomy (e.g., “Individuals, not governments, should decide how best to act during the COVID-19 pandemic”), whereas the other three statements emphasized collective security (e.g., “Government health officials should do everything in their power to address the spread of COVID-19, even if it severely limits daily activities for citizens”).

The five questions were presented in a randomized order and all responses were on a 7-point Likert scale (1 = Strongly disagree to 7 = Strongly agree).

Next, the survey asked participants to indicate the extent to which they felt anxious, afraid, and fearful when considering the COVID-19 health recommendations. The three questions were presented in a randomized order and all responses were on 5-point Likert scales (1 = Not at all to 5 = Extremely).

Last, participants were asked if they would like to learn more information about COVID-19. (All participants, regardless of stated preference, received additional information about COVID-19 at the end of the study.) A one-item question asked participants: "At the end of the study today, would you like to learn the latest reliable information about COVID-19?" The dependent variable was assessed as a binary variable (Yes, No).

Ethics

All participating research groups either obtained approval from their host institution's ethics committee, explicitly indicated that their institution did not require approval to conduct this type of experiment, or explicitly indicated that the experiment was covered by a preexisting ethics approval. All participants provided informed consent.

Results

We first conducted a set of preliminary analyses concerning the manipulation check, internal consistency of scales, and convergent validity among variables. Next, we report the results of our inferential analyses. Data, code, materials, power simulation details, and the pre-registered analysis plan for this experiment are available at https://osf.io/m6q8f/.

Preliminary Analyses

Manipulation check. Results revealed that 73% of participants correctly identified their condition from among three different response options (gain message, loss message, or neither). In order to be conservative, and to keep with our pre-registration plan, we reported results with the full (Intent to Treat) sample even though 27% of participants did not correctly identify which treatment they received. Importantly, however, the pattern of results was similar when we restricted the sample to just the portion of the sample that passed the manipulation check (see *SI* for more information).

Internal consistency of outcome measures. Internal consistency for both the four-item behavioral intention and three-item self-reported anxiety measures was appropriate ($\alpha > .78$, average inter-item $r > .47$). The internal consistency of the five-item policy support measure, however, was lower than expected ($\alpha = .67$; average inter-item $r = .29$). Thus, per our pre-registration plan, we performed an exploratory factor analysis. This exploratory factor analysis used varimax rotation and a minimal residual factoring method to identify two distinct subgroups of items: support for (1) policies that empower individuals to make decisions about COVID-19 (two items; $\alpha = .74$; average inter-item $r = .59$), and (2) policies that extend governments' ability to stop the spread of COVID-19 (three items; $\alpha = .77$; average inter-item $r = .53$). These two scales were weakly and negatively correlated ($r = -.15$, $p < .001$), and we analyzed the two subscales separately. Our behavioral measure of information-seeking was a single item and thus internal consistency analyses are not applicable.

Convergent validity of outcome variables. We examined the extent to which our outcome measures were associated with conceptually-related variables. To do so, we (a) post-hoc identified conceptually-related variables from the pre-study general survey, and (b) examined the extent to which they were associated with the outcome variables. Notably, these general survey

items were administered before the present study (and thus were not affected by participants' experience in the study). In all cases, we observed associations in the anticipated direction (ps < .001) that ranged from very small ($|r|$ = .04) to medium ($|r|$ = .35) in size. For example, behavioral intentions were positively associated with the self-reported number of times that participants had recently worn a mask (r = .28, p < .001; see *SI* for more detail).

Inferential Analyses

We first modeled each outcome variable using linear (for continuous variables) or logistic (for dichotomized variables) mixed-effects regression with message framing entered as an effect-coded factor, country-level random intercepts, and country-level random slopes. For all outcomes besides behavioral intentions, country-level random slopes led to singular fits and were subsequently removed. These convergence issues provided preliminary evidence that the estimated effects of message framing on our outcomes of interest were consistent across countries. To facilitate comparisons across outcomes, we also estimated the overall message framing effects using random-effects meta-analysis. For the meta-analysis, we used Cohen's d as the effect size index, wherein positive values indicated higher levels of the outcome variables in the loss- (vs. gain-) framed conditions.[4]

Effects on behavioral intentions, policy support, and information seeking. Our first set of analyses tested the effect of message framing on behavioral intentions, attitudes towards two types of policies, and information seeking. Results indicated that framing messages in terms of losses vs. gains had extremely small, non-significant effects on: (1) intentions to engage in protective behavior (a 0.03 increase on a 7-point scale; $F(1, 35.17) = 2.70$, $p = .110$, $d = 0.03$,

[4] For dichotomous outcomes (i.e., information seeking), we converted log odds ratios to Cohen's ds (Borenstein, Hedges, Higgins, & Rothstein, 2009). Countries without at least one observation in each of the conditions were excluded from the meta-analysis.

95% CI [-0.01, 0.07], $\tau^2 = 0.005$); (2) support for policies that empower individuals to make decisions about COVID-19 (a 0.01 increase on a 7-point scale; $F(1, 15871) = 0.05$, $p = .826$, $d = 0.004$, 95% CI [-0.03, 0.04], $\tau^2 \approx 0$); (3) support for policies that extend governments' ability to stop the spread of COVID-19 (a 0.04 increase on a 7-point scale; $F(1, 15877) = 3.46$, $p = .063$, $d = 0.03$, 95% CI [0.002, 0.06], $\tau^2 \approx 0$); and (4) the probability that participants sought additional information about COVID-19 (a 1.2% point decrease; $z = -1.80$, $p = .071$, $d = -0.008$, 95% CI [-0.02, 0.004], $\tau^2 \approx 0$). Notably, the low τ^2 values suggest that the estimated effects of message framing on our outcomes of interest were consistent across countries (see Figure 2).

While we found little evidence of between-country heterogeneity in the effects of message framing on behavioral intentions, attitudes, and information seeking, we next examined whether these estimated effects were moderated by methodological features of the study, such as: (a) the version of the framed message (neutral, self-focused, health-focused), (b) the sampling pool (panel, non-panel), and (c) the order in which participants completed the two bundled studies (present experiment first, present experiment second). To do so, we separately added each moderator-of-interest and its higher-order interaction with message framing as effect-coded factors in the mixed-effects models described above. Results did not indicate that the message framing effects interacted with any of the moderators of interest (ps > .138).

To probe the robustness of the estimated effects of message framing on behavioral intentions, attitudes, and information seeking, we performed exploratory *multiverse analyses* (also sometimes described as a specification-curve analysis; Simonsohn, Simmons, & Nelson, 2020; Steegen, Tuerlinckx, Gelman, & Vanpaemel, 2016).[5] The present multiverse analyses

[5] Such multiverse analyses acknowledge that (1) there are often many justifiable approaches to processing and modeling data, (2) justifiable differences in the processing and modeling of data can change the inferences one might draw from the data, (3) examining different data processing and modeling approaches helps probe the

examined how 398 justifiable approaches to data processing and modeling affected our conclusions. Most approaches indicated that message framing did not impact intentions to engage in protective behavior (87% of models) or support for COVID-19-related policies (67% of models). In the scenarios where the estimated message framing effects were significant, the magnitudes were extremely small (i.e., less than a 0.06 change on a 7-point behavioral intentions measure; less than a 0.20 change in a 7-point policy support measure). Many justifiable data processing and analysis approaches did indicate that framing messages in terms of losses (vs. gains) decreased information seeking (80% of models). However, in these scenarios, the magnitude was small (i.e., less than a 4% point decrease in the probability of seeking information; see *SI* for more information).

Effects on self-reported anxiety. The next set of analyses examined whether loss-framed vs. gain-framed messages had a differential impact on self-reported anxiety. Results indicated that participants reported higher levels of anxiety after being exposed to loss- ($M = 2.58$, $SD = 1.18$) vs. gain-framed ($M = 2.30$, $SD = 1.14$) messages, $F(1, 15881) = 253.67$, $p < .001$, $d = 0.25$, 95% CI [0.21, 0.29], $\tau^2 = 0.007$. Once again, the low τ^2 value suggests that the estimated effect of message framing on anxiety was consistent across countries (see Figure 2).

To assess these anxiety results in terms of practical perspective, we estimated the association between (a) self-reported personal exposure to COVID-19 (a presumably anxiety-producing event that was measured as a binary variable in the pre-study survey), and (b) experienced anxiety after the framing manipulation. The estimated effect of message framing on

robustness of a set of results, and (4) reporting how different data processing and modeling approaches impact results can improve the transparency and credibility of research findings (Lebel, McCarthy, Earp, Elson, & Vanpaemel, 2018). In the main text, we describe the results of multiverse analysis models that converged. Nevertheless, we describe the results of additional analytic approaches that yielded model convergence issues in the *SI*.

anxiety was nearly 1.5 times the size of the estimated association between actual exposure to COVID-19 and anxiety (which was associated with a 0.20 increase on the 5-point anxiety measure). Thus, in practical terms, the effect of message framing on anxiety was substantial.

Similar to the analyses of the other outcome variables, we next examined whether the estimated effect of framing on anxiety was moderated by methodological features of the study. Results did not indicate that the effect of message framing on anxiety was moderated by the version of the message ($p = .368$) or the sampling pool ($p = .799$). This implies that the underlying construct itself (loss vs. gain framing), rather than the particular wording associated with any instantiation of it, drives the effects. Inconsequentially, the message framing effect was moderated by the order in which participants completed the study, $F(1, 15880) = 4.35$, $p = .037$. Follow-up contrasts indicated that the effect of framing on anxiety was slightly larger when participants completed our study second (where message framing led to a 0.32 shift on the 5-point anxiety measure) vs. first (where message framing led to a 0.24 shift in the anxiety measure). Nevertheless, the observed effect of message framing on anxiety was significant regardless of the order of the studies (both ps $< .0001$).

Finally, we conducted a multiverse analysis to examine how 162 justifiable approaches to data processing and modeling affected our conclusions about anxiety. Strikingly, *all* 162 justifiable data processing and modeling approaches examined in the multiverse analysis indicated that framing messages in terms of losses (vs. gains) significantly increased anxiety (all ps $< .001$; *all mean differences* > 0.21). These results suggest that the inferences regarding the effects of message framing on anxiety are robust across a wide variety of justifiable analytic decisions.

Summary. While framing messages in terms of loss (versus gain) conferred no measurable, consistent benefits, such loss framing exerted moderately-sized and extremely consistent costs in terms of increased anxiety (see Figure 2). Moreover, the results for anxiety appeared consistent across countries, message wording, sampling pool, study order, and analytic choices—suggesting that the results are broadly generalizable.

Discussion

The COVID-19 pandemic highlights a critical need to effectively communicate health information to the global public. It also highlights the importance of rapidly testing psychological interventions on a global scale. We experimentally tested the differential effects of framing messages in terms of losses vs. gains on COVID-19-related behavioral intentions, policy attitudes, information seeking, and experienced anxiety.

Results indicated that message framing had little-to-no measurable benefit for behavioral intentions, policy attitudes, or information seeking--but did have a significant emotional cost in terms of increased anxiety. These results were consistent across 84 countries, three variations of the message framing wording, across semi-representative and non-representative samples, across survey order, and across 560 data processing and analytic choices. Taken together, these results imply that the conceptual difference between loss- and gain-framing accounts for its effect on anxiety (rather than any particular phrasing of stimuli, culturally specific connotation, methodological feature, or data analytic approach).

The effect of message framing on anxiety when reading loss- vs. gain-framed health recommendations was nearly 1.5 times the size of the association between self-reported personal exposure to COVID-19 and anxiety when reading the health messages, revealing the important practical impact of loss framing. Because heightened anxiety has been associated with major

causes of morbidity and mortality, diminished coping abilities, and neuroendocrine dysregulation, the heightened levels of anxiety under loss-framed messages represent an important outcome. Of course, the anxiety triggered in our study was relatively mild compared to acute levels associated with clinically-diagnosable anxiety disorders. Nevertheless, public health communicators should benefit from learning that gain-framed messages COVID-19 messages are at least as effective as loss-framed messages in their impact on behavioral intentions, policy attitudes, and information seeking behavior--but induce significantly less anxiety at a population level.

While some commentators have urged organizations to "scare people" when communicating COVID-19 health information (e.g., in the *New York Times*; Rosenthal, 2020), the present results cast doubt on the wisdom of reminding people how much they stand to lose during the pandemic. Despite eliciting higher levels of anxiety, loss-framed (vs. gain-framed) messages did not meaningfully change behavioral intentions, information seeking behavior, or policy attitudes in the context of COVID-19. Admittedly, literature on fear appeals is nuanced (e.g., Kok et al., 2018; Peters et al., 2018). But because the present study is the largest and most globally-representative study ever conducted on message framing and anxiety in the context of COVID-19, there is compelling evidence that triggering anxiety in the COVID-19 context (more than has already been triggered by daily news) was not helpful.

In behavioral science literature, more generally, the results of message framing on anxiety contribute to a nascent literature broadening the scope of behavioral decision (nudge-style) interventions beyond strictly behavioral outcomes. Fields such as public health and health psychology have long considered emotional states, such as anxiety, key outcome variables worth measuring (e.g., Taylor, 2021; Epel et al., 2018). In the present work, we build both on these

fields and on an emerging literature in behavioral decision research (Allcott & Kessler, 2019; Zlatev & Rogers, 2020; Haushofer, Mudida, & Shapiro, 2021) to propose that emotional consequences should be considered when evaluating the costs vs. benefits of nudge-style interventions (c.f., Glaeser, 2005), especially because certain emotional states are linked to physical and mental health. In the present case, under an expanded cost-benefit analysis that includes emotional consequences (c.f. Dukes et al., 2021), messages framed in terms of gains appear superior (for related discussion, see Loewenstein & O'Donoghue, 2006).

Limitations and Future Directions

Despite its global scope, the present experiment features some methodological limitations. First, it remains unknown whether sustained framing interventions (rather than single shot) could have stronger effects. Second, the behavioral intentions variable exhibited restriction of range, which may have contributed to diminishing a message framing effect. However, behavioral intentions had sufficient variance to correlate with other expected predictors in the study (e.g., self-reported mask wearing), providing some evidence that the range was not sufficiently limited to preclude the detection of meaningful relationships. Moreover, we did not observe restrictions of range on policy attitudes and information seeking (variables that we similarly did not find affected by message framing).

A few future directions merit note. First, while we found limited heterogeneity by country, future research could explore heterogeneity in the effect of message framing across other dimensions (e.g., such as the tightness vs. looseness of the culture; Gelfand et al., 2021). Second, future research could examine the effects of loss vs. gain framing on health behavior regarding novel issues about which participants have not yet already crystalized opinions. Decisions regarding newly-emerging genetic testing could be one such example. Finally, while

the present work expanded the scope of analysis beyond behavior to include anxiety, future research is needed to further integrate emotional outcomes (both immediate and long-term) into cost-benefit calculations for implementing nudge-style interventions (e.g., framing).

Conclusion

In a global experiment spanning 84 countries and nearly 16,000 participants, loss vs. gain message framing had a widespread effect on self-reported anxiety while exerting no notable effects on cognitive and behavioral outcomes related to the COVID-19 pandemic. To the extent that policymakers and health organizations aim to minimize anxiety during a pandemic that has engendered high levels of stress and illness, our results provide evidence that gain framing may be superior to loss framing in communicating COVID-19 prevention messages. The results hold theoretical implications for multiple literatures, including research on health message framing, social influence, affective science, and public policy. More generally, the results underscore the lesson that, for policymakers and health organizations, empirical answers to global questions are attainable, freeing communicators from having to rely on either intuition or speculation about applications of theory in particular contexts (c.f., Haushofer & Metcalf, 2020).

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Figure 1. An example of a public service announcement from the CDC. This public service announcement used gain-framed messages to encourage mask-wearing (image from May, 2021).

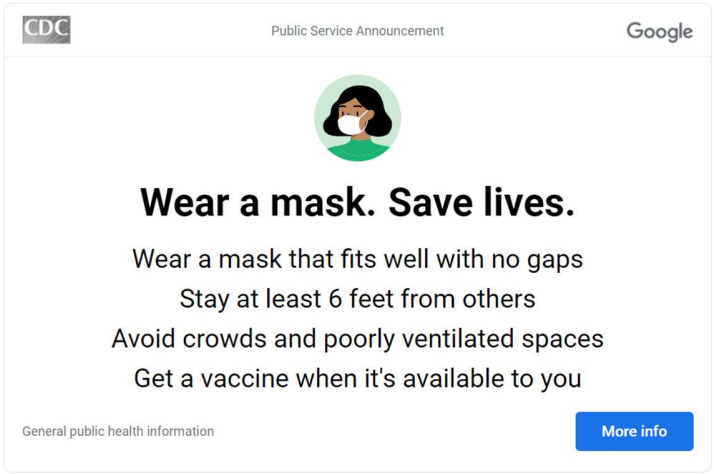

Figure 2. Loss-framed vs. gain-framed messages regarding COVID-19 influenced anxiety but not behavioral intentions, policy support, or information seeking. Cohen's *d* was used as the effect size, with positive values indicating higher levels of the outcome variable in the loss-framed vs. gain-framed condition. Dots and bars represent the effect size estimates and 95% confidence intervals respectively. Country-level effect size estimates are denoted in black and overall effect size estimates are denoted in yellow. Country names are denoted by their International Organization for Standardization codes. To improve the viewability of the x-axis, 40 countries with fewer than 30 participants per group (i.e., relatively wide error bars) are removed from the plot. Nevertheless, these countries are still included in the overall effect size estimates.