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The impact of rumination on information seeking, depressive symptomology, and protective actions in response to COVID-19

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ABSTRACT

A lengthy history of research in the crisis communication literature has documented sex differences in information needs and responses. Response Styles Theory is introduced as a potential explanatory mechanism for these findings, which may be attributable to differences in rumination tendency. A representative survey of over 5000 US residents explored information seeking and risk perceptions regarding the coronavirus disease 2019 (COVID-19) pandemic. Results support the argument that previously observed sex differences may be accounted for rumination, and rumination is predictive of specific (but not general) risk estimation. Rumination may also drive information seeking and subsequent depressive symptoms, especially among men. The findings are discussed in terms of their implications for risk and crisis communicators, and our consideration of gender norms and their impact on risk message processing.

Key words: mental health, COVID-19

INTRODUCTION

Research examining media use during crises consumption has suggested highly specified processes concerning source reliance and trust under such conditions. Media Dependency Theory (MDT)[1] argues that individuals are dependent on mediated information for information that they cannot or should not experience first-hand; as they become dependent on a given source for information they deem accurate and useful, they will return to that source and that source will subsequently become more influential on their thinking and decision making. MDT scholarship has further argued that uncertainty, ambiguity, and lack of clarity will intensify media dependencies.[1,2] It is likely than that in the face of some kind of widespread threat, such as a natural disaster or pandemic, individuals will actively consume information based on standing preferences and impressions of source credibility.[3]

It is troublesome that the same behaviors intended to achieve resolution and uncertainty reduction may produce depressive reactions that inhibit these very responses. For example, a number of studies following the 9/11 terrorist attacks found evidence of a link between extensive media consumption about the attacks and confusion, fear, depression, and post-traumatic stress disorder (PTSD) symptoms.[4,5] This raises the question of what might be driving people to consume information even though it produces negative psychological responses.

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RESPONSE STYLES THEORY AND RUMINATION

One overlooked approach to the connection between crisis information and negative psychological responses can be found in Response Styles Theory.[6] Conceptualized as a personality characteristic, ruminative coping tendencies[7-9] are a coping style typified by an inclination toward reliving and replaying traumatic or high-stress information in an attempt to understand it and respond. Individuals indicating ruminative coping styles are likely to experience longer and more severe distress responses to stressful events, which may in turn lead to acute depressive disorders.[10-12] Further, a substantive body of research has provided evidence for sex differences in rumination tendencies; a meta-analysis examining 59 studies on the matter concludes that women are more likely than men to exhibit ruminative tendencies, across a variety of outcomes.[13]

Research on this difference largely attributes it to gender norms and differential socialization experiences between men and women in western cultures. For example, numerous studies posit that women are more likely to receive reinforcement for the outward display of negative emotions, and may experience rumination when outward displays are not met with resolution.[14,15] Similarly, women, more so than men, may be socialized to monitor their own emotions and those of others as a function of gender norms concerning relational maintenance.[16,17] Nolen-Hoeksema et al.[18] add that women also experience more uncontrollable and negative events than men, further motivating a desire to control the environment. All three explanations have received considerable empirical support in the extant research.[19]

Given the strength of the evidence for differences in ruminative tendency, a few studies have suggested that rumination may account for sex differences in information seeking concerning crises and risks.[20] Lachlan et al.[21] found evidence that rumination tendency moderated sex differences in information seeking concerning a coastal storm threat, as these differences essentially disappeared at higher levels of rumination. To replicate this initial finding in a new context, the following hypotheses are offered:

> H1: Women will consume more information than men.

> H2: This will be moderated by rumination, such that sex differences attenuate at high rumination.

Taken together with evidence that seeking information may produce symptoms of depression,[4,5] it is likely that information seeking mediates sex differences in depressive symptomology. While Lachlan et al.[21] found evidence that previously documented sex differences in crisis information seeking may be attributable to rumination tendency, it is yet unknown if this heightened information seeking drives an anticipated increase in depressive symptomology, as per Nolen-Hoeksema et al.[10–12] To extend the findings of Lachlan et al.[21] and test the proposition that information seeking may play a role in subsequent depressive symptomology, the following hypotheses are proposed:

> H3: Women will report higher rates of depressive symptomology than men.

> H4: Information seeking mediates sex differences in depressive symptomology.

> H5: This mediation effect is moderated by rumination.

Further, rumination has also gone largely unexamined in the crisis communication literature. While Nolen-Hoeksema et al.[18] offer that rumination will drive individuals to attempt to control their environment, it is unclear if this implies specific risk assessments and/or attempts at engaging in protective actions. To that end, the following research questions are proposed:

> RQ1: Will rumination predict general risk perception?

RQ2: Will rumination predict perceptions of the probability of negative coronavirus disease 2019 (COVID-19) outcomes?

RQ3: Will rumination predict protective actions?

METHODS

The hypotheses and research questions above were examined in the natural laboratory of the 2020 COVID-19 pandemic in the United States. A representative sample of US citizens was collected through the Qualtrics survey panel service, between April 21 and June 23, 2020. The sample consisted of 5019 participants. Responses were screened for data quality, including evidence of straight-lining and irregular completion times. Participants were paid $2.25 for a fully completed and usable survey. Funding for the study was provided by a grant from the National Science Foundation, award number 2029258. Average respondent age was 45.56 (SD = 17.81). In terms of sex, 2435 respondents (48.5 percent) self-identified as male, 2558 (51.1 percent) identified as female, and 25 identified as other (with one missing case).

Instrumentation

Ruminative coping tendencies: The Ruminative Responses Scale[22] was used to measure trait propensity toward ruminative processing tendency. The scale consists of 22 items on a 4-point scalar ranging from "almost never" to "almost always." Confirmatory factor analysis supported the 1-factor scale in its intact form, CFI = .95, RMSEA = .06, α = .96.

Time spent seeking information: Participants were asked to consider their preferred media sources for information concerning COVID-19 and estimate their time spent seeking information on the pandemic. They were asked to estimate the number of hours they spend on a typical weekday, Saturday, and Sunday. Mean weekly hours spent information seeking across the sample was found to be 42.88 (SD = 44.59).

Depressive symptomology: To measure depressive symptoms, participants were asked to respond to the Beck Depression Inventory (BDI).[23] Evidence was once again detected for a one-factor measure in its original form, CFI = .95, RMSEA = .06, α = .95.

General risk perception: Participants completed the Event Hazard-Outrage Scale (EHOS).[24] Confirmatory Factor Analysis supported a two-factor solution with the removal of multiple items, CFI = .91, RMSEA = .09. Only the hazard factor was retained for the current analysis (α = .91).

Probability estimation: Three single-item indicators based on previous research assessed participants' understanding of the probability of COVID-19 infection and resultant consequences.[25] Participants were asked to estimate the percentage of the US population that will become infected (M = 48.47, SD = 26.50), the percentage of those infected that will develop a serious illness (M = 37.39, SD = 26.56), and the percentage of those infected that will die as a result (M =30.80, SD = 28.46).

Protective action: Participants were asked to respond to a series of seven yes/no questions concerning specific protective actions recommended by the CDC.[26] Responses of "yes" were then summed to create an additive measure of protective actions, (M = 6.11, SD = 1.36).

Demographics: Participants were asked a series of demographic questions, including age, sex, ethnicity, occupation, zip code and state (to verify respondent location), socioeconomic status, and highest level of education achieved. Germane to this study, the sample was found to consist of 2435 individuals who identified as male (48.5 percent) and 2558 who identified as female (51.0 percent). For purposes of analysis, sex was recoded into −1 for men and 1 for women, both for purposes of effect coding and ease of interpretation given the hypotheses and research questions.

RESULTS

Hypothesis 1 predicted that women would consume more information than men. An independent samples *t*-test failed to reveal differences between

men (M = 42.15, SD = 44.73) and women (M = 43.50, SD = 44.43) in their weekly media use, t (4792) = 1.06, n.s. Given the suppressor effect detected in prior research, analyses continued to test hypothesis 2.

The second hypothesis predicted that sex effects on information seeking would be moderated by rumination tendency. This moderation analysis was performed using PROCESS.[27] The moderating variable of rumination was mean-centered (M = 2.05, SD = 0.76). The overall model was found to be significant, F (3, 4790) = 412.32, p < .001, R^2 = .21; significant linear effects were detected for both rumination and the sex by rumination interaction; for rumination, b = 26.25, 95 percent CI = [24.75, 27.73], p < .001, and for the interaction effect b = −4.32, 95 percent CI = [−5.81, −2.84], p < .001. At low moderation, the effect of sex on information seeking was found to be b = 2.34, p < .004, 95 percent CI = [0.74, 3.49]. At the mean, this effect was found to be b = 0.95, n.s., 95 percent CI = [−2.07, 0.18], while at high moderation it was detected at −4.23, p < .001, 95 percent CI = [−5.83, −2.63]. In short, the direction of the relationship changed across different levels of rumination (see Figure 1). The trend in the data supports a general main effect for rumination on information seeking, but one in which the slope for men is steeper than that for women. This was supported in two post-hoc regression analyses; for women, rumination significantly predicted information seeking, F (1, 2426) = 376.95, p <.001, R^2 = 0.13, β = 0.37. For men, this effect was found to be significant at F (1, 2364) = 903.58, p <.001, R^2 = 0.28, β = 0.53.

Hypothesis 3 posited than women would experience greater depressive symptomology than men.

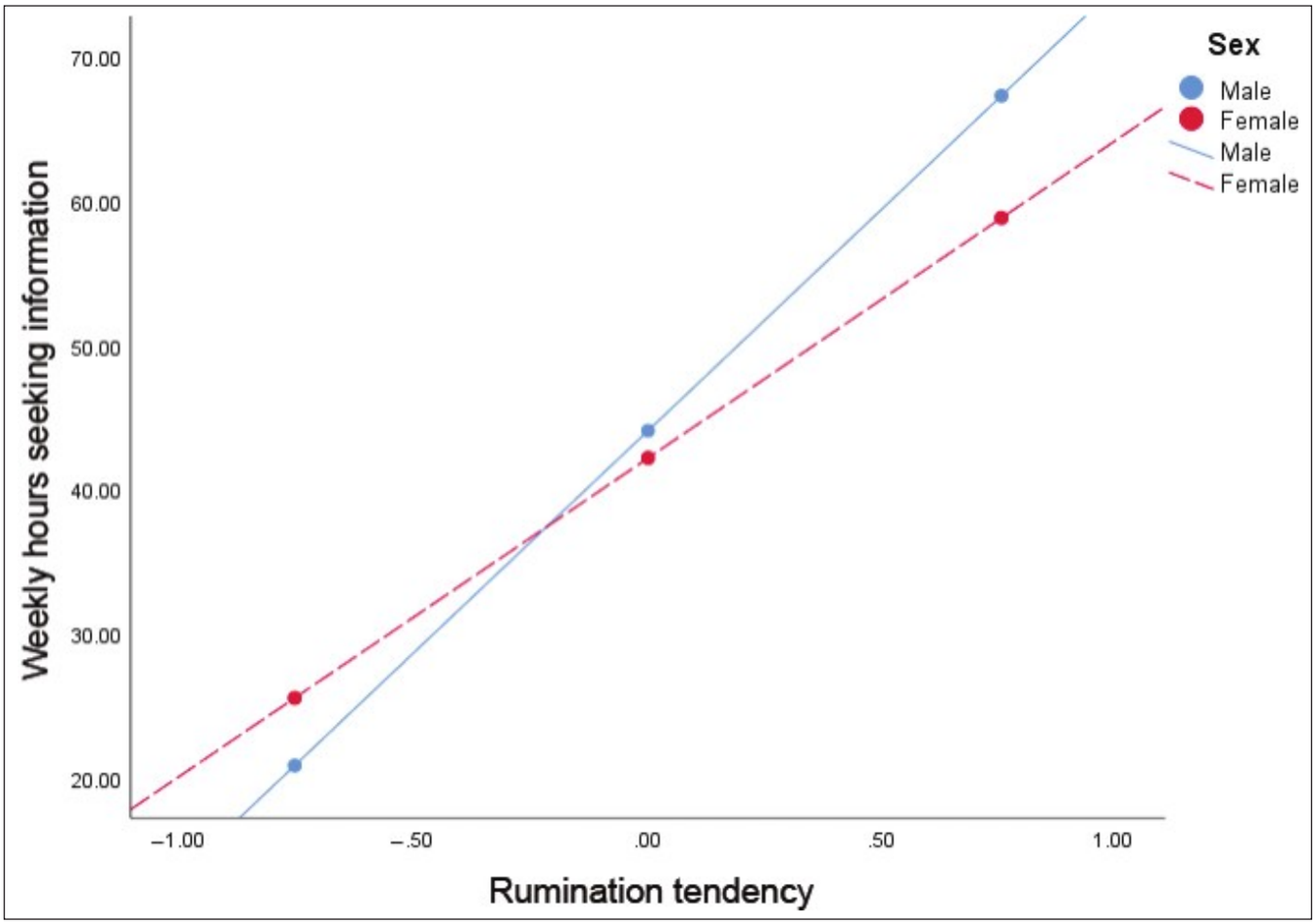

Figure 1: Rumination by sex interaction on information seeking.

A small but significant difference was detected, t (4991) = −4.72, p <.001, d = .14. Women (M = 1.74, SD = .65) reported higher levels of depressive symptomology than did men (M = 1.65, SD = .66) on a 4-point scalar. The analyses then went on to examine the impact of key predictors on depressive symptomology.

For the simple mediation model, overall model fit was found to be significant at F (2, 4791) = 531.14, p < .001, R^2 = .18. The test of the interaction effect was also found significant, F (1, 4790) = 41.12, p <.001. A significant main effect was detected for sex on depressive symptomology, b = 0.04, p < .001, 95 percent CI = [0.03, 0.06]. Evidence was not detected for an indirect effect through information seeking, b = 0.004, n.s., 95 percent CI = [−0.004, 0.12] (Figure 2).

Hypothesis 5 predicted a moderated mediation effect, whereby the indirect effect of sex on depressive symptomology would be moderated by rumination tendency (see Figure 3). The index of moderated mediation suggested a small but relevant moderated mediation process at −0.03, 95 percent CI = [−0.04, −0.02]. At low rumination the indirect effect for sex on depressive symptomology through information seeking was found to be 0.01, 95 percent CI = [0.01, 0.02]. At the mean, it was detected at −0.01, 95 percent CI = [−0.01, 0.01], while at high rumination it was detected at −0.03, 95 percent CI = [−0.04, −0.01]. In brief, there does not appear to be an indirect effect at mean rumination, and the effect at low rumination may not be pragmatically relevant. However, at high rumination there exists an indirect effect whereby men are seeking more information and are subsequently experiencing higher levels of depressive symptoms when they do. Additional interactions were probed to rule out alternate explanations for the findings regarding hypothesis 5. No interaction effect was detected for rumination and the direct effect of sex on depressive symptoms, nor was one detected for the direct effect of information seeking on depressive symptoms.

Research question 1 asked if rumination would predict general risk perceptions. This was examined through stepwise regression analysis, entering sex on the first step, followed by sex and rumination on the second. For the hazard outcome variable, the initial model was found to be statistically significant, though it accounted for a trivial amount of variance,

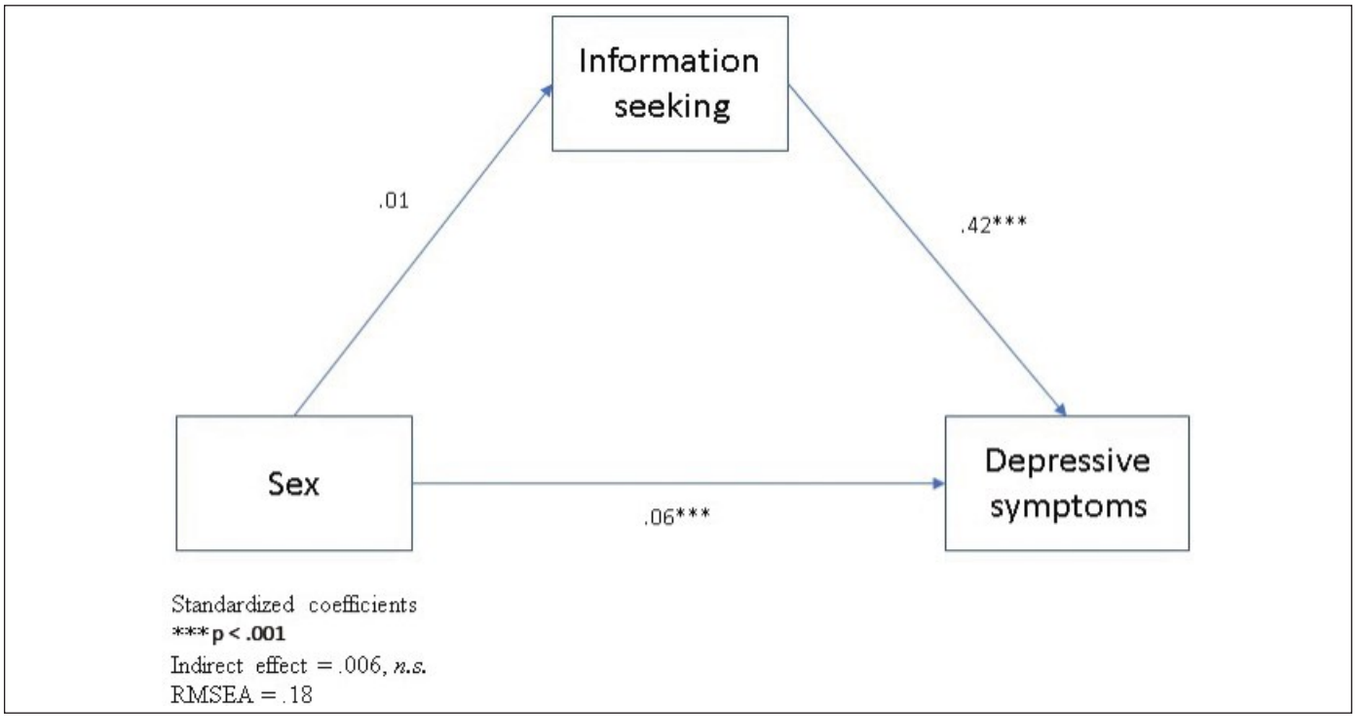

Figure 2: Mediation model.

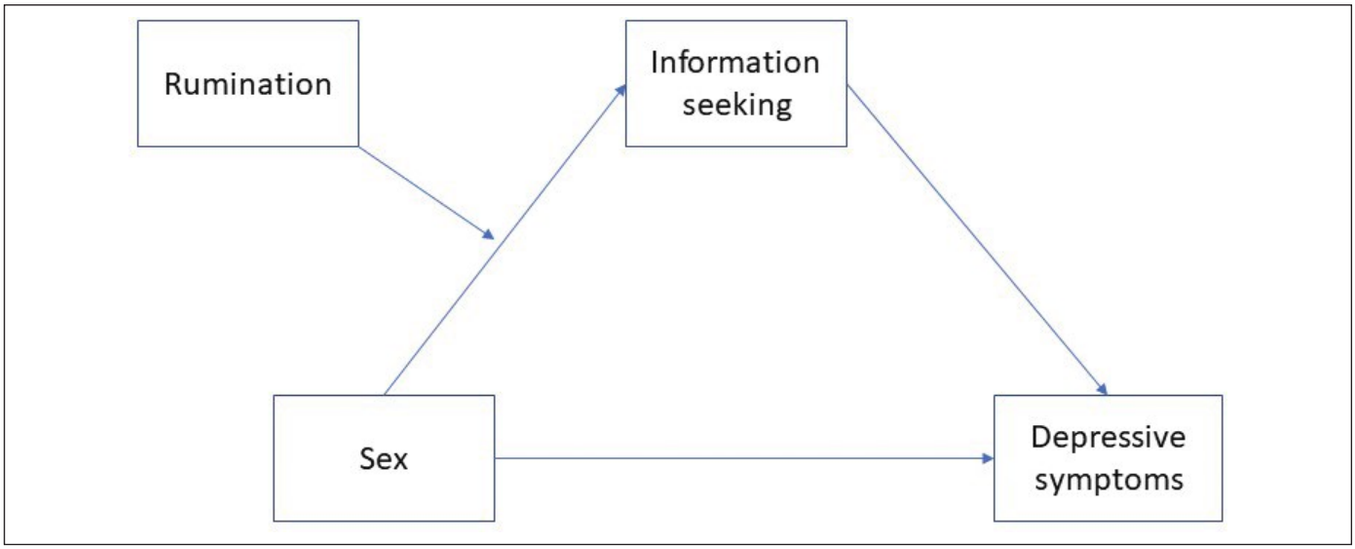

Figure 3: Conceptual model of moderated mediation.

F (1, 4991) = 28.79, $p < .001$ $R^2 = .01$. Entering rumination on the second step improved the model ($\beta = .15$), though it still accounted for a small degree of variance, F (2, 4990) = 73.21, $p < .001$, $\Delta R^2 = .03$.

A similar analytic strategy was followed for research question 2. For perceptions of the percentage of the US population that would contract COVID-19, the initial model was found significant, F (1, 4978) = 142.52, $p < .001$ $R^2 = .03$. The addition of rumination ($\beta = .25$) into the model improved model fit, F (2, 4997) = 238.27, $p < .001$, $\Delta R^2 = .06$. For severe health problems, the initial model was found significant, F (1, 4963) = 103.25, $p < .001$ $R^2 = .02$. Adding rumination ($\beta = .36$) substantively improved the model, F (2, 4962) = 441.00, $p < .001$, $\Delta R^2 = .13$. Likewise, for estimated deaths, the model for sex was small but significant, F (1, 4964) = 78.57, $p < .001$ $R^2 = .02$; adding rumination ($\beta = .40$) on the second step substantively improved the model, F (2, 4963) = 522.68, $p < .001$, $\Delta R^2 = .16$. Finally, this analysis was repeated for the summed measure of protective actions. The models, while statistically significant, do not account for relevant variance. Diagnostics did not reveal collinearity issues across any of the stepwise analyses above (all Variance Inflation Factor (VIF) < 1.2).

DISCUSSION

In the current findings, the failure of hypothesis 1 may be the first indication of erroneous attribution toward respondent sex. Significant differences were not detected between men and women in terms of the amount of aggregate information seeking concerning the virus, in contrast to prior studies. The uniqueness of the COVID-19 pandemic may be part of the reason. While past studies have documented such differences in motivation to seek information, they have centered on terrorist attacks, coastal storms, and other events with predictable and finite durations.[28,29] It may be the case that the lack of definite parameters surrounding the pandemic, coupled with the absence of a national-level response plan, produced an exceptionally high amount of uncertainty among the respondents. As such, it may be the case that most people are simply consuming a lot of content about the pandemic, and differences across audience segmentation seen in more predictable crises with definite timelines simply are not taking place. It should be noted that the grand mean for the sample was exceptionally high (M = 42.88), or an average of about 6 hours per day scanning for information. Emergency management agencies and those developing interventions aimed at encouraging positive behavior related to pandemics should be mindful of this difference, and in fact this may be positive; in a global crisis of this magnitude, it can be safely assumed that audiences are actively seeking information and updates to the extent that

they can give the information resources available to them.

Despite the failure of the first hypothesis, analyses continued to examine hypothesis 2—that any observed sex differences would be moderated by rumination, such that sex differences attenuate at high rumination. This decision was made considering another possible explanation for the failure of hypothesis 1—that sex differences were masked by rumination tendency, which may be a more robust predictor of information seeking. The findings provide some evidence that this may in fact be the case. In examining the moderating effect of rumination on sex differences in information seeking, Lachlan et al.[21] report that among those with low rumination tendencies, women consume substantially more information than men; however, this sex differences attenuated at high levels of rumination, where male and female respondents reported an almost identical number of hours spent for information seeking. In the current data, this moderating effect was even stronger, and *reversed the direction of the relationship* (Figure 1). Among low rumination women are reporting more information seeking than men; at mean rumination the scores are fairly close, and at high levels of rumination men are engaging in substantially more information seeking than women. This change in the direction of the means may account for the failure of the first hypothesis as it suggests different patterns of information seeking at high and low levels of rumination.

Hypotheses 3 and 4 then went on to examine sex differences in depressive symptoms, and extent to which information seeking may mediate these differences. A small but statistically significant difference was detected in the expected direction for hypothesis 3 in which women were reporting slightly higher levels of depressive symptoms than men. This is consistent with past research in the area suggesting stronger emotional responses by female audience members under conditions of crisis and duress.

Given the failure of hypothesis one—as men and women did not differ in terms of aggregate information seeking—the simple mediation hypothesis was unsurprisingly not supported (Figure 2) as the indirect effect of sex on depressive symptoms through information seeking approached zero. While further evidence was detected for a small effect for sex on depressive symptoms, along with a sizable effect for information seeking, there was almost no relationship between sex and information seeking and the mediation model thus failed. At least in the context of the COVID-19 pandemic, it does not appear as though men and women are experiencing different levels of information seeking on the whole, thus driving depressive symptomology. The simple relationship between information seeking and depression is confirmed, as per previous research.[5]

As an alternative, hypothesis 5 proposed a moderated mediation model, whereby the mediating effect of information seeking on sex differences is moderated by the effect of rumination (see Figure 3). The results support hypothesis 5, as at high levels of rumination, men are engaging in more information seeking and subsequently experiencing more depressive symptoms. This suggests a necessary conversation regarding gender norms and the processing of emotionally difficult information concerning health outcomes. The findings call into question a number of assumptions in the literature concerning sex differences in emotional responses to crisis and risk information and suggest consideration of differences in gender norms that may be driving depressive responses. Set to the mean for rumination, women and men in this study expressed highly similar levels of depressive symptoms. Women indicated slightly higher level of rumination than men, which is consistent with the arguments of Nolen-Hoeksema et al.[10,19] concerning socialization into subordinate roles, socialization into emotional support roles in interpersonal interactions, and inclination to make continual attempts at situational control in order to offset negative outcomes. The consistency in this finding across the rumination literature, and evident in the current data, raises concerns that gender normativity and socialization at an early age may have a real and tangible impact on depression responses at a later age.

While accounting for a smaller proportion of the sample, the findings for high rumination men also force a troubling consideration of gender norms. High

rumination men experienced the highest levels of information seeking, and this information seeking translated into high levels of depressive symptomology. A long history of research suggests that male gender norms reduce the range of accepted responses to information that is emotionally valanced as in western cultures men are likely to be socialized to restrain from outward affective behaviors.[30,31] Real[32] has argued that this leads to a type of "invisible depression" among men, who experience strong emotional reactions without an outlet for expression. While beyond the scope of this study, it may be the case that high rumination men are turning to mediated information to make sense of equivocal, high-risk events; over a long timeframe and without other coping mechanisms, this may push them toward deeper levels of depression.

Research questions 1 and 2then sought to examine the impact of rumination tendency on risk perceptions and specific estimates of risk probability. While statistically significant, the impact of rumination tendency on general risk perception is negligible. However, rumination significantly and substantially predicted specific estimates of infection rates, severe illness among those infected, and fatality rate. It should be noted that generalized perception of risk and specific probability estimates are related yet different outcomes, and there may be underlying processing tendencies accounting for the inconsistency of these results. Given that rumination requires some degree of active processing, one possible explanation may be found in recent work on fuzzy trace theory.[33]

This model suggests that more or less detail concerning an object or event may impact the ease with which the information is recalled, depending on the processing style of that individual.[34] People may be inclined to retain and recall "gist" content when the content is relatively low involvement, as heuristics and mental shortcuts may facilitate easier recall than highly detailed information. By way of comparison, something as specific as a risk estimate by percentage may not be as easy to compartmentalize into a heuristic or mental shortcut. Therefore, those ruminating on topics such as infection, illness, and fatality rates are experiencing more active processing, and are therefore likely to express higher levels of perceived risk.

Finally, the third research question explored the impact of rumination on protective actions. While statistically significant, the findings do not suggest a meaningful relationship between the two. Two competing explanations are offered. First, rumination does not necessarily translate into action. If those high in rumination tendency are consuming large amounts of information, and continue to scan until seeking some kind of resolution, this may leave less time to engage in mitigative behaviors, despite heightened risk perceptions.

Alternately, the recommended protective actions for COVID-19 are fairly simple, such as covering one's mouth when sneezing, disinfecting eating surfaces more frequently, and maintaining social distance. The grand mean for the index of protective actions was 6.1 (SD = 1.36) out of a maximum score of 7. The ease of the instructions, coupled with the long duration of the event, make these mitigative actions easy for most individuals. Future research on the relationship between rumination and protective actions may wish to examine it in the context of crisis that occur with greater spontaneity, or that require more complex protective actions (evacuation instructions, sheltering in place, etc.).

In summation, the findings suggest that rumination may play an important role in the way individuals process information concerning crises. If high ruminators are comparatively seeking more information, and this information seeking translates into depressive symptoms, then crisis and risk communication practitioners may wish to consider appeals to self-efficacy and the inclusion of mental health resources in crafting these messages. In the context of Response Styles Theory, the findings suggest a necessary research conversation about gender norms and socialization, and the extent to which these norms translate into maladaptive responses to crises. While this is only a single study, couched in a rather unique health crisis, it may be the case that differential norms and expectations associated with gender are translating into cognitive, emotional, and behavioral differences

in the processing of risk information. Further empirical inquiry is necessary to identify the steps in this process and develop best practices in health crisis response.

The potential importance of rumination as an explanatory mechanism for information consumption, negative mental health outcomes, and risk perceptions is also an important consideration for emergency management agencies evaluating the impact of messaging on affected audiences. Ultimately, emergency communication should aim to inform those affected and motivate them toward taking protective actions concerning their health. While rumination is predictive of risk perceptions, it is also predictive of depressive symptoms, which may inhibit behavioral responses if they translate into hopelessness or a failure to respond. Once again, this also highlights the importance of self-efficacy in risk messaging; it may be especially important to remind audiences that they have the power to effectively protect themselves, and these reminders may be especially critical in disaster and crisis scenarios that are global, overpowering, and lack a clear endpoint. The importance of self-efficacy in effective risk messaging is well documented in the literature.[35-38]

Alongside self-efficacy, the consideration of rumination as a variable of note is not dissimilar from the concept of pain catastrophization, which has been explicated elsewhere in the public health literature.[39-41] In this process, individuals who catastrophize a particular health risk or threat may be more inclined to subsequently make poor health decisions that are driven by hopelessness, or persistent unrealistic beliefs about the condition. Much of this literature has suggested that interventions aimed at reducing these unrealistic perceptions may be effective in promoting positive health outcomes. In a similar vein, the current data suggest that emergency managers and crisis communication practitioners find ways of countering misinformation and engendering a sense that positive outcomes can be achieved.

Further, emergency management agencies should consider the overall glut of information in the media environment concerning a given risk in order to ascertain the extent to which rumination and depressive symptomology may be associated with media use and information seeking. Much of what we already know about the impact of emergency messaging comes from research that has taken place in the context of novel circumstances and highly localized events; by way of comparison, a global pandemic may trigger different audience responses. The long, ongoing nature of the pandemic may be particularly impactful on mental health, especially when periods of quarantine and isolation are necessary.[42-44] Interventions and campaigns aimed at encouraging and maintaining good public health behaviors should be mindful of these widespread mental health concerns as they design and disseminate information.

EXECUTIVE SUMMARY

While a substantive body of research has examined information needs and use during emergencies and disasters, comparatively little has looked at underlying psychological mechanisms related to mental health. This study offers data suggesting that in the context of an ongoing public health crisis, such as a pandemic, ruminative information processing may drive specific depressive responses that should be taken into consideration when designing health interventions. Messaging focused on self-efficacy and behavioral responses may be especially critical if audiences are inclined to experience depression or hopelessness.

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