Full Length Article

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Humor styles predict emotional and behavioral responses to COVID-19

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Abstract: A correlational study ($n = 180$ adults) in the United States tested the hypothesis that self-directed humor styles predict emotional responses to COVID-19, specifically stress and hopelessness, and in turn predict engagement in protective behaviors. Results from a sequential mediation analysis supported our hypotheses. First, to the extent that people have a self-enhancing humor style they perceived less stress and hopelessness associated with COVID-19 and as a result reported engaging in more protective behaviors. Second, people higher in self-defeating humor style showed the opposite pattern; they perceived more stress and hopelessness due to COVID-19 and thus reported engaging in less protective behaviors. Implications for theory and application are discussed.

Keywords: health protective behaviors; health psychology; hopelessness; humor styles; stress

1 Introduction

On January 20th, 2020, the first case of a COVID-19 infection in the United States was identified in the state of Washington (Harcourt et al. 2020). This highly-contagious virus spread quickly; by March 1st the U.S. reached 30 cases; just ten days later, an additional 1,200 cases were confirmed, and by the end of the month the country reached 186,101 confirmed cases, with over 3,100 confirmed deaths. At the writing of this article 5 months later, the United States has 5.9 million confirmed cases, with over 190,000 deaths (Centers for Disease Control and Prevention 2020a).

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In March 2020, when the World Health Organization and federal governments throughout the world recognized the outbreak of COVID-19 as a pandemic, citizens throughout the world suddenly faced new and unprecedented challenges, adversities, and disruptions to daily life. Travel between countries was heavily restricted, with many states imposing quarantine on people who traveled to or from other states. Major sports leagues postponed or cancelled their seasons. Universities ended face-to-face instruction and cancelled graduation ceremonies. Organizations either adapted or closed. As a result, many people lost their jobs or were forced to switch to telework procedures, while those considered “essential” remained on the frontlines with a higher risk of exposure to the virus. Policy was quickly put into place to contain the pandemic. Large gatherings were restricted, leading people to delay or reformat events ranging from weddings and parties, to concerts and political conventions. Restaurants and bars were not permitted to offer indoor dining, and entertainment venues like movie theaters shut down entirely. Simultaneously, public health officials recommended a variety of protective measures designed to reduce the spread of the virus including the use of face coverings, frequent hand washing, social distancing, and self-isolation (Centers for Disease Control and Prevention 2020b).

Given the magnitude, pervasiveness, and swiftness of these changes, it's not surprising that this virus has taken an emotional toll on people. Indeed, the United States has seen an increase in rates of mental health problems, substance abuse, and suicidal ideation (Czeisler et al. 2020). Schimmenti et al. (2020) identified four domains of COVID-19–related stress: *bodily* (e.g. physical health concerns), *interpersonal* (e.g. social isolation, concerns for family members), *cognitive* (e.g. processing frightening information that is pertinent to managing the pandemic), and *behavioral* (e.g. concerns around going to the grocery store, sharing relevant information on social media). People also experience *economic* stress from financial hardship, job loss, and the resulting job search (American Psychological Association 2020a; Crayne 2020). In addition, *politics* surrounding the pandemic has created stressors, with two-thirds of people saying that the local, state and federal government's response to the pandemic is a significant source of stress (American Psychological Association 2020b). Indeed, the pandemic has also exacerbated the stress associated with the 2020 U.S. presidential election, raising concerns about the integrity of mass mail-in ballots (Dzhanova 2020).

Previous research has established that humor is an effective means of coping with adversity by, for instance, reducing perceived stress and promoting positive affect (e.g. Strick et al. 2009; Szabo 2007). Thus, it's not surprising that people have created and shared a plethora of humorous memes poking fun at the pandemic; the same trend emerged earlier the same year when memes about a potential World War III flooded social media after the assassination of an Iranian general (Romano

2020). Beyond *exposure* to humor, one's humor style—their habitual way of expressing humor in their daily lives—can serve to mitigate or exacerbate the psychological effects of stressors, hardships, and challenges (e.g. Cann et al. 2010; Martin et al. 2003).

Although previous research has connected humor styles to psychological well-being and ability to cope with adversity (e.g. Cann and Collette, 2014; Martin et al. 2003), no research to date has directly addressed the relationship between humor styles and engagement in protective *behaviors*, nor how humor styles relate to psychological distress caused by COVID-19. Thus, in the present study we investigated the ways humor styles relate to psychological responses to the stressors of COVID-19 and the likelihood of engaging in protective behaviors to contain the spread of COVID-19. The pervasiveness of the COVID-19 pandemic and the need for everyone to take action to diminish its impact underscores the importance and social relevance of the present research.

1.1 Humor styles, stress, and hopelessness

Martin et al. (2003) proposed that people spontaneously and habitually use humor in daily life in four different ways relating to whether the humor has beneficial or detrimental consequences for the self or others. People who utilize an affiliative humor style use humor in positive ways to affirm and amuse others. Those who have a self-enhancing humor style use humor in ways that benefit the self; specifically, they cope with adversity by using humor to reframe it in a more light-hearted, less threatening manner. People who endorse an aggressive humor style use humor in detrimental ways, teasing and ridiculing others as a means of insult and criticism. Lastly, people who have a self-defeating humor style habitually engage in humiliating and diminishing self-disparaging humor to entertain others or to avoid confronting problems and dealing with negative feelings (Stieger et al. 2011).

A considerable body of research has accumulated showing that various indices of psychological well-being correlate positively with the two beneficial humor styles (affiliative, self-enhancing), and negatively with the two detrimental humor styles (aggressive, self-defeating; for reviews, see Cann and Collette, 2014; Martin et al. 2003; Schneider et al. 2018). For instance, trait self-esteem positively correlates with affiliative and self-enhancing humor styles, and negatively with aggressive and self-defeating humor styles (Galloway 2010; Kuiper et al. 2004; Martin et al. 2003; Zeigler-Hill and Besser 2011). In addition, people report being generally happier insofar as they have a beneficial humor style; they are less happy insofar as they have a self-defeating or aggressive humor style (e.g. Ford et al. 2014;

Martin et al. 2003). Schneider et al. (2018) report similar findings for depression, optimism, and life satisfaction.

Cann et al. (2010) more fully enumerated the relationship between humor styles and psychological well-being. They examined how well each humor style predicts hopefulness and stress while controlling for the influence of the three other humor styles. They found that only the two self-directed humor styles (self-enhancing and self-defeating) emerged as significant predictors. People reported greater hope and decreased stress to the extent they were high in self-enhancing humor; they reported less hope and higher stress insofar as they were high in self-defeating humor. Similarly, Cann and Cann (2013) found that a self-enhancing humor style was associated with less chronic worry, whereas a self-defeating humor style was associated with greater chronic worry. The other-directed humor styles (affiliative, aggressive) did not significantly relate to chronic worry. Further, Cann and Collette (2014) found that when controlling for the influence of the other three humor styles, only the self-enhancing humor style significantly predicted enduring positive affect over a seven-day period.

On the basis of this research, we propose that self-enhancing and self-defeating humor styles are related to the amount of stress and hopelessness people feel in response to the threat of COVID-19. Specifically, we hypothesize that people experience less stress and hopelessness in response to the threat of COVID-19 to the extent they have a self-enhancing humor style. Conversely, we hypothesize that people experience more stress and hopelessness to the extent they have a self-defeating humor style.

The experiences of stress and hopelessness are known to be positively correlated (e.g. Nalipay and Ku 2019; O'Connor et al. 2004; Yarcheski and Mahon 2016; Yarcheski et al. 2004), though the causal direction of this relationship appears to depend on whether the two variables are conceptualized as stable individual difference variables or as transitory psychological states induced by specific events. Cann et al. (2010) demonstrated that a chronic disposition of hopelessness predicted reports of how stressful one's life is. In contrast, Elliott and Frude (2001) found that the experience of stressors in daily life (e.g. one's own health problems or those of loved ones, change in work or social activities, new living conditions) predicts momentary feelings of hopelessness. Elliott and Frude (2001) surveyed patients admitted to an inpatient treatment unit following self-poisoning (i.e. deliberately consuming a substance in excess of the prescribed or recommended dosage). When controlling for depression and coping style, the number of stressful life events that one experienced predicted momentary hopelessness, which in turn predicted suicidal intent. Thus, the experience of stressful life events appears to foster feelings of hopelessness.

Because we are interested in stress and hopelessness specifically related to the COVID-19 pandemic, we propose that the relationship between humor style and hopelessness is mediated by perceived stress. Specifically, we hypothesized that a self-enhancing humor style is associated with less stress in response to COVID-19 and thus less hopelessness; conversely, a self-defeating humor style is associated with greater stress in response to COVID-19 and thus greater hopelessness.

1.2 Predicting health protective behaviors

Protective behaviors refer to actions that maintain health and prevent the exacerbation of existing health problems (e.g. taking medication, eating healthy, practicing proper hygiene; Ping et al. 2018). In the current climate of COVID-19, for instance, one could engage in protective behaviors advised by the CDC for avoiding contracting and spreading the virus, such as engaging in social distancing, wearing a face covering in public, and regularly washing their hands.

The extent to which people engage in protective behaviors appears to be affected by how hopeful they are in the efficacy of those behaviors. In a survey of patients with Type-2 diabetes, Walker et al. (2012) explored how *fatalism* (composed of hopelessness, powerlessness, and emotional distress) relates to the practice of protective self-care behaviors (e.g. dieting, exercising, testing blood sugar, and taking medication as directed). They found that patients were less likely to engage in protective behaviors insofar as they had a hopeless, fatalistic view of their disease. Notably, these effects remained even after controlling for depressive symptoms. That is, hopelessness, powerlessness, and distress about one's diabetes were each associated with decreased performance of the relevant protective behaviors apart from the experience of depression. Similarly, Elliott and Frude (2001) found that hopelessness correlated negatively with problem-focused coping behaviors (e.g. attempts to take corrective action to address stressors) among patients who recently self-poisoned. Gebreweld et al. (2018) found similar trends on treatment adherence among tuberculosis patients.

On the basis of these findings, we hypothesized a sequential mediation model by which self-enhancing and self-defeating humor styles relate to engagement in protective behaviors (see Figure 1). Specifically, a self-enhancing humor style should predict greater protective behaviors by reducing COVID-19-related stress and hopelessness. Conversely, we hypothesize that self-defeating humor style predicts less engagement in protective behaviors by increasing COVID-19-related stress and hopelessness.

Figure 1: Hypothesized sequential mediation model.

In addition to stress and hopelessness, perceived threat predicts engagement in self-protective behaviors. People are more likely to comply with medical recommendations if they believe an illness threatens their well-being. In a study on the 2009 H1N1 (“swine flu”) pandemic, for example, perceived threat of the H1N1 virus was one of the strongest predictors of engagement in medically-recommended behaviors (Prati et al. 2011). Particularly relevant to the present study, Harper et al. (2020) reported that perceived threat of COVID-19 was correlated with self-reported behavioral changes (e.g. hand washing, stockpiling food or medicine). In addition, perceived health threat has also been linked to greater stress and hopelessness (e.g. Fry and Prentice-Dunn 2005). Accordingly, in the present study we measured perceived threat of COVID-19 and treated it as a covariate in all analyses.

2 Method

2.1 Overview

This study was conducted through Amazon Mechanical Turk (mTurk), an online platform for people to participate in studies researchers post to the site. Past research has demonstrated that the reliability of mTurk is comparable to in-person lab-based administration (Buhrmester et al. 2011; Casler et al. 2013), and offers both greater diversity and more accurate representation of the general United States population than typical college sample pools (McCredie and Morey 2018; Miller et al. 2017). Upon accessing a link to the survey through mTurk, participants read a brief introduction and proceeded to complete measures of (1) humor styles, (2) perceived threat of COVID-19, (3) perceived stress associated with COVID-19, (4) hopelessness associated with COVID-19, and (5) engagement in protective behaviors against COVID-19.

2.2 Participants

A total of 225 adult participants completed our survey. We removed the responses of 45 participants who indicated response bias or inattention (e.g. using two repeating keystrokes for all dependent measures, rapid survey completion [below 3 standard deviations of mean completion time], irrelevant responses in open-ended questions), leaving a final sample of 180 participants (91 males, 87 females, 2 “other”). The average age was 39.20 years old (with 39 participants falling into the 50+ age group). At the time of data collection, 77 (34%) participants reported living in one of the ten states most affected by COVID-19 (in descending order by number of reported cases: New York, New Jersey, California, Michigan, Florida, Massachusetts, Illinois, Louisiana, Pennsylvania, and Washington). These states collectively made up 77.41% of the country’s 214,879 known cases.

2.3 Procedure

Upon accessing the survey participants read an overview of the study as an investigation of “the relationship between humor styles (how people use humor in daily life) and stress in light of the COVID-19 pandemic.” After providing informed consent participants completed the following measures: (a) Martin et al.’s (2003) Humor Styles Questionnaire (HSQ), (b) an adaptation of Cohen et al.’s (1983) Perceived Stress Scale (PSS), (c) a measure of perceived threat from COVID-19, (d) an adaptation of the Beck Hopelessness Scale (BHS; Abbey et al. 2006; Fisher and Overholser, 2013), and (e) a measure of participants’ engagement in protective behaviors we developed based on recommendations on the CDC’s COVID-19 resources website (Centers for Disease Control and Prevention 2020c). Participants then completed a standard demographics survey and wrote one sentence describing their reactions to the study. Finally, participants were thanked for their participation and exited the study.

2.4 Measures

2.4.1 Humor Styles Questionnaire (HSQ)

Martin et al.’s (2003) HSQ contains four 8-item subscales assessing the degree to which one habitually engages in affiliative humor (e.g. “I don’t have to work very hard at making other people laugh- I seem to be a naturally humorous person.”), self-enhancing humor (“If I am feeling depressed, I can usually cheer myself up

with humor.”), aggressive humor (“If someone makes a mistake, I will often tease them about it.”) and self-defeating humor (“I let people laugh at me or make fun at my expense more than I should.”). Participants indicated agreement with each item on a 7-point scale ranging from 1 (*Strongly Disagree*) to 7 (*Strongly Agree*). Cronbach’s α was 0.86 for the self-enhancing humor scale and 0.84 for the self-defeating humor scale.

2.4.2 Perceived Stress Scale (PSS)

We assessed participant’s stress resulting from COVID-19 by adapting four items from Cohen et al.’s (1983) PSS. Upon accessing this survey, participants read the following instructions:

The questions on this page ask you about your thoughts and feelings during the PAST WEEK in response to COVID-19. In each case, please indicate HOW OFTEN you have felt or thought a certain way. Although some of the questions are similar, there are differences between them and you should treat each on as a separate question. The best approach is to answer each question fairly quickly, that is, don’t try to count up the number of times you felt a certain way, but rather, indicate what seems like a reasonable estimate.

A sample item reads “In the past week, how often have you felt ‘stressed’ because of COVID-19?” Participants responded to each item on a 5-point scale ranging from 1 (*Never*) to 5 (*Very Often*). Cronbach’s α was 0.91.

2.4.3 Perceived threat from COVID-19

We developed a 3-item survey to measure participants’ perceived threat from COVID-19. The items were displayed on the same page as the stress items described above, and thus shared the same instructions. The items¹ read as follows: (1) “All things considered, how dangerous do you think COVID-19 is?,” (2) “How threatening do you perceive COVID-19 to be to your own health?,” and (3) “How threatening do you perceive COVID-19 to be to your community?.” Participants responded on a 5-point scale ranging from 1 (*Not at all*) to 5 (*Extremely*). Cronbach’s α was 0.86.

¹ These items were crafted to reflect health-related threat. At the time the study was conducted, the economic impact of the pandemic was not the focus of public attention, and so economic-based threat was not directly assessed.

2.4.4 Beck Hopelessness Scale (BHS)

Upon accessing the BHS participants read the following instructions:

People have used each of the statements below to describe themselves in response to COVID-19. Read each statement and then select the response that best indicates how you feel right now, at this moment in light of COVID-19. There are no right or wrong answers. Do not spend too much time on any one statement but give the answer which seems to describe your present feelings best.

Participants then read seven statements designed to assess their feelings of hopelessness “at this moment in light of COVID-19” (e.g. “My future seems dark to me.”). Participants responded to each item on a 5-point scale ranging from 1 (*Not at all*) to 5 (*Very much*). Cronbach’s α was 0.90.

2.4.5 Protective behaviors

Upon accessing this survey participants read the following instructions: “We are interested in the types of protective behaviors you are engaging in during the COVID-19 outbreak. Please rate the extent to which you willfully engage in each behavior.” The survey consisted of seven items: (1) “I wash my hands often, using either hand sanitizer or soap and water,” (2) “I avoid close contact with others who are sick,” (3) “I avoid touching my face with unwashed hands,” (4) “When I go out, I practice social distancing, putting distance between myself and other people when possible,” (5) “If I feel sick, I stay home,” (6) “I cover my mouth when I cough, either with a tissue or into the inside of my elbow,” and (7) “I clean frequently touched surfaces daily (e.g. keyboards, tables, handles).” Participants responded to each item on a 5-point scale ranging from 1 (*Not at all*) to 5 (*Very much*). Cronbach’s α was 0.86.

3 Results

3.1 Overview

We first present descriptive statistics for the study variables. Then, we present separate serial mediation analyses for self-enhancing and self-defeating humor styles to test our hypotheses represented in the sequential mediation model depicted in Figure 1. For both analyses, we used Hayes’ (2017) bootstrapping macro for SPSS (PROCESS v3.1), computing bias-corrected 95% confidence intervals for 5,000 samples with replacement. The bootstrapping procedures determine if an

effect is different from zero by providing a 95% confidence interval for the population value for that effect; if zero is not in the 95% confidence interval, the effect is significant at $p < 0.05$. We treated participants' age group² and perceived threat from COVID-19 as covariates. A post hoc Monte Carlo power analysis on the indirect effect (with 2,000 replications and 20,000 draws per replication; Schoemann et al. 2017) of humor style on engagement in protective behavior through stress and hopelessness shows we attained 56% power. Finally, preliminary analyses revealed no significant effects involving participant gender, thus we collapsed all analyses across gender.

3.2 Descriptive statistics

We present descriptive statistics for the measures of humor styles, threat, stress, hopelessness, and engagement in protective behaviors in Table 1. As expected, stress from COVID-19 positively correlated with hopelessness from COVID-19 ($r = 0.43$, $p < 0.001$), and hopelessness negatively correlated with engagement in protective behaviors ($r = -0.29$, $p < 0.001$); the correlation between stress and engagement in protective behaviors was not significant ($r = 0.10$, $p = 0.188$). Also as

Table 1: Means, standard deviations, & correlation matrix.

	1.	2.	3.	4.	5.	6.	7.	8.
1. Affiliative HSQ	1	0.55**	0.12	0.07	-0.17*	-0.26**	-0.27**	0.19*
2. Self-Enhancing HSQ		1	0.01	-0.00	-0.06	-0.23**	-0.44**	0.35**
3. Aggressive HSQ			1	0.51**	-0.09	0.01	0.24**	-0.19*
4. Self-Defeating HSQ				1	0.10	0.13	0.20**	-0.17*
5. Threat					1	0.43**	0.16*	0.36**
6. Stress						1	0.43**	0.10
7. Hopelessness							1	-0.29**
8. Protective behaviors								1
Mean	5.27	5.06	3.44	3.58	3.63	2.81	2.17	4.42
Standard deviation	1.02	0.98	1.02	1.10	0.96	1.03	0.90	0.64

* $p < 0.05$, ** $p < 0.01$.

² We use a categorical age group factor (rather than simply continuous age) because, at the time of data collection, it was highly publicized in news and social media that “people over the age of 50” were at a higher risk for complications and death from COVID-19 (e.g. Dowd et al. 2020; Godoy 2020). This naturally creates a dichotomy of “high risk” and “low risk” based on whether a person is younger than 50 years old.

predicted, perceived threat from COVID-19 positively correlated with stress ($r = 0.43, p < 0.001$), hopelessness ($r = 0.16, p = 0.034$), and engagement in protective behaviors ($r = 0.36, p < 0.001$). Furthermore, self-enhancing humor style negatively correlated with stress ($r = -0.23, p = 0.002$) and hopelessness ($r = -0.44, p < 0.001$), and positively correlated with engagement in protective behaviors ($r = 0.35, p < 0.001$). Self-defeating humor style did not correlate significantly with stress ($r = 0.13, p = 0.090$). However, it positively correlated with hopelessness ($r = 0.20, p = 0.006$), and negatively correlated with engagement in protective behaviors ($r = -0.17, p = 0.024$).

3.3 Self-enhancing humor style

We first hypothesized that a self-enhancing humor style is associated with less stress in response to COVID-19 and thus less hopelessness. Supporting our hypothesis, we found that self-enhancing humor style was directly and negatively related to stress due to COVID-19, $b = -0.22, t(176) = -3.10, p = 0.002, 95\% \text{ CI } [-0.36, -0.08]$. Furthermore, we observed a direct and negative relationship between self-enhancing humor style and hopelessness about COVID-19, $b = -0.33, t(175) = -5.54, p < 0.001, 95\% \text{ CI } [0.45, -0.21]$. Finally, the relationship between self-enhancing humor style and hopelessness was mediated by perceived stress associated with COVID-19 stress, *boot coefficient for the indirect effect* = $-0.07, SE = 0.03, 95\% \text{ CI } [-0.13, -0.02]$. Together these findings suggest that a self-enhancing humor style buffers one against stress from COVID-19, thereby mitigating feelings of hopelessness.

We also hypothesized that a self-enhancing humor style predicts greater engagement in protective behaviors because it reduces COVID-19-related stress and hopelessness. Accordingly, there was a significant indirect effect through stress and hopelessness, *boot coefficient for the indirect effect* = $0.01, SE = 0.01, 95\% \text{ CI } [0.00, 0.03]$. There was an additional indirect effect in the same direction through just hopelessness, *boot coefficient for the indirect effect* = $0.07, SE = 0.02, 95\% \text{ CI } [0.03, 0.12]$. Unexpectedly, there remained a direct effect of self-enhancing humor on engagement in protective behavior, $b = 0.18, t(174) = 3.92, p < 0.001, 95\% \text{ CI } [0.09, 0.27]$. Collectively, these results suggest that people with a more self-enhancing humor style engage in more protective behaviors against COVID-19, in part, *because* they experience less stress and hopelessness in response to COVID-19 (see Figure 2).

Figure 2: Mediation model for self-enhancing humor Style. $*p < 0.05$.

3.4 Self-defeating humor style

We hypothesized that a self-defeating humor style is associated with more stress in response to COVID-19 and thus greater hopelessness. Contrary to our hypothesis, self-defeating humor style did not significantly relate to stress from COVID-19, $b = 0.09$, $t(176) = -1.34$, $p = 0.182$, 95% CI $[-0.04, 0.22]$. This suggests self-defeating humor has no relationship with stress from COVID-19. Self-defeating humor style did, however, relate significantly and positively to hopelessness about COVID-19, $b = 0.13$, $t(175) = 2.25$, $p = 0.026$, 95% CI $[0.02, 0.24]$. Finally, there was not a significant indirect relationship between self-defeating humor and hopelessness through stress, *boot coefficient for the indirect effect* = 0.03, SE = 0.03, 95% CI $[-0.09, 0.02]$. Overall, it appears that people with a more self-defeating humor style experience more hopelessness about COVID-19 independent of perceived COVID-19-related stress.

Regarding engagement in protective behaviors, we hypothesized that a self-defeating humor style predicts less engagement in protective behaviors because it increases COVID-19-related stress and hopelessness. Partially supporting our hypothesis, we found that self-defeating humor style is indirectly and negatively related to engagement in protective behaviors through hopelessness, *boot coefficient for the indirect effect* = -0.03 , SE = 0.02, 95% CI $[-0.08, -0.00]$. Finally, unlike self-enhancing humor style, the direct relationship between self-defeating humor and engagement in protective behavior was not significant, $b = -0.07$, $t(174) = -1.87$, $p = 0.063$, 95% CI $[-0.15, 0.00]$. Overall, then, it appears that insofar as people have a self-defeating humor style, they engage in fewer protective behaviors because of their hopelessness about COVID-19 (see Figure 3).

Figure 3: Mediation model for self-defeating humor Style. $^*p < 0.05$.

3.5 Exploratory analysis

In an effort to better understand the unanticipated direct positive relationship between self-enhancing humor style and engagement in protective behaviors, we examined whether the degree of perceived threat from COVID-19 moderates the effect of self-enhancing humor style on engagement in protective behaviors. We regressed engagement in protective behaviors onto standardized scores for the self-enhancing humor style and perceived threat measures, the interaction between self-enhancing humor and threat and the covariates.³ We entered self-enhancing humor style, threat, and the covariates in the first step of the model, and the interaction term into the second step. The first step of the model accounted for 33.35% of the variance, $R^2 = 0.33$, $F(5, 174) = 17.41$, $p < 0.001$. Adding the interaction term to the second step of the model accounted for an additional 6.86% of the variance, $\Delta R^2 = 0.07$, $F(6, 173) = 19.34$, $p < 0.001$. The addition of the interaction term significantly improved the model.

We computed simple slopes for 1 SD above and below the mean on the perceived threat measure through the PROCESS macro using the bootstrapping procedure with 5,000 resamples (Hayes 2017; see Figure 4). Among people perceiving high levels of threat, self-enhancing humor was not associated with engagement in protective behaviors, $b = 0.02$ SE = 0.06, $t(173) = 0.36$, $p = 0.719$, 95% CI [-0.09, 0.13], $r = 0.03$. Among people experiencing low threat, self-enhancing humor was positively associated with engagement in protective behaviors, $b = 0.34$, SE = 0.06, $t(173) = 6.02$, $p < 0.001$, 95% CI [0.23, 0.45], $r = 0.42$. In other words, self-enhancing humor predicts greater engagement in protective behaviors particularly when perceived threat of COVID-19 is low.

3 For the exploratory analysis, “the covariates” include age group, stress from COVID-19, and hopelessness about COVID-19. This is done to explore the moderation on specifically the direct effect within the mediation model illustrated in Figure 1.

Figure 4: Perceived threat moderates effect of self-enhancing humor style on engagement in protective behaviors.

We repeated the same analysis, replacing self-enhancing humor with self-defeating humor. The first step of the model accounted for 28.90% of the variance, $R^2 = 0.29$, $F(5, 174) = 14.15$, $p < 0.001$. Adding the interaction term to the second step of the model accounted for an additional 2.92% of the variance, $\Delta R^2 = 0.03$, $F(6, 173) = 13.46$, $p < 0.001$, a significant improvement to the model.

Simple slopes analyses showed similar results. Specifically, self-defeating humor was not associated with engagement in protective behaviors among people perceiving high levels of threat, $b = 0.02$, $SE = 0.05$, $t(173) = 0.36$, $p = 0.722$, 95% CI $[-0.08, 0.12]$, $r = 0.03$. But among people perceiving low levels of threat, self-defeating humor was negatively associated with engagement in protective behaviors, $b = -0.15$, $SE = 0.05$, $t(173) = -3.17$, $p = 0.002$, 95% CI $[-0.25, -0.06]$, $r = 0.23$. That is, self-defeating humor predicts decreased engagement in protective behaviors only for people who don't perceive COVID-19 as a threat (see Figure 5).

Figure 5: Perceived threat moderates effect of self-defeating humor style on engagement in protective behaviors.

4 Discussion

In the present study, we investigated the ways humor styles relate to psychological responses to the stressors of COVID-19 and the likelihood of engaging in protective behaviors. We hypothesized that the two self-directed humor styles from Martin et al.'s (2003) model—self-enhancing and self-defeating humor styles—would differentially relate to feelings of stress and hopelessness related to COVID-19, which would in turn affect engagement in relevant protective behaviors. Supporting our hypotheses, we found that insofar as people have a self-enhancing humor style, they reported less stress and hopelessness related to COVID-19, and as a result engaged in more protective behaviors to stop the spread of the virus. Conversely, those with a more self-defeating humor style reported experiencing more hopelessness (but not more stress) associated with COVID-19 and thus engaged in fewer protective behaviors. Notably, the effects for self-enhancing humor were stronger than those for self-defeating humor across all outcomes. This suggests that people who strongly endorse both styles should ultimately experience less stress and hopelessness and engage in more protective behaviors, though perhaps not to the same extent as those who endorse only the self-enhancing humor style (for an overview of humor style clusters, see Galloway 2010).

We did not find the hypothesized positive relationship between self-defeating humor style and stress found in previous research (e.g. Cann et al. 2010). Cann et al. (2010) assessed global stress using the Perceived Stress Scale (PSS) whereas we used an adaptation of the PSS to assess stress specifically related to COVID-19. This inconsistency between our findings and those of previous research raises the possibility that the relationship between self-defeating humor and perceived stress depends on whether perceived stress is operationalized as global or specific. Further research is necessary to more fully explore this possibility.

Interestingly, self-enhancing humor predicted engagement in protective behaviors apart from experiences of COVID-related stress and hopelessness. Exploratory analyses revealed that perceived threat from COVID-19 moderated this relationship. Specifically, humor styles related to engagement in protective behaviors to the extent that people did not perceive much threat from COVID-19. That is, people feeling less threatened by COVID-19 engage in more protective behaviors to the extent they have a self-enhancing humor style; they engage in less protective behaviors insofar as they have a self-defeating humor style. In contrast, people feeling more threatened do not differentially engage in protective behaviors as a function of their humor styles.

One explanation for these findings is that people with a self-enhancing humor style versus a self-defeating humor style are differentially able to regulate or

control how they experience and express negative emotions, in general, apart from stress and hopelessness, which in turn also relate to engagement in protective behaviors. Indeed, the ability to regulate emotions has been linked to a number of protective health behaviors, such as treatment adherence (Sofia et al. 2018), condom use (Brown et al. 2013), and healthy diet choices (Caldwell et al. 2018). Furthermore, Schimmenti et al. (2020) suggested that better emotion regulation relates to more effective coping with COVID-related fears.

Importantly, self-enhancing and self-defeating humor styles both relate to emotion regulation. Boerner et al. (2017), for instance, surveyed people who have experienced trauma and found that self-enhancing humor predicted fewer emotion regulation difficulties, while self-defeating humor style predicted more emotion regulation difficulties. Focusing solely on the maladaptive humor styles, Poncy (2017) found that self-defeating humor style mediated the detrimental effects of attachment anxiety on emotion regulation. And when looking specifically at regulating the emotion of anger, self-enhancing humor is associated with more positive management of the feeling and expression of anger, while those with a high self-defeating humor style are more inclined towards unhealthy anger suppression (Torres-Marín et al. 2018). Thus, it is possible that by facilitating or impairing one's ability to positively regulate emotions in general, a self-enhancing humor style and a self-defeating humor style foster a general emotional outlook in response to COVID-19 that relates to proclivity to engage in protective behaviors.

Though this study focused on the self-directed humor styles, correlation tests revealed relationships for both the affiliative and aggressive humor styles. Consistent with Cann et al. (2010), we found that affiliative humor style related to stress, hopelessness and protective behaviors in the same way but not as strongly as self-enhancing humor (see Table 1). Further, self-enhancing and affiliative humor styles likely relate to psychological and behavioral responses to the stressors of COVID through different mechanisms. People with a self-enhancing humor style use humor as a way of re-appraising stressful events, whereas those with an affiliative humor style use humor in interpersonal settings to enhance social relationships (Martin et al. 2003). Thus, an affiliative humor style likely relates to responses to COVID-19 through more interpersonal or relational mechanisms. It is possible that people with an affiliative humor style experience less stress and hopelessness in response to COVID-19, not because they use humor to re-appraise the stressors of COVID-19, but because they have more supportive and reassuring relationships. Likewise, they might engage in more protective behaviors because they experience greater social support for doing so (Richards and Kruger 2017).

Finally, we found that people tend to experience more hopelessness and engage in fewer protective behaviors insofar as they have an aggressive humor

style. It is possible that aggressive humor style negatively predicts engagement in protective behaviors through other personality variables. People higher in aggressive humor tend to be more impulsive and prone to taking risks (Cann and Cann 2013). Avoidance of protective behaviors, then, could be an expression of those personality traits.

4.1 Implications: using humor adaptively

In the present research, we conceptualized humor styles as a personality variable or trait that guides the way a person thinks about and responds to events across different contexts. Recent research, however, has shown that humor characterized by the different humor styles can be activated externally in a given context, and that engaging in contextually activated self-enhancing humor can have beneficial psychological outcomes (Ford et al. 2017; Samson and Gross 2012). Ford et al. (2017, Exp 3) for instance, presented participants with the stressful situation of taking a difficult math test. Participants exposed to self-enhancing humor (e.g. jokes that made math tests or math in general seem inconsequential or absurd in some way) while awaiting the test reported less anxiety associated with the test compared to participants in a control condition. Nabi (2016) found similar effects of humor for reducing anxiety around self-examinations for breast and testicular cancers.

These studies suggest that humor styles can function, not only as personality traits that guide stable patterns of behavior, but as conscious strategies that people can learn to use to cope with potentially stressful events in the immediate situation. Indeed, researchers have shown that people can be coached to interpret an event using humor characterized by the different humor styles (McGhee 2010; Olah et al. 2019; Ruch et al. 2018). In a study focusing on military veterans, for instance, Olah et al. (2019) found that relative to a control group, participants in a 7-week stand-up comedy class (modeled after an established humor training program, McGhee 2010) experienced an increase in their self-enhancing humor style, which in turn enhanced their psychological well-being (i.e. reduced stress, improved resilience).

This line of research suggests that even those who do not have a self-enhancing humor style can be trained to interpret the stressors of COVID-19 using self-enhancing humor and thus experience the positive psychological outcomes associated with a self-enhancing humor style. This line of research further suggests that the mere exposure to humor material that mocks COVID-19 (e.g. Internet memes) could allow people to momentarily experience less COVID-related anxiety.

4.2 Limitations

One limitation of this study is our measure of engagement in protective behaviors may have assessed tangentially-related constructs in addition to (or instead of) engagement in protective behaviors. For instance, to the extent that participants are aware these behaviors are recommended by the CDC, the scale may assess compliance with authority. Additionally, we did not distinguish between self-versus other-focused behaviors. Some behavioral recommendations are intended to protect one's self (e.g. frequent handwashing), whereas others are intended to prevent the spread of the virus and thus protect others (e.g. wearing a face mask); some behaviors can serve both purposes (e.g. social distancing). Future research may address whether the humor styles differentially relate to engagement in self-versus other-focused protective behaviors. For instance, it is possible that self-directed humor styles predict engagement in self-focused protective behaviors, but other-directed humor styles predict engagement in other-focused protective behaviors.

We conducted our study using a sample of adults in the United States. However, humor styles do not emerge in identical ways across all cultures. For example, Galloway (2010) identified four clusters of humor styles in adults from Australia, while Leist and Müller (2013) identified only three clusters in a sample of German adults (one of which was not found in Galloway's study). In a study of children in the United Kingdom, researchers found four clusters, two of which were not presented in the Australian or German adult samples (Fox et al. 2016). Accordingly, future research could examine possible cross-cultural differences in the ways humor styles predict responses to the stressors of COVID-19.

4.3 Conclusion

The present study makes important, novel contributions to our understanding of the psychological and behavioral functions of humor styles. First, it delineated the relationships between self-enhancing and self-defeating humor styles and psychological well-being in the context of a public health crisis (humor scholars were largely silent during past outbreaks; for the only exception from our literature search, see Kim et al. 2009). Second, it revealed the unique and nuanced relationships between those humor styles and engagement in protective behaviors, identifying both mediating and moderating variables. As such, our results suggest a number of interesting avenues for future theoretical and applied research. For instance, humor theorists could further expand on the direct relationship between

humor styles and engagement in protective behaviors, testing potential mediators and expanding to other contexts. Additionally, applied researchers might explore ways to harness humor to intentionally promote favorable protective behaviors that can help curb pandemics both current and future.

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