Exploring the Psychological Mechanism Underlying the Effect of COVID-19 Information Exposure via Digital Media on COVID-19 Preventive Behavioral Intention[1]

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Abstract

Despite the increasing use of digital media and their powerful impact on risk management during recent outbreaks of emerging infectious diseases, the question of how digital media exposure influences preventive behaviors has not been fully explained. Using the appraisal tendency framework and protection motivation theory as theoretical frameworks, we theorized the affective and cognitive mechanisms under which the differential roles of three negative emotions (fear, anger, worry) on two cognitive appraisals (perceived threat and perceived efficacy) were examined. Based on data collected from a survey of 1,500 South Koreans during the COVID-19 pandemic, we found that while worry and anger increased perceived efficacy, fear reduced perceived efficacy. The results also showed that although exposure to COVID-19 information via digital formats increased preventive behavioral intention in general, digital media use for COVID-19 information had a negative influence on preventive behavioral intention through the sequential mediation of fear and perceived efficacy.

Keywords: COVID-19, discrete negative emotions, perceived threat, perceived efficacy, preventive behavioral intention, South Korea

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While the novel coronavirus disease (COVID-19) quickly spread around the world and posed considerable risks to people's daily lives, digital media such as online news media, social media, and mobile messaging apps have emerged as the dominant channel for obtaining health information (Bao et al., 2020). In fact, a recent report from the Korea Institute of Public Administration showed that over 60%(63.4%) of South Koreans use digital media outlets, including online news portals, Korea CDC SNS, and government websites, as the largest sources for COVID-19 information, which is almost 2.5 times more than those (25.7%) who obtain information mostly through mass media (H. Lee et al., 2020). This could be partially attributed to the advantage of digital media, which has helped users keep up to date with the latest news and real-time updates about the disease and retrieve helpful information for risk management at their own convenience (Liu, 2020).

As digital media attracted attention as a powerful tool for risk communication during recent outbreaks of emerging infectious diseases such as Ebola, SARS, and MERS, scholars have examined the role of digital media in improving the public's behavior in disease prevention (Seo, 2021; Yoo et al., 2016). Furthermore, more recent studies have attempted to explain how such effects occur (Liu, 2021; Oh et al., 2021). However, most studies that explored the underlying mechanism of how risk information exposure via digital media affects behavioral outcomes focused primarily on documenting the mediating roles of cognitive evaluations (e.g., risk perception, perceived knowledge) or affective reactions (e.g., fear, anger), or the sequential mediating role of cognition and affect (e.g., Heydari et al., 2021; Liu, 2020; Zhang et al., 2015). Although emotional reactions to risky situations are often more rapid than cognitive evaluations of risk, and the impact of risk exposure on affective responses is not always mediated by cognitive assessments (LeDoux, 1996; Zajonc, 1980, 1984), surprisingly little attention has been given to how affect influences cognition in the association between risk information exposure and health-related behaviors for disease prevention. Focusing on negative emotions, although fear and anger have been shown to have opposite effects on people's perceptions of risk (Lerner et al., 2003), little is known about how discrete negative emotions differentially affect other cognitive responses to the emerging risks.

Therefore, the purpose of this study is to provide a comprehensive

understanding of the psychological mechanisms that explain how risk information exposure through digital media influences intentions to adopt preventive behaviors of COVID-19, especially investigating the effects of distinct negative emotions on cognitive responses to the risk. This study is guided by two conceptual frameworks: one is the appraisal tendency framework (ATF), which explains that distinct feelings of the same valence, such as anger, fear, and sadness, can have different effects on cognition and judgment (Lerner & Keltner, 2000); the other is the protection motivation theory (PMT), which postulates that two cognitive appraisal dimensions, consisting of threat appraisal (generally operationalized as perceived threat) and coping appraisal (generally operationalized as perceived efficacy), play key roles in shaping protection behaviors (Rogers, 1975, 1983). Drawing upon the ATF and PMT, this study focused on evaluating the effects of three negative emotions (i.e., fear, anger, and worry) on two cognitive responses (i.e., perceived threat and perceived efficacy) that empirically identified the affective-cognitive processes in the relationship between digital media use for COVID-19 information and COVID-19 preventive behavioral intention.

Literature Review

The Impact of Risk Information Exposure via Digital Media on Negative Emotions

Media use for information about a public health issue has been shown to affect negative emotional states (Chae & Lee, 2019). In this study, we focus on fear, anger, and worry, because these emotions are commonly addressed in public health crises research, particularly infectious disease outbreaks (Hansen, 2009; Oh, et al., 2021; Seo, 2021). Fear as an unpleasant emotional state is generally triggered by a threat or danger (de Hoog et al., 2008). Similarly, anger is defined as an emotional response to unpleasant events that are considered negative, threatening, or fear-provoking. Since a pandemic outbreak is a serious threat and negative incident with widespread illness and death, media coverage of the disease often includes negative news stories. Negative news exposure has been reported to increase negative emotional states (Balzarotti & Ciceri, 2014; Marin et al., 2012), and risk information exposure via digital media outlets could arouse fear and anger as emotional reactions to threatening

events. For example, Oh et al. (2021) surveyed 400 South Korean adults to explore the effect of social media use on users' emotional reactions to the 2015 MERS outbreak and found that MERS communication via social media directly and positively related to fear and anger.

While the impact of digital media exposure on fear and anger has been identified in health crises, research has found that digital media formats as information sources about a health hazard act as a drive that evokes worry. Worry refers to a feeling elicited as a response to one's assessment of risk (Kummeneje & Rundmo, 2019). For instance, Sasaki et al., (2020) explored how fourteen types of media use are related to fear and worry during the COVID-19 pandemic. They found that only the use of television and online media as information sources about the pandemic had positive effects on fear and worry over COVID-19. A similar result was found in Liu's (2020) study in which an online survey was conducted to explore the impact of COVID-19 information exposure via four types of digital media (i.e., social media, social live streaming services [SLSSs], mobile apps for social networking, and online news media) on worry. The results revealed that all digital media formats used to obtain information about COVID-19 have been shown to increase COVID-19-related worry. Taking all the information together, COVID-19 information exposure through digital media outlets is assumed to increase fear, anger, and worry about COVID-19, and therefore the current study suggests the following hypothesis:

H1: Digital media use to obtain COVID-19 information will be positively related to (a) COVID-19 fear, (b) COVID-19 anger, and (c) COVID-19 worry.

The Effects of Discrete Negative Emotions on Perceived Threat and Perceived Efficacy

While the effects of emotions on people's appraisal processes have been mainly discussed on the basis of a valence-based approach (i.e., positive vs. negative), some scholars have emphasized the importance of studying how distinct emotions with the same valence (e.g., fear, anger, worry) affect cognitive and behavioral outcomes (Lench et al., 2011; Lerner & Keltner, 2000; Nabi, 2010). One theoretical framework that explains how specific negative emotions differentially influence people's perceptual and cognitive responses to risk is the appraisal tendency framework (ATF) (Lerner &

Keltner, 2000). The theory postulates that feelings of the same valence often work in opposite ways due to the function of appraisal dimensions such as certainty, responsibility, control, pleasantness, anticipated effort, and attentional activity (Lerner & Keltner, 2000). Lerner and Keltner (2000, 2001) argued that "control" is one of the central dimensions that distinguish anger from fear, whereby these affective responses have different impacts on perceived threat. Specifically, fearful people tend to perceive a risky situation as more threatening, because fear is associated with the situation being out of one's control. Anger, by contrast, is associated with the tendency by which people perceive a risky situation as controllable, and therefore angry people tend to perceive the situation as less threatening. Thus, each emotion should be distinguished to investigate its impact on cognitive processes.

Based on the above notion, two cognitive variables that can be differentially influenced by discrete negative emotions are perceived threat and perceived efficacy. Perceived threat is conceptualized as beliefs about the seriousness of a risk event and one's susceptibility to the event (Rosenstock et al., 1988). Perceived efficacy, which consists of self-efficacy and response efficacy, is conceptualized as one's belief in the capability to exert control over a situation affecting their life (Bandura, 1997). Lerner et al. (2003) suggested that fear and anger differed in their effects on risk judgments, in which fear increased risk estimates, while anger had the opposite effect. In addition, perceived efficacy can also vary substantially over different emotions, because fear is closely related to uncontrollability, but anger is associated with controllability. Thus, it can be postulated that although fear and anger are negative feelings, each negative emotional state exerts a differential effect on perceived threat and perceived efficacy. Therefore, the following hypotheses were proposed in this study:

H2: COVID-19 fear will be (a) positively associated with perceived threat and (b) negatively associated with perceived efficacy.

H3: COVID-19 anger will be (a) negatively associated with perceived threat and (b) positively associated with perceived efficacy.

Although worry has been less investigated compared to fear and anger, scholars have reported how worry influences perceived threat and perceived efficacy in the public health domain (Vacondio et al., 2021). Vacondio et al. (2021), for example,

conducted an online survey of 731 people living in three countries (Austria, Italy, and the United Kingdom) and empirically examined the association between emotional reactions and perceived threat during the COVID-19 pandemic. The result that participants with higher worry tended to have a higher perceived threat to COVID-19 was confirmed across all countries. Given that worry is often used as an interchangeable term for anxiety (Borkovee et al., 1991; Silverman et al., 1995), worry has the potential to increase efficacy beliefs, because empirical evidence has shown that anxiety has significant and positive influences on self-efficacy and response efficacy (J. Lee, 2020). Therefore, COVID-19 worry is expected to have a positive influence on perceived threat and perceived efficacy, and we propose the following hypothesis:

H4: COVID-19 worry will be (a) positively associated with perceived threat and (b) positively associated with perceived efficacy.

Protection Motivators: Perceived Threat and Perceived Efficacy

A useful theoretical framework that explicates the influences of perceived threat and perceived efficacy on preventive behavioral intention is the protection motivation theory (PMT) (Rogers, 1975, 1983). Based on the PMT, protection motivation is shaped by two cognitive mediating processes: threat and coping appraisals (Floyd et al., 2000; Fry & Prentice-Dunn, 2005). On the one hand, in the threat appraisal process, protection motivation can be aroused when a threatening event is perceived to be severe (i.e., perceived severity) and/or as likely to occur (i.e., perceived susceptibility). On the other hand, in the coping-appraisal process, the belief that one's response can effectively prevent harmful consequences of the event (i.e., response efficacy) and one's perceived ability to carry out the response (i.e., self-efficacy) can generate protection motivation. The theory postulates that not only factors associated with threat appraisal (perceived threat), but also factors associated with coping appraisal (perceived efficacy) are assessed together to determine protection motivation, which is generally operationalized as preventive behavioral intention in risky situations (Rogers & Prentice-Dunn, 1997).

In fact, perceived threat and perceived efficacy have been reported as strong predictors of one's intention to take preventive actions in several health and risk settings such as mammography screening, condom use for HIV prevention, flooding,

climate change, and even infectious disease outbreaks (Grothmann & Reusswig, 2006; Ivanova & Kvalem, 2021; Lwin et al., 2010; Rainear & Christensen, 2017). During the outbreak of MERS in 2015, Yoo et al. (2016) examined the influences of perceived threat of MERS and self-efficacy for MERS on handwashing and cough etiquette intentions and found that people with higher perceived threat and self-efficacy reported higher intentions to perform handwashing and cough etiquette. Similar results were found in Kim and Hawkins's study, in which perceived threat and self-efficacy were positively associated with preventive hygiene intention during the 2019 measles outbreak in the United States (Kim & Hawkins, 2020). In addition, Guidry et al. (2019) conducted an online survey with 339 women of reproductive age in the United States, which revealed that perceived susceptibility, self-efficacy, and response efficacy directly increased Zika vaccine uptake intent.

In the current study, protection motivation is conceptualized as the individual's intent to follow the recommended behaviors for COVID-19 prevention; therefore, we examined the relationship between two cognitive appraisal processes and preventive behavioral intention in the context of COVID-19. If the threat elicited by COVID-19 is perceived as highly severe and highly likely to occur and/or people exhibit high efficacy in health management during the COVID-19 pandemic, they may be motivated to adopt protective behaviors to avoid COVID-19-induced dangers. Therefore, the current study proposes the following hypothesis:

H5: (a) Perceived threat and (b) perceived efficacy will be positively related to preventive behavioral intention.

The mediating effects of affect and cognition in the association between media exposure and protection behavior have also been investigated in previous research (Kim et al., 2020; Oh et al., 2021). Oh et al. (2021) reported that negative emotions (e.g., fear and anger) and risk perception successively mediated the relation between social media use for MERS information and MERS preventive behaviors during the 2015 outbreak of MERS in South Korea. In a similar vein, digital media use for COVID-19 information may indirectly influence COVID-19 preventive behavioral intention via negative emotions and cognitive appraisals in the current COVID-19 risk situation. Therefore, we will test whether negative emotions (i.e., fear, anger, and worry) and

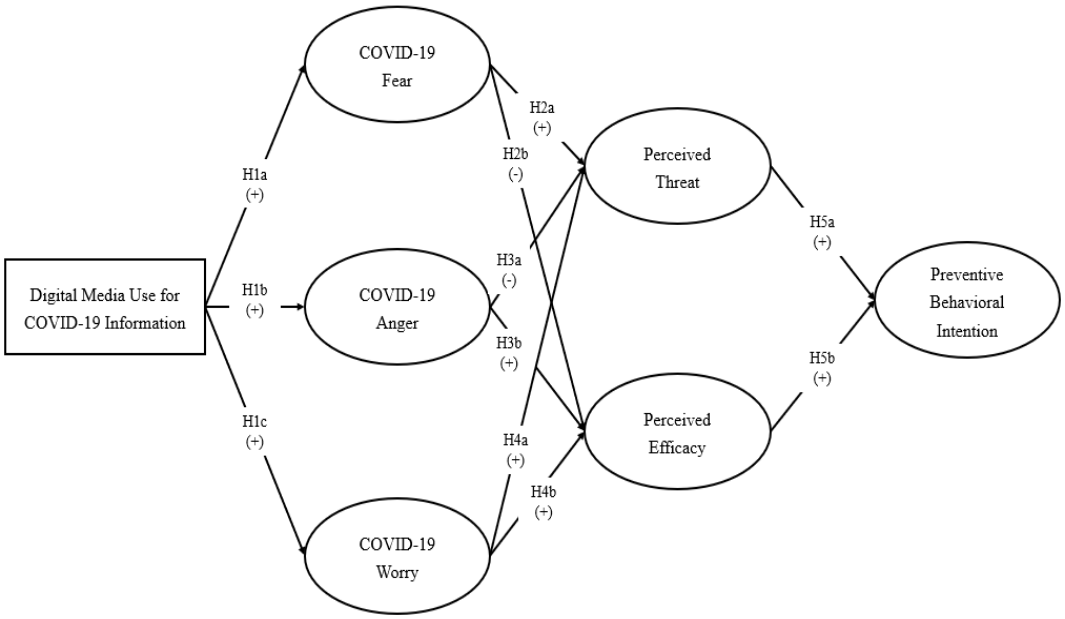
cognitive appraisals (i.e., perceived threat and perceived efficacy) have a sequential mediating effect on the relationship between digital media use and preventive behavioral intention. Inspired by the discussion above, however, such mediation effects may differ across discrete negative emotions and cognitive appraisal processes, and thus we will also test how such affective and cognitive variables differentially mediate the relationship. Therefore, this study poses the following research question:

RQ1: Does digital media use for COVID-19 information have an indirect impact on preventive behavioral intention via negative emotions and cognitive appraisals?

Figure 1 shows the hypothesized research model.

Figure 1

Hypothesized Research Model



Method

Sample

In the study, data were collected from February 24 to March 3, 2020, via an online survey. The survey for this study was conducted by Global Research Group (www.globalri.co.kr), an online survey company in South Korea with a panel of 1.16

million people who represent national demographics. Of those panel members, 127,362 people were selected as the survey sample via a computer algorithm, using quota sampling by age, gender, and region of residence. They were invited to participate in the survey, but about 2% of them (2,225 people) responded to the survey. After removing 725 participants' incomplete and invalid responses, the final sample size was 1,500 participants (or about a 1% response rate), and their responses were used for the analysis. Once the respondents completed the online survey, they were rewarded with reward points as a token of appreciation. The reward points can be redeemed as gifts.

The sociodemographic and socioeconomic characteristics of the respondents are presented in Table 1.

Table 1

Final Sample Characteristics

	Number	***(percent)***
Gender		
Male	769	(51.3)
Female	731	(48.7)
Age, M (SD)	40.31	(10.92)
Education		
High school or lower	235	(15.7)
Some college	88	(5.9)
Associate's or bachelor's degree	1,020	(68.0)
Graduate school	21	(1.4)
Graduate degree	136	(9.1)
Income (Korean Won)		
< 1.99 million	179	(11.9)
2.00-3.99 million	477	(31.8)
4.00-5.99 million	479	(32.0)
6.00-10.00 million	310	(20.6)
> 10.00 million	55	(3.7)
Respiratory diseases experience		
Yes	149	(9.9)
No	1,351	(90.1)
N	1,500	(100)

The mean age of the final sample was 40.31 (*SD* = 10.92), and their age ranges from 19 to 59 years old. More specifically, 20s, 30s, 40s, and 50s were 356 (23.7%), 335 (22.3%), 397 (26.5%), and 412 (27.5%), respectively. Also, 769 men (51.3%) and 731 women (48.7%) participated in this study. Their educational backgrounds were diverse, with 68% having an associate's or bachelor's degree, 15.7% graduated high school or lower, and 9.1% had a graduate degree. The median household monthly income of the participants was 4,000,000-4,990,000 won (US$ 3,603-4,505). Of those participants, about 10% (*n* = 149) reported that they had experienced respiratory diseases such as asthma, bronchitis, pneumonia, and emphysema during the last year.

Measures

Digital Media Use

Digital media use was measured with an item asking how often the respondents had viewed risk information about COVID-19 through digital media outlets such as online news media, social media, and mobile messaging apps in the past thirty days. Their responses were obtained on a 5-point Likert-type scale, which ranges from "never" to "very often." Higher values represented greater exposure to risk information about COVID-19 via digital media (*M* = 3.99, *SD* = 0.78).

Fear

In order to measure the participants' fear of COVID-19, this study used the following three items on a 5-point Likert-type scale that ranges from "not at all" to "very much" (Chae & Lee, 2019; Oh et al., 2021; Yang & Chu, 2018): (1) "When I think about COVID-19, I'm fearful"; (2) "When I think about COVID-19, I get jittery"; (3) "When I think about COVID-19, my heart beats faster" (*M* = 3.15, *SD* = 0.94, Cronbach's α = .82).

Anger

We assessed anger about COVID-19 using three items adapted from previous studies (Griffin et al., 2008; Oh et al., 2021). The participants' responses were obtained on a 5-point Likert-type scale (1 = not at all to 5 = very much). The statements included: "I am angry about COVID-19"; "I am irritated about COVID-19"; "I am upset by COVID-

19" (*M* = 3.91, *SD* = 0.87, Cronbach's α = .88).

Worry

Worry about COVID-19 was measured using three items adapted from Chae and Lee (2019). Responses were obtained using a 5-point Likert-type scale ranging from not at all (1) to very much (5). For example, "I am afraid of the physical outcomes of getting COVID-19"; "I worry about my health because of my chances of getting COVID-19"; "I feel anxiety when I think of the possible outcomes of getting COVID-19" (*M* = 4.11, *SD* = 0.80, Cronbach's α = .87).

Perceived Threat

Perceived threat was measured using the following six statements on a 5-point scale, which ranges from "strongly disagree" to "strongly agree" (Krieger & Sarge, 2013). Three out of six items were used to evaluate perceived susceptibility, and the other three items measured perceived severity. The statements were, for example, "I am at high risk for getting health issues from COVID-19"; "It is likely that I will get health issues from COVID-19"; "If I were to get health issues related to COVID-19, it would be a very serious threat to my quality of life"; "Health issues related to COVID-19 would be harmful to my well-being" (*M* = 3.55, *SD* = 0.70, Cronbach's α = .84).

Perceived Efficacy

Perceived efficacy was measured using six items taken from Schwarzer et al. (2005) and Krieger and Sarge (2013) on a 5-point scale with anchors 1: strongly disagree to 5: strongly agree. Three items were used for self-efficacy, and the other three were used for response efficacy. They included items such as "I can prevent myself from getting health issues from COVID-19"; "I am confident that I could efficiently deal with health issues from COVID-19"; "Wearing a certified mask would protect me from the negative effects of COVID-19"; "Washing my hands is an effective way to prevent my health issues from COVID-19 (*M* = 3.93, *SD* = 0.62, Cronbach's α = .82).

Preventive Behavioral Intention

To measure one's intent to enact preventive behaviors against COVID-19, we used six items on a 5-point scale, which ranges from "not at all" to "very much." These

items were adopted from the Korea Centers for Disease Control and Prevention's behavioral guidelines regarding the prevention of COVID-19-related health risks (Korea CDC, 2020). Participants were asked to report their intention to follow each of the six behaviors for COVID-19 prevention. For example, "To avoid COVID-19, I intend to wear a certified mask when I go out"; "I intend to wash my hands for at least 30 seconds to avoid COVID-19" (M = 4.49, SD = 0.49, Cronbach's α = .82). Descriptive statistics and bivariate correlations among the key variables are presented in Table 2.

Table 2

Descriptive Statistics and Bivariate Correlations Among Study Variables

	1.	2.	3.	4.	5.	6.	7.
1. DMU	-						
2. Fear	.18**	-					
3. Anger	.24**	.49**	-				
4. Worry	.16**	.53**	.63**	-			
5. PT	.14**	.47**	.56**	.53**	-		
6. PE	.02	−.10**	.10**	.09*	.06	-	
7. PBI	.06**	.13**	.25**	.35**	.30**	.55**	-
M	3.99	3.15	3.91	4.11	3.55	3.93	4.49
SD	.78	.94	.87	.80	.70	.62	.49

Note. DMU = digital media use; PT = perceived threat; PE = perceived efficacy; PBI = preventive behavioral intention. *p < .05, **p < .01.

Data Analysis

Data were first preliminarily analyzed for descriptive statistics and bivariate correlations using SPSS 22.0. Structural equation modeling (SEM) was performed using AMOS 25.0 to test the hypothesized associations in our proposed research model. We implemented maximum likelihood estimation (MLE) to evaluate the overall model fit, as MLE is a least squares-based parameter estimate (Johnson & Wichern,

2007). Four fit indices were administered to examine the goodness of fit (criteria indicating good fit in parentheses): comparative fit index (CFI ≥ .95), Tucker-Lewis index (TLI ≥ .95), root mean square error of approximation (RMSEA ≤ .06), and standardized root mean square residual (SRMR ≤ .08) (Hu & Bentler, 1999). As control variables, demographic factors such as gender, age, education level, family income, and health status were linked to all the endogenous variables. Lastly, the mediation effects were analyzed using a bootstrapping approach with 1,000 bootstrap samples, through which indirect effects and confidence intervals were generated (Preacher & Hayes, 2008).

For the model testing, we first examined the validity of the measurement model using confirmatory factor analysis (CFA). The results showed that all items within the measurement model had significant factor loadings on the latent variables (p < .001), which ranged from .51 to .88. Therefore, we tentatively concluded that the measurement model was acceptable to further test the structural model. Based on the model fit criteria, the proposed structural model showed a good fit: $x^2(402, N = 1500) = 1217.62$ ($p < .001$); CFI = .97; TLI = .95; RMSEA = .04 (90% CI: .034 to .039); SRMR = .05. Overall, the proposed model explained approximately 43.6% of the total variance in people's intention to engage in preventive behaviors against COVID-19.

Results

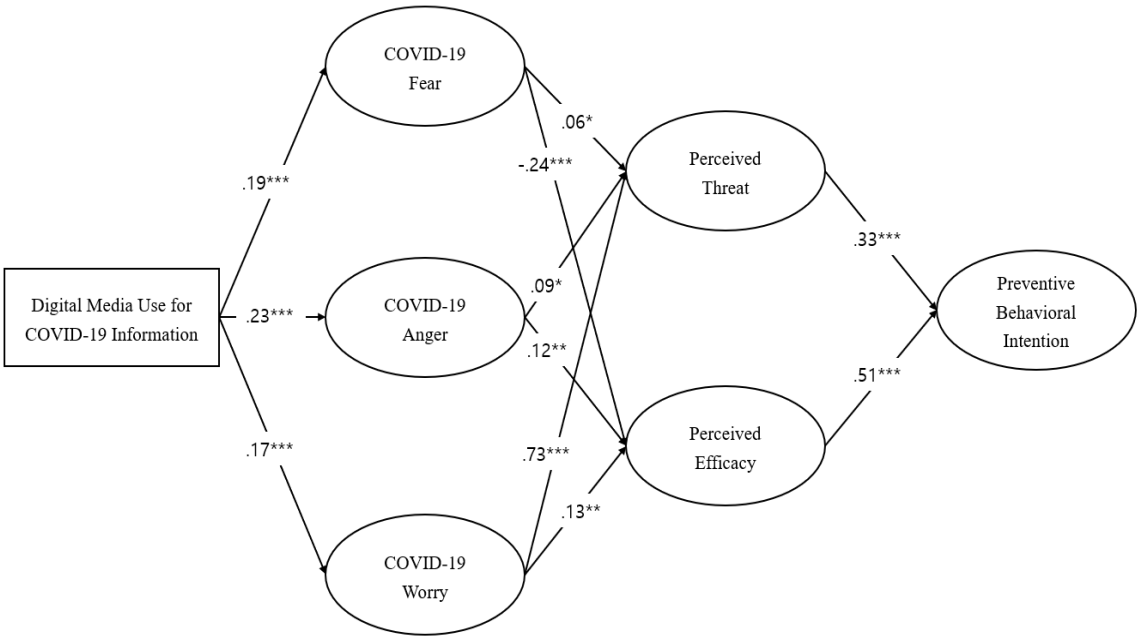
Testing Direct Effects

The standardized path coefficients and their statistical significance in the proposed research model are shown in Figure 2. With respect to H1, digital media use for COVID-19 information was positively related to COVID-19 fear (H1a: β = .19, p < .001), COVID-19 anger (H1b: β = .23, p < .001), and COVID-19 worry (H1c: β = .17, p < .001). Thus, these findings supported H1a, H1b, and H1c. Regarding H2, we tested the effects of COVID-19 fear on two cognitive appraisals (perceived threat and perceived efficacy). The results revealed that COVID-19 fear was positively associated with perceived threat (H2a: β = .06, p = .026), whereas it was negatively associated with perceived efficacy (H2b: β = −.24, p < .001). Therefore, both H2a and H2b were

supported in this study. H3 investigated whether COVID-19 anger would be negatively related to perceived threat and positively related to perceived efficacy. The results showed that COVID-19 anger had positive and significant effects not only on perceived efficacy (H3b: β = .12, p = .003) but also on perceived threat (H3a: β = .09, p = .013). Thus, H3a was not supported, whereas the results supported H3b. H4 examined whether COVID-19 worry was positively associated with perceived threat and perceived efficacy. The results showed that COVID-19 worry had a significant and positive influence on perceived threat (H4a: β = .73, p < .001) and perceived efficacy (H4b: β = .13, p = .003). Thus, these findings supported H4a and H4b. In H5, we proposed that both perceived threat and perceived efficacy would be positively related to preventive behavioral intention. As expected, there were significant and positive relations between perceived threat and preventive behavioral intention (H5a: β = .33, p < .001) and perceived efficacy and preventive behavioral intention (H5b: β = .51, p < .001), and both H5a and H5b were supported in this study.

Figure 2

Results of Hypothesized Research Model



Note. All values are standardized coefficients. Gender, age, education level, family income, and health status were included as control variables in the analysis. *p < .05, **p < .01, ***p < .001.

Testing Indirect Effects

RQ1 asked whether there would be indirect effects of digital media use for COVID-19 information on preventive behavioral intention via three affective responses (i.e., fear, anger, and worry) and two cognitive appraisals (i.e., perceived threat and perceived efficacy). As shown in Table 3, the sequential mediation effects of three affective responses and two cognitive appraisals on the association between digital media use and preventive behavioral intention were confirmed in this study. Specifically, digital media use for COVID-19 information had significant indirect effects on preventive behavioral intention via COVID-19 fear and perceived threat (*indirect effect* = .0024; CI = .0003 to .0058), COVID-19 anger and perceived threat (*indirect effect* = .0042; CI = .0004 to .0086), and COVID-19 worry and perceived threat (*indirect effect* = .0270; CI = .0178 to .0377). Moreover, the indirect effects of digital media use for COVID-19 information on preventive behavioral intention were also significant via COVID-19 fear and perceived efficacy (*indirect effect* = −.0147; CI = −.0226 to −.0087), COVID-19 anger and perceived efficacy (*indirect effect* = .0094; CI = .0027 to .0182), and COVID-19 worry and perceived efficacy (*indirect effect* = .0074; CI = .0017 to .0151).

Table 3

Results of Indirect Effects

Path	Estimate (SE)	CI
DMU → Fear → PT → PBI	.0024 (.0014)*	.0003 to .0058
DMU → Anger → PT → PBI	.0042 (.0021)*	.0004 to .0086
DMU → Worry → PT → PBI	.0270 (.0051)**	.0178 to .0377
DMU → Fear → PE → PBI	−.0147 (.0036)**	−.0226 to −.0087
DMU → Anger → PE → PBI	.0094 (.0039)*	.0027 to .0182
DMU → Worry → PE → PBI	.0074 (.0033)*	.0017 to .0151

Note. DMU = digital media use; PT = perceived threat; PE = perceived efficacy; PBI = preventive behavioral intention; 95% CIs, bias-corrected based on 1,000 bootstrap samples. *$p < .05$, **$p < .01$.

Discussion

Under the risky situation of the COVID-19 pandemic in South Korea, this study aimed to identify the affective and cognitive factors that explain the impacts of digital media use as COVID-19 informational resources on people's intention to adopt protective behaviors to avoid COVID-19 risks. Based on the ATF (Lerner & Keltner, 2000) and the PMT (Rogers, 1975, 1983), we constructed a conceptual model to explore how distinct negative emotions (i.e., fear, anger, or worry) differentially affect threat (i.e., perceived threat) or coping (i.e., perceived efficacy) appraisal in addressing digital media effects.

Based on the results, digital media use for information about COVID-19 was positively related to COVID-19 fear, COVID-19 anger, and COVID-19 worry. These findings are similar to previous research, which found that information exposure through digital media outlets such as online new media, social media, mobile apps for social networking, and social live streaming services evokes fear, anger, and worry during infectious disease outbreaks (Liu, 2020; Oh et al., 2021).

In the threat appraisal processes described in this study, COVID-19 fear and COVID-19 worry were positively associated with perceived threat of COVID-19. However, the finding that COVID-19 anger had a positive association with perceived threat was contrary to our expectations. The opposite finding may result from diverse conceptualizations of the "perceived threat" construct. In this study, perceived threat is an umbrella term that encompasses two dimensions: perceived severity (seriousness of the health consequences) and perceived susceptibility (probability of the disease's occurrence). Since the effects of anger on each dimension may have offset each other, and thus yielded unexpected outcomes, a post-hoc analysis was conducted to test the assumption that anger has different effects on the two dimensions. The results showed that, while anger was negatively and significantly associated with perceived severity (β = −.13, p < .001), the relationship between anger and perceived susceptibility was not significant (β = .02, p = .511). The results indicate that future research is required to define the construct explicitly and explore these pathways separately. Within the coping appraisal framework, although all of the negative emotions significantly predicted perceived efficacy for COVID-19, their effects were different in that COVID-19 anger and COVID-19 worry were positively associated with

perceived efficacy, but the association between COVID-19 fear and perceived efficacy was negative. These findings provide additional empirical evidence on the propositions of Lerner and Keltner (2001) and Nabi (1999) that discrete negative emotions have differential effects.

In addition, both perceived threat of COVID-19 and perceived efficacy for COVID-19 were positively related to one's intention to adopt preventive behaviors, which reaffirms the basic postulates of health-related theories such as the health belief model (Rosenstock et al., 1988), protection motivation theory (Rogers, 1975, 1983), and the extended parallel process model (Witte, 1994). Perceived efficacy (β = .51) had a stronger influence on preventive behavioral intention than perceived threat (β = .33), which is consistent with the findings of a meta-analysis by Floyd et al. (2000). These findings are also confirmed with the findings of previous studies, which revealed that perceived threat and perceived efficacy are important predictors of preventive behavioral intention across past infectious disease outbreaks such as SARS (Lau et al., 2003), swine flu (Rubin et al., 2009), and MERS (Yoo et al., 2016).

To further explore the mediating mechanism of discrete negative emotions and cognitive appraisal processes, we analyzed the indirect effects of digital media use on preventive behavioral intention via three negative emotions and two cognitive appraisals. This study found that distinct negative emotions and cognitive appraisal constructs sequentially mediated the association between digital media use and preventive behavioral intention. Specifically, the results indicated that people who were exposed to more information about COVID-19 via digital media platforms had greater fear, anger, and worry about COVID-19, which influenced higher perceived threat of COVID-19, and which eventually showed greater intention to engage in preventive behaviors. Unlike perceived threat, however, perceived efficacy generated mixed finding. Using digital media for COVID-19 information indirectly decreased people's intention to take preventive behaviors when fear and perceived efficacy mediated the relationship; otherwise, preventive behavioral intention was increased.

Implications

The findings of the current research contribute to a better understanding of affective and cognitive mechanisms that explain how using digital media as

information resources influences preventive behavioral intention during emergent public health crises such as the COVID-19 pandemic. It is important to understand the role of emotion in risk communication because risk-related emotions affect people's judgment (e.g., risk perception), decision-making, and behavior (e.g., risk information seeking and processing) toward a risk-related crisis (Yang, 2012; Yang & Liu, 2021). The findings of this study may extend our knowledge of how discrete risk-related emotions (e.g., fear, anger, worry) function differentially on health outcomes in the risk communication process. Beyond fear and anger, worry is another highly relevant emotion, often involved in public health hazards (e.g., Oh et al., 2021; So et al., 2016). Thus, this study extends previous knowledge by empirically testing the role of worry that may have differential impacts on cognitive appraisals. Another contribution of this study is to provide a more comprehensive explanation of the cognitive appraisal processes by not only testing the links between distinct negative emotions and perceived threat but also by considering the often-ignored relationship between distinct negative emotions and perceived efficacy. These analyses help enhance our understanding of the affect-cognition relationship, which may activate health protective behaviors to combat a public health issue, within the context of the digital media risk information exposure phenomenon.

As for practical implications, the findings of the study help public health practitioners develop effective communication strategies in public health crises. This study shows that using digital media can be an effective channel for risk information delivery, in which emotional and cognitive reactions to the risky event can act as powerful predictors of preventive behaviors. However, caution is needed when fear is evoked. Fear can be a double-edged sword in risk communication with the potential not only to increase perceived threat but also to decrease perceived efficacy, which in turn may yield unintended and undesirable outcomes such as lowered intention to engage in preventive behaviors. Besides this, some digital media such as social media and online forums have often produced and provided misinformation about the risk and provocative information on the risk, which has caused excessive public emotional reactions. Thus, public health practitioners and officials need to monitor whether the information conveyed through the digital media is accurate or which kind of emotions is frequently evoked in the digital media setting.

Limitations and Future Directions

Some limitations of this study need to be considered. First, the data analyzed in this study were collected at the early stage of the COVID-19 pandemic in South Korea. Perhaps information about COVID-19 online may differ depending on the stages of infectious disease outbreaks and location, and therefore our findings may be difficult to generalize. Thus, future studies are needed to replicate the affective-cognitive mechanisms at different stages and locations.

In addition, although people receive risk information about COVID-19 through different types of digital media, such as online new media, social media, and mobile applications, a single item was used to measure individuals' COVID-19 information consumption via digital media platforms. Since each digital media platform may have a differential effect on the public's responses to risk situations, future studies are necessary to examine the effects of each digital media outlet separately.

Another limitation is in the sampling. In this study, the respondents were sampled from an online panel with members who have agreed to answer surveys via the Internet. Since older people or those without Internet access may have been excluded from sampling, the results from the online survey panel may differ from population-based estimates, which eventually may limit the external validity of study findings.

Finally, this study also has a limitation in that other explanations may exist in addressing the effect of risk information exposure via media on preventive behaviors toward COVID-19. One possibility is that cognitive responses to the risk may be able to evoke risk-related emotions. For example, people with low self-efficacy can feel more fear than those with high self-efficacy when the crisis is out of control. Also, although television is one of the major information sources of COVID-19, this study did not address the roles of traditional media as risk information sources in crisis. In future studies, it would be interesting to compare the roles of traditional media and digital media during risk communication process.

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