Original Research

Roles of Temporal Message Framing and Digital Channel Type in Perception and Dissemination of Food Risk Rumors

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ABSTRACT

Now that online media channels have become important sources of risk information, online rumors about risks have become increasingly problematic. Guided by construal level theory and the social-mediated crisis communication model, this study tests direct, mediating, and moderating effects of temporal message frame and digital media channel type on people's perceptions of food risk rumors and their intentions to share them. An online experiment with a 2 temporal frame (near vs. distant in time) x 2 channel type (web portal vs. social media site) between-subjects design was conducted among 413 Korean adults. Results show that risk perceptions are affected more by the channel on which rumor information is encountered than by the framing of the information. Specifically, rumor messages presumed to appear on social media generated (a) higher perceived susceptibility than those presumed to appear on web portals (main effects) and (b) higher levels of perceived susceptibility in a distant-future frame condition than in a near-future frame condition (conditional moderating effects). Perceived susceptibility also mediated the interaction effects of temporal frame and channel type on intention to share rumor. This study provides theoretical and practical implications for digital media channel effects on risk perceptions and dissemination intention for risk rumors.

KEYWORDS

media channel, temporal message framing, rumors, construal level theory, risk perception, intention to share

Digital and online media channels are becoming increasingly important sources of health and risk information. According to the 2020 Digital News Report, in many countries online news has become more frequently used than television news (Reuters Institute for the Study of Journalism at Oxford University, 2020). However, this trend raises new challenges for maintaining truthfulness and accuracy in the public information environment. One of these challenges is the spread of rumors. Rumors not only contain unverified information but also often circulate more rapidly than verified news (Chua &

Banerjee, 2017; Vosoughi et al., 2018). The prevalence of health- and risk-related rumors online is particularly problematic because it can exacerbate health problems and untimely deaths (Meagher, 2019). People are exposed to and share rumors throughout their social networks, and that sharing behavior can lead to societal-level harms (Pal et al., 2017). In efforts to prevent undesirable health- and risk-related outcomes, an important goal is to identify factors that determine how rumors are circulated. As a contribution to that goal, this study examines factors and mechanisms associated with people's perceptions of risk rumors and their intentions to share them.

The ways in which people perceive and spread rumors about risks may be related to both the characteristics of rumor messages (Paek & Hove, 2019a) and the type of media channel on which they appear (Jiang, 2017). One important message characteristic is the degree to which a rumor frames a risk as being close and relevant to the lives of people in its intended audience. Support for these presumptions can be found in construal level theory (CLT, Trope & Liberman, 2010). According to CLT, when people perceive an issue, for example a risk, to be closely relevant to their life circumstances, they tend to construe it in terms of concrete and contextualized details. When people perceive it as distant from their life circumstances, they tend to construe it in terms of generalities and abstractions (Liberman et al., 2007). Perceptions of distance from a risk issue can be affected differently by various message characteristics, including spatial framing (how physically close or distant the risk's effects will be) and temporal framing (how immediate or delayed the risk's effects will be). In particular, the degree to which a message frames a risk as temporally near or distant has been found to affect people's risk perceptions and health-related outcomes (Chandran & Menon, 2004; Lutchyn & Yzer, 2011).

In the era of easily disseminated digital information, rumors have become more potentially influential and harmful. Two major digital media channels on which health- and risk-related rumors can be widely circulated are web portals and social media sites. These channels have different characteristics that may lead to differences in how rumors circulate on them. Although some recent studies have examined rumor dissemination on social media (e.g., Lee et al., 2021; Oh & Lee, 2019), none to our knowledge have investigated the possible differential effects and roles of media channel type in rumor dissemination. We expect that the perceptions and dissemination of a risk rumor message will differ depending on whether it appears on a web portal or on a social media site. Accordingly, this study investigates whether and how channel type plays a moderating role in rumor dissemination. The overall aim is to examine direct, mediating, and moderating effects of temporal framing and media channels on people's perceptions of and intentions to share rumors about a food safety risk.

Rumors in Risk Communication

A substantial amount of health and risk information available on the Internet is unreliable, particularly when it is conveyed through rumors. According to a classic definition, a rumor is a topical, informational proposition that is disseminated before it has been officially verified (Knapp, 1944). Rumors express beliefs about particular issues, events, or persons, and those beliefs tend to be uncertain and inadequately supported by evidence (Allport and Postman, 1946). Rumors are often shared because they satisfy emotional needs, and they typically circulate via individual word of mouth.

Rumor sharing behavior has been linked to several message characteristics, including the type of rumor (Chua & Banerjee, 2017) and its featured topic or issue (Lee et al., 2021; Oh et al., 2013). For example, people share rumors when

they are trying to make sense of an uncertain issue or ambiguous situation (DiFonzo & Bordia, 2007; Lee et al., 2021). People may share rumors more quickly when they perceive its featured issue to be important or relevant, and especially when the rumor reflects widespread fears and anxieties (Allport & Postman, 1946; Bordia & DiFonzo, 2005; Rosnow, 1991). Other factors include normative cues (Kim, 2018; Lee & Oh, 2017) and types of responses to the rumor (Paek & Hove, 2019a, 2019b). Rumor sharing behaviors are also affected by the sharers' personal characteristics and motivations (DiFonzo & Bordia, 2007; Oh & Lee, 2019; Oh et al., 2013; Pezzo & Beckstead, 2006). For example, people with high health anxiety are more likely to share rumors than those with low health anxiety (Pezzo & Beckstead, 2006). The more that people are personally involved with a specific issue or risk, the more they tend to share rumors on the Internet (Chua & Barnergee, 2017; Oh et al., 2013).

Although communication research has yielded valuable insights about how people respond to and share health- and risk-related rumors, more characteristics of these processes need to be explored. The extent to which people share information about risks tends to be affected more by their subjective perceptions of risks rather than their direct experiences of them (Slovic, 2000). When risk perceptions are mainly the result of media messages, they are likely to be influenced by message characteristics such as presentation or framing (Chua & Banergee, 2017; Kim & Choi, 2017; Paek & Hove, 2020). One message characteristic that has been found to affect risk perceptions and subsequent outcomes is temporal framing (Chandran & Menon, 2004). Another factor that may affect how risk rumors are shared is the type of media channel on which people encounter them (Paek, 2018; Schultz et al., 2011). The following two sections explain why these two factors—temporal framing and media channel type—occupy center

stage in this study.

Temporal Framing and Risk Perceptions

The effect of temporal framing on risk perceptions can be explained by construal level theory (Trope & Liberman, 2010). A basic tenet of CLT is that people's perceived psychological distance from an event or an object influences the way they think about it. Psychological distance is defined as "a subjective experience that something is close or far away from the self, here, and now" (Trope & Liberman, 2010, p. 440). The more distant people perceive an event to be from themselves, the more they tend to construe it as a generalized and decontextualized abstraction; the closer they perceive it to be to themselves, the more they construe it as a specific and concrete phenomenon occurring in a personally relevant context. Although there are several dimensions of psychological distance, CLT research has focused on the temporal dimension as particularly important in determining how abstractly or concretely people will construe an event. As a result, psychologists have developed the offshoot of temporal construal theory, which "proposes that abstract features are likely to be used in construing distant future events whereas more concrete features are likely to be used in construing near future events" (Liberman & Trope, 1998, p. 6).

Based on the logic of temporal construal theory, temporal framing may influence people's perceptions of rumors and their rumor sharing behaviors. Risk rumors often include specific temporal references. Some refer to short-term, temporally close effects of risks, while others refer to long-term, temporally distant effects. Differences in these types of temporal framing within health- and risk-related messages may influence people's risk perceptions. For example, Chandran and Menon (2004) found that self-risk perceptions and concerns were influenced more by a present-oriented health message (e.g., "every

day, a significant number of people fall prey to Mono," p. 377) than by a future-oriented message (e.g., "every year, a significant number of people fall prey to Mono," p. 377). Similarly, Lutchyn and Yzer (2011) demonstrated that people tend to have higher self-efficacy about dieting when considering behaviors in the near future (tomorrow) than when considering behaviors in the distant future (a few years from now).

Temporal framing may also influence two fundamental risk perceptions that have been extensively studied as antecedents to health- and risk-related outcomes—perceived severity and perceived susceptibility (Rosenstock, 1960). *Perceived severity* refers to people's judgments about how harmful a risk may be, including evaluations of health consequences such as death, disability, and pain, as well as social consequences in the areas of work, family life, and other relationships. *Perceived susceptibility* refers to people's subjective beliefs about how likely they would be affected by or vulnerable to a risk (Janz & Becker, 1984). According to a risk communication meta-analysis (Tannenbaum et al., 2015), people's perceptions of severity and susceptibility influence their subsequent attitudes, intentions, and behaviors. For example, Lu and Schuldt (2018) found that perceived severity and susceptibility positively influenced behavioral intentions to prevent mosquito bites. Similarly, Kim and Kim (2018) found that perceived susceptibility positively influenced intention to quit smoking.

Based on the above rationales and evidence, we predict that risks framed as near-future events will lead to higher perceptions of severity and susceptibility than risks framed as distant-future events. Because people tend to construe short-term consequences as more concrete and personally relevant, their behaviors are likely to be more strongly affected by rumors referring to short-term and near-future consequences than by those referring to long-term and distant-future consequences. At least two studies support

this reasoning. Kim and Kim (2018) found that messages indicating a temporally close health risk of smoking (heart attack) generated higher perceived susceptibility than those indicating a temporally distant risk (larynx cancer). Gerend and Cullen (2008) found that undergraduate students were less likely to drink alcohol when they were exposed to a message about immediate consequences of alcohol use than when they were exposed to one about long-term consequences. To investigate similar effects of temporal framing, we propose the following hypotheses:

H1a: Perceived severity will be higher when the risk rumor message is framed in the near future than in the distant future.

H1b: Perceived susceptibility will be higher when the risk rumor message is framed in the near future than in the distant future.

H1c: Intention to share rumor will be higher when the risk rumor message is framed in the near future than in the distant future.

The Role of Digital Channel Type

When people encounter unexpected risk information, factors such as anxiety about health motivate them to check its veracity (Oh & Lee, 2019). One technique for doing so is to search for information on a variety of channels. According to the social-mediated crisis communication model (SMCC), social media have become more important than other types of digital media in influencing people to express their opinions and share them with others, particularly during a crisis (Cheng, 2020; Schultz et al., 2011). While SMCC has been studied in the context of a few crisis situations, it needs to be further investigated in other risk information and rumor conditions. One of those conditions is media channel type. The type of media channel on which information appears has been shown to have a significant impact on people's perceptions of risk and health issues, and different effects may occur when the

same message appears on different channels (Oh et al., 2015). Furthermore, certain channels may be more likely than others to increase the speed of rumor dissemination (Garrett, 2011). Accordingly, we propose that the type of media channel through which a rumor is conveyed may influence perceived severity, perceived susceptibility, and intention to share rumor. Two prominent digital channels on which misinformation about health often appears are web portals and social media sites (Doerr et al., 2012; Vraga & Bode, 2017). Although both channel types play important roles in circulating rumors, those roles may differ in two key ways.

First, people use web portals and social media sites for different purposes. Major web portals such as Google and South Korea's Naver are built around search engines, and information seeking is one of their main uses (Paek, 2018). When people use web portals to find information, they tend to search purposefully for topics or issues that already interest them (Morahan-Martin, 2004). By contrast, people use social media sites more for social interaction and social support (Kim et al., 2011; Paek, 2018). Accordingly, social media usage may result in greater tendencies to support rather than deny rumors (Zubiaga et al., 2016), and to share information more as a result of normative influence rather than its actual veracity (Kim, 2018; Lee & Oh, 2017).

Second, depending on the different ways people use web portals and social media sites, they will have different perceptions of the information sources they encounter on each channel. On websites and web portals, information sources (including those for rumors) often have anonymous or uncertain identities that are difficult to verify (Lee & Youn, 2009). On social media, information sources are more often people whom users already know or are at least familiar with. As a result, the actual veracity of information may be a more important influence on information searching and sharing

behaviors on web portals, whereas tie strength, trust in the members of one's social network, and susceptibility to interpersonal influence may be more important on social media sites (Chu & Kim, 2011; Son et al., 2020). For example, people are more likely to share rumors that they receive from people with whom they have strong social ties because they perceive them to be trustworthy sources (Cheng et al., 2013).

Several studies have examined rumor circulation on specific media channels such as websites (Pal et al., 2020) and Twitter (Kim, 2018; Lee & Oh, 2017; Oh & Lee, 2019). However, no studies to our knowledge have compared different media channels' specific roles in the rumor circulation process. Due to insufficient evidence for developing hypotheses, we raise the following research questions.

RQ1: Will channel type be directly related to (a) perceived severity, (b) perceived susceptibility, and (c) intention to share rumor?

RQ2: Will channel type significantly moderate the relationship between a risk rumor's temporal framing and risk perceptions—i.e., (a) perceived severity and (b) perceived susceptibility?

RQ3: Will channel type significantly moderate the relationship between a risk rumor's temporal framing and intention to share?

The Roles of Risk Perceptions in Intention to Share Rumor

The circulation of risk rumors is also likely to be influenced by people's risk perceptions—specifically, their subjective judgments about the expected negative consequences and relevance of a rumor's featured issue (Allport & Postman, 1946; Pezzo & Beckstead, 2006; Rosnow, 1991). The mediating roles of perceived severity and perceived susceptibility have been documented in several studies (Kim & Kim, 2018; Lu &

Schuldt, 2018; Ma & Nan, 2019; Tannenbaum et al., 2015). It is reasonable to expect that these two variables would also be related to rumor circulation. For example, one study found that perceived susceptibility to a risk mediates the relationship between perceived temporal distance of antismoking messages (imminent vs. distant) and intention to quit smoking (Kim & Kim, 2018). Similarly, other studies have documented the mediating role of risk perceptions between health and risk messages and attitudes or behavioral intentions (Lu & Schuldt, 2018; Ma & Nan, 2019).

We aim to extend these findings by investigating the direct and mediating roles of risk perceptions in intention to share rumor. Direct effects of risk perceptions on behavioral intentions have been found to be robust and consistent (Kim & Kim, 2018; Lu & Schuldt, 2018). However, few studies on risk rumors have focused on perceived severity and perceived susceptibility. Accordingly, we propose hypotheses for these two risk perceptions' direct effects on intention to share, and we raise a research question about their possible mediating roles.

H2a: Perceived severity will be positively related to intention to share rumor.

H2b: Perceived susceptibility will be positively related to intention to share rumor.

RQ4: Will risk perceptions (perceived severity and perceived susceptibility) mediate the interaction effect of temporal framing and channel type on intention to share rumor?

The proposed model is presented in Figure 1.

We tested our hypotheses and research questions in the context of rumors about radiation-contaminated Japanese seafood products imported to and sold in South Korea. After a powerful earthquake and tsunami caused the meltdown of Japan's Fukushima Daiichi Nuclear Power Plant in March 2011, South Korea banned imports of agricultural and seafood products originating from the area. In the wake of this disaster, many rumors circulated claiming that Japan was trying to export contaminated seafood (Kim & Kim, 2017). At present, South Koreans continue to hold strong beliefs that seafood and other food products from Japan may pose radiation health risks. Such beliefs remain relevant in light of recent reports that the Japanese government is planning to discharge contaminated water from the Fukushima Daiichi plant into the sea (Lee, 2020).

Figure 1. *Proposed Model of Predicted Relationships Among the Variables*
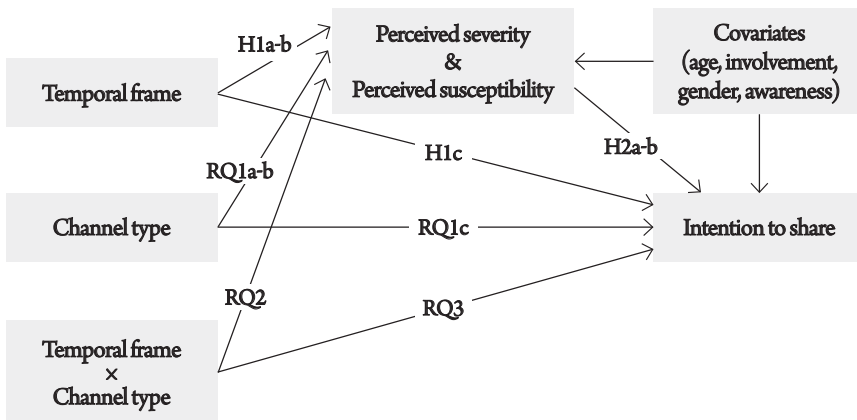
METHOD

Study Design

To test the hypotheses and answer the research question, we used a between-subjects experimental design of 2 temporal message frames (near vs. distant future) × 2 channel types (web portal vs. social media site). Temporal frame was manipulated; channel type was measured.

Sample and Procedure

The current study is part of a larger risk communication project in which the participants were randomly assigned to different rumor message conditions. The sample for the current study was recruited by a major research firm, which secured a panel of about 1.3 million South Korean residents proportionate to gender, region, and age (one exception was that it underrepresented people over 50). Each person was given a unique ID and the choice to volunteer in the study in exchange for points that could count toward online purchases from designated companies.

Once participants logged in to the study website, they reported their level of issue involvement for radiation. On the next page, Javascript directed them randomly to one of two message conditions (introduced as "unidentified information online"). After reading the assigned message, they were asked to identify a digital media channel on which they would be likely to encounter the information—either a web portal (e.g., Naver, Daum, Nate, Google, Yahoo) or a social media site (e.g., Twitter, Facebook, YouTube, blog). The remaining parts of the questionnaire included items related to manipulation checks, dependent variables, and demographic information. After completing the survey, participants were debriefed about the study's purpose and informed that the rumors in the messages they read had been fabricated for that purpose.

A total of 413 adult participants were included in our data analysis. Among them, 79.7% (n = 329) responded that they would be likely to encounter the risk rumor message on a web portal. Regarding sample characteristics, average age was 39.13 (SD = 10.76 years), and there was a near-even ratio of males (51.3%) and females (48.7%). More than a half had a four-year college degree (60.7%), followed by two- to three-year technical college degree (18.2%), and high school degree (13.8%). For monthly household income, 22.8% reported above 6 million Korean won (equivalent to about 5,500 USD); 19.1%, 4-5 million Korean won (equivalent to about 3,700-4,600 USD); 17.7%, 3-4 million won; 14%, more than 5 million won; 14%, 2-3 million won; and 12.3%, less than 2 million won.

Stimulus Development

Several Korean-language news and health organization sources were consulted in order to develop appropriate manipulations of the temporal frame for the risk topic of radiation-contaminated Japanese seafood products. In general, experts indicated that the effects of radiation exposure would take several years or decades to appear. The temporal frame manipulation was therefore designated as 3 years for *near future* and 30 years for *distant future*. Two versions of a rumor message about radiation-contaminated seafood were created by modifying an actual online news article. Except for the manipulation of near-future and distant-future frames, the two messages were identical, as indicated by this English translation:

> Radiation has been detected in Russian seafood products that have recently entered South Korea. Russian fishermen have made deals with Japan to catch and import seafood from the waters near Fukushima. As a result, people who eat Russian seafood may be exposed to radiation. Radiation exposure can affect our living area *within 3 years / within 30 years.*

Measures

Temporal frame (near future, distant future) and channel type (web portal, social media site) were used as independent variables. The three dependent variables were perceived severity, perceived susceptibility, and intention to share rumor. The two risk perception measures were adopted from previous studies (e.g., Ma & Nan, 2019; Paek, 2016) and modified to fit the context of radiation-contaminated food. Perceived severity was measured by asking participants to indicate their level of agreement with each of the following three statements on a seven-point Likert scale (1 = strongly disagree to 7 = strongly agree): "I believe that the risk due to radiation is very severe"; "I believe that the risks caused by radiation are hard to undo"; "I believe that the risk of radiation is very deadly" (Cronbach's α = .92). *Perceived susceptibility* was likewise measured with three items (7-point Likert scale, 1 = *not at all* to 7 = *very much*): "I believe I am likely to be exposed to the risk of radiation"; "I believe I am going to be affected by the risk of radiation"; "I believe I have a high chance of being exposed to radiation" (Cronbach's α = .95). *Intention to share rumor* was measured by averaging levels of agreement with two items (7-point Likert scale, 1 = *not all* to 7 = *very much*): "I will talk about this information with other people"; "I will share this information with other people" (Blodgett etal., 1997) (inter-item correlation = .88).[1]

Previous studies have shown that personal involvement with an issue influences rumor sharing behaviors (Oh et al., 2013). According to the elaboration likelihood model (ELM), people tend to scrutinize message claims more under high-involvement conditions (Petty & Cacioppo, 1986). When message claims include important health- and risk-related information, people tend to perceive the information as beneficial and to share it with others (Oh et al., 2013). These findings suggest that issue involvement may increase the speed of rumor dissemination (Allport & Postman, 1946; Oh et al., 2013; Rosnow, 1991). To control for the impact of issue involvement, participants were asked to rate their level of agreement with four statements topically modified from previous research (Chua & Banerjee, 2017) (7-point Likert scale, 1 = *not at all* to 7 = *very much*): "I am interested in the issue of radiation"; "The issue of radiation is relevant to me"; "I have often thought about the issue of radiation"; "The issue of radiation is important to me" (Cronbach's α = .90). Also controlled for was *rumor awareness*, which refers to prior knowledge about a rumor and has been shown to affect intention to share (Kwon & Cho, 2017). Since rumors include unverified and abstract information, people tend to evaluate them based on their pre-existing knowledge (Kwon & Cho, 2017). When people have sufficient knowledge about an issue, they tend to process information about it more carefully. However, as the Heuristic-Systematic Model predicts, people who lack prior knowledge tend to rely on external cues—e.g., the surroundings in which they take the survey, the design of the questionnaire—more than message content (Maheswaran & Sternthal, 1990). Accordingly, we controlled for varying degrees of rumor awareness to prevent them from biasing our findings. For this question item, participants were asked to answer yes or no to the question, "Have you ever heard about the above information?" Demographic variables, such as age and gender, also served as control variables because they are known to be related to digital media uses and risk perceptions. For subsequent analyses, scores of all items for each construct were averaged.

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[1] Since Cronbach's alpha is sensitive to the number of item scales, it is appropriate for multiple items (Pallant, 2011). For two-item scales, correlation coefficient has been deemed more appropriate. Accordingly, this study used inter-item correlation rather than Cronbach's alpha.

RESULTS

Manipulation Check

To confirm success for the message manipulation, participants were asked to rank on a scale of 1 to 7 the degree to which their thoughts about the provided message were close to either of the following two statements: "The effects of radiation are likely to appear in the relatively near future ← (1) (2) (3) (4) (5) (6) (7) → The effects of radiation are likely to appear in the relatively distant future." Independent samples t-test showed that participants exposed to the near-future rumor had a higher tendency to believe that the effects of radiation exposure would appear in the near future ($M = 5.49$, $SD = 0.92$) than did those exposed to the distant-future rumor ($M = 5.25$, $SD = 1.13$), $t(411) = 2.34$, $p < .05$. By contrast, those exposed to the distant-future rumor had a higher tendency to believe that the effects of radiation exposure would appear in the distant future ($M = 3.27$, $SD = 1.51$) than did those exposed to the near-future rumor ($M = 2.99$, $SD = 1.34$), $t(411) = -2.02$, $p < .05$. These results indicate that the temporal frame manipulations were successful.

Hypothesis Testing and Research Question Results

H1 predicted main effects of temporal frame on perceived severity (H1a), perceived susceptibility (H2b), and intention to share rumor (H1c). To

test these hypotheses, three independent samples t-tests were conducted. As shown in Table 1, there were no significant differences between near and distant future rumor frames in perceived severity, perceived susceptibility, and intention to share rumor. H1a-c were therefore not supported.

The research questions inquired whether there were direct, moderating, and mediating effects of channel type, perceived severity, and perceived susceptibility simultaneously. To answer these questions, a regression-based path analysis was performed via the PROCESS Macro with model 8 (Hayes, 2018). PROCESS allows for simultaneous tests of the impact of temporal frame (independent variable), channel type (moderating variable), and the elicited risk perceptions (mediating variables) on intention to share rumors. PROCESS generates bias-corrected and 95% confidence intervals based on the bootstrapping method to test mediation and moderation simultaneously (Hayes, 2018). Since the base of PROCESS is regression, temporal frame (0 = *distant future*, 1 = *near future*) and channel type (0 = *social media*, 1 = *web portals*) were dummy coded. Results are presented in Table 2.

RQ1 asked whether there was a main effect of channel type on perceived severity (RQ1a), perceived susceptibility (RQ1b), and intention to share rumor (RQ1c). Results showed that channel type was significantly related to perceived susceptibility ($B = -0.49$, $SE = 0.16$, $p = .003$). When participants indicated that they

Table 1. *Independent Samples t-test Results*

	Temporal Frame	N	M	SD	t	p
Perceived severity	Near future	205	5.88	.93	1.12	.263
	Distant future	208	5.77	.98		
Perceived susceptibility	Near future	205	5.01	1.10	-.52	.603
	Distant future	208	5.07	1.08		
Intention to share	Near future	205	4.84.	1.29	.64	.522
	Distant future	208	4.73	1.14		

would encounter the rumor on social media, as opposed to web portals, they tended to have higher perceived susceptibility. However, there were no significant direct effects of channel type on perceived severity (B = -0.23, SE = 0.15, p = .137) and intention to share rumor (B = 0.09, SE = 0.18, p = .594).

RQ2 asked whether channel type would moderate the relationship between temporal frame and risk perceptions. Positive interaction effects were observed between temporal frame and channel type on perceived severity (B = 0.44, SE = 0.23, p = .049) and perceived susceptibility (B = 0.72, SE = 0.24, p = .002). More closely examined, conditional effects were significant: when participants indicated that they would encounter the rumor on social media, as opposed to a web portal, the distant-future rumor generated a higher level of perceived susceptibility than the near-future rumor (B = -0.66, SE = 0.21, 95% CI [-1.08, -0.25].

RQ3 asked whether channel type would moderate the relationship between temporal frame and intention to share rumors. There was no significant interaction effect between temporal frame and channel type on intention to share (B = 0.14, SE = 0.26, p = .593).

Hypotheses 2a and 2b predicted direct positive effects of perceived severity and perceived susceptibility on intention to share rumor. Results support both hypotheses. The higher people's perceived severity (B = 0.15, SE = 0.06, p = .015) and perceived susceptibility (B = 0.32, SE = 0.06, p < .001), the more likely they intended to share the rumor.

RQ4 asked whether risk perceptions (perceived severity and perceived susceptibility) would mediate the interaction effects of temporal frame and channel type on intention to share rumor. A significant conditional indirect effect was found only for perceived susceptibility, and when the rumor was presumed to appear on social media (Conditional indirect coeffsocial media = -0.21, Boot SE = 0.08, Boot CI [-0.40, -0.07].

Table 2. *Results of Moderated Mediation Model*

Predictor	Perceived severity		Perceived susceptibility		Intention to share	
	$B(SE)$	95% CI	$B(SE)$	95% CI	$B(SE)$	95% CI
Temporal frame (TF)	-.28(.20)	-.68 to .11	-.66(.21)**	-1.08 to -.25	-.07(.24)	-.53 to .40
Channel type (CT)	-.23(.15)	-.53 to .07	-.49(.16)**	-.81 to -.17	.10(.18)	-.26 to .45
TF × CT	.44(.23)*	.001 to .89	.72(.24)**	.25 to 1.18	.14(.26)	-.38 to .66
Perceived severity	-	-	-	-	.15(.06)*	.03 to .27
Perceived susceptibility	-	-	-	-	.32(.06)***	.21 to .44
Gender	.24(.09)**	.06 to .41	.41(.09)***	.22 to .59	.13(.11)	-.08 to .34
Age	.01(.004)	-.003 to .01	.002(.005)	-.01 to .01	.01(.01)	-.003 to .02
Rumor awareness	.12(.09)	-.07 to .31	.02(.10)	-.17 to .22	-.08(.11)	-.30 to .13
Involvement	.23(.04)***	.16 to .30	.38(.04)***	.30 to .45	.21(.05)***	.11 to .30
Model summary	R^2 = .12; $F(7,405)$ = 8.24, p <.001		R^2 = .26; $F(7,405)$ = 20.24, p < .001		R^2 = .27; $F(9,403)$ = 16.69, p < .001	

Note. Temporal frame: 0 = distant, 1 = near, Channel type: 0 = social media, 1 = web portals.
*p < .05. **p < .01. ***p < .001.

DISCUSSION

Now more than ever, digital media channels such as web portals and social media sites are enabling potentially harmful rumors to circulate both rapidly and widely. Particularly when such rumors are easily shared, the risk perceptions they elicit may lead to serious unintended consequences. This study aimed to investigate how the characteristics of a risk rumor message and the type of media channel on which it appears might jointly affect perceptions of and intention to share a rumor about radiation risks in seafood.

Contrary to previous findings (Chandran & Menon, 2004; Kim & Kim, 2018), no statistically significant differences were found between the two temporal frame conditions in terms of two risk perceptions and intention to share rumor. The framing of a risk as being either closer or more distant in time may not be sufficient enough to differentiate the level of either people's risk perceptions (perceived susceptibility and perceived severity) or their intention to share the rumor. In the specific case of radiation exposure, people may not perceive its consequences to be immediate or tangible. As a result, temporal framing of a radiation risk may not have the same direct impact as it does in the case of more immediate risks such as drinking (Gerend & Cullen, 2008) or contracting mononucleosis (Chandran & Menon, 2004). This atypical finding about temporal framing may also stem from the unverified nature of the rumor message used in this study. Since a rumor is unverified by default, it likely elicits abstract rather than concrete construals, and in that case the way it is temporally framed may not matter.

This reasoning may also explain our PROCESS model's unexpected finding that temporal frame had a significant direct impact on perceived susceptibility. Participants exposed to the near-future framed message ("Radiation exposure can affect our living area within 3 years") indicated

lower perceived susceptibility than those exposed to the distant-future framed message ("... within 30 years"). When people think about the distant future, they are more likely to have in mind generalized abstractions rather than concrete and specific details (Liberman et al., 2002). As a result, the evaluative implications of abstract construals would be more prominent in the distant future. Temporal construal theory proposes that construals of the distant future are less ambiguous, simpler, and more coherent than construals of the near future. If this reasoning is valid, people may presume that exposure to radiation-contaminated food products has only long-term consequences that will affect them in the distant rather than near future. In other words, coupled with the uncertain nature of risk rumors, the way this rumor was temporally framed—3 years vs. 30 years—might have led people to assume they would more likely be affected by radiation in the distant future.

Another explanation for our unexpected finding may be the degree of concreteness of the given rumor message. The rumor issue of radiation-contaminated seafood from Japan may be too concrete or specific to leave any room for construal thinking to come into play. This possibility, though, remains speculative because not much research has tested the CLT by directly comparing varying degrees of concreteness or abstraction in risk presentation. Future research should explore this variability further. Overall, more needs to be learned about whether temporal framing works differently across different types of risk rumors.

Compared to the weak and unexpected effects of temporal frame, some significant direct effects of channel type are noteworthy. In particular, people who assumed they would first encounter the rumor on social media perceived that they would likely be affected by it. This finding is consistent with an earlier study which found that people who were exposed to a cholesterol-related risk issue on a social media site had a

higher level of risk perceptions than those who were exposed to the same issue on a web portal (Paek, 2018). Such findings may be explained by the characteristics of social media in terms of information source, tie strengths, and trust within user networks. Specifically, as mentioned above, information sources on social media are more often people whom users already know or are at least familiar with. Thus, people are more likely to share rumors that they receive from sources with strong social ties because they perceive them to be trustworthy (Cheng et al., 2013). The significant role of social media was also found in interaction effects of temporal frame and channel type on risk perceptions. That is, people who assumed they would first encounter the rumor on social media had higher levels of perceived susceptibility in the distant-future frame condition than in the near-future frame condition. There are several theoretical implications for this finding.

First, the significant role of social media, which is highlighted in the social-mediated crisis communication model (SMCC) model, was also found in the context of a risk rumor. SMCC claims that social media have greater influence than other types of digital and traditional media on people's thoughts, attitudes, and intentions to express and rapidly share their opinions to others (Cheng, 2020; Schultz et al., 2011). SMCC has been studied mainly in the context of crisis situations, which may explain why there was little evidence of direct and moderating effects of social media on rumor sharing intention. However, our findings indicate that SMCC might also be applied to other message contexts such as risk rumors. More research is needed for deeper understanding of the roles of social media in rumor dissemination.

Second, our findings show that the effects of temporal frame and channel type seem more pronounced on perceived susceptibility than on perceived severity. This disparity may be due to the different roles that different types of risk

perceptions play in the processes of sharing and disseminating risk rumors. A similar disparity in the effects of risk perceptions was found in a previous study (Paek, 2018), although that study focused on the different typology of personal-level versus societal-level risk perceptions. A related point is that perceived susceptibility, not perceived severity, significantly mediated the interaction effects of temporal frame and channel type on intention to share rumor. This finding is also partially consistent with Paek (2018), who found conditional mediating roles of societal-level but not personal-level risk perceptions on intention to take preventive actions. Together with that study, the current study indicates that different types of risk perception may work differently across various risk and rumor contexts. Future research should explore this possibility further for different risk perceptions, across different types of media channels, and in various risk contexts.

Limitations and Future Research

Limitations are as follows. First and foremost, this focused on only a single risk topic—radiation contaminated seafood. Previous studies have indicated that both rumor type (Chua & Banerjee, 2017) and the characteristics of the featured topic or issue (Lee et al., 2021; Oh et al., 2013) are related to risk perceptions and intention to share rumor. Generalizability would be enhanced by using multiple types of rumors and multiple risk topics.

Second, we focused on the dimension of temporal framing in order to elicit perceptions of the featured risk as more or less concrete versus abstract. However, construal level theory acknowledges several other dimensions of psychological distance, for example spatial and social, that determine the degree to which people will construe an issue as a specific and concrete phenomenon occurring in a personally relevant context. Future research should explore these

other dimensions of psychological distance and examine how they affect people's risk perceptions and dissemination behaviors for various types of risk rumors.

Third, we used slightly different terms between the message manipulation and manipulation check question item. While we used "radiation exposure" in our manipulated messages, "effects of radiation" was used in the question item. Since the concept that we wanted to manipulate was temporal distance (near vs. distant future), not the various possible objects of radiation effects, we believe that this discrepancy does not influence the manipulation. However, future research should be careful to use consistent terms in order to avoid any discrepancies between manipulation messages and manipulation check questions.

Finally, in contrast to the study discussed above (Paek, 2018), we measured rather than manipulated channel type by asking people where they would first be likely to encounter the rumor message. The main reason why we measured channel type instead of manipulating it relates to achieving external validity. In actual situations, people are exposed to rumors on various channels by chance. One study found that the three channels where rumor exposure most frequently occurs are social media (89%), TV (63%), and online news sites (58%) (Jiang, 2017). Measuring channel type, however, resulted in unbalanced sample sizes between conditions because most people responded that they would be likely to encounter the rumor message on a web portal. One could also speculate that the channel type condition is not independent of the temporal frame condition, and that their possible relation may blur the findings. To rule out this speculation, we performed a test of independence to see whether the two categorical variables are related. A chi-square test indicated that they are not, $\chi^2(1) = 2.68$, $p = .102$. Nevertheless, measuring rather than manipulating channel could weaken

our findings. Given the scarcity of research on channel effects, future research should explore those effects in a wider variety of ways.

Despite this limitation, our findings on the role of social media sites in risk perceptions are consistent with Paek (2018), and this consistency enhances the generalizability of our findings. Nevertheless, future research should test and manipulate various types of digital media channels to build more robust theoretical arguments about channel effects.

Implications

This study provides theoretical implications for understanding the rumor circulation process in digital risk communication, and practical implications for risk communication management. The main theoretical implication is that it documents the different roles that digital media channel types play in the processes of eliciting risk perceptions and disseminating risk rumors. In particular, risk perceptions are affected more by where the rumor information is encountered rather than by how it is framed in the rumor message.

The main practical implication is that health and risk communication managers should monitor and pay more attention to risk rumors that appear on social media sites. According to our findings, when risk rumors appear on social media, as opposed to a web portal, they may elicit higher risk perceptions, intensify message reactions, and, jointly with message characteristics, generate higher tendencies to share the rumor (even if indirectly via risk perceptions). Since people receive information on social media from people in their social networks, they are likely to trust and share that information more than information circulated on Web portals. For this reason, health and risk information circulated on social media needs to be monitored for its truthfulness and correctness and then publicly corrected when it

is false or unreliable. Furthermore, to curb rumor circulation on social media, communicators need to make efforts to manage the public's perceived susceptibility. Although people are often exposed on social media to risk rumors that have distant future frames, they tend not to share rumors about risks for which they have low perceived susceptibility. However, once people perceive that they are susceptible to a risk, they are more likely to share rumors about it with others in their social network. One way to prevent this sharing by lowering perceived susceptibility is to provide clear call-to-action messages that specify how people can cope with or avoid the risk.

In addition to understanding the roles of digital media channels in the rumor sharing process, health and risk communicators also need to develop strategies for countering rumors and their potential harmful effects. Public health authorities worldwide, such as the World Health Organization and the Centers for Disease Control and Prevention, have been developing manuals for handling risks and crisis communication. In recent years, these manuals have included instructions on how to deal with health- and risk-related rumors on social media. These manuals need to be regularly updated so that they can provide health and risk professionals with the most current findings on the nature of rumors and the best ways to effectively manage them in times of crisis.

Although effective rumor response strategies are beginning to be explored (Paek & Hove, 2019a), more research needs to determine which ones can effectively correct or refute different types of risk rumors, particularly depending on whether they appear on different digital media channels.

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