A MODEL FOR EXAMINING THE EFFECTS OF FAKE NEWS AND SOCIAL ENDORSEMENT CUES ON INFORMATION SEEKING ABOUT PUBLIC HEALTH RISK

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by

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ABSTRACT

This study investigates the effects of fake news and social endorsement cues (e.g., number of likes and shares) of social media on individuals' information seeking intentions in the context of public health risk. Particularly, this study focuses on perceived credibility of messages and message source, perceived uncertainty about an issue, and emotional responses as cognitive and affective factors to understand how individuals perceive fake news and how their behavioral intentions to seek information about an issue are influenced by exposure to fake news on social media.

An online experiment (N = 172) was conducted with college students, which are part of young adults of heavy social media consumers, using the Zika virus outbreak as a subject of social media news. The results of this study showed perceived credibility of messages and message source as an important factor in explaining how individuals process fake news and factual news on social media and perceived uncertainty as a significant predictor of attitudes and behavioral intentions of information seeking. Also, this study found what are characteristics of fake news and how the cognitive and affective factors work together in individuals' perceptions of fake news and the effects of social media messages on information seeking intentions. With future directions of communication studies about fake news and social media messages, implications are discussed in terms of what communication efforts are needed to guide people to use social media as a news source in a more critical and healthier way in health risk and crisis situations.

CHAPTER 1: INTRODUCTION

In February 2020, after the novel coronavirus (COVID-19) outbreak spread worldwide and was declared as a highest level of public health emergency by the World Health Organization (WHO), WHO teams for risk communication and social media started working on plans to fight an epidemic of over-abundance of information. This "infodemic" can make it difficult for people to find and identify trustworthy and reliable sources and messages during the public health emergency (World Health Organization, 2020a). With increasing cases of infections, a lot of information about the virus has been generated and disseminated across various social media platforms. WHO teams reported that social media is rife with information about the virus, including myths, rumors, and false, inaccurate, and unverified information which can negatively influence the public's preventative behaviors and mental health related to the virus (World Health Organization, 2020a). At the Munich Security Conference held on February 15, 2020, the WHO director-general stated "we're not just fighting an epidemic; we're fighting an infodemic. Fake news spreads faster and more easily than this virus, and is just as dangerous. That's why we're also working with search and media companies like Facebook, Google, Pinterest, Tencent, Twitter, TikTok, YouTube and others to counter the spread of rumours and misinformation" (World Health Organization, 2020b).

With emerging social media platforms, people are able to obtain real-time information not only from mass media channels, but also from other diverse digital sources at any time and in any place. Social media are popular communication channels to generate, gather, share, express, discuss, and disseminate information and messages about social issues (Pew Research, 2016, 2018). The functions of social media have made

the platforms useful mass communication tools particularly in risk and crisis scenarios, since such situations require quick exchange of information with diverse groups of people (Mendoza, Poblete, & Castillo, 2010; Vieweg, 2010). Focusing on social media as crucial communication tools, scholars have examined their roles and potential impacts in risk and crisis events in term of the flow of information (e.g., Oh, Kwon, & Rao, 2010; Takahashi, Tandoc, & Carmichael, 2015; Toriumi et al., 2013).

Messages on social media, however, are not always useful for crisis situations as messages are generated and communicated quickly on social media regardless of their accuracy. Moreover, in comparison to traditional media outlets, there are fewer gatekeepers and systems to monitor and filter content (Li & Suh, 2015; Tandoc et al., 2018). One of the recent problems frequently discussed, in terms of social media messages and their accuracy, is the proliferation of fake news. Fake news is defined in the contemporary media environment as "fabricated information that mimics news media content in form but not in organizational process or intent" (Lazer et al., 2018, p. 1) or "news articles that are intentionally and verifiably false, and could mislead readers" (Allcott & Gentzkow, 2017, p. 213). Based on current discussions and conceptualizations of fake news in the academic and practical fields, fake news can be defined as a message that looks like real news but contains unverified and false information without journalistic or professional standards and ethics. Risk and crisis events can elicit a high level of uncertainty and anxiety among individuals when they have insufficient information about the issues. In this context, fake news shared via social media could potentially increase the public's anxiety and worry about the situation (Lee, Agrawal, & Rao, 2015) and spread inaccurate information.

Research has investigated how social media messages are generated and diffused related to public emergency events (e.g., Liu, Burton-Jones, & Xu, 2014; Starbird et al., 2014), but less research has explored the effects of fake news on individuals' attitudes and behavioral intentions, such as intentions to seek information about risk and crisis situations as well as to stay safe and/or reduce risk to others. Fake news is frequently regarded as detrimental to the public's understanding of an issue because it provides inaccurate information, however, there is little empirical research examining how fake news may influence individuals' cognitive and affective responses to the issue and what implications fake news has in people's news consumption. Thus, the current study focuses on fake news on social media and its message characteristics, individuals' perceptions of fake news, and how exposure to fake news could influence their information seeking behaviors.

In the field of communication, perceived credibility of messages and sources has been considered as an important factor in understanding the effects of specific types of messages on individuals' perceptions, attitudes, and behaviors (e.g., Chaiken, Liberman, & Eagly, 1989; Jone, Sinclair, & Courneya, 2003; Petty & Cacioppo, 1986). In the online media environment, there are unique message characteristics that could affect individuals' perceptions of the content. One of these characteristics is the interactivity of social media platforms that enables people to comment and like and share messages. These interactive message elements allow individual users to express their opinions, agreement or disagreement, and, overall, acknowledge the level of social endorsement of messages (Borah & Xiao, 2018). These message cues are distinctive communication factors only shown in online platforms by enabling people to engage in the communication process or

interact with media messages by clicking and posting something about the content (Kim & Stout, 2010; McMillan & Hwang, 2002). Individuals may use such interactive message cues in forming their perceptions of the credibility of online messages. Specifically, the number of likes and shares could function as heuristic cues of social endorsement in judging whether a message on social media, including fake news, is credible or not (Borah & Xiao, 2018).

In understanding how people process messages, it is also important to look at whether the messages are perceived as uncertain and what emotions are evoked (Babrow, 1992; Brashers, 2001). People feel uncertain "when details of situations are ambiguous, complex, unpredictable, or probabilistic; when information is unavailable or inconsistent; and when people feel insecure in their own state of knowledge or the state of knowledge in general" (Brashers, 2001, p. 478). Risk and crisis situations are unexpected, unpredictable, and threatening events (Reynolds & Seeger, 2012), so it is likely people will experience a level of uncertainty after exposure to messages about public health risks. Depending on the perceptions of uncertainty, individuals' behaviors, particularly their information seeking behaviors, could be influenced to help manage their unfavorable state (Babrow, 1992; Brashers, 2001).

Risk and crisis situations evoke not only uncertainty but also emotional reactions. Typically, negative emotions could be aroused with uncertainty in risk-related issues (Babrow, 1992; Brashers, 2001). Not just during risk and crisis events, fake news in general tends to contain sensational content to grab the public's attention and increase their curiosity; these techniques are used for generating financial gain by content producers from a high number of clicks on these fake news stories (Watson, 2018).

Exposure to unverified and stimulating messages such as fake news can evoke a level of both uncertainty and negative emotional response by the public. These factors may provide explanations for how people are influenced by messages in public health emergencies. Therefore, the current study focuses on perceived credibility of messages and message source, perceived uncertainty, and emotional reactions as cognitive and affective factors that contribute to understanding how people process social media messages, particularly fake news, about a public health risk issue.

Based on previous studies about social media in the context of public emergency situations, this study first discusses the use of social media in general and then narrows down the discussion to fake news and its message characteristics specifically. Next, the study looks at how people may process information on social media focusing on perceived credibility of messages and message source, perceived uncertainty, and emotional responses. Finally, the study provides a hypothesized model that explores how individuals' information seeking intentions could be affected by fake news and its social endorsement cues on social media using persuasion models (e.g., Elaboration Likelihood Model) and the Uncertainty Management Theory as theoretical frameworks.

The current study employed an online experiment to investigate the effects of fake news and its social endorsement cues on information seeking intentions using the Zika virus outbreak - which is a significant and on-going public health risk and crisis - as a subject of social media messages. When the Zika virus infection has been a widespread epidemic outbreak all around the world in 2015, there was not enough information about the virus, which does not have a developed vaccine for prevention or medicine for treatment. Because of the Zika virus's severity coupled with insufficient information

about the disease, unverified messages have been generated and spread related to its symptoms, transmission, and risks. In order to counteract false and misinformation about the virus, health organizations, such as the World Health Organization and the Centers for Disease Control and Prevention, have provided accurate information about the issue as well as offered recommendations to prevent the disease. The virus epidemic is a global public health risk and crisis and a topic for fake news on social media, thus the current study used the Zika virus as a public health risk issue of social media news in the experiment.

Based on the results of the study, it will be discussed how people perceive fake news and social endorsement cues (e.g., number of likes and shares) on social media in terms of credibility, uncertainty, and emotional reactions. Also, it will be examined whether those factors significantly explain the overall effects of different types of social media news (e.g., factual vs. fake news) on individuals' information seeking intentions. Research suggests that fake news on social media has been a significant issue to disturb people's information gathering and consumption (Watson, 2018), but less is known about how individuals are affected by different types of social media messages. This study will offer in-depth insights into the effects of fake news and social media message cues on individuals' behavioral intentions to seek health risk-related information.

This study proposes a theoretical model that accounts for how message cues, cognitive and affective responses to social media messages, as well as attitudes toward information seeking may work together to predict an individual's information seeking intentions regarding the health risk issue. To help combat public health epidemics, the diffusion of information about the risk is important to the health of the public and

containment of the crisis. Better understanding the conditions under which social media news may contribute to public health-related information seeking will be helpful to health and news organizations, as well as social media companies. The results of this research will contribute to our theoretical understanding of the cognitive and affective processes at work in evaluation of social media messages about public health issues and provide directions for practical applications of the findings to future message construction.

CHAPTER 2: LITERATURE REVIEW

Social Media in Risk and Crisis Events

Social media make it convenient for users to access, obtain, create, and share information about social issues without the constrains of time and place. They are the primary communication channels that individuals use to access information but also to exchange and discuss information and stories with others about a variety of topics (Pew Research, 2016, 2018). Social media can be particularly useful in risk and crisis events because the emergency situations require real-time communication with organizations, communities, and publics (Mendoza et al., 2010; Vieweg, 2010). Through social media, people can be quickly made aware of risks that they face, what has occurred, and what should be done to prevent the negative impacts in these situations.

With the increasingly important role of social media in information dissemination, organizations that manage emergency situations such as the Center for Disease Control and Prevention have made more efforts in using social media in their communications with publics (e.g., Centers for Disease Control and Prevention, 2014). In terms of social media in risks and crises, studies have examined how social media play a role as communication tools and what are the impacts of social media in emergency scenarios (e.g., Starbird et al., 2015; Takahashi et al., 2015; Velev & Zlateva, 2012). In risk and crisis events, social media usually keep their function as channels for connecting with people and delivering and exchanging information immediately to large and dispersed audiences while other traditional communication channels, such as television, radio, and newspapers, could be not accessible or take more time in communication (Velev & Zlateva, 2012).

Social media have received considerable attention in both academic and practical fields as important media channels as well as complementary tools of traditional media during risks and crises, however, many of studies have focused on how institutions use social media with taking the public as passive users of information (Takahashi et al., 2015). As online media research has demonstrated, individuals can be active producers, consumers, and disseminators of media content on social media, so it is also necessary to look at how people use social media and understand what are the patterns of their message processing on the platforms (Takahashi et al., 2015).

Compared to traditional media outlets, social media platforms are absent from gatekeepers and professional controls to monitor content based on journalistic ethics (Li & Suh, 2015; Watson, 2018). On the one hand, this may be perceived as a positive characteristic of social media in terms of bringing down the dominant structure of some news institutions (Tandoc & Vos, 2016), but on the other hand, inaccurate information such as fake news can be generated, delivered, and spread quickly through social media in emergency situations without systematic process (Bode & Vraga, 2018; Castillo, Mendoza, & Poblete, 2011; Lee et al., 2015; Tandoc et al., 2018). That is, anyone who has access to online media can create and distribute any type of information to mass audiences without filtering the messages by professional gatekeepers or journalistic norms (Borah & Xiao, 2018; Tandoc et al., 2018). Social media enable people to access diverse messages for their awareness, knowledge, understanding, and preparedness for risk and crisis situations, however, they are also platforms that could easily disseminate unverified and false messages such as fake news (Tandoc et al., 2018; Watson, 2018).

According to Pew Research Center's survey (2018), over two-thirds of U.S. adults

reported they use social media to get news, however more than half of them (57%) stated they are skeptical toward social media messages because they think the news they see on social media is largely inaccurate. Many of the public use social media because of their benefits, but they also have concerns about inaccuracy of social media news including fake news (Pew Research, 2018). Fake news has become one of the critical aspects of online media environments with growing the use of social media.

Fake News on Social Media

With concerns about the spread of false information on social media, the conceptualization and characteristics of fake news have been discussed in both academic and practical areas. In the article about the scientific review of fake news, Lazer and colleagues (2018) defined fake news as "fabricated information that mimics news media content in form but not in organizational process or intent" and argued its outlets have no "news media's editorial norms and processes for ensuring the accuracy and credibility of information" (p. 1). In the study about social media and the spread of fake news in the 2016 presidential election, Allcott and Gentzkow (2017) conceptualized fake news as "news articles that are intentionally and verifiably false, and could mislead readers" (p. 213). Barbara Friedman, a media scholar and associate professor in the school of journalism and media at the University of North Carolina, also stated fake news is "deliberately and strategically constructed lies that are presented as news articles and are intended to mislead the public" (as cited in Seidenberg, 2017, para 15). Tandoc and colleagues (2018) examined the use of the term, fake news, in academic fields and argued fake news is fabricated and manipulated news that intends to mislead people without

factual basis.

Scholars have commonly discussed fake news as inaccurate and false news about a certain issue that looks like real news and tends to manipulate or mislead public opinions without journalistic or professional standards and ethics. Traditional media outlets have their own systems to check if messages they report are based on facts or verified information and to correct their mistakes in reporting inaccurate news to their audiences. Fake news is produced by non-traditional news outlets, but the news source, such as its logo or website name, looks like an established news organization (Watson, 2018). Fake news is usually disseminated online, often through social media (Tandoc et al., 2018; Watson, 2018). Based on these conceptualizations, the current study uses the term, fake news, as unverified and false news that looks like real news media content but not produced by an established news organization with journalistic norms and ethics.

Risk and crisis events have a high level of potential threats and make people fearful and anxious; such conditions offer grounds for unverified messages to be generated and shared among the public (Comfort, 2005; Oh et al., 2010). Based on literatures of crisis communication and management (e.g., Barton, 2001; Coombs, 2014, Zaremba, 2014), a crisis is an atypical, unexpected, and overwhelming event that can have threats and negative impacts on multiple areas. A risk refers to "a situation or event where something of human value (including humans themselves) is at stake and where the outcome is uncertain" or "an uncertain consequence of an event or an activity with respect to something that human value" in social sciences (Aven & Renn, 2009, p. 1). Both risk and crisis are emergency situations when something is happening unexpectedly and with potentially negative consequences, usually requiring immediate responses and

communication (Reynolds & Seeger, 2012).

Risk and crisis events can provide fertile ground for unverified information because of situational characteristics such as potential threats and unpredicted impacts (Comfort, 2005; Oh et al., 2010). More specifically, public health emergencies, such as the outbreak of a specific disease, could pose a risk to the general public and be a crisis to the players (e.g., public health agencies) involved in the situation (Reynolds & Seeger, 2005, 2012). During a public health risk and crisis, any messages could be created by diverse groups of people to manage their cognitive and affective states or to attack certain organizations if they do not handle the situation well. According to DiFonzo and Bordia (2007a, 2007b), rumors, one type of unverified information, are emergent when the situations are dangerous, have potentially negative impacts on the public, and are not clear in terms of the causes and known outcomes. Because fake news tends to have sensational headlines, images, and content to grab attention and stimulate curiosity, fake news could attract a high number of clicks and generate financial gain from the clicks (Watson, 2018). This may be another explanation of the proliferation of fake news on social media these days.

Fake news has been considered to be problematic information with negative impacts on the public, and social media have been criticized as platforms that make fake news easily created and shared with mass audiences (Watson, 2018). In public emergency events, if unverified messages are quickly disseminated on social media without any corrective information that shows if the messages are true or not, the public could be in a chaotic situation with the absence of reliable messages (Mendoza et al., 2010). In the study about news in the Ebola panic period (Kilgo, Yoo, & Johnson, 2018), it was shown

that social media were more likely to spread and intensify panic in comparison to traditional newspaper coverage. The study focused on news shared on Reddit, a social networking site, and how news coverage on the social media platform is different from newspaper articles in terms of the emphasis of blame, praise, general risk, risk in the country, solution, and speculation related to the issue. The results of the study demonstrated that news shared on social media networks tended to intensify panic by emphasizing blame or risk, while newspaper articles tended to have neutral or panic-reducing content. Since any type of news can be distributed by anyone on social media, unfiltered news shared online may inflame people's negative responses, such as panic, to the health risk (Kilgo et al., 2018).

Fake news shared on social media can also disrupt the delivering of important factual news to the public in emergency situations. Organizations may take additional communication efforts to manage risk and crisis by sending out fact and corrected information to counteract unverified and false information being spread about the event. If people are exposed to both verified and unverified messages about the issue, then their understanding of the event is incomplete without having enough fact-based information. As a result, they may become confused, disturbed, and frustrated about the issue.

People also could be resistant to verified information and solutions if fake news are pervasive and dominates media platforms with a high level of general public's endorsement. The spread of fake news via social media has resulted in people being dismissive of the seriousness of a health risk (e.g., COVID-19) and the recommendations to the public from respected public health organizations to help stop the spread of a disease (Robson, 2020). Although the problem of the spread of fake news has been a hot

topic in the United States, few empirical studies have been conducted in terms of its actual effects on individuals' information processing, such as how people perceive fake news, how they use fake news in their message processing, and what message cues make fake news look more reliable and believable on social media.

Credibility and Cues of Social Media Messages

In the field of communication, individuals' perceived credibility of message and message source has been regarded as a crucial factor in understanding the effects of specific types of messages on perceptions, attitudes, and behaviors (e.g., Chaiken, Liberman, & Eagly, 1989; Jone, Sinclair, & Courneya, 2003). For example, one of the often-cited persuasion theories, the Heuristic Systematic Model (HSM), shows source credibility as a common heuristic cue that affect people's attitude and behavior changes following exposure to messages (Chaiken & Eagly, 1993; Chaiken et al., 1989). The HSM demonstrates the dual message processing - systematic and heuristic processing - based on their level of motivation (e.g., personal relevance to the message) and cognitive ability (e.g., knowledge of the message topic) (Chaiken & Eagly, 1993). In systematic processing, messages are analyzed and considered thoroughly and carefully with a typically high level of personal motivation and cognitive ability. Heuristic processing is when people use simple message cues, such as a source of messages, for making their judgment with a low level of motivation and cognitive ability. In this mode of processing, people are more likely to believe a message if they perceive the message source is credible.

Another persuasion theory, the Elaboration Likelihood Model (ELM), also asserts

that people use their perceptions of message and source credibility as heuristic cues that influence the persuasive effects of messages on attitude and behavior changes (Petty & Cacioppo, 1986). Like the HSM, the ELM provides two routes of message processing, central and peripheral routes, depending on individual's cognitive ability, motivation, and/or involvement to the topic of messages (Petty & Cacioppo, 1986). The model posits that people are more likely to concentrate on messages in detail when they have a high level of cognitive ability and/or motivation, whereas they are likely to rely on peripheral cues of messages, such as source expertise and credibility, when their cognitive ability and/or motivation is not high. In both models, perceived credibility of message and its source has been considered importantly in processing messages.

Particularly in the social media environment with information overload, individuals' perceptions of authentication of information could heavily depend on how they judge the source and the message (Tandoc et al., 2018). Source credibility is an individual's perception of a message provider's expertise or trustworthiness to offer credible information to audiences (Hovland et al., 1953; Hovland & Weiss, 1951). Message credibility is "an individuals' judgment of the veracity of the content of communication" (Appelman & Sundar, 2016, p. 63). It is the individuals' perceived credibility of the message itself such as its quality and accuracy (Metzger et al., 2003). Exposure to messages from credible sources can lead to greater retention and recall of information, as well as prosocial behavioral intentions, than less credible sources (e.g., Jones, Sinclair, & Courneya, 2003).

Perceived credibility of social media messages could also affect people's behaviors toward health-related risk issues (Borah & Xiao, 2018). When individuals are

satisfied with credibility of the message and its source, they are more likely to accept the information and their perceptions and attitudes can be more influenced by the message. However, if the message is not perceived to be believable and trustworthy, individuals may take further actions such as seeking additional information through other news sources or personal contacts rather than just relying on the message (Tandoc et al., 2018). In the present case, exposure to social media messages about a public health risk that are deemed to be untrustworthy, many prompt individuals to seek out further information for clarity.

In the study of fake news and individuals' judgment of message authentication (Tandoc et al., 2018), it was explained that quantitative heuristics such as a number of likes and shares and others' comments are used in evaluating social media messages. In a study about the effects of audience feedback on news production and consumption online (Lee & Tandoc, 2017), it is argued that news users' responses and judgment about news are affected by audiences' feedback. The authors argue that a high number of likes and shares on social media messages can be a signal of favorable feedback and it can influence the veracity of information and make fake news more trustworthy.

Those factors are unique message elements on social media that are constructed by users' interactive engagement in message production and dissemination (e.g., Lee & Tandoc, 2017; Kim & Stout, 2010). The concept of interactivity in web-based technologies is when people can participate in communication process or interact with media messages or content, such as by having control over messages or doing actions or responses to content, in real time (McMillan & Hwang, 2002; Kim & Stout, 2010; Steuer, 1992). On social media, individuals can easily generate, discuss, modify, and distribute

messages but also express their opinions about the message by posting comments or clicking ‘like’ and/or ‘share’. These interactive elements can be considered as distinct message cues on social media that could affect individuals’ message perceptions (Li & Suh, 2015).

In Borah and Xiao’s (2018) empirical study about the effects of message framing, endorsement heuristic, and source on perceived credibility of health information on Facebook, it was found that the number of ‘likes’ influences individuals’ perceived credibility of given messages. The study conceptualized the number of ‘likes’ as social endorsement that shows the amount of collective endorsement indicating how much the message get agreement, trust, and/or support on social media. The results of the study showed that a high number of ‘likes’ of messages with an expert source and message framing emphasizing benefits were perceived as more credible to readers (Borah & Xiao, 2018).

In the online environment, however, individuals rely more on heuristic cues in processing information, because they tend to use less cognitive efforts in an online environment which has information overload (Metzger et al., 2010; Walther & Jang, 2012). Metzger and Flanagin (2013) argued that social endorsement plays a powerful role in the digital media world, because it directly presents how others – both known and unknown people – think about the media content, site, or source. They explain that social endorsement online, such as liking or agreement heuristics, could be more powerful than information itself in forming perceptions of the message. Metzger and colleagues (2010) also described the impacts of endorsement heuristics by stating that people could trust the information with a high number of endorsements even though they are not familiar with

the source of information or have skepticism toward the source.

In summary, individuals encounter a large amount of information from diverse sources on social media. They may use less cognitive efforts in judging credibility of source and messages, and thus are likely to rely on heuristic message cues for their message perceptions. The current study, therefore, focuses on the number of likes and shares as unique message cues of social endorsement on social media that could affect individuals' perceptions of message and source credibility. Individuals may perceive social media messages more credible and trust the source of messages if messages have a high level of social endorsement cues.

Uncertainty, Affective Responses, and Information Seeking

As described above, risk and crisis events may incite reactions in the public and provide grounds for unverified information to circulate because of the situational characteristics of the events, such as potential threats and unpredicted impacts (Comfort, 2005; Oh et al., 2010). In emergency situations, it is important for both publics and organizations to have communications with accurate information about what is the current state of the issue, what are the potential impacts of the issue, and how they could prevent the negative consequences of the event. Social media enable real-time communications with diverse groups in risk and crisis situations (Mendoza et al., 2010; Vieweg, 2010); however, they also deliver and spread false information (Bode & Vraga, 2018; Castillo, Mendoza, & Poblete, 2011; Lee et al., 2015; Tandoc et al., 2018). Individuals' efforts to learn about a public health issue have been crucial for their information processing and managing emergency situations in the modern media

environment.

In the context of risk and crisis, specifically related to health issues, individuals' information seeking behaviors are affected by their level of uncertainty of the situations. Uncertainty is a state that people feel "when details of situations are ambiguous, complex, unpredictable, or probabilistic; when information is unavailable or inconsistent; and when people feel insecure in their own state of knowledge or the state of knowledge in general" and it is "a self-perception about one's own cognitions or ability to derive meaning, a person who believes himself or herself to be uncertain is uncertain" (Brashers, 2001, p. 478). Crises are unexpected and threatening events that potentially imply harmful impacts (Reynolds & Seeger, 2012) and risks are "the product of probability of occurrence and intensity or magnitude of harm" (Heath & O'Hair, 2009, p. 10). Aven and Renn (2009) demonstrate that a risk as "an event or consequence in a certain setting: the consequences (outcomes) are uncertain and something of human value is at stake" (p. 2-3) in their study of the definition of risk. They state that uncertainty and severity are key components of risk based on the use of risk in the academic fields. In such situations, uncertainty exists when an individual assesses the probability that a certain event will occur (Babrow, 1992). When a person is not certain about the occurrence of the event, their level of uncertainty could be increased (Babrow, 1992; Brashers, 2001), and such an uncertain state could influence information seeking behaviors. If individuals have a high level of uncertainty, they often take further actions to manage their unfavorable state such as follow-up information seeking about the issue. This, uncertainty is positively associated the information seeking behaviors.

The Uncertainty Management Theory (Brasher, 2001) demonstrates the idea of

the role of uncertainty in explaining when people have motivations to seek further information about issues. The theory has been proposed in the context of health communication and used widely in understanding information processing for risk and crisis issues related to health. The theory argues people manage their uncertainty by seeking or avoiding information. The framework proposes individuals' perceived uncertainty is a core factor in influencing individuals' behavioral intentions to seek information.

Uncertainty management also posits that affective responses should be considered in explaining information seeking behaviors, because emotions are highly related to uncertainty appraisals in health risk issues (Babrow, 1992; Brashers, 2001). Uncertainty can evoke and exist along with negative emotional reactions, such as worry and anxiety, if the issue threatens health and safety. Like uncertainty, affective responses can predict behavioral intentions to seek information. Previous studies have shown that negative emotions promote information seeking behaviors (e.g., Griffin et al., 2008; Yang & Kahlor, 2013). Specifically, if people feel uncertain and anxious or concerned about a risk issue, they may seek further information to manage their unfavorable feeling by acquiring more information and knowledge. Affective responses have been considered importantly not only in the context of uncertainty management, but also in other theories of information processing such as the risk information seeking and processing (RISP) model (Griffin et al., 1999) and the extended parallel process model (EPPM) (Witte, 1992).

The RISP model demonstrates how people's risk-related information seeking and processing can be predicted and provides several factors, that affect one another and

guide individuals' behaviors, such as individual characteristics (e.g., demographic/sociocultural factors, relevant hazard experience), perceived hazard characteristics, affective response, informational subjective norms, information sufficiency, relevant channel beliefs, and perceived information gathering capacity (Griffin et al., 1999). As stated, the model uses individuals' affective response to the issue as one of the variables in explaining the process of risk information seeking behavior. Based on the model, it has been shown that negative emotions could play a role to stimulate information seeking behaviors with other key variables like social and communicative factors of the model (Griffin et al., 2008).

The EPPM describes how people respond to fear appeal messages in the context of health and risk (Witte, 1992, 1994). The model explains the control of danger and fear as primary process when people determine their responses to health risk messages (e.g., message acceptance or message rejection) based on their perceived threat (e.g., susceptibility, severity) and perceived efficacy (e.g., self-efficacy, response efficacy). Like these two models, affective responses have been considered as key elements in understanding how people respond to and process risk information in communication studies. As stated above, exposure to fake news which is unverified and sensational messages could evoke certain level of uncertainty and negative emotional responses to message receivers.

Hypotheses, Research Questions, and a Proposed Model of the Present Study

To sum up, people can get information about a health risk issue from diverse sources on social media. In this online environment with information overload, people

may be more likely to use message cues such as the number of likes and shares in judging if the information is reliable and believable. The message cues could play an important role in explaining how people process social media messages including fake news. Specifically, people may perceive social media news differently by the types of news (fake news vs. factual news) and the level of social endorsement cues (high number of 'likes' and 'shares' vs. low number of 'likes' and 'shares'). As discussed above, these news types and message cues could affect individuals' evaluations differently about whether the messages and message sources are trustworthy and credible (e.g., Borah & Xiao, 2018; Lee & Tandoc, 2017). Based on previous studies, it is predicted that factual news and news stories with greater social endorsement on social media will be perceived as more credible, in comparison to fake news and news with little social endorsement. Therefore, the current study suggests the following hypotheses and research question about the effects of social media news and social endorsement cues on individuals' perceived credibility of messages and message source:

Hypothesis 1a: Participants exposed to fake news will evaluate the message source as less credible than those exposed to factual news.

Hypothesis 1b: Participants exposed to news with a high number of likes and shares will evaluate the message source as more credible than those exposed to news with a low number of likes and shares.

Hypothesis 1c: Participants exposed to fake news will evaluate the messages as less credible than those exposed to factual news.

Hypothesis 1d: Participants exposed to news with a high number of likes and shares will evaluate the messages as more credible than those exposed to news

with a low number of likes and shares.

Research question 1: How will the interplay of news type (factual and fake news) and social endorsement (number of likes and shares) influence participants' evaluation of (a) the credibility of message source and (b) the credibility of messages?

As explained in the literature review, in health-related risk and crisis events, individuals could have uncertainty and emotional responses to the issues. Those are important factors to predict individuals' attitudes and behavioral intentions in risk and crisis situations (Babrow, 1992; Brashers, 2001; Griffin et al., 1999). Based on definitions of uncertainty (e.g., Brashers, 2001), people may feel uncertainty when messages about an issue are not presented and supported with verified, clear, and consistent information about an issue. In the same line, people may have more negative emotions when they are exposed to unverified, inconsistent, and ambiguous messages than when exposure to messages with clear, verified, and sufficient information. Thus, it is expected that fake news as well as news stories with less social endorsement online (e.g., low number of likes and shares) will generate greater levels of uncertainty and negative emotion, in comparison to viewing factual news and news with high social endorsement online. Based on that, this study proposes the following hypotheses and research questions about how social media news and its unique message cues affect individuals' uncertainty and negative emotional responses about the issue:

Hypothesis 2a: Participants exposed to fake news will report more uncertainty about the Zika virus compared to those exposed to factual news.

Hypothesis 2b: Participants exposed to news with a high number of likes and

shares will report less uncertainty about the Zika virus compared to those exposed to news with a low number of likes and shares.

Research question 2: How will the interplay of news type (factual and fake news) and social endorsement (number of likes and shares) influence participants' uncertainty about the Zika virus?

Hypothesis 3a: Participants exposed to fake news will report more negative emotional responses to the Zika virus compared to those exposed to factual news.

Hypothesis 3b: Participants exposed to news with a high number of likes and shares will show less negative emotional responses to the Zika virus compared to those exposed to news with a low number of likes and shares.

Research question 3: How will the interplay of news type (factual and fake news) and social endorsement (number of likes and shares) influence participants' emotional responses to the Zika virus?

According to communication models about message processing (e.g., ELM, HSM), uncertainty management (e.g., Brasher, 2001), and risk information processing (e.g., Griffin et al., 2008), individuals' attitudes and behavioral intentions could be influenced by perceived credibility of messages and message source, perceived uncertainty, and emotional responses. When people perceive the given messages and message source are credible, their attitudes and behavioral intentions can be more influenced by exposure to the messages. When people feel uncertain about an issue, they can have motivations to seek additional information about it. Negative emotions can stimulate information seeking behaviors. Focusing on attitudes and behavioral intentions to seek information about the issue as outcomes, this study will look at how these

cognitive and affective factors play a role as predictors of attitudes and how the attitudes affect behavioral intentions of information seeking in the context of public health risk. Based on that, this study proposes the following hypotheses:

Hypothesis 4: Participants' (a) perceived credibility of message source, (b) perceived credibility of messages, (c) perceived uncertainty about the Zika virus, and (d) negative emotional responses to the Zika virus will be positively related to attitudes toward Zika information seeking.

Hypothesis 5: Participants' behavioral intentions to seek information about the Zika virus will be positively associated with attitudes toward Zika information seeking.

After examining the above pathways, the current study will explore the role of perceived credibility of messages and message source, perceived uncertainty, and emotional responses as cognitive and affective factors for understanding how individuals are influenced by fake news on social media. By proposing a hypothesized structural model of the effects of social media news on attitudes and information seeking intentions through cognitive and affective responses (Figure 1), this study provides an overall picture to understand how people process social media messages in the context of public health risk events.

Hypothesis 6: Participants' (a) perceived credibility of message source, (b) perceived credibility of messages, (c) perceived uncertainty about the Zika virus, and (d) emotional responses to the Zika virus will mediate the effects of social media news on participants' (1) attitudes toward Zika information seeking and (2) behavioral intentions of Zika information seeking.

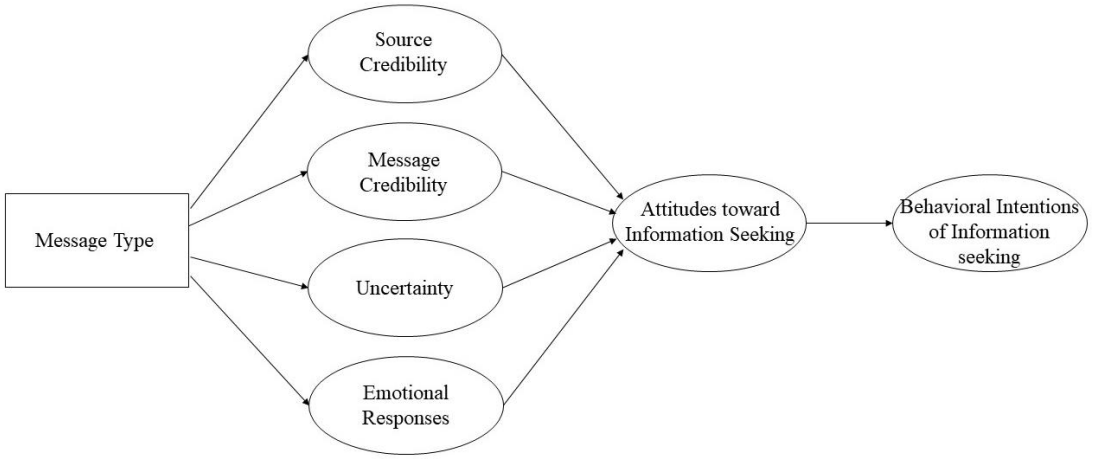

Figure 1. Hypothesized structural model of the effects of social media news on information processing in the public health risk

For further investigation, this study explores the relationships between cognitive and affective factors by proposing a research question below.

Research question 4: What are the relationships between perceived credibility of message source, perceived credibility of messages, perceived uncertainty about the Zika virus, and emotional responses to the Zika virus?

In addition, based on the discussions about conceptualizations of fake news on social media, this study examines what characteristics participants perceive as message elements of fake news on social media compared to factual news.

Research question 5: What are perceived message characteristics of fake news (e.g., unverified source of information, misleading information, logical, realistic, alarming, sensational, eye-catching) compared to factual news?

CHAPTER 3: METHOD

Design and Participants

In November and December 2019, an online experiment was conducted to test the hypotheses and explore the research questions. According to Pew Research Center (2019), more than 70% of U.S. adults use at least one social media platform, and among them, young adults aged from 18 to 29 years old are the greatest adopters and users of social media sites compared to other age groups. To provide implications of using social media as a news source and its impacts on social media users, the current study focuses on college students, which are part of this young adult group of heavy social media consumers, as subjects of the study. Participants were recruited from undergraduate courses at a large public university in the United States. They received extra credit as a compensation for their participation in the experimental survey.

This study used a 2 (social media news: factual vs. fake) x 2 (level of social endorsement: low vs. high) experimental design (see Table 1): group 1 (factual news with a low number of 'likes' and 'shares'), group 2 (factual news with a high number of 'likes' and 'shares'), group 3 (fake news with a low number of 'likes' and 'shares'), and group 4 (fake news with a high number of 'likes' and 'shares'). Participants were randomly assigned one of the four experimental conditions after reading the consent form and voluntarily consented to participate in the study.

In total, 428 participants completed the experimental survey. The age of the participants ranged from 18 – 31 years old (M = 20.0, SD = 1.49). Females were 63.6% (n = 272) and males were 35.7% (n = 153) of the sample. An additional 0.7% (n = 3) participants indicated their gender as other. A majority of participants identified as White

Table 1. Experimental conditions (Total *N* = 172)

		Type of Social Media News	
		Factual News (*n* = 74)	Fake News (*n* = 98)
Level of Social Endorsement	Low (*n* = 47)	Factual news with a low number of likes and shares (Group 1, *n* = 21)	Fake news with a low number of likes and shares (Group 3, *n* = 26)
	High (*n* = 125)	Factual new with a high number of likes and shares (Group 2, *n* = 53)	Fake news with a high number of likes and shares (Group 4, *n* = 72)

(*n* = 354, 82.7%), followed by Black or African American (*n* = 31, 7.2%), Asian (*n* = 18, 4.2%), Hispanic or Latino (*n* = 9, 2.1%), and others 3.7% (*n* = 16). Most participants were juniors (*n* = 128, 29.9%) and seniors (*n* = 94, 22.0%), followed by sophomores (*n* = 115, 26.9%) and freshmen (*n* = 91, 21.3%).

The study used experimental materials manipulated in terms of factual/fake news and number of likes and shares of the news. In order to show the effects of social media news manipulated based on the purpose of this study, it was necessary that participants perceived these differences for the experimental manipulation to potentially work and result in effects. Thus, as a first step, participants were asked to report whether the social media messages they read was fake or factual news and with a high or low number of likes and shares. A chi-square test was conducted to verify whether participants correctly responded the social media messages they viewed as fake or factual news and high or low level of social endorsement messages based on their experimental conditions[1].

[1] A chi-square test showed that the manipulation of fake or factual news was statistically significant, X^2 (1, 428) = 94.73, $p < .001$. Almost 84% of those who were exposed to fake news reported the social media messages they viewed were fake news and about 62% of those who were in factual news conditions correctly reported the messages they viewed as factual news.

Those who did not correctly identified the types of social media messages were removed and the following participants were used for the final data analysis: participants who were assigned to group 1 and responded the social media news they read was factual news with a low number of likes and shares, participants who were assigned to group 2 and responded the social media news they read was factual news with a high number of likes and shares, participants who were assigned to group 3 and responded the social media news they read was fake news with a low number of likes and shares, and participants who were assigned to group 4 and responded the social media news they read was fake news with a high number of likes and shares. Accordingly, the final sample size used in the data analysis was 172[2]. The number of participants selected and used in the final data analysis was 21 in the group 1, 53 in the group 2, 26 in the group 3, and 72 in the group 4.

However, the manipulation of level of social endorsement cues were not statistically significant, X^2 (1, 428) = 3.458, $p > .05$ ($p = .063$). Most of participants in high social endorsement conditions reported the social media messages they read were with a high number of likes and shares, but many of the participants (72%) who were in low social endorsement conditions also reported the social media messages they read were with a high number of likes and shares. Thus, the manipulation of level of social endorsement was not successful in this study. This result will be discussed further in the discussion section. As stated, to show the effects of social media messages manipulated based on the purpose of this study, depending on the participant's experimental condition, only those who correctly identified the type of social media news (factual or fake news) and the level of social endorsement cues (high or low number of likes and shares) were included in the data analysis ($N = 172$, see Table 1).

[2] The number of participants who reported correctly to the manipulation check questions (final sample) was 172. The age of the participants ranged from 18 – 27 years old ($M = 20.06$, $SD = 1.58$). Of the final sample, females were 60.5% ($n = 104$), males were 39.0% ($n = 67$), and 0.6% ($n = 1$) of the participants indicated their gender as other. A majority of participants in the final sample identified as White ($n = 143$, 83.1%), followed by Black or African American ($n = 14$, 8.1%), Asian ($n = 6$, 3.5%), Hispanic or Latino ($n = 4$, 2.3%), and others ($n = 5$, 2.9%). In terms of year in school, sophomores were 31.4% ($n = 54$), seniors were 25% ($n = 43$), juniors were 23.3% ($n = 40$), and freshmen were 20.3 % ($n = 35$) of the final sample.

Procedure

Participants were first asked to report their demographic information and frequency of social media use. Then, each participant was randomly exposed to one of the experimental conditions of social media messages about a public health risk, the Zika virus. After exposure, all participants reported their attitudes and behavioral intentions of seeking additional information about the issue, perceived credibility of social media messages and message source, perceived uncertainty, and emotional responses after exposure to social media messages. In the survey, there were several questions to check participants' attention to the survey. If participants failed to answer correctly to the attention-check questions, they were directed out of the survey[3] and only those who correctly answered to the questions could continue the survey. Since participants in the fake news conditions (group 3 and group 4) were given social media messages about the Zika virus that were unverified and inaccurate, those participants were debriefed with the following statement at the end of the survey: "The social media messages that you were exposed to are unverified information about the Zika Virus. There is no scientific evidence to support the messages. Please know that the messages are not factual information about the Zika virus."

Experimental Materials

[3] The number of people who failed to respond to the attention check questions was 8. These people were unable to complete the survey with being directed out of the survey and not included in the total number of participants of the study.

The current study used the Zika virus outbreak for the health news topic addressed in the experimental social media materials. The Zika virus outbreak was first recorded in 2007 in the Island of Yap, and a large outbreak of the virus infection was reported from French Polynesia and other Pacific regions in 2013 (World Health Organization, 2018). In 2015, a large outbreak of the virus infection occurred in Brazil and outbreaks began to be reported in more than 86 countries including the Americas (World Health Organization, 2018). Around the time of outbreaks, with increasing concerns about the scope of the outbreak and potentially negative and long-lasting effects of the infection on people, numerous unverified messages about the virus were generated and shared on social media than verified stories (Sommariva et al., 2018). The Zika virus is a significant and on-going public health risk all around the world including the United States, thus this study created four types of social media messages (factual news with a high or low level of 'likes' and 'shares', fake news with a high or low level of 'likes' and 'shares') using the Zika virus as a public health risk topic for the experimental materials. To achieve the external validity of the study, existing social media news about the Zika virus were adopted for the manipulation of experimental materials. Social media messages about causes, symptoms/negative impacts, and transmissions of the virus were selected in both factual and fake news conditions for consistency of the message content. The sources of materials are described below.

Among various social media platforms, Facebook has been the most popular platform in the United States for the last decade (Pew Research, 2018, 2019). Facebook has been also recorded as the most used site for getting news compared to other social media sites, such as YouTube, Twitter, and Instagram, among U.S. adults (Pew Research,

2019). Given the popularity of Facebook, this study employed Facebook as a social media platform for the experimental materials.

For the factual news condition, this study used messages about the Zika virus posted on Facebook by the U.S. Centers for Disease Control and Prevention (CDC), which is the primary U.S. public health agency that manages public health risks and crises and provides verified information to both the public and other organizations. The actual CDC messages about causes, symptoms/negative impacts, and transmissions of the virus were manipulated to appear as social media news attributed to an established U.S. news organization, *USA Today*.

For the fake news messages, this study used four fake news stories about causes, symptoms/negative impacts, and transmissions of the Zika virus from the NaturalNews.com, which is a popular source of unverified and false information and conspiracy theories related to health issues (Heilweil, 2020). When the outbreak began, there was a Facebook page for NaturalNews.com that included messages about the Zika virus. However, after Facebook began to ban fake news sources, NaturalNews.com Facebook page was taken down. NaturalNews.com has their own website to deliver health-related fake news to audiences. This study used the actual fake news about the Zika virus that NaturalNews.com posted on Facebook in the past.

Pre-test

Prior to the main study, a pre-test was conducted to examine how many ‘likes’ and ‘shares’ are perceived by college students to constitute a high and low number of social endorsements in the experimental materials. In the pre-test, four different types of

social endorsements were tested based on the actual number of likes and shares the Facebook messages about the Zika virus have: (Type 1) 50 likes and 35 shares, (Type 2) 250 likes and 135 shares, (Type 3) 650 likes and 535 shares, (Type 4) 1250 likes and 1135 shares. The pre-test had two groups, fake social media news and factual social media news groups. Participants were randomly assigned to one of the groups and viewed a series of fake/factual social media news with four different levels of likes and shares described above. After exposure to each social media news, participants were asked to report whether they think the social media news they read had a low/medium/high number of likes and shares.

In both fake news and factual news groups, more than two-thirds of participants reported Type 1 and Type 2 are a low number of likes and shares, Type 3 is a medium level, and Type 4 is a high degree of social endorsement. The current study adopted the pre-test results in creating experimental materials for the high and low social endorsement conditions.

Measures

At the beginning of the experiment, participants were asked to indicate their basic information such as demographic information (e.g., age, gender, race, education year, income) and their frequency of social media use. After exposure to the experimental social media messages, the following variables were measured: perceived credibility of social media messages, perceived credibility of message source, perceived uncertainty about the Zika virus, emotional responses to the Zika virus, attitudes toward Zika

information seeking, behavioral intentions of Zika information seeking, and perceived characteristics of Zika fake/factual news.

Perceived credibility of social media messages and message source. To assess participants' perceived credibility of social media messages and message source, six items were adopted from Meyer's credibility measure (1988). For perceived credibility of social media messages, participants were first asked to indicate how much they feel about the social media messages about the Zika virus they read in terms of the following items: (1) trusted? (2) accurate? (3) fair? (4) tell the whole story? (5) biased? (reversed). And then, their overall perception about the social media messages they read was measured using the following question: (6) "overall, how much do you think the social media messages you read are credible?" Response options ranged from 1 (*not at all*) to 7 (*very much*) (M = 3.14, SD = 1.50, Cronbach's alpha = .92).[4]

For perceived credibility of message source, participants were asked to indicate how much they feel about the source of social media messages about the Zika virus they read using the following items: (1) trusted? (2) accurate? (3) fair? (4) tell the whole story? (5) biased? (reversed). And then, they were asked to report their overall perception about the message source using the following question: (6) "overall, how much do you think the source of social media messages you read is credible?" All six items were measured on a 7-point scale (1 = *not at all* to 7 = *very much*) (M = 3.42, SD = 1.68, Cronbach's alpha = .94).

[4] All the statistics reported in this measurement section were analyzed using the final sample of this study (N = 172).

***Perceived uncertainty about the Zika virus*.** To assess individuals' uncertainty about the Zika virus after exposure to social media news, four items were adopted from Rains and Tukachinsky's study (2015) about uncertainty management and information-seeking in health-related issues. Participants were asked how much they felt uncertain about (1) the current status of the virus, (2) the symptoms of the virus, (3) the consequences of the virus, and (4) the way to prevent the virus. Response options ranged from 1 (*feel completely uncertain*) to 7 (*feel completely certain*) (M = 3.68, SD = 1.56, Cronbach's alpha =.85)

Emotional responses to the Zika virus. For the measurement of emotional responses to the Zika virus after exposure to social media news, items used in Yang and Kahlor's study (2013) about the role of affective responses in information seeking were adopted. Participants were asked to report how much they felt negative emotions to the Zika virus after exposure to social media news on a 7-point scale (1 = *not at all* to 7 = *very much*): "How much do you feel (1) concerned, (2) worried, (3) anxious, (4) upset/angry, (5) afraid, and (6) fearful about the virus after reading the social media news?" They were also asked a general question to indicate their overall negative feelings after exposure to social media news on a 7-point scale (1 = *not at all* to 7 = *very much*): (7) "How much negative feelings do you have about the virus after reading the social media news?" The seven items were composited for individuals' negative emotional responses (M = 3.30, SD = 1.45, Cronbach's alpha =.93).

Attitudes toward Zika information seeking. To measure individuals' attitudes toward Zika information seeking behaviors, four items used in the study about the relationship between attitudes and behaviors in the context of risk and crisis (e.g., Kahlor, 2007) were adapted. On a 7-point scale, the following questions were asked: "Do you feel that seeking information about the Zika virus is worthless or valuable?" (1 = *worthless* to 7 = *valuable*), "Do you feel that seeking information about the Zika virus is harmful or beneficial?" (1 = *harmful* to 7 = *beneficial*), "Do you feel that seeking information about the Zika virus is unhelpful or helpful?" (1 = *unhelpful* to 7 = *helpful*), "Do you feel that seeking information about the Zika virus is bad or good?" (1 = *bad* to 7 = *good*) (M = 5.31, SD = 1.30, Cronbach's alpha =.90).

Behavioral intentions of Zika information seeking. To measure information seeking intentions, participants were asked to respond to the following items on a 6-point scale (1 = *strongly disagree* to 6 = *strongly agree*): "I desire to find out more information about the Zika virus," "I plan to further educate myself about the Zika virus," "I plan to seek out additional news stories about the Zika virus," and "I do not plan to learn more about the Zika virus (reversed)." (M = 2.81, SD = 1.29, Cronbach's alpha =.85)

Message characteristics of Zika fake/factual news. To explore the message characteristics of fake news, the following questions were asked to participants: "Do you think the social media messages you read seem like they came from an established news organization? (1 = *no*, 2 = *yes*)", "Do you think the social media message you read use verified sources of information?", "Do you think the social media messages you read

contain misleading information?", "Do you think the social media messages you read are logical?" "Do you think the social media messages you read are realistic?", "How alarming were the social media messages you read?", "How sensational were the headlines of the social media messages you read?", "How eye catching were the images included in the social media messages you read?" (1 = *not at all*, 7 = *very much*). The questions were treated as individual items for message characteristics of Zika fake news.

Data Analysis

To answer the hypotheses and research questions 1 to 3 about differences between the experimental groups in perceived credibility of messages and message source, perceived uncertainty, and emotional responses, an ANOVA (Analysis of Variance) was used. For the hypotheses 4 and 5 about the relationships between perceived credibility of message source, perceived credibility of messages, perceived uncertainty, emotional responses, and attitudes and behavioral intentions of information seeking, a linear regression was conducted. For the research question 4 about relationships between primary variables, a correlation and a linear regression were employed. To analyze message characteristics of fake news (research question 5), a chi-square and an ANOVA were used (Table 2).

Table 2. Types of analysis used for hypotheses and research questions

	Types of analysis				
	ANOVA	Regression	Correlation	Chi-square	SEM
Hypothesis (H)	H1a, H1b, H1c, H1d, H2a, H2b, H3a, H3b	H4, H5			
Research question (RQ)	RQ1, RQ2, RQ3, RQ5	RQ4	RQ4	RQ5	H6

To examine the hypothesized model (figure 1), a structural equation modeling (SEM) was utilized with the *Lavaan* software package for the *R* ecosystem (Rosseel, 2012). SEM is beneficial for conducting factor analysis and path analysis simultaneously, so it is a useful tool to analyze data for the current study using multiple items for the measurements and having both direct and indirect paths among the variables. Moreover, in the analysis, measurement errors are corrected and relationships among variables are estimated with true scores. The hypothesized model was tested through the two-step procedure suggested by Kline (2005).

In testing the model, first, a measurement model was conducted to verify the multiple items are appropriate indicators for the latent variables. Then, the structural model was estimated. The indirect effects of types of social media news on attitude and behavioral intentions about information seeking through perceived source and message credibility, perceived uncertainty, and emotional responses were tested with the 95% confidence intervals through bootstrapping resampling method. By conducting inspections of residual matrix and modification indices, some of correlated indicators were included in the model depending on their correlated residuals values. The assessment of model fit was based on four values of the analysis output according to Little (2013): the Comparative Fit Index (CFI), the Tucker-Lewis Index (TLI)/ Non-Normed Fit Index(NNFI), the Root Mean Square Error of Approximation (RMSEA), and the Standardized Root Mean Square Residual (SRMR). The good model fit has more than .90 values of CFI and TLI/NNFI and less than .08 values of RMSEA/SRMR (Little, 2013).

CHAPTER 4: RESULTS

Message Characteristics of Fake News

Before testing the relationships between primary variables of this study, a set of analyses (e.g., chi-square test and ANOVA) were performed to examine what message elements participants perceived as characteristics of fake news (RQ5). The results showed that there were significant differences between the fake news group and the factual news group in terms of whether they perceived the given social media messages (1) came from an established news organization, (2) used verified sources of information, (3) contained misleading information, and (4) were logical and (5) realistic.

In the fake news group, 86.7% of participants reported they did not think the given social media messages were from an established news organization, whereas 70.3% of participants in the factual news group said the given social media messages were from an established news organization, X^2 (1, 172) = 58.28, $p < .001$. The factual news group ($M = 5.01$, $SD = 1.26$) also reported the social media messages used verified sources of information more than the fake news group ($M = 2.51$, $SD = 1.49$), $F(1, 170) = 136.33$, $p < .001$, partial $\eta 2 = .45$. In terms of perception of using misleading information in the messages, the fake news group ($M = 5.53$, $SD = 1.51$) more indicated that the social media messages they read contained misleading information than the factual news group ($M = 3.81$, $SD = 1.47$), $F(1, 170) = 55.83$, $p < .001$, partial $\eta 2 = .25$. The factual news group ($M = 5.38$, $SD = 1.11$) more reported that the social media messages they read were logical compared to the fake news group ($M = 3.02$, $SD = 1.51$), $F(1, 170) = 128.82$, $p < .001$, partial $\eta 2 = .43$. In terms of whether the social media messages looked realistic or not, the factual news group ($M = 5.31$, $SD = 1.17$) showed greater perception of that than

the fake news group (M = 3.16, SD = 1.58), F(1, 170) = 96.87, p < .001, partial η2 = .36. There were no significant differences between the fake news group and the factual news group in other message characteristics such as alarming, sensational, and eye-catching.

Hypotheses and Research Questions 1 to 3

First, an ANOVA was conducted to investigate whether participants in each experimental group reported differently in term of perceived credibility of message source and messages (H1a, H1b, H1c, H1d), perceived uncertainty (H2a, H2b), and emotional responses (H3a, H3b). The results showed the differences between the fake news group and the factual news group in perceived source credibility, F(1, 170) = 186.88, p < .001, partial η2 = .52. Participants in the factual news group (M = 4.81, SD = 1.11) reported greater perceived credibility toward the source of the messages than did participants in the fake news group (M = 2.36, SD = 1.21). The two groups were also shown differently in their perceptions of message credibility, F(1, 170) = 193.46, p < .001, partial η2 = .53. Specifically, participants exposed to factual news (M = 4.40, SD = .93) reported more perceived credibility of messages than those exposed to fake news (M = 2.20, SD = 1.10). Thus, H1a and H1c were supported. There were no significant differences between the high and low social endorsement groups in perceived credibility of message source (F(1, 170) = .24, p = .624, partial η2 = .001) and messages (F(1, 170) = .12, p = .727, partial η2 = .001). The H1b and H1d were not supported.

To answer the RQ1, it was tested whether the interplay of news type and social endorsement influences participants' perceptions of message source and messages. The result showed significant differences among the four experimental groups in their

perceived message credibility, $F(3, 168) = 65.63$, $p < .001$, partial $\eta 2 = .54$, and perceived source credibility, $F(3, 168) = 63.13$, $p < .001$, partial $\eta 2 = .53$. However, as shown in the above tests, the differences were significant just between the factual and fake news groups, not between the high and low social endorsement groups based on multiple comparisons using post hoc tests (e.g., Bonferroni). There were differences in perceived credibility of messages and message source only by news type (factual vs. fake news).

In terms of perceived uncertainty, there was a significant difference between the fake news group and the factual news group, but the direction was opposite to the H2a, $F(1, 170) = 24.76$, $p < .001$, partial $\eta 2 = .13$. It was expected that exposure to fake news would result in more uncertainty, however, participants in the factual news group ($M = 4.32$, $SD = 1.25$) reported more perceived uncertainty about the issue after reading the given social media messages compared to participants in the fake news group ($M = 3.19$, $SD = 1.61$). There was no significant difference between the high and low social endorsement groups ($F(1, 170) = .933$, $p = .933$, partial $\eta 2 = .005$). The H2b was not supported.

To answer the RQ2, it was tested whether the interplay of news type and social endorsement influences participants' perceived uncertainty about the issue. The result showed significant differences among the four experimental groups, $F(3, 168) = 9.59$, $p < .001$, partial $\eta 2 = .15$. However, like the result of the experimental conditions on perceived message and source credibility, these differences were also shown because of the comparisons by news type (factual vs. fake news), not by level of social endorsement. There were differences in perceived uncertainty only between the factual and fake news experimental conditions.

For the negative emotional responses to the issue, the result showed no significant differences by news type ($F(1, 170) = .044$, $p = .833$) and level of social endorsement ($F(1, 170) = 2.14$, $p = .145$), and there was no effect of the interplay of news type and social endorsement on emotional responses ($F(3, 168) = .809$, $p = .490$). Both H3a and H3b were not supported.

Hypotheses 4 and 5

To test whether participants' attitudes toward information seeking behaviors are predicted by their perceived credibility of message source, perceived credibility of messages, perceived uncertainty, and emotional responses (H4), a linear regression was conducted. The result showed a significant relationship between participants' attitudes toward the behavior and their perceived source credibility, perceived message credibility, perceived uncertainty, and negative emotional responses, $R^2 = .10$, $F(4, 167) = 4.66$, $p < .01$, but in the model, only perceived uncertainty was shown as a significant predictor of the attitude while controlling for the role of perceived source credibility, perceived message credibility, and emotional responses, $\beta = .20$, $t(167) = 2.59$, $p < .05$. The greater perceived uncertainty predicted greater positive attitudes toward the behavior. In terms of the relationship between individuals' attitudes toward information seeking and behavioral intentions to seek additional information about the issue, the relationship was statistically significant with indicating that the greater positive attitudes predicted greater behavioral intentions, $\beta = .38$, $t(170) = 5.39$, $p < .001$. The H5 was supported.

Research Question 4

To answer the RQ4 about possible relationships between perceived source credibility, perceived message credibility, perceived uncertainty, and emotional responses, a correlation test was conducted. In the result, all bivariate correlations were shown significantly except for the relationship between perceived uncertainty and emotional responses (Table 3). A linear regression was also conducted to explore more about their relationships. In terms of prediction of perceived uncertainty, it was shown that perceived uncertainty was significantly predicted by perceived message credibility while controlling for the role of perceived source credibility, emotional responses, $\beta = .40$, $t(168) = 2.77$, $p < .01$. The greater perceived message credibility was related to greater perceived uncertainty.

Table 3. Correlations between perceived source credibility, perceived message credibility, perceived uncertainty, and emotional responses

	1	2	3	4
1. Perceived source credibility	1			
2. Perceived message credibility	.869***	1		
3. Perceived uncertainty	.309***	.366***	1	
4. Emotional responses	.218**	.208**	.055	1

Note: * $p < .05$; ** $p < .01$; *** $p < .001$

Hypothesized Structural Model (Hypothesis 6)

To assess the hypothesized structural model (H6), the measurement model was first tested and then the structural model was conducted. The measurement model fit was good with the following values: $\chi^2(419) = 815.93$, $p < .001$, RMSEA = .08, CFI = .91, TLI = .90, SRMR = .07. The loadings for each latent variable were good with over .4 - .6 values. For the better measurement model fit, additional inspections of residual matrix and modification indices were conducted. Based on the results, it was suggested to

correlate the following items in the model: emotional response (ER) items (item 1 and 2, 1 and 5, 2 and 3, 2 and 5, 2 and 6, 3 and 4, 5 and 6), perceived uncertainty (PU) items (item 1 and 3), perceived message credibility (PMC) and perceived source credibility (PSC) items. Those items are under the same variables having similar wordings in the statements. In measuring emotional response and message and source credibility, there was a question to ask participants' overall thought about their negative emotions and credibility, and these questions were highly related to each item of the variables. So, the correlated relationships between each item and the general question of the variable were also included. Source credibility and message credibility have similar wordings in the questions and each item of the variables are highly related, so these relationships were also added. In addition, the following correlated relationships were included based on the additional inspections and correlations among latent variables: PMC and PSC, PMC and ER, PMC and PU, PSC and ER, PSC and PU, ER and PU. By examining additional measurement models including each correlation and conducting inspections of modification indices step by step, the final measurement model achieved a better measurement model fit, $\chi^2(389) = 509.97$, $p < .001$, RMSEA = .04, CFI = .97, TLI = .97, SRMR = .06.

Next, a structural equation model was conducted to examine regression paths between variables with a maximum likelihood estimator, using the 95% confidence intervals from 1000 bootstrapped resampling method. As shown in the results above, the manipulation of level of social endorsement was not successful. Also, no effects were shown significantly in terms of the level of social endorsement and primary variables of the study in the analyses using those who correctly answered to the manipulation check

questions. Thus, as an observed variable of the experimental condition, the two groups of news type (fake and factual news conditions) were included in the model. The structural model fit was good with the following values, $\chi^2(420) = 627.78$, $p < .001$, RMSEA = .05, CFI = .96, TLI = .95, SRMR = .08.

Message and source credibility, uncertainty, emotional responses by groups. As shown in the data analysis using ANOVA, there was a significant difference between the fake news group and the factual news group in perceived message and source credibility and perceived uncertainty (Figure 2). The factual news group reported more perceived source credibility and message credibility of the given social media news than the fake news group; (source credibility) $\beta = .75$, $p < .001$; (message credibility) $\beta = .74$, $p < .001$. The factual news group also showed more perceived uncertainty than the fake news group, $\beta = .47$, $p < .001$. There was no significant difference between the fake news group and the factual news group in terms of negative emotional responses.

Attitudes and behavioral intentions toward information seeking. Individuals' attitudes toward the behavior (information seeking) were predicted significantly only by perceived uncertainty (figure 2). The greater perceived uncertainty was related to greater positive attitudes toward the behavior to seek additional information about the Zika virus while controlling the role of perceived source credibility, perceived message credibility, and emotional responses, $\beta = .20$, $p < .05$. Individuals' behavioral intentions to seek additional information about the issue were predicted significantly by the attitudes toward the behavior, $\beta = .40$, $p < .001$. The greater positive attitudes predicted greater behavioral

intentions. These results are also same as the data analysis shown above.

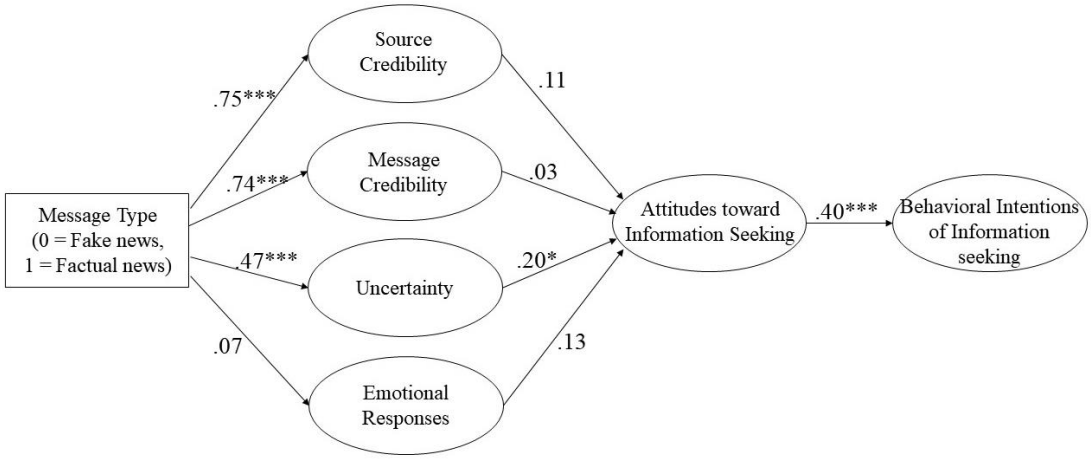

Figure 2. Structural model of the effects of social media news on information processing in the public health risk

Indirect effects of social media news on attitudes and behavioral intentions. The indirect effects of type of social media news on attitudes toward the behavior only through perceived uncertainty were shown significantly in the 95 % confidence level. Participants who were exposed to factual news reported higher level of perceived uncertainty and the higher perceived uncertainty predicted greater positive attitudes toward the behavior, $B = .20$, $SE = .10$, $p < .05$, 95% CI [.03, .41]. There were no indirect effects of type of social media news on attitudes through message credibility, source credibility, and emotional responses.

The indirect effects of type of social media news on information seeking behavioral intentions only through perceived uncertainty and attitudes were closely significant in the 95 % confidence level. Participants who were exposed to factual news reported greater perceived uncertainty and attitudes toward the behavior and it predicted

greater behavioral intentions of information seeking, $B = .08$, $SE = .04$, $p = .06$. There were no indirect effects of types of social media news on information seeking behavioral intentions through message credibility/source credibility/emotional responses and attitudes.

CHAPTER 5: DISCUSSION

During times of a public health epidemic, it is critical for the public to receive accurate information. Fake news and misinformation can have deleterious effects on containing the health risk and protecting individuals from becoming ill or infecting others. “It is a sad truth that any health crisis will spawn its own pandemic of misinformation” (Robson, 2020). In the present “post-fact culture” in which individuals are inundated with information (making it more difficult to use out the truth from falsehoods), messages are spread rapidly on social media and individuals do not agree upon a shared reality (Mihailidis & Viotty, 2017). The effects of exposure to factual versus fake news about a public health issue have not been extensively studied. Little is known about the cognitive effects of fake news on intentions to seek out further information and formation of beliefs about a public health risk and crisis. The purpose of this dissertation is to test a theoretical model to increase understanding of the predictors of information seeking from exposure to social media messages about a public health risk, the Zika virus. Fake news about the Zika virus has been an issue, since the large outbreak began in 2015, and it is still a significant and on-going issue all around the world. Likewise, the current COVID-19 pandemic has resulted in an infodemic on social media, with the circulation of inaccurate and false information (World Health Organization, 2020b).

This research primarily focused on fake news and the number of likes and shares as unique social endorsement cues of social media messages that may influence peoples’ perceptions of health risk messages on social media. In order to understand the cognitive and affective process of information among young adults who are dominant users of

social media, this research also examined perceived credibility of messages and message source, perceived uncertainty about the issue, and emotional reactions as primary factors that may explain the effects of social media news on individuals' behavioral intentions to seek additional information about the issue. As theoretical frameworks, persuasion models and health and risk communication theories like the elaboration likelihood model and the uncertainty management theory were used to support the possible effects of each variable in investigating people's information processing about the public health risk.

Message Characteristics and Conceptualization of Fake News

Based on conceptualizations of fake news in academic and practical areas (e.g., Allcott & Gentzkow, 2017; Lazer et al., 2018; Tandoc et al., 2018; Watson, 2018), the current study defines the term fake news as unverified and false news that looks like real news media content but is not produced by an established news organization with journalistic norms and ethics. In order to ensure the conceptualization of fake news, this study first examined how participants in each group (fake and factual news conditions) perceived the given social media messages differently. In the results, it was shown that the fake news group significantly responded the social media messages they read are not from an established news organization, contain misleading information, do not use verified sources of information, and do not look like logical and realistic, compared to the factual news group's responses. As described in the conceptualization, false and misleading information and unverified and non-established source are crucial and common characteristics to figure out what messages are fake news (e.g., Allcott & Gentzkow, 2017; Tandoc et al., 2018). The results of this study provide empirical

evidence that these characteristics of fake news are used to college students to recognize whether social media news they view is fake or factual news.

With these characteristics, fake news has been also discussed with other message elements, such as sensational headlines, images, or content that grab people's attention and clicks (Watson, 2018). Though these aspects are not always shown in fake news and has not primarily used in conceptualizing fake news, the current study also examined whether participants perceived fake news as an alarming, sensational, and/or eye-catching content more than factual news. The results of this study showed no significant differences in terms of how much they think the social media news they read are alarming, sensational, and eye-catching between the fake and factual news groups. Both experimental conditions reported the social media news about the Zika virus are somewhat alarming, sensational, and eye-catching, this might be based on the characteristics of the issue itself and message content. In the experiment, the content of social media messages was about causes, symptoms/negative impacts, and transmissions of the virus in both fake and factual news groups. The Zika virus itself could be viewed as some level of alarming, sensational, and eye-catching messages to participants. It is hard to say these characteristics can't be considered as characteristics of fake news just based on the results, but from this study, at least message components frequently used in conceptualizing fake news, such as misleading and unreal information and unverified and non-established source, are clear factors to define what is fake news as discussed in both academic and practical areas.

Cognitive and Affective Responses to Fake News

The results of this study showed that individuals' perceived credibility of social media messages and message source were significantly different between the factual news group and the fake news group. Participants exposed to factual news reported higher perceived message and source credibility compared to those exposed to fake news. In perceived uncertainty about the issue, it was expected that fake news may evoke more uncertainty about the issue to individuals than factual news. The results showed a significant difference of perceived uncertainty by news type; however, the data showed an opposite direction to what was expected. The factual news group reported more uncertainty about the Zika virus than the fake news group after exposure to social media news. This result can be interpreted in multiple ways.

First, perceived uncertainty might be influenced by other factors, not just by news type. According to the definition of uncertainty, individuals could have feeling of uncertainty when they do not sure about their knowledge of the issue and situations, when the situations are not predictable, and/or when inconsistent information about the issue is given or the information is not available (Brasher, 2001). A risk and crisis situation is unpredictable and threatening event to produce potentially negative impacts to individuals and society (Reynolds & Seeger, 2012), so the issue itself could produce certain level of uncertainty to individuals, especially when the issue is not familiar with and they do not think they have enough knowledge about the topic. In the experiment, participants were asked how much they are familiar with the topic and how much knowledge they have about the issue, and they showed not high level of issue familiarity and knowledge. In this case, perceived uncertainty could be evoked by not only given messages but also situational factors and the topic itself.

Participants were given a series of fake or factual news of Facebook posts. Fake news tends to inherently explain something is certain without clear evidence. Regardless of whether people think the messages are certain or uncertain, the message characteristic could make people not curious about the issue. Also, individuals' perceived uncertainty could be highly related to perceived credibility of messages and message source. According to the results of the research question 4, there was a significant correlation between perceived source/message credibility and perceived uncertainty. The higher perception of source/message credibility was related to the greater perceived uncertainty about the issue. If participants perceived the social media messages they read are not credible, they might be less confident that there is factual information in what are described in the messages, and that could affect their perceived uncertainty about the issue. Thus, participants might feel whether the issue and situation are uncertain or not depending on whether they believe the given risk-related information, not just by news type.

Even though the result is opposite to what was anticipated, this result has an important implication of the problematic of fake news. In health and risk communication, uncertainty is highly related to individuals' information seeking behavior, which is one of the active behaviors to prevent them from risk (Babrow, 1992; Brashers, 2001; Griffin et al., 2008). If people are exposed to fake news more than factual news and the messages are inherently certain, then people could be less active in information seeking about an issue. This could negatively affect people's preparedness and preventive actions in risk and crisis situations. In future research, there is a need to look at negative impacts of fake news in the context of its inherent characteristics and uncertainty and additional factors to

influence perceptions of uncertainty about an issue with considering the relationships with perceived source and message credibility.

There was no significant difference between the factual and fake news groups in emotional responses. Both groups reported a moderate level of negative emotions about the issue after exposure to the social media messages. This result might also be related to the characteristics of message topic or content. As explained, risk and crisis issues contain negative consequences and potential threats to people, so the issue itself could make people feel negative emotions. In analyzing the results of perceived uncertainty and emotional reactions and their roles in health risk-related information processing, it should be investigated how people feel about a health risk issue itself, what aspects of the issue are highly related to their affective responses, how they are interrelated with people's reactions to the social media messages in forming their attitudes and behaviors to seek follow-up information.

In terms of the high and low social endorsement groups, the manipulation check failed and there were also no significant results in all cognitive and affective variables (perceived credibility of messages and message source, perceived uncertainty, and emotional responses) in the analyses using those who correctly responded to the manipulation check questions. All the significant differences among the four experimental groups were resultant from the differences between the fake and factual news groups, not the different level of social endorsement or the interplay of news type and social endorsement. It cannot be concluded from this study that the social endorsement does not have any impacts on peoples' perceptions of social media messages. Future research will need to explore this further. As explained in the method

and result sections, there was an issue in the manipulation of experimental materials. The number of high and low social endorsement were manipulated based on findings of the pre-test. Using the actual number of likes and shares the social media messages about the Zika virus have, four different levels of social endorsement were tested to figure out how many likes and shares people perceive high and low in terms of the Zika virus messages. However, the manipulation of social endorsement was not successful whereas the manipulation of news type was successful.

Perceptions of high and low level of social endorsement might be relative and hard to generalize. Individuals' perceptions of high and low number of likes and shares may be different depending on their own experiences and judgments of popularity of social media messages and platforms. I recommend future studies further investigate how perceived level of social endorsement may influence individual's information processing of fake and factual news as well as other message factors (e.g., message content and source) that may influence the perception of the level of social endorsement.

The Role of Perceived Uncertainty

Individuals' attitudes toward information seeking behaviors were significantly explained by cognitive and affective factors in the model, but only perceived uncertainty was a significant predictor of attitudes toward the specific behavior, information seeking about the issue, while controlling the role of the other variables in the model. The higher perceived uncertainty of the issue predicted greater positive attitudes toward the behavior to seek additional information. This result is in line with previous research about the relationships between uncertainty and information seeking behaviors in health and risk

communication. As described in the literature review, according to the uncertainty management theory (Brasher, 2001), individuals' information seeking intentions are highly related to their level of perceived uncertainty since people would have more willingness to seek additional information about an issue to manage their unfavorable feelings such as uncertainty.

In other communication theories and models, such as the Risk Information Processing Model (Griffin et al., 1999), people's psychological factors are core elements to guide information seeking and processing with individual and other social and communication factors. In the same line, it was shown that perceived uncertainty plays a significant mediator in the effect of different type of social media news on attitudes and behavioral intentions toward information seeking from the analysis of the hypothesized model. Results of this study suggest that perceived uncertainty plays an important and primary role in information processing also on social media in the context of health and risk communication.

Theoretical Implications

The current study examined how people perceive fake news and what are the effects of exposure to fake social media news on information seeking about public health risk by comparing the effects of exposure to factual social media news. First, this study shows what message characteristics primarily focused on in perceiving fake news. With increasing issues of fake news, there has been discussions what makes messages look like fake news and how fake news can be defined. As discussed, the result of this study supports characteristics of fake news frequently used in defining the concept, such as

containing false and misleading information and non-established source. This empirical evidence could be a guidance to clarify the conceptualization of fake news.

Also, this study explored the cognitive and affective process of exposure to fake news on social media focusing on perceived message credibility, perceived source credibility, perceived uncertainty, and emotional responses, which have been considered important factors to understand how people process certain types of messages. As suggested in the communication models, perceived credibility was shown as a crucial factor to understand how people process fake news and factual news on social media. In addition, perceived uncertainty, which has been considered as an important element in predicting information seeking behaviors in the context of health and risk communication, significantly predicted attitudes and behavioral intentions of Zika information seeking. This study particularly examined how these factors work together in explaining the effects of fake news on social media by proposing a hypothesized structural model.

Overall, this study emphasized the important role of perceived uncertainty as a mediator in the effects of fake versus factual news on social media and its relationships with message credibility in information processing. Based on the results, this study could provide what would be next steps that communication scholars investigate in building a model for communication process of fake news on social media by placing the variables at a different level or adding additional variables to the model.

Practical Implications

When public health crises like endemics and pandemics occur, there is a need to

quickly deliver and receive information about what happens and what actions should be taken to protect people's health and well-being of communities. Social media enable quick exchange of information with multiple benefits as communication channels in the emergency situations. However, social media also provide grounds of overabundance of information and spread of false, inaccurate, and unverified information. As the director-general of WHO mentioned, fake news is distributed and disseminated to the public more easily and quickly than infectious diseases and threats the society. With increasing uses and dependency on social media as a news source, it has become to prepare for another epidemic of overload information, infodemic, in public health emergencies.

To fight against spreading of fake news on social media, we should know what fake news is, what characteristics fake news has, what makes people perceive social media news as fake or fact, and how exposure to fake news affects people's information processing. This study provides guidance in understanding how people identify credible and reliable sources of information and how their perceptions, attitudes, and behaviors are influenced by messages on social media. Also, based on the characteristics and cognitive perceptions of fake news that this study showed, this study could be used for educating how individuals could recognize fake news on social media and avoid negative impacts of fake news and how health organizations and communicators could build communication strategies to lead people to use social media as a news source in a more critical and healthier way for their awareness, knowledge, understanding, and preparedness for health risk and crisis situations.

Limitations and Suggestions for Future Studies

First, this study was conducted using college students as a study population. College students are included in young adults aged from 18 to 29, who are the major group of social media users (Pew Research, 2018), however, they are not representative of the overall population of young adults. Thus, the results of this research are limited to specific group of young population and social media users. To generalize the findings, there is a need to conduct further studies using more broad and diverse population with different age groups and demographic factors.

Second, this study used Facebook as a social media platform for the experimental stimuli. According to Pew Research report (2018, 2019), Facebook is still the most used and popular social media site, especially as a source of getting news, for U.S. adults even though the site has been criticized in terms of proliferation of fake news and their censorship. However, currently, Facebook has their own system to prevent spreading of false information by filtering and banning unverified news sources. Also, there are other social media platforms that are getting more popular especially among young adults, such as YouTube and Instagram as sources of information. Like people have different perceptions of social media platforms, the results of this study could be shown differently depending on characteristics of social media platforms and people's social media use patterns. There would be meaningful implications if conducting research using different social media platforms and focusing on their characteristics in figuring out people's information processing on social media.

Third, as described above, this study had a methodological issue in manipulating the high and low number of likes and shares of the social media messages. It would be hard to determine how many likes and shares people think high and low social

endorsement because the perception may be relative by individuals' own experiences of social media use (e.g., what type of social media they typically use, what type of social media content they consume, how frequently they are exposed to social media messages, etc.). As suggested above, instead of using specific number of likes and shares, it would be one of the ways to use perceived level of social endorsement in studying the effects of social endorsement cues on people's perception of different types of fake and factual news on social media. There may be many other factors to influence what level of social endorsement is high, moderate, and low, such as social media use pattern, frequency of specific social media platform, perceptions about likes and shares on social media, etc. Depending on the factors, people may perceive a certain level of likes and shares differently. Rather than using specific number of likes and shares as high or low social endorsement conditions, it could be employed measuring participants' perceptions of likes and shares and how the perceptions would affect their cognitive and affective responses to social media messages and information seeking intentions.

Fourth, in this study, the Zika virus was used as a health risk issue for the experimental materials. People may have different responses to social media news depending on what is the issue, how much information they have been accessible, how much they are previously exposed to, and what are characteristics of the issue (e.g., number of cases, severity, rate of infection and mortality, etc.). Health risk issues have their own elements to evoke certain level of uncertainty and emotional responses. In health and risk communication, it should be examined how different health risk issues can be categorized by what characteristics and how the characteristics would play a role in the spread and impacts of fake news on social media.

Lastly, there are many additional factors that could affect people's information processing such as individual characteristics, psychological factors, situational elements in health and risk communication (e.g., Griffin et al., 2008; Witte, 1992). In terms of individual characteristics, individuals' dependency on social media and digital media literacy may play important roles in understanding how fake news disturb information processing in what group of people. In order to provide more detailed explanations of the effects of exposure to social media news and fake news, there is a need to investigate how all different individual, psychological, situational factors are correlated and predict attitudes and behavioral intentions related to health risk and crisis issues. Also, as shown in this study, cognitive and affective factors could affect each other in processing messages about health risks. Thus, in future studies, it should be investigated how those factors work at a different level in processing health risk news on social media.

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