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Media Exposure, Perceived Efficacy, and Protective Behaviors in a Public Health Emergency

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Based on the extended parallel process model and social cognitive theory, this study developed and tested a model of media exposure, perceived efficacy, and protective behaviors in a public health emergency. The findings from a survey of 717 Hong Kong residents show that media exposure had variant effects on perceived societal-level risks and personal-level risks. The study introduced the three aspects of perceived efficacy as the predictors of health protective behaviors. It found that self-efficacy, collective efficacy, and proxy efficacy varied in their effects on danger control and fear control outcomes. Self-efficacy and proxy efficacy positively predicted danger control outcomes, whereas proxy efficacy negatively predicted fear control outcomes. The effect of perceived threat on danger control outcomes was present as self-efficacy increased.

Keywords: media exposure, perceived risk, perceived efficacy, extended parallel process model (EPPM), social cognitive theory, protective behavior

Massive emergencies such as public health threats occur frequently and have significant social impact. People seek information on public emergencies from various channels, and the coverage of these events by the media often provides the most important source of information. The extensive media coverage of an emergency affects people's perceptions of and attitudes toward the issues involved and ultimately influences their reactions to the crisis in ways that may have both immediate and long-term impacts for society. The changes in perceptions, attitudes, and behavior wrought by media messages have important implications for public interest, especially in the case of public health emergencies. For instance, the Ebola outbreak in 2014 generated extensive media coverage that not only provided information on the epidemic but also could have affected people's perceptions of and attitudes toward it, with potential consequences on society. When a public health emergency occurs, it is crucial to understand people's responses to the crisis in order to ensure that proper measures are taken to control the situation and reduce the negative effects of the emergency on society. This study will examine the protective behaviors in response to the media coverage of a public health threat. It will also investigate the effects of media coverage of the public health emergency on the perceived threat and the perceived efficacy as well as the subsequent effects on people's responses to a massive public health emergency and their protective behaviors.

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Literature Review

A public health emergency is an occurrence induced by a health threat that poses imminent risks or severe damage to everyone in a widespread area(s) (Parmet & Mello, 2014). When a public health emergency takes place, people seek information from different channels, and the media coverage of the event becomes the most important source of information (Holland, Blood, Imison, Chapman, & Fogarty, 2012). Media coverage affects people's perceptions of the threat and may ultimately determine their behavior in response to the crisis (Coleman & Thorson, 2002). This study examines the process of how news coverage by the media influences people's perceptions and behaviors in the context of a public health emergency. The study is informed by the extended parallel process model (EPPM) and social cognitive theory.

EPPM and Responses to Messages of Threat

The EPPM provides a dual/parallel approach to explaining individuals' responses to messages about a threat (Witte, 1992, 1994). According to the EPPM, when individuals are exposed to a message regarding a threat, there are two stages in the cognitive appraisal of the message: first, the "appraisal of the threat," and second, the "appraisal of the efficacy of the message's recommended response" (Witte, Meyer, & Martell, 2001, p. 24). The greater the perceived significance and relevance of the threat, the more likely individuals are motivated to start efficacy appraisal. Perceived threat and perceived efficacy are the two key factors influencing the attitudes and the eventual behavior in response to the threat. Perceived threat has two dimensions: perceived susceptibility and perceived severity (Rosenstock, 1974). Perceived susceptibility refers to the perceived likelihood that the risk will directly affect an individual; perceived severity describes the perceived seriousness of the risk. The EPPM distinguishes between two types of efficacy: self-efficacy and response efficacy. Self-efficacy (Bandura, 1977) is a person's perception of his or her ability to perform the recommended response to reduce the threat (Witte, 1998; Witte et al., 2001). Response efficacy refers to one's beliefs about the effectiveness of the recommended response in deterring the threat (Witte, 1992, 1994). When the threat is perceived to be high, the appraisal of efficacy will determine whether an individual will implement danger control responses or fear control responses. Danger control is a cognitive process whereby individuals develop protective strategies to reduce the likelihood that they will be affected by a given danger. Fear control is an emotional process that promotes defensive avoidance. Individuals under fear control are likely to ignore risk messages or otherwise resist the need to take action, which leads to maladaptive behavior (Lazarus, 1991).

Studies have confirmed the effects of perceived threat and perceived efficacy on behaviors (Roberto, Zimmerman, Carlyle, & Abner, 2007; Witte, 1994). Most studies applying EPPM used fear appeal as the stimulus to test the effect of message manipulation on changes in attitude, intention, and behavior (e.g., Roberto, Zimmerman, Carlyle, & Abner et al., 2007). A fear appeal is a persuasive message that attempts to arouse fear in order to divert behavior through the threat of impending danger or harm (Witte, 1992). A meta-analysis found that fear appeals produce moderate effects for fear arousal, large effects for perceived severity, and moderately large effects for perceived susceptibility (Witte & Allen, 2000).

This study examines the effect of exposure to news messages on perceived threat, perceived efficacy, and the consequent protective behaviors. Media are major sources of risk perception (Keown, 1989). Risk perception has been used to distinguish how lay people understand risk versus how scientists evaluate risk (Bradbury, 1989). Studies found that news media exposure exerts influence on risk perception of the H1N1 flu (Lin & Lagoe, 2013; Oh, Paek, & Hove, 2015). Another study found that exposure to health-related news not only affects perception about the health threat but also produces behavioral responses to the perception (Wei, Lo, & Lu, 2008). Tyler & Cook (1984) proposed the impersonal-impact hypothesis to test the effect of media exposure on risk perception. They differentiated risk into societal and personal. Societal-level risk perception refers to individuals' judgment of the overall loss or damage to society; personal-level risk perception refers to the likelihood of loss or damage deemed by individuals on themselves (Tyler & Cook, 1984). It was found that the mass media affect societal-level risk perception, whereas they have little impact on personal-level risk perception (Tyler & Cook, 1984). The effect of media exposure on societal-level risk perception was confirmed in several studies (Culbertson & Stempel, 1985; Pilisuk & Acredolo, 1988). But a study also found that personal-level risk was influenced, to some degree, by mass media channels (Coleman, 1993). To explain the inconsistent findings regarding the impersonal-impact hypothesis, the differential-impact hypothesis further suggests that the media effect on risk perception varies by conditions, issues, types of people, and type of media (Snyder & Rouse, 1995; Sussman et al., 1989). However, most of the studies examining the effect of media exposure on risk perception measure media exposure only by frequency (e.g., Coleman, 1993). Exposure extensity—the extent of the issue that one is exposed to—is often overlooked. It is not clear how the mode of media exposure (i.e., exposure frequency or extensity) actually produces a variation of effect on risk perception at the societal or personal level. We propose that the effect of media exposure be examined from two aspects, exposure frequency and exposure extensity, which are two different dimensions of media exposure and could produce a variation of risk perception. Exposure frequency gauges how often an individual accesses news information about the health emergency without going deep into the issue of the health emergency. The general information access raises concerns about how the epidemic poses a threat to everyone. Therefore, it would affect susceptibility, which relates to personal-level risk. Exposure extensity, on the other hand, taps into a wide range of information and different aspects of the epidemic to enable one to understand the health threat with a broader perspective. It also prompts people to evaluate the seriousness of the health emergency, which concerns the societal-level risks and therefore would produce severity.

When conveying risk information, fear appeal messages and news messages are different in several aspects. Because fear appeal messages are designed to produce behavioral changes, their threat component is highly visible and emphatic. For example, a fear appeal message about preventing melanoma presented a 5-minute video delineating the symptoms of melanoma to test the effect of such a message on perceived threat (Shi & Smith, 2016). News messages contain more diverse information, and the threat in news messages varies by stories. For example, a story of an Ebola epidemic may inform the public about the epidemic, explain the situation of the epidemic worldwide, or analyze the economic impact of the epidemic. Exposure to fear appeal messages is occasional, whereas news messages are pervasive during a public health emergency, and exposure to them is often frequent. The cognitive processing of fear appeal messages is relatively simple because the messages contain focused information to arouse fear. Processing news messages, however, is continuous. The effects of news messages are multifaceted and cumulative.

Fear appeal messages also differ from news messages in recommended responses. The experimental studies that applied EPPM incorporated recommended responses into fear appeal messages. Therefore, the appraisal of efficacy was based on the message's recommended response. When a public health emergency occurs, health agencies and institutions will make recommendations for actions to reduce the threat (Koplan, 2003; Sugerman et al., 2012). However, these recommendations vary by the nature of the threat. In some health emergencies, the response measures are clear and easy to follow and can help the public reduce the risks. For a public health emergency like Ebola, an epidemic with a high fatality rate but few effective protective measures, the recommendations from the health agencies and institutions appeared more as public service announcements with a general warning of the threat instead of specific advice on how to combat the threat. The recommendations were less of an individual behavioral solution and more of a larger, collective solution. Such announcements are less likely to generate response efficacy as the recommended response presented with a fear appeal message in an experiment.

Media coverage of the Ebola epidemic was also different from the fear appeal messages in message focus. News coverage of a public health emergency, as with other news stories of health risks, is oriented toward news value. Media coverage regarding a public health emergency focuses more on the exceptional nature, event development, or human interest associated with a hazardous event (Spencer & Triche, 1994). Because coverage of the epidemic lasted for a few months and was oriented toward news value, the recommended response, if any, might not appear as the focal issue of media coverage with repeated discussion and was likely to be buried in the pile of stories about the epidemic. Even if some recommended responses were made, they might not have been as visible as those presented with a fear appeal message in an experiment.

In the case of an Ebola epidemic, if individuals perceive a threat to be high, the appraisal of efficacy is less likely to be generated from the recommended responses in news messages, but be based on a few factors associated with the threat, such as past experience with an epidemic and how one deals with similar difficult situations generally. Therefore, the appraisal of efficacy could be based on self-efficacy, or how capable individuals judge themselves in dealing with important tasks that affect their lives. Self-efficacy in the case of Ebola under the extensive media coverage takes into account the response efficacy to the public health emergency using one's past experience and perceived personal capacity in dealing with difficult situations in life as the recommended responses. Self-efficacy was used in this study as a more general measure that implies some degree of response efficacy and captured one's efficacy in dealing with the threat in a public health emergency.

Media coverage of a public health emergency not only differs from a fear appeal message in terms of the focus of the information and the recommended responses but also differs from the regular coverage of risk in its extensity of message delivery during a short period of time, urgency of the issues, relevance to the general public, and scope (macro or micro) of the issues concerned. The literature on media effects on health-related behavior are mostly related to nonurgent risks, and few touched protective behaviors in a public health emergency. Studies of media effect on risk perception are conducted through either an experiment (Siu, 2008) or surveys that concern a variety of nonurgent risks (e.g., Slater, Hayes, & Ford, 2007). When a study dealt with a public health emergency, the mode of media exposure to the coverage of a public health emergency was overlooked (Oh et al., 2015). By examining the effect of media exposure in a public health

emergency on perceived risk with probing inquiries, this study fills a void in the existing literature concerning the effects of media coverage in a public health emergency.

Social Cognitive Theory, Collective Efficacy, and Proxy Efficacy

Social cognitive theory states that a behavior is the result of an interaction between the cognition of social environment and personal retrospection (Bandura, 2001). People are active agents who judge their own capacity based on the situation they face. Among the types of self-evaluation that affect actions, none is more crucial or pervasive than people's judgment of their ability to exercise control over the situations or tasks that affect their lives (Bandura, 1997). Self-efficacy plays a crucial role in human behavior (Bandura, 1997, 2000). In the context of risk prevention, self-efficacy is an individual's confidence in his or her ability to fulfill the tasks necessary to reduce the possibility of being affected by the threat. Previous studies have shown self-efficacy to be a significant predictor of health-related motivation and behavior (Milne, Sheeran, & Orbell, 2000; Siu, 2008).

However, when facing a public health emergency, people "don't have direct control over social conditions and institutional practices that affect their lives" (Bandura, 2000, p. 75). Public health threats could spread through direct human contact and create social conditions such that preventing infection requires not only personal action but also the cooperation and collective effort of all people in the community. As a result, confidence in one's own ability to take preventive action is not sufficient. An individual's confidence in the ability of other community members to work toward the same goal may affect whether and how that individual carries out a preventive action. Therefore, the appraisal of efficacy in a public health emergency will involve other social entities in addition to oneself. In social cognitive theory, besides self-efficacy, Bandura (1997) identified two additional cognitive properties regarding people's efficacy in achieving certain goals: collective efficacy and proxy efficacy.

Collective efficacy is the belief in "the performance capability of a social system as a whole" (Bandura, 1997, p. 469). People are socially interdependent and rely on collective efforts to solve the problems they face in the same environment for the quality of life (Bandura, 1986). Collective efficacy measures one's confidence in a community's ability to attain a common goal (Smith, Ferrara, & Witte, 2007). Collective efficacy serves "as (a) separate, group-oriented attribute that acts in addition to self-efficacy" (Klassen, 2004, p. 209). People with a high level of self-efficacy may not have high confidence in the ability of other community members to fulfill specific tasks (Alavi & McCormick, 2008). However, if an individual believes that other members of the community are capable of carrying out a disease-prevention task, he or she will be more likely to engage in fulfilling the common goal of preventing the health threat (Browning, Burrington, Leventhal, & Brooks-Gunn, 2008). When collective efforts are needed to achieve community-wide health-related goals, collective efficacy could predict individuals' behavior in relation to health protection (Campbell & Jovchelovitch, 2000; Smith et al., 2007).

Proxy efficacy refers to an individual's belief in a third party's positive involvement in the individual's own goal fulfillment (Dzewaltowski et al., 2007). When a public health emergency occurs, the local authority will lead in combating the health threat. The belief that some government agent plays an effective role in mobilizing its members to fulfill the common goal of the community is proxy efficacy. Here,

the "self" assigns the agent a "proxy" role and assumes that the agent will act in the interest of the community. Proxy efficacy is an individual's confidence that the agent is capable of assuming its role on the individual's behalf in the goal fulfillment actions (Bandura, 1997; Elias & MacDonald, 2007). Bandura (1997) pointed out that an individual's proxy efficacy could influence his or her self-efficacy, and these two efficacies could affect the individual's behavior regarding a specific goal and produce behavioral changes.

The effects of proxy efficacy were observed by scholars in addition to those of self-efficacy and collective efficacy (Elias & MacDonald, 2007). The confidence that proxy agents facilitate an individual's goal fulfillment can decrease the individual's perceived difficulty of a challenging task (Shields & Brawley, 2007) and increase his or her satisfaction and sustainability in participating activities (Lent & Lopez, 2002). In the case of a public health emergency, if one perceives that the government agent is capable of mobilizing its members to take effective preventive action against the threat, one is more likely to cooperate with other members and take similar action to protect both oneself and others. Whereas self-efficacy will motivate individuals to take protective actions, proxy efficacy will render them more confident in combating the epidemic when the difficulty to solve a problem is beyond personal reach, as in the case of a public health emergency.

Analytical Model and Hypotheses

We have developed an analytical model based on the EPPM and social cognitive theory to examine the role of media messages in a public health emergency, and the effect of perceived threat and perceived efficacy on protective behaviors in response to the emergency (Figure 1).

According to this model, exposure to media messages about a public health emergency will affect perceived threat and perceived efficacy, which will in turn determine the fear aroused and whether danger control or fear control will proceed. Perceived efficacy and perceived threat induced by media messages will influence danger control outcomes; a high level of perceived threat and a low level of perceived efficacy will produce fear control outcomes. In light of this analytic model, we will test the following hypotheses:

H1: Exposure to media coverage of a public health emergency positively predicts perceived threat.

H2: The effect of exposure to media coverage of a public health emergency on fear is mediated by perceived threat.

H3: Self-efficacy will moderate the effect of perceived threat on danger control outcomes such that the effect will be present as efficacy increases.

H4: Self-efficacy will moderate the effect of perceived threat on fear control outcomes such that the effect will be present as efficacy decreases.

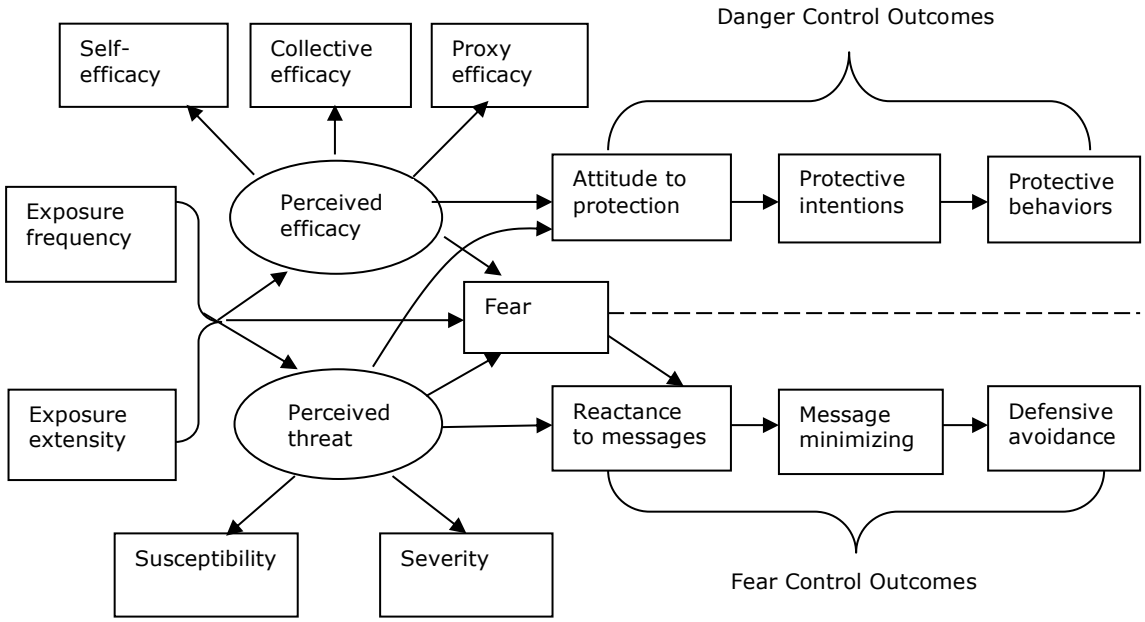

Figure 1. A model of media exposure, perceived threat, perceived efficacy, and protective behaviors in a public health emergency. The model is adapted from the extended parallel process model (Witte, 1992).

While self-efficacy will positively affect danger control outcomes, its effect could be enhanced by collective efficacy and proxy efficacy because the perceived efficacy of other members of the community and the government agency will assure an individual that he or she is not working alone in dealing with the threat. Therefore, collective efficacy and proxy efficacy could moderate the effect of self-efficacy on danger control outcomes in a public health emergency. Because the leadership of the government agent is essential in a public health emergency, proxy efficacy could play a more crucial role in the process. We therefore propose the following hypotheses:

H5: The effect of proxy efficacy on danger control outcomes is stronger than that of self-efficacy and collective efficacy.

H6: The effect of self-efficacy on danger control outcomes is moderated by collective efficacy and proxy efficacy.

Method

We conducted a cross-sectional survey in Hong Kong to test the hypotheses. The population of the study was Cantonese-speaking Hong Kong residents aged 18 or greater. Cantonese speakers in Hong Kong compose 89.5% of the population. A probability sample was drawn from the Hong Kong population. A telephone interview was used to collect the data.

The study was implemented in Hong Kong during the period of November 14, 2014, to December 1, 2014. The study period was selected based on the following considerations:

- A public health emergency was in effect worldwide. The World Health Organization reported that Ebola had spread fast in several West African countries since July 2014. By November 12, 2014, there had been 14,098 reported cases of Ebola worldwide, with 5,160 reported deaths. The Hong Kong government started to issue warnings about Ebola in July 2014. The first suspect case in Hong Kong on July 31, 2014 drew extensive media coverage, and several suspect cases were reported in the next three months.

- The media covered the health emergency extensively. The media in Hong Kong followed the event closely beginning in July 2014 and maintained attentive coverage of the epidemic. The Hong Kong media continued their focused coverage as several suspect cases of Ebola emerged in the next three months. During the study period, Hong Kong was still on alert against Ebola, and local residents had been exposed to media coverage of Ebola for three months.

The target sample size was 700 Hong Kong residents. The study was executed by a public poll organization in Hong Kong through a telephone interview. Simple random sampling was applied to select telephone lines from a pool of approximately 5 million numbers maintained in a database. Telephone numbers were randomly generated using the known prefixes assigned to telecommunication services providers and were mixed in random order to produce the sample for the telephone survey. Out of the 8,061 residents whose eligibility was confirmed, 7,267 residents could not be reached during the interview period, and 77 residents either refused to participate or finished partial interviews. A total of 717 eligible respondents were successfully interviewed. According to the international standards proposed by the American Association for Public Opinion Research (2016), the overall effective response rate of this survey was 63.6%.

Measurement of Variables

The measures of the key variables were adapted from previous studies that applied the EPPM and social cognitive theory. The measures of these key variables have fairly high reliability and validity (Gore & Bracken, 2005; McMahan, Witte, & Meyer, 1998). The Chinese version of the questionnaire was finalized after being checked by three independent bilingual researchers and by taking into account their suggestions. All variables except media exposure were measured using a 5-point Likert scale with responses ranging from strongly disagree to strongly agree. A reliability test was conducted for each variable to ensure internal consistency of the items measuring the variable. A composite score was created for each variable by averaging all items measuring the variable.

Exposure to media coverage of a public health emergency measures (a) frequency of access to news about the Ebola epidemic and (b) extensity of news messages accessed from media channels. Frequency of media exposure was measured by how often one accessed news about the Ebola epidemic

from the following media channels since Hong Kong was on alert: (a) newspapers, (b) television, (c) radio, (d) news websites, (e) social media (i.e., Facebook, and microblogs), and (f) mobile media (e.g., mobile applications such as WhatsApp and other media apps). Extensity of media exposure was measured by how inclusive one accessed the news messages in the following aspects: (a) general trends of the epidemic, (b) extent of the epidemic, (c) measures taken against the epidemic, (d) reactions to the epidemic, and (e) consequences of the epidemic. A 5-point verbal frequency scale (1 = never, 5 = frequently) was used to measure exposure frequency (M = 2.73, SD = .64, α = .55) and exposure extensity (M = 3.62, SD = .79, α = .90). Exposure frequency is an index that taps into an individual's access to news through different media channels instead of a scale based on an overarching concept. Therefore, a reliability of .55 of exposure frequency does not jeopardize its purpose to summarize the access to news information.

Perceived threat and perceived efficacy. The measures of these two variables were developed and validated by Witte, Cameron, McKeon, and Berkowitz (1996). Perceived threat is measured using 10 items, with five items measuring perceived susceptibility (e.g., "I am at risk of catching Ebola") and five items measuring perceived severity (e.g., "I believe that Ebola is a serious threat to public health"). Perceived susceptibility (M = 2.63, SD = .84, α = .81) and perceived severity (M = 2.63, SD = .88, α = .78) were combined to form the measure of perceived threat (M = 2.62, SD = .80, α = .86).

Perceived efficacy is measured with four items in each of three dimensions: self-efficacy (individual), collective efficacy (the community as a whole), and proxy efficacy (an agent working on behalf of the individual). For example, "I am confident that I can protect myself from the epidemic" is an item for self-efficacy (M = 3.59, SD = .62, α = .78), "I am confident that all members in the community can protect themselves from the epidemic" for collective efficacy (M = 3.51, SD = .68, α = .85), and "I am confident that Hong Kong government can mobilize the community to protect it from the epidemic" for proxy efficacy (M = 3.76, SD = .68, α = .88).

Fear, the emotion in expectation of being hurt, was measured with three items using a 5-point Likert scale. The respondents were asked to rate how "frightened," "scared," and "anxious" the public health threat had made them (M = 3.24, SD = .85, α = .76).

Danger control contains three outcome variables: (a) attitude toward protection, (b) protection intentions, and (c) protective behaviors. For attitudes, respondents rated their attitudes toward reducing the likelihood of being affected by the threat on three items. For example, "I think taking active steps to reduce the chances of contracting Ebola is desirable" (M = 3.88, SD = .57, α = .72). Protective intentions were assessed with five items on steps one intends to take, for example, "I plan to take active measures to reduce the likelihood of being affected" (M = 4.04, SD = .53, α = .78). Protective behaviors were assessed through five items regarding the actual preventive actions one took, for example, "I currently avoid contacting sources of infection to protect myself from being affected by Ebola" (M = 3.65, SD = .67, α = .79).

Fear control contains three outcome variables: (a) reactance to risk messages, (b) message minimization, and (c) defensive avoidance. Reactance measures the degree of dislike that respondents feel against the risk messages. Participants were asked whether they feel the messages were "manipulative," "misleading," or "distorted" (M = 2.65, SD = .77, α = .69). Message minimization assesses whether

participants think the messages are "exaggerated," "overblown," or "overstated" (*M* = 2.60, *SD* = .80, α = .80). Defensive avoidance measures the degree to which participants wish to avoid thinking further about the threat. One statement read: "When I hear of the effects from being affected by Ebola, I spend additional time thinking about it." The responses to the question will be reverse coded (*M* = 2.15, *SD* = .65).

Results

A total of 717 respondents completed the survey. Eighty percent of the respondents were between the ages of 18 and 60 (*M* = 27.34, *SD* = 52.24). Fifty-five percent were female, and 45.0% were male, compared with 53.2% versus 46.8% in the population. The respondents came from a wide range of occupations, and 28.0% of them had college education versus 25.4% had some college education in the population. No control variables were theoretically relevant.

We constructed two structural equation models (SEMs) to test our hypotheses. The first one was for the danger control route (Figure 2). Media exposure was included as the exogenous variable. The three aspects of perceived efficacy, self-efficacy, collective efficacy, and proxy efficacy, and perceived threat with two dimensions, susceptibility and severity, were included as the independent variables, and the danger control outcomes were the dependent variable. The model had a relatively good fit, X^2 = 140.12, *df* = 30, *p* < .01; *CMINDF* = 4.67; *NFI* = .91, *CFI* = .93, and *IFI* = .93; *RMSEA* = .07, 90% CI [.06, .08].

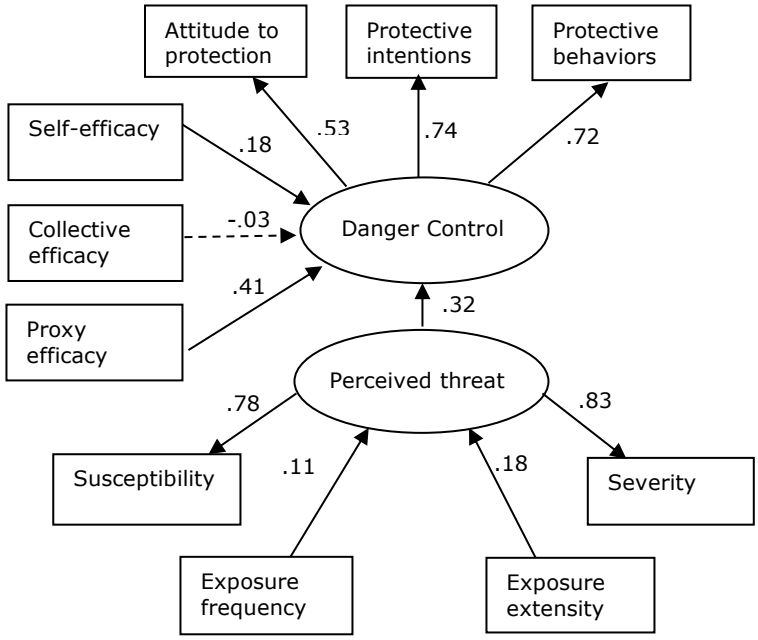

Figure 2. Structural equation model for the danger control route. Solid line,* p *< .05; dotted line,* p *> .05.

We created the second SEM for the fear control route (Figure 3). Media exposure was included as the exogenous variable. The three aspects of perceived efficacy, self-efficacy, collective efficacy, and proxy efficacy and perceived threat with two dimensions, susceptibility and severity, were included as the independent variables, with fear as a mediator of the effect of perceived threat on fear control outcomes, the dependent variable. The model had a good fit, X^2 = 63.63, *df* = 29, *p* < .01; *CMINDF* = 2.19; *NFI* = .96, *CFI* = .98, and *IFI* = .98; *RMSEA* = .04, 90% CI [.03, .05].

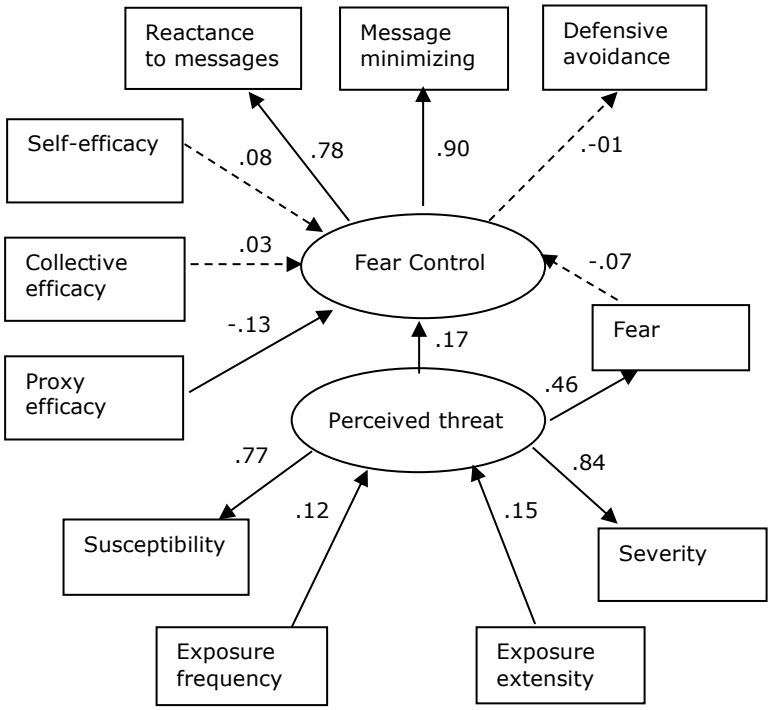

***Figure 3. Structural equation model for the fear control route. Solid line,* p < .05; *dotted line,* p > .05**

Hypothesis 1, that exposure to media coverage of a public health emergency positively predicts perceived threat, is supported. Based on the SEM for the danger control route, the two aspects of media exposure—exposure frequency (β = .11, *p* < .01) and exposure extensity (β = .18, *p* < .01)—positively predicted perceived threat.

We ran two additional regression models to test how each aspect of media exposure—exposure frequency and exposure extensity—predicts the two aspects of perceived threat: susceptibility and severity, respectively. The two exposure measures were included as predictors in the same regression model predicting susceptibility and then in another model predicting severity. In the first regression model, exposure frequency was a significant predictor of susceptibility (β = .16, *p* < .01), and exposure extensity

was not a significant predictor (β = .07, p > .05). In the second model, exposure extensity was a significant predictor of severity (β = .13, p < .01), and exposure frequency was not a significant predictor (β = .07, p > .05).

Hypothesis 2, that the effect of media exposure on fear is mediated by perceived threat, is supported. We tested the hypothesis using mediation analysis to estimate bootstrap with 1,000 samples. The two dimensions of exposure to media coverage of a public health emergency—frequency and extensity—were combined as media exposure, which is a positive predictor of perceived threat (β = .28, p < .01). In the mediation model, media exposure (β = .12, p < .05) and perceived threat (β = .41, p < .01) were significant predictors of fear. The mediation effect test showed an indirect effect of media exposure on fear mediated by perceived threat, β = .12, p < .05, 95% CI [.06, .17]. Therefore, the partial mediation effect of perceived threat is confirmed.

Hypothesis 3, that self-efficacy will moderate the effect of perceived threat on danger control outcomes such that the effect will be present as efficacy increases, is supported. Based on the SEM for the danger control route, both perceived threat (β = .32, p < .01) and self-efficacy (β = .18, p < .01) were positive predictors of danger control outcomes. We conducted a regression analysis to test self-efficacy as a moderator of the effect of perceived threat on danger control outcomes. The interaction term was statistically significant (β = .09, p < .05). The conditional effect of perceived threat on danger control outcomes moderated by self-efficacy was significant at a medium level (β = .13, p < .01) and high level (β = .18, p < .01). The effect of perceived threat on danger control outcomes was present as self-efficacy increased.

Hypothesis 4, that self-efficacy will moderate the effect of perceived threat on fear control outcomes such that the effect will be present as efficacy decreases, was not supported. Based on the SEM for the fear control route, perceived threat (β = .17, p < .01) was a significant positive predictor of fear control outcomes, whereas proxy efficacy (β = -.13, p < .01) was a significant negative predictor, and self-efficacy (β = .08, p > .05) was not a significant predictor. We conducted a regression analysis to test self-efficacy as a moderator of the effect of perceived threat on fear control outcomes. The interaction term was not statistically significant (β = .04, p > .05). There was no interaction effect between perceived threat and self-efficacy in their prediction of fear control outcomes.

Hypothesis 5, that the effect of proxy efficacy on danger control outcomes is stronger than that of self-efficacy and collective efficacy, is supported. In the SEM for the danger control route, self-efficacy (β = .18, p < .01) and proxy efficacy (β = .41, p < .01) were significant predictors of danger control outcomes; collective efficacy was not a significant predictor (β = −.03, p > .05). Fisher's z-score transformation shows that the difference between the regression coefficients of proxy efficacy (β = .41, p < .01) and self-efficacy (β = .18, p < .01) on danger control outcomes was statistically significant (z = 4.79, p < .01). Proxy efficacy had a stronger effect on danger control outcomes than self-efficacy.

Hypothesis 6, that the effect of self-efficacy on danger control outcomes is moderated by collective efficacy and proxy efficacy, is partially supported. We tested the hypothesis through two sets of multiple regression analyses with collective efficacy and proxy efficacy as the moderators. The product of self-efficacy

and collective efficacy and the product of self-efficacy and proxy efficacy as the interaction terms were computed with a standardized measure of self-efficacy, collective efficacy, and proxy efficacy.

The regression analyses results indicated that the effect of self-efficacy on danger control outcomes was moderated by collective efficacy. In the regression model, both self-efficacy ($\beta = .17$, $p < .01$) and collective efficacy ($\beta = .09$, $p < .05$) were positive predictors of danger control outcomes, and the interaction term was statistically significant ($\beta = .09$, $p < .05$). The conditional effect of self-efficacy on danger control outcomes moderated by collective efficacy was significant at a low level ($\beta = .11$, $p < .05$) and a high level ($\beta = .23$, $p < .01$).

The regression analyses' results indicated that the effect of self-efficacy on danger control was not moderated by proxy efficacy. In the regression model, both self-efficacy ($\beta = .12$, $p < .01$) and proxy efficacy ($\beta = .25$, $p < .01$) were positive predictors of danger control, and the interaction term was not statistically significant ($\beta = -.03$, $p > .05$). The conditional effect of self-efficacy on danger control outcomes at three different levels of proxy efficacy showed no significant changes (R^2 change = .00, $p > .05$).

Discussion

Guided by the EPPM and social cognitive theory, this study examined the effects of media coverage of a public health emergency on perceived threat and perceived efficacy, which further affect people's protective behaviors. The results of the study offer new insight into the health protection behavior in response to the extensive media coverage of a public health emergency.

Media exposure was found to have an effect on perceived threat, as shown in the result of H1, but the effect varied by exposure frequency and extensity in relation to susceptibility and severity. Exposure frequency that produced susceptibility raises concerns about personal-level risk. Exposure extensity, on the other hand, prompts people to evaluate the overall situation of the health emergency, which concerns the societal-level risks. The finding implies that the access mode of media coverage of the epidemic could produce different orientations of risk perception in a public health emergency. The variation of the effect further clarifies the impersonal-impact hypothesis. The impersonal-impact hypothesis proposes that media produce effect more on societal-level risk perception than on personal-level risk perception. The findings of this study distinguish the effects of media exposure on the two different levels of risk perception and corroborate what has been found previously (Coleman, 1993; Culbertson & Stempel, 1985; Pilisuk & Acredolo, 1988). Media exposure produces societal-level risk perception more due to exposure extensity than exposure frequency. Future studies can further verify the effect of access mode of media coverage on different levels of risk perception.

The finding of H2 confirmed a direct and indirect effect of media exposure on fear in a public health emergency. News messages delivered through media arouse fear like the messages that are designed with fear appeal in experiments. The finding shows the effect on fear aroused from a real-life information source, which is different from the messages designed for an experiment in content and the information-access mode. News messages may not contain an obvious fear appeal all the time, and swings in risk or threat levels. The effects of media coverage on fear are cumulative rather than immediate. Media coverage that

lasts for a period of time could produce continual fear that leads to enduring behavior changes compared with the temporal changes elicited by the fear appeal messages. The effects of media exposure on fear mediated by perceived threat further confirmed the role of media exposure in arousing fear under the condition of an intervening variable. To what degree the fear aroused by media messages differs from that induced by fear appeal from manipulated messages and the consequent effect on health behaviors by different stages of an event are worth exploring further during a period of extensive media coverage of a public health emergency.

The EPPM suggests that an appraisal of efficacy is based on the recommended responses in the message. With an observation of the specific nature of a public health emergency and the media coverage of the emergency with regard to recommended response, we argue that although the recommended responses could be made by health agencies and institutions in a public health emergency, they are different from those in the fear appeal messages in an experiment and may not be easily identifiable from the media coverage of the emergency. The appraisal of the efficacy is less likely to be based on a recommended response in news messages due to the nature of the emergency and the focus of the media coverage. Our model used self-efficacy as a more general measure that implies some degree of response efficacy based on past experience and perceived personal capacity. The measure of self-efficacy could capture both self- and response efficacy in dealing with the public health emergency.

Self-efficacy is examined as a core in predicting danger control and fear control outcomes in the EPPM. The results of H3 and H4 clarified the role of self-efficacy as a moderator of the effect of perceived threat on danger control and fear control outcomes. The finding prompts further thought on the nature of the threat and how people behave when facing a severe threat. First, self-efficacy was essential and did play a crucial role in the danger control process. The moderating role became stronger as self-efficacy increased in the process of danger control. Second, the nature of the threat and the level of risk information contained in the news message could be the reason why self-efficacy did not moderate the effect of perceived threat on fear control outcomes. The fear appeal messages applied in previous studies normally contained a lower level of threat than the news messages in a public health emergency, and the threat was not imminent such as those relating to anti-smoking (Emery, Szczypka, Abril, Kim, & Vera, 2014) and oral hygiene (Ajit & Raj, 2015). Therefore, people taking the fear control route will not face immediate danger. In the case of the Ebola epidemic, because of its high fatality rate, few people could afford to ignore the threat and proceed with the fear control route. What people could do in a public health emergency with imminent and severe threat is to take the threat seriously and proceed with necessary protective behaviors. The nature of the threat and the need to protect oneself reduce the negative moderating role of self-efficacy in the process of fear control.

The leading role of self-efficacy in affecting danger control shifted a little when proxy efficacy was included in the examination of the effect of perceived efficacy on protective behaviors in a public health emergency. The finding of H5 confirmed that proxy efficacy had a stronger effect than self-efficacy on danger control outcomes. Although self-efficacy will always play a major role in any goal fulfillment, in the case of the Ebola epidemic, the government as a proxy agent with more resources was more powerful in combating the health threat. Which aspects of efficacy will play a leading role in danger control depends on the nature of the health threat and individuals' versus proxy agency's capacity in combating the health threat. When

people as individuals face a public health emergency, they may realize that they are vulnerable and their capacity to protect themselves is inadequate. The leading role of self-efficacy on danger control outcomes would therefore give way to proxy efficacy, when the proxy agent is perceived as more powerful in the process and the public has confidence in the agent's ability to address the crisis and protect the people. The negative effect of proxy efficacy on fear control outcomes further confirms the role of a powerful proxy agent in a public health emergency in deterring people from proceeding with the fear control route.

Because Ebola is a public health emergency that has an immense social impact, and an individual needs to work with other community members and the government agency to deal with it, collective and proxy efficacy are expected to moderate the effect of self-efficacy on danger control outcomes. However, the results of H6 show that collective efficacy had a relatively weak moderating role of the effect of self-efficacy on danger control outcomes, and proxy efficacy had no moderating effect. The finding suggests an independent role of self-efficacy in the process of generating danger control outcomes, and the diminishing facilitating role of collective efficacy and proxy efficacy. Past research suggests that collective and proxy efficacy would facilitate the health-related activities, but those health-related activities concern no imminent threat (Browning et al., 2008; Dzewaltowski et al., 2007; Smith et al., 2007). When facing an immediate threat like Ebola, an individual would need to rely more on oneself for health protection, which could reduce the power of collective and proxy efficacy in moderating the effect of self-efficacy on danger control outcomes. The nature of the health threat, the social context, and the stage of a public health emergency could make collective efficacy and proxy efficacy less essential factors to interact with self-efficacy.

The study examined the effect of three different types of efficacy on danger control outcomes to explore the impact of societal factors aside from self-efficacy. Both collective efficacy and proxy efficacy are societal factors, but their measures were limited to the behavior-specific aspects of response efficacy of the community members and the proxy agent. When examining the influence of social and contextual factors, the model of effects of media exposure, perceived threat, and perceived efficacy on protective behaviors in a public health emergency needs to be adjusted to include relevant variables to match the societal and environmental impacts.

This study revealed the effects of media exposure, perceived threat, and perceived efficacy on protective behaviors and advanced the EPPM in a public health emergency under extensive media coverage. However, the results should be treated with caution due to the limitations of the study. The main limitations of the study are the cross-sectional nature, the sole reliance on retrospective self-report, the large risk of overfitting in SEM, and the lack of content analysis to gain insight into how media messages exactly influence these assumed processes. The study looked at the effect of media exposure on perceived threat and perceived efficacy, but what messages the respondents actually received and processed were not examined. Some news messages might present a recommended response at an individual level or societal level. The messages the respondents accessed and processed could make a difference in perceived threat and perceived efficacy and thereafter the fear aroused, which would further influence protective behaviors.

Future studies of media exposure and protective behaviors in a public health emergency could include a content analysis of the news stories, which would provide a base for further analysis of the messages that people actually receive and process. Besides the effects of perceived threat and perceived

efficacy, other personal and social factors might play a role in producing protective behaviors. For example, previous experience of a public health emergency could make a person less emotional, less fearful, and more likely to proceed with danger control outcomes. Social factors such as social assimilation and social involvement could strengthen one's attachment to the community and therefore enhance the role of collective efficacy in producing protective behaviors in a public health emergency.

Conclusion

This study examined how media coverage of a public health emergency affects perceived threat and perceived efficacy, and henceforth the protective behaviors. The major contributions of this study are as described below.

First, the study goes beyond the fear appeal messages designed for experiments and tests the effect of media coverage of a public health emergency on perceived threat and the consequent protective behaviors. Using media messages as information sources in real life presents an alternative way of looking at how people are influenced by messages regarding an immediate threat and the extended parallel process that leads to the two routes of health-related behaviors. The test of a model of protective behaviors in a public health emergency offers empirical evidence that exposure to the information from media sources in real life will lead to the extended parallel process and variant health protective behaviors.

Second, this study tested the effect of media exposure on perceived threat through two aspects: exposure frequency and exposure extensity. The findings clarify the impersonal-impact hypothesis and the effect of media exposure on different levels of risk perception in a public health emergency. The test results distinguish the effects of the two aspects of media exposure. Exposure frequency has an effect on susceptibility, which is the concern on personal-level risk, whereas exposure extensity produces an effect on severity, which is the societal-level risk perception.

Third, this study introduced the three aspects of efficacy based on social cognitive theory as the predictors of health protective behaviors. The findings clarify the effect of collective efficacy and proxy efficacy on protective behaviors in addition to that of self-efficacy. The results suggest that the effects of perceived efficacy on protective behaviors are contingent upon the nature and social context of a public health emergency. Other societal, and surrounding, environmental factors could be taken into account to provide more insight into people's protective behaviors in a public health emergency.

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