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**The Cognitive Mediation Model: Factors Influencing Public Knowledge of the H1N1
Pandemic and Intention to Take Precautionary Behaviors**

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Abstract

This study uses the cognitive mediation model as the theoretical framework to examine the influence of motivations, communication, and news elaboration on public knowledge of the H1N1 pandemic and the intention to take precautionary behaviors in Singapore. Using a nationally representative random digit dialing telephone survey of 1,055 adult Singaporeans, the authors' results show that the cognitive mediation model can be applied to health contexts, in which motivations (surveillance gratification, guidance, and need for cognition) were positively associated with news attention, elaboration, and interpersonal communication. News attention, elaboration, and interpersonal communication in turn positively influence public knowledge about the H1N1 influenza. In addition, results show that the motivations have significant indirect effects on behavioral intentions, as partially mediated by communication (media attention and interpersonal communication), elaboration, and knowledge. The authors conclude that the cognitive mediation model can be extended to behavioral outcomes, above and beyond knowledge. Implications for theory and practice for health communication were discussed.

The Cognitive Mediation Model: Factors Influencing Public Knowledge of the H1N1 Pandemic and Intention to Take Precautionary Behaviors

As early as February 2009, villagers in La Gloria, Mexico began showing signs of a novel flu strain (Landau, 2009). This was the beginning of the Influenza A (H1N1) pandemic which would soon make headlines around the world. As of March 14, 2010, the virus has spread to six continents and has caused almost 17,000 H1N1-related deaths (World Health Organization, 2010). Many experts estimated that the total number of infections could already be in the millions, and the World Health Organization expected that 2 billion people will eventually be infected (Lynn, 2009).

Singapore, a city-state in Southeast Asia, was first added to the global tally when a 22-year-old Singaporean student infected with the H1N1 virus returned from New York in May 2009. Since then, widespread community transmission occurred in the densely populated country which resulted in 21 H1N1-related deaths (Singapore Swine Flu Statistics Centre, 2010). Experts have highlighted the need to rely on communication channels to educate and mobilize the public to take precautionary actions within the early phases of an infectious disease outbreak to put it under control (Ratzan, 2009; Syed, Hjarnoe, Krumkamp, Reintjes, & Aro, 2010; Yap, Lee, Yau, Ng, & Tor, 2010). During the early phases of the H1N1 pandemic, the Singapore Ministry of Health worked closely with the national television and newspapers to swiftly disseminate large volume of news about influenza preventive measures to the public (Ho, 2012). It is, therefore, worthwhile to gauge the effect of factors such as individuals' levels of news attention and elaboration on their knowledge and willingness to undertake preventive behavior in times of such a health crisis. Specifically, this study will apply Eveland's (2001) cognitive mediation model (CMM) to examine how news attention, elaboration, and interpersonal communication, can potentially mediate the influence of various motivations on public level of H1N1-related knowledge and intentions to

engage in precautionary behavior. Our findings will enable health communicators to develop useful intervention and information dissemination strategies that can activate citizens to engage in preventive measures during an influenza outbreak. Moreover, although health knowledge is generally deemed as an antecedent to preventive behaviors, some studies found mixed association between knowledge and behavior (e.g., Viswanath et al., 2006). By sorting out the relation between knowledge and behavior using the H1N1 pandemic as a context, findings from our study will contribute to the current body of literature in health communication.

Health communication researchers have also emphasized the importance of conducting research on the emergence and control of new infectious diseases in Southeast Asia, as the increasing population and the tropical climate in the region could trigger pandemic-level infectious diseases (Coker, Hunter, Rudge, Liverani, & Hanvoravongchai, 2011; Haider, Frank, & Noreen, 2010; Sleight, Leng, Yeoh, Phua, & Safman, 2006). Singapore went through the 1918 Spanish Flu, the 1957 Asian Flu, and the 1968 Hong Kong Flu pandemics in the last century (V. J. Lee et al., 2007; V. J. Lee et al., 2008). As such, findings from this study, that focus on examining the CMM in a densely populated city-state such as Singapore, will open up new research trajectories for future comparative studies among other Asian countries.

Moreover, previous studies on the CMM have mostly tested the theory in political contexts (e.g., Beaudoin & Thorson, 2004; Eveland, 2001, 2002). We will contribute to existing literature by assessing the applicability of the CMM to a salient health context in this study. Our study also aims to extend the original CMM in two ways: (a) by including interpersonal communication as a new mediating variable into the model; and (b) by examining whether knowledge, along with motivations, communication, and news elaboration, can potentially influence behavioral intentions. We hope to build a stronger

model with the new additions. Since previous studies have assessed the CMM mostly in the contexts of North America, this study will therefore offer a worthwhile examination of media effects highlighted in the CMM on the basis of a unique cultural context. We will first articulate the original CMM and its various hypotheses, followed by the justifications of the extended CMM and related hypotheses.

The Cognitive Mediation Model

The CMM (Eveland, 2001) posits that various motivations propel individuals to pay attention and to actively process news information. News attention, in turn, will influence the amount of knowledge that individuals will acquire from the media through two paths: (a) a direct path to knowledge, and (b) an indirect path to knowledge, which is mediated by news elaboration. The relations in the original CMM are shown in Figure 1.

[Insert Figure 1 about here.]

Motivation is the force that propels individuals to initiate and perform an intended action (Deci & Ryan, 1985; Reiss, 2004). Motivation can often influence individuals' perception, cognition, emotion, and behavior (Reeve, 1997; Reiss, 2004). In CMM, the roles of motivations of media use can be understood in the context of the uses and gratifications approach. The uses and gratifications approach (Blumler, 1979; Katz, Blumler, & Gurevitch, 1974) assumes that audience members are active, in which their use of the media is goal-oriented and purposive. It also assumes that motivations drive audience members to pay attention to a particular type of medium to fulfill their wants and needs. Put simply, audience members develop expectations for media use and choose a particular type of medium to fulfill their motives (Katz, Blumler, & Gurevitch, 1974).

In the original CMM, Eveland (2001) suggested that individuals' motivations would affect how they pay attention to and process news information, and how this information will alter knowledge acquisition. News attention is defined as individuals' focus of mental effort

(Chaffee & Schleuder, 1986). News attention is a necessary but not a sufficient precursor to knowledge acquisition. Eveland (2001) further postulated that news elaboration will mediate the influence of news attention on knowledge. News elaboration (Eveland, 2001) is defined as “the process of connecting new information with other pieces of information store in memory, including prior knowledge, personal experiences, or the connection of two new bits of information together in new ways” (p. 573). Through this cognitive process, individuals can increase the strength of the memory store and the number of mental pathways with which information can be accessed.

In sum, by integrating research on uses and gratifications (e.g., Blumler, 1979; Katz, Blumler & Gurevitch, 1974), information processing (e.g., Kosicki & McLeod, 1990; Perse, 1990), and media effects (e.g., Neuman, Just, & Crigler, 1982), the CMM essentially highlights the importance of cognition and the active role of the audience members in the mediated knowledge acquisition process.

Motivations of Media Use

We will examine four motivations of news attention and elaboration in this study: surveillance gratification, anticipated interaction, guidance, and need for cognition. First, Eveland (2001) defined surveillance gratification as individuals’ tendency to use the news media to gain information about their social environment. Research has shown that individuals who view news with a surveillance gratification objective tend to acquire more knowledge than those who do so for diversion or entertainment (McLeod & McDonald, 1985). Surveillance gratification is one of the most common motives that compel individuals to use the mass media (Bantz, 1982; Blumler, 1979).

Beaudoin and Thorson (2004) added two motivations that could influence attention and elaboration, namely anticipated interaction and guidance. Anticipated interaction involves securing information for individuals to use as social resources in impending

conversations with others (Payne, Severn, & Dozier, 1988). Levine and Russo (1995) found that individuals preparing to defend their stance on a controversial issue among a group of people tend to acquire more information to support their viewpoint. Next, guidance drives individuals to acquire news from the media for making informed decisions (Lometti, Reeves, & Bybee, 1977). Guidance involves both the affective and behavioral components. For the affective component, guidance refers to individuals seeking assistance to make decisions about how they feel toward an issue; for the behavioral component, guidance refers to individuals seeking help for decision-making (Lometti et al., 1977). Scholars have proposed that guidance is a gratification that can drive media use and information processing (Atkin, 1973; Lometti et al., 1977; McLeod & Becker, 1974).

Several scholars in CMM have highlighted the need to include need for cognition as a potential motivation for media use in future studies (e.g., Eveland, 2001; Eveland, Shah, & Kwak, 2003). Need for cognition is an individual's predisposition to engage in thinking (Cacioppo & Petty, 1982). High need for cognition individuals tended to think about and reflect back on information to make sense of their environment whereas low need for cognition individuals tended to rely on heuristics such as expert advice or social comparison processes (Cacioppo, Petty, Feinstein, & Jarvis, 1996). Need for cognition can potentially determine whether individuals will engage in effortful processing of the information that they consume. As such, we will include the variable as an additional motivation in our study.

Motivations and News Attention

Empirical studies have shown that surveillance gratification is positively associated with individuals' attention to print and broadcast news (David, 2010; Eveland, 2001; McLeod & McDonald, 1985), general television viewing (Rubin, 1983), and news media reliance (Beaudoin & Thorson, 2004). Likewise, research found anticipated interaction predicts individuals' attention to public affairs news (McLeod & McDonald, 1985) and news media

reliance (Beaudoin & Thorson, 2004). Studies have shown guidance to be positively associated with individuals' reliance on the news media (Beaudoin & Thorson, 2004). Need for cognition is shown to motivate news viewing and attention to government news reports (Perse, 1992). As such, we expect that these motivations will be positively associated with individuals' news attention:

Hypothesis 1: (a) Surveillance gratification, (b) anticipated interaction, (c) guidance, and (d) need for cognition will be positively associated with news attention.

Motivations and News Elaboration

Studies have shown surveillance gratification and anticipated interaction to be positively associated with elaboration in numerous political contexts (Eveland, 2001, 2002, 2004). Likewise, Perse (1990) demonstrated that an instrumental viewing motive is positively related to elaboration, suggesting support for guidance. Empirical research have also shown that people with a high need for cognition tend to engage in cognitively effortful tasks (Meyers-Levy & Peracchio, 1992; Thompson et al., 1993) and to use greater cognitive effort in processing than people with a low need for cognition (Cacioppo, Petty, Kao, & Rodriguez, 1986). Therefore, we hypothesize the following:

Hypothesis 2: (a) Surveillance gratification, (b) anticipated interaction, (c) guidance, and (d) need for cognition will be positively associated with news elaboration.

News Attention, News Elaboration, and Knowledge

According to the CMM, attention is essential for knowledge gain (Eveland, 2001). The Singapore media has been used as the main avenue for health authorities to disseminate information about the H1N1 pandemic (Ho, 2012). The volume of media coverage has been shown to be positively associated with public levels of attention paid to infectious diseases

such as the avian flu and the Mad Cow disease (e.g., Ho, Brossard, & Scheufele, 2007).

Several studies have shown that news attention can enhance public learning (e.g., Chaffee & Schleuder, 1986; Chaffee, Zhao & Leshner, 1994; McLeod & McDonald, 1985).

News elaboration can play important roles as well. Scholars have highlighted the role of elaboration in knowledge acquisition (Eveland, 2001; Hamilton, 1989; Perse, 1990). For example, Beaudoin and Thorson (2004) found that elaboration partially mediated the positive influence of news media on political knowledge. Eveland (2001) demonstrated that attention drives elaboration, and elaboration in turn promotes knowledge. Several studies on the CMM established similar conclusions (Eveland, 2004; Eveland et al., 2003). We therefore postulate the following hypotheses:

Hypothesis 3: News attention will be positively associated with news elaboration.

Hypothesis 4: News attention will be positively associated with knowledge.

Hypothesis 5: News elaboration will be positively associated with knowledge.

New Extensions to CMM

We contend that the original CMM can be extended in two ways: (a) by including interpersonal communication as a new mediating variable into the model, and (b) by examining the potential influence of motivations, communication, news elaboration, and knowledge on behavioral intentions. Relations in the hypothesized expanded model are shown in Figure 2.

[Insert Figure 2 about here.]

Mediating Role of Interpersonal Communication

In this study, we propose that interpersonal communication is a mediating variable that can be incorporated into the CMM. Interpersonal communication can serve two important functions in times of uncertain situations such as the H1N1 pandemic. First, people can rely on interpersonal communication as a form of information channel for determining

behaviors. Studies have shown that individuals prefer interpersonal channels to mediated ones when they need to determine personal courses of action (e.g., Morton & Duck, 2001). In other words, although mass media channels can provide information about a risk such as the H1N1 pandemic, individuals will be inclined to discuss the matter with their social network to determine if the risk will affect them personally. Moreover, other research on the two-step flow model have shown that the timing and context of the information received by individuals from mass media channels allows them to recognize the relevance of this information in their lives, which propels them to discuss the issue with other people in their social network (Katz & Lazarsfeld, 1955; Southwell & Yzer, 2009). Morgan (2009) argued that ideas that originated from the mass media could be spread through individuals' interpersonal communication within their social networks, which could then produce other subsequent behavioral effects.

The second important function of interpersonal communication is that it could serve as a form of systematic information processing strategy. Kosicki and McLeod (1990) defined information processing strategy as individuals' efforts to think about the information that they gather from the mass media, and their attempts to talk to others about what they have learnt from the mass media. Eveland (2004) explained that in the process of communicating with others, individuals are compelled to retrieve information from their memory and to make connections between the news information that they are exposed to with their larger knowledge structure. During or after a discussion, conversation partners may stimulate individuals to make new associations between preexisting ideas in their memory (Eveland, 2004). Since interpersonal discussion can serve as an information channel and as a form of information processing strategy akin to elaboration, we posit the following:

Hypothesis 6: (a) Surveillance gratification, (b) anticipated interaction, (c) guidance, and (d) need for cognition will be positively associated with interpersonal

communication.

Studies have demonstrated that interpersonal discussion enhances knowledge (Conduit, Parott, & Harris, 2002; Powell, Dunwoody, Griffin, & Neuwirth, 2007; Stamm, Clark, & Eblacas, 2000). Moreover, the recent communication mediation model indicated that media use and interpersonal discussion could act as stimuli by mediating individuals' orientations and knowledge (Shah et al., 2007). Cho and colleagues (2009) found that interpersonal communication in political contexts mediated the relation between media use and knowledge, and they further suggested that this process can be extended to health communication. Morgan (2009) argued that ideas that originated from the mass media could be spread through individuals' interpersonal communication within their social networks. Therefore, we hypothesize the following:

Hypothesis 7: News attention will be positively associated with interpersonal communication.

Hypothesis 8: Interpersonal communication will be positively associated with knowledge.

Extensions to Behavioral Intentions

We propose that the CMM can be extended to behavioral intentions. Specifically, we argue that elaboration, interpersonal communication, and knowledge will be positively associated with behavioral intentions¹. Behavioral intentions, or indicators of how much effort people are willing to put in to perform a certain task, are strongly correlated with actual behavior (e.g., Ajzen, 1991; Manstead, Proffitt, & Smart, 1983). Behavioral intentions should

¹ Past studies have shown that the direct effects of media attention on health behaviors are small or almost negligible (e.g., Atkin & Wallack, 1990; Morley, Wakefield, Dunlop, & Hill, 2009; Rogers, 1973; Tambashe, Speizer, Amouzou, & Djangone, 2003). At the same time, a growing body of literature has demonstrated that the effects of media attention on behaviour are indirect, as mediated by social and cultural factors (e.g., Beaudoin, 2009; Randolph & Viswanath, 2004; Rogers, 1973; Yanovitzky & Bennett, 1999). Therefore, given the inconclusive evidence, we opted not to examine the direct effects of news attention on individuals' intention to undertake H1N1 precautionary behavior in our study. By so doing, we could also ensure that our model is parsimonious.

be a good proxy for actual behavior in our proposed expanded CMM.

Nenkov and colleagues (2008) found that individuals' tendency to elaborate on potential outcomes of behavior significantly predicted their behavior. The higher the elaborative tendency was, the higher the self-reported frequency of regulating behaviors such as money management and working out. Hence, this suggests a positive relation between elaboration and behavioral intentions.

Cassell and colleagues (1998) found that interpersonal interactions are necessary to persuade individuals to adopt healthy behaviors. Hafstad and Aaro (1997) showed that discussion with peers was a major predictor of anti-smoking behaviors among adolescents. Studies have shown that interpersonal communication is positively associated with participatory behaviors and political engagement in political contexts (Mutz, 2006; Sotirovic & McLeod, 2005). These suggest a positive association between interpersonal communication and behavioral intentions.

Last, we posit that individuals who are knowledgeable about the H1N1 pandemic are more likely to undertake precautionary behaviors than those who are less knowledgeable. Empirical studies on the knowledge-attitude-practice sequence have shown that people gain knowledge which predisposes them to attitudes that motivate them to practice a certain behavior (Leung, Chan, Fu, & Lam, 2010; Okobia, Bunker, Okonofua, & Osime, 2006; Wang, Huang, & Knerr, 2010). Several theories such as the theory of planned behavior (Ajzen, 1991) and the health belief model (Rosenstock, 1974), which relied on the knowledge-attitude-practice sequence, have also highlighted the role of knowledge as a precursor to the formation of attitudes and practices. Although studies that applied the knowledge-attitude-practice sequence have shown that attitudes tend to mediate the influence of knowledge on behaviors (e.g., Sessa, Giuseppe, Albano, & Angelillo, 2011; Wang et al., 2010), empirical evidence have also demonstrated that knowledge can have a direct (albeit

small) effect on health behaviors (Chew et al., 2002; Morgan & Miller, 2002; Viswanath, 2006; Yap, Lee, Yau, Ng, & Tor, 2010). For example, Yap and colleagues (2010) demonstrated that knowledge has a significant influence on attitudes and behavioral changes among Singaporeans during the H1N1 pandemic. Morgan and Miller (2002) found that among non-organ donors, an increase in knowledge significantly enhances their behavioral intention to donate. Therefore, on the basis of these considerations, we hypothesize the following:

Hypothesis 9: (a) Elaboration, (b) interpersonal communication, and (c) knowledge will be positively associated with behavioral intentions.

We plan to test two models in this study. In the first model, we will test a version of the original CMM which includes motivations, news attention, news elaboration, and knowledge. In the second model, we will test the extended CMM by including interpersonal communication and behavioral intentions to the original model. We expect to find support for both models.

Method

Data for this study came from a nationally representative CATI survey of 1,055 randomly selected Singapore citizens and permanent residents aged 18 years and older in Singapore. The fieldwork was conducted from December 14 to 21, 2009. To maximize the response rate of our telephone survey, the interview was conducted in either English or Mandarin. The youngest male/oldest female technique was used to randomize within households. Interviewers asked to speak with “a male 18 years or older who is now at home,” and if there was no eligible male at home, they asked to speak to the oldest female at home. This technique has been effective in yielding representative samples in Singapore (Ho, Detenber, Malik, & Neo, 2012; Ho, Lee, & Hameed, 2008). Extensive amount of effort was invested in call-backs and refusal conversions to minimize systematic non-response. The

response rate was 34.3% (AAPOR Formula 3), with a $\pm 3\%$ margin of error at the 95% confidence level².

Measures

Surveillance gratification was measured with two items (adapted from Beaudoin & Thorson, 2004) on a 10-point scale ranging from 1 (*strongly disagree*) to 10 (*strongly agree*): “I keep myself informed about news related to the H1N1 influenza because (a) ‘I want to know about any new updates on the H1N1 pandemic;’ and (b) ‘I want to understand what is going on with the H1N1 pandemic.’” Responses were averaged to create a scale with higher scores indicating higher levels of surveillance gratification ($M = 6.96$, $SD = 2.45$, $r = .80$, $p < .001$).

Anticipated interaction was measured with two items (adapted from Beaudoin & Thorson, 2004) on a 10-point scale ranging from 1 (*strongly disagree*) to 10 (*strongly agree*): “I keep myself informed about news related to the H1N1 influenza because (a) ‘I like to be prepared to discuss about the H1N1 pandemic;’ and (b) ‘I can advise others on what to do about the risk posed by the H1N1 pandemic.’” Responses were averaged to create a scale with higher scores indicating higher levels of anticipated interaction ($M = 6.16$, $SD = 2.54$, $r = .72$, $p < .001$).

Guidance was measured with three items (derived from Beaudoin & Thorson, 2004) on a 10-point scale ranging from 1 (*strongly disagree*) to 10 (*strongly agree*): “I keep myself informed about news related to the H1N1 influenza because (a) ‘The information helps me decide if I should be worried about the risk posed by the H1N1 pandemic;’ (b) ‘The information helps me decide if I should do anything about the risk posed by the H1N1

² Our sample demographics are similar to the characteristics in the 2000 Census of Population (Singapore Department of Statistics, 2010) in terms of age, gender, education, and income. The median age groups were “35–39 years old” in the census and “40 years old” in our sample. Women comprised 50.1% of the population in the census, and women comprised 54.7% of the respondents in our sample. The median education level attained in the census was “secondary education” and the median education level of our survey respondents was “A level.” The median monthly household income was “\$2000–\$2999” in the census and “\$3001–\$4000” in our sample. In general, our sample was a relatively good reflection of the Singapore population.

pandemic;’ (c) ‘The information helps me decide what to do about the risk posed by the H1N1 pandemic.’” Responses were averaged to create a scale with higher scores indicating higher levels of guidance ($M = 6.86$, $SD = 2.34$, *Cronbach’s* $\alpha = .91$).

Need for cognition was measured using four items (adapted from David, 2009) on a 10-point scale ranging from 1 (*strongly disagree*) to 10 (*strongly agree*): (a) “I usually end up deliberating about issues even when they do not affect me personally;” (b) “I really enjoy a task that involves coming up with new solutions to problems;” (c) “I prefer my life to be filled with puzzles that I must solve;” and (d) “I find satisfaction deliberating long and hard for hours.” Responses were averaged to create a scale with higher scores indicating a higher need for cognition ($M = 5.56$, $SD = 1.53$, *Cronbach’s* $\alpha = .70$).

News attention was measured using three items (adapted from Eveland, 2002, 2004), where respondents were asked to indicate on a 10-point scale ranging from 1 (*little attention*) to 10 (*very close attention*), the amount of attention they paid to news related to the H1N1 pandemic on television, newspapers, and the Internet (e.g., “Please tell me how much attention you pay to news related to the H1N1 pandemic on television.”). Responses were averaged to create a scale, with higher scores indicating higher levels of attention ($M = 4.37$, $SD = 2.24$, *Cronbach’s* $\alpha = .79$).

Elaboration was measured using three items (adapted from Beaudoin & Thorson, 2004; Eveland, 2001, 2004; Ho, Scheufele, & Corley, 2010) on a 10-point scale ranging from 1 (*strongly disagree*) to 10 (*strongly agree*): (a) “When reading or watching the news, I carefully analyze the information given about the H1N1 influenza in the news;” (b) “After I encounter news on the H1N1 influenza, I am likely to stop and think about it;” and (c) “I often relate what I learnt from the news on the H1N1 influenza to other things I know.” Responses were averaged to form a scale with higher scores indicating higher levels of elaboration ($M = 6.22$, $SD = 2.09$, *Cronbach’s* $\alpha = .90$). Items (a) and (b) assess the extent to

which the respondents engage mentally with the subject matter at hand, which is a necessary requirement in news elaboration. Similar elaboration measures regarding thinking about, interpreting, and analyzing news were used in previous CMM studies (e.g., Beaudoin & Thorson, 2003; Eveland, 2001). Item (c) assesses the extent to which respondents connect new information with other pieces of preexisting information stored in their memory. This is consistent with the definition of elaboration, in which through this process, the strength of individuals' memory stored is increased, along with the number of mental pathways where information can be accessed (Eveland, 2001). Similar elaboration item with regard to relating new information with preexisting information was also used in previous CMM studies (e.g., Eveland, 2004).

Interpersonal communication was measured using three items (adapted from Ho et al., 2010). Respondents were asked to indicate on a 10-point scale ranging from 1 (*not at all*) to 10 (*very frequently*) how frequently they discuss issues related to H1N1 with their (a) friends, (b) family, (c) doctor, and (d) coworkers. Responses were averaged to form a scale with higher scores indicating higher levels of interpersonal discussion ($M = 3.87$, $SD = 2.10$, *Cronbach's* $\alpha = .78$).

Given the developmental press system in Singapore, the Ministry of Health was able to work closely with the mass media to ensure that the necessary information was disseminated to the public. We obtain eight questions from the information published on the Singapore Ministry of Health and World Health Organization Websites as it could well reflect the H1N1 facts disseminated in the mass media. To measure *knowledge*, respondents were asked to state true or false for the following sentences (1 = "true," 2 = "false"): (a) "A person carrying the H1N1 influenza can spread the virus by coughing in public;" (b) "Fever can be a symptom of the H1N1 influenza;" (c) "A person infected with the H1N1 influenza can remain free of signs and symptoms for up to 7 days;" (d) "Diabetics are at a higher risk of

complications from H1N1 infection than are non-diabetics;” (e) “Wearing a N95 mask can effectively protect you from contracting the H1N1 influenza;” (f) “Taking the H1N1 flu vaccine can effectively protect a person from the H1N1 influenza;” (g) “The seven steps of washing hands with soap and water can help to reduce a person’s chances of contracting the H1N1 virus;” and (h) “A person infected with the H1N1 virus can be effectively treated using Tamiflu tablets.” The responses were recoded into “0” (incorrect) and “1” (correct), and summed into a combined scale, in which higher scores correspond to higher levels of H1N1 knowledge ($M = 5.96$, $SD = 1.61$, $KR-20 = .61$).

Behavioral intentions were measured using a 10-point scale ranging from 1 (*least likely*) to 10 (*most likely*) in which respondents were asked how likely they were to engage in the following H1N1 preventive measures in the coming month: (a) “Wear a face mask in public;” (b) “Follow the prescribed 7 steps in hand washing;” (c) “Avoid people who cough in public without masks;” (d) “Avoid crowded places;” (e) “Adopt a balanced diet;” and (f) “Take the H1N1 vaccine.” The six items were averaged to create a scale, with higher values indicating higher behavioral intentions ($M = 5.92$, $SD = 1.83$, *Cronbach’s* $\alpha = .68$).

We included age, gender, formal education, and monthly household income as *control variables*. Age was measured as a continuous variable ($M = 40.37$, $SD = 15.01$) and gender was measured as a dichotomous variable, with men coded as “1” and women coded as “2” (54.7 percent females). Formal education³ (median = 6.00 or “A level,” $SD = 2.16$) and monthly household income (median = 4.00 or “\$3001 to \$4000,” $SD = 3.01$) were also included.

Analytical Approach

We ran structural equation models using maximum likelihood estimation in Mplus

6.0. Structural equation modeling allows us to test the links from our exogenous and

³ Formal education was categorized as 1 = “no formal education,” 2 = “primary 6 or below,” 3 = “some secondary education,” 4 = “N level/Institute of Technical Education,” 5 = “O level,” 6 = “A level,” 7 = “diploma,” 8 = “degree,” and 9 = “postgraduate.”

antecedent endogenous variables to the consequent endogenous variable, and also for the relations among all exogenous and antecedent endogenous variables (Kelloway, 1998). In this study, our control variables constituted the exogenous variables, and the other variables were treated as endogenous variables in the models. Direct and indirect paths were tested among the manifest variables in our analyses. We treated missing data using maximum likelihood estimation in Mplus, as this method is likely to produce unbiased results for data that are either missing completely at random or missing at random compared to other methods (Kaplan, 2009). There were less than 10 percent of missing values for each of the independent variables in our data, and this was considered an acceptable range for producing unbiased results (Allison, 2001; Kline, 2005; Little & Rubin, 2002).

We used five fit indices to gauge our model fit: model chi-square (χ^2), relative chi-square (χ^2/df ; Bentler, 1989), comparative fit index, Tucker-Lewis index, and root mean square error of approximation. If the model fits the data well, χ^2 should not be significant (Kline, 2004). The χ^2 is divided by its degrees of freedom to adjust for its sensitivity to sample size. Relative χ^2 values that falls between 1.0 and 5.0 are considered as good fit (Bollen, 1989). For comparative fit index and Tucker-Lewis index, a value that falls between .95 and 1.00 indicate a good fit (Hu & Bentler, 1999). For root mean square error of approximation, a value of .05 or less indicates a good fit (Browne & Cudeck, 1993).

Results

Bivariate correlations among all the variables are shown in Table 1. Relations among the endogenous variables of interests were significantly correlated at the zero-order level. We first test the original CMM model⁴ with knowledge as the consequent endogenous variable. Our model fits the data well ($\chi^2 = 18.07$, $df = 12$; $\chi^2 / df = 1.51$; comparative fit index = 1.00;

⁴ Confirmatory factor analyses on the four motivations were conducted to assess the multidimensionality of the concepts. Confirmatory factor analysis result shows that surveillance gratification, anticipated interaction, guidance, and need for cognition were empirically distinct dimensions ($\chi^2 (df) = 165.68(38)$; $\chi^2 / df = 4.36$; comparative fit index = .98; Tucker-Lewis index = .97; root mean square error of approximation = .04).

Tucker-Lewis index = .99; root mean square error of approximation = .02). Figure 3 presents the empirical findings of the original CMM model with the significant structural paths and their standardized (β) regression weights. The model accounted for 27.6% of the variance in news attention, 56.0% in elaboration, and 7.30% in knowledge.

[Insert Table 1 and Figure 3 about here.]

Hypothesis 1a–1d posited that surveillance gratification, anticipated interaction, guidance, and need for cognition would be significantly associated with news attention. As expected, our results show that surveillance gratification ($\beta = .20$), guidance ($\beta = .20$), and need for cognition ($\beta = .10$) were positively associated with news attention. However, anticipated interaction was not significantly associated with news attention. Hence, 1a, 1c, and 1d were supported, but 1b was not supported.

Next, Hypothesis 2a–2d postulated that surveillance gratification, anticipated interaction, guidance, and need for cognition would be significantly associated with elaboration. Results indicate that surveillance gratification ($\beta = .29$), anticipated interaction ($\beta = .26$), guidance ($\beta = .22$), and need for cognition ($\beta = .07$) were positively associated with news elaboration, lending support to Hypothesis 2.

News attention was positively associated with news elaboration ($\beta = .10$), lending support to Hypothesis 3. Hypotheses 4 and 5 postulated that news attention and elaboration, respectively, would be positively associated with knowledge. As expected, news attention ($\beta = .13$) and elaboration ($\beta = .13$) were positively associated with H1N1-related knowledge, lending support to Hypotheses 4 and 5. The results indicate that the original CMM was supported by our data.

We then tested the extended CMM model, with the inclusion of interpersonal communication and behavioral intentions into our model. Our second model fits the data well: $\chi^2 = 50.37$, $df = 23$, $\chi^2/df = 2.19$, comparative fit index = .99, Tucker-Lewis index =

.97, root mean square error of approximation = .03. As shown in Figure 4, the model accounted for 27.6% of the variance in news attention, 56.0% in elaboration, 32.3% in interpersonal discussion, 7.80% in knowledge, and 29.0% in behavioral intentions.

[Insert Figure 4 about here.]

Results indicate that surveillance gratification ($\beta = .20$), guidance ($\beta = .20$), and need for cognition ($\beta = .10$) were positively associated with news attention, but anticipated interaction was not significantly associated with attention, lending further support to Hypothesis 1a, 1c, and 1d but not 1b. Results show that surveillance gratification ($\beta = .29$), anticipated interaction ($\beta = .26$), guidance ($\beta = .22$), and need for cognition ($\beta = .07$) were positively associated with elaboration, lending further support to Hypothesis 2. News attention was positively associated with news elaboration ($\beta = .10$), lending further support to Hypothesis 3. News attention ($\beta = .11$) and news elaboration ($\beta = .09$) were positively associated with H1N1-related knowledge, supporting Hypotheses 4 and 5.

Hypothesis 6a–6d postulated that surveillance gratification, anticipated interaction, guidance, and need for cognition would be significantly associated with interpersonal communication. As expected, findings indicate that surveillance gratification ($\beta = .10$), anticipated interaction ($\beta = .25$), guidance ($\beta = .12$), and need for cognition ($\beta = .08$) were positively associated with interpersonal communication, supporting Hypothesis 6.

Our results show that news attention was positively associated with interpersonal communication ($\beta = .20$), lending support to Hypothesis 7. Interpersonal communication ($\beta =$

.09) was positively associated with knowledge⁵. Hence, Hypothesis 8 was supported.

Last, Hypothesis 9a–9c posited that elaboration, interpersonal communication, and knowledge would be positively associated with behavioral intentions. As expected, we found that elaboration ($\beta = .31$), interpersonal communication ($\beta = .23$), and knowledge ($\beta = .11$) were positively related to behavioral intentions, supporting Hypothesis 9.

Discussion

Overall, our study demonstrated that the original CMM theory is applicable to health contexts such as the H1N1 pandemic. It is notable that we expanded the CMM model by showing that behavioral intention could be included as a second outcome variable and interpersonal communication could be added as a mediating factor in the learning process. Third, we made a comprehensive assessment of the motivations behind media use in this study.

As expected, surveillance gratification was associated with news attention, elaboration, and interpersonal communication, consistent with the results of previous studies (e.g., Eveland, 2001; Beaudoin & Thorson, 2004; Eveland, 2004). Surveillance gratification is one of the most common motivations shown to drive news media use (Blumler, 1979).

Likewise, anticipated interaction was positively associated with elaboration and interpersonal

⁵ We use the framework suggested by Baron and Kenny (1986) to test for mediation for the key variables in the original CMM. There are evidence for mediating effects when (a) the independent variable significantly influence the mediator, (b) the independent variables significantly influence the dependent variable in the absence of the mediator, (c) the mediator has a significant unique influence on the dependent variable, and (d) the influence of the independent variable on the dependent variable is reduced when the mediator is added to the model. The Sobel test could be computed to establish the statistical significance of the mediating relation (Mackinnon & Dwyer, 1993). The mediation tests were conducted separately for elaboration and interpersonal communication. The direct path from attention to elaboration was significant ($\beta = .44, p < .001$); the path from news attention to knowledge was significant ($\beta = .18, p < .001$); the path from elaboration to knowledge was significant ($\beta = .19, p < .001$); and the addition of elaboration resulted in a reduced influence of attention on knowledge ($\beta = .12, p < .001$). The Sobel test for the mediating path was significant, $z = 2.33, p < .05$. These results suggest that elaboration partially mediated the influence of attention on knowledge. The direct path from attention to interpersonal communication was significant ($\beta = .53, p < .001$); the path from news attention to knowledge was significant ($\beta = .18, p < .001$); the path from interpersonal communication to knowledge was significant ($\beta = .18, p < .001$); and the addition of interpersonal communication resulted in a reduced influence of attention on knowledge ($\beta = .13, p < .001$). The Sobel test for the mediating path was significant, $z = 2.31, p < .05$. These results suggest that interpersonal communication partially mediated the influence of attention on knowledge.

communication, consistent with previous studies (Eveland, 2004; Beaudoin & Thorson, 2004). This suggests that those who approach learning with the motive of anticipated interaction may well learn most of their news from these avenues. However, anticipated interaction was not significantly associated with attention to news media. One plausible explanation may be that although previous CMM studies have found significant association between anticipated interaction and media reliance (e.g., Beaudoin & Thorson, 2004), media reliance could be conceptually distinct from news attention. This indicates that we should take a closer examination of the differential influence of anticipated interaction on media reliance and news attention in future studies.

Guidance was positively associated with news attention, elaboration, and interpersonal communication. This was not surprising given that it was found in previous studies to be a salient motivation in the learning process and therefore was able to drive information acquisition processes (Atkin, 1973; Lometti et al., 1977; McLeod & Becker, 1974). As expected, need for cognition was positively associated with news attention, elaboration, and interpersonal communication, although the statistically significant relations between need for cognition and these variables were somewhat modest (as compared with the other motivations in the model). Nevertheless, these findings suggest that need for cognition is a driving factor that motivates one to start the process of learning and to engage in effortful processing of information (Cacioppo et al., 1996). The findings demonstrated that the different motivations have unique effects on news attention, elaboration, and interpersonal communication. This highlights the importance of recognizing the specific kinds of motivation that drive individuals to acquire information from the news media, above and beyond gauging individuals' levels of motivations. Therefore, it is worthwhile for future research to identify other relevant motivations that may potentially influence news attention and knowledge in various health contexts.

News attention had both direct and indirect associations with knowledge, consistent with results of previous studies (e.g., Beaudoin & Thorson, 2004; Eveland et al., 2003). As expected, elaboration was positively associated with knowledge as people who actively process the information they receive naturally learn more about the given topic, consistent with the results of previous studies (Craik & Tulving, 1975; Eveland, 2001). This suggests the important roles of attention and elaboration as mediating variables between motivations and knowledge within the CMM.

Generally, the original CMM is largely supported in the present study. The relations between all four motivations and knowledge were mediated by news attention and elaboration, with the exception of one non-significant association between anticipated interaction and news attention. This adds to a growing body of research which supports the CMM in the areas of political and health communication (Beaudoin & Thorson, 2004; Eveland et al., 2005; Lo & Chang, 2006). This suggests that news attention and elaboration are consequential stages in learning about health issues and that it is not sufficient for an individual to simply have a high level of motivations.

More importantly, interpersonal communication was included in the model as an important part of the learning process. This is consistent with previous studies that have identified the role of interpersonal communication in the context of the CMM, where interpersonal communication can increase knowledge by conversation-partner-generated elaboration and anticipatory elaboration (e.g., Eveland, 2001, 2004). This highlights the importance of integrating interpersonal communication into the model in future studies. Of course, the measurement used in our study could not make a clear distinction as to whether interpersonal communication served as an information channel or as a form of information processing strategy in knowledge acquisition. This suggests that future studies should develop distinct measurements to tap into the two different dimensions of interpersonal

communication in the context of CMM.

Furthermore, we found that elaboration significantly predicted behavioral intentions, consistent with results from previous studies (e.g., Nenkov, Inman, & Hulland, 2008). Interpersonal communication was positively associated with behavioral intentions, congruent with studies in health communication (Cassell et al., 1998; Hafstaad & Aaro, 1997; Steele, 2008). We found that knowledge was positively associated with behavioral intentions, consistent with the results of previous studies (e.g., Chew et al., 2002; Morgan & Miller, 2002). Overall, these findings suggest that behavioral intentions can be integrated into the CMM framework as a second outcome variable. Evidently, being actively engaged in news information processing and being informed about the H1N1 pandemic plays a pertinent role in driving individuals to engage in precautionary behaviors.

Despite this, our study has some limitations that can be overcome in future research. First, the cross-sectional nature of the data makes it difficult for us to infer causality. Future research should use panel studies with measurements taken at multiple points in time to examine the model. A panel study of the CMM was conducted with surveillance gratification, news attention, elaboration, and knowledge, and it showed that most of the relations were not unidirectional but mutually causal (Eveland et al., 2003). Nonetheless, the relations among the variables established in our study were based on strong theoretical reasoning and this would have compensated for the use of cross-sectional data.

Moreover, this study has not taken into account the multidimensional aspect of the variables tested. Some scholars have proposed that interpersonal communication is a multidimensional construct, including the nature, medium, and depth of discussion (Scheufele, Nisbet, Brossard, & Nisbet, 2004). Future studies can explicate the concept of elaboration by examining other information-processing strategies such as selective scanning, reflective integration, and verification (Kosicki & McLeod, 1990). Likewise, future studies

on CMM can explicate the concept of knowledge by examining other dimensions such as system knowledge, action-related knowledge, and effectiveness knowledge (Frick, Kaiser, & Wilson, 2004). The internal consistency scores of some of our measures (e.g., knowledge and behavioral intentions) were rather low. Despite this, stronger relations in the model would have been established if we were able to use more reliable measures. Future studies should improve on these measures to enhance their reliability. Our measures for guidance were general and made no channel distinctions. Given that people often prefer interpersonal channels to mediated ones when they need to determine personal courses of action in uncertain situations (e.g., Morton & Duck, 2001), significant channel differences may emerge in the relation between guidance and the communication variables. Future research should take into account channel differences when adapting the guidance measures used in our study.

In addition, behavioral intention instead of actual behavior was tested in the study. There are methodological difficulties in testing the actual behavior of a large number of respondents in a random telephone survey. Despite this, previous studies have shown that behavioral intentions are often a good indicator of actual behavior, in which both variables are highly correlated (Ajzen, 1991; Manstead, Proffitt, & Smart, 1983). We therefore believe that behavioral intentions measured in our study would be a close approximation of actual precautionary behavior. Of course, by applying the CMM, we are not suggesting that knowledge is the sole predictor of behavioral intentions. Future studies should examine attitudes as a mediating variable between knowledge and behavior. Examining the knowledge-attitude-behavior link would give a more complete picture of the process of learning and adopting behaviors. Besides this, it is possible that the relation between knowledge and behavioral intention in our model may be stronger if we had used variables that explore the same specific issue (e.g., knowledge of face mask and behavioral intention of

wearing a face mask). Therefore, it is worthwhile for future research to examine the CMM by testing the relations between knowledge-specific issue and behavioral-specific intention.

This study has made a number of important theoretical contributions. First, we show that the original CMM is suitable for non-political contexts, thus extending the applicability of the theory. Likewise, our study also demonstrates that the CMM can be used to explain health knowledge and behavioral intentions in a Southeast Asian population. It is clear that this opens up new research trajectories for health communication scholars as it highlights that more studies should be conducted in different parts of Asia to compare whether the CMM is applicable cross-culturally. Next, we have enhanced the understanding of the learning process by including interpersonal communication and behavioral intentions in the model, as well as a more comprehensive list of motivations. This has enabled us to extend and build the original CMM into a stronger theoretical model. Moreover, our findings have shown that being knowledgeable induces individuals to indicate higher likelihood of engaging in preventive behaviors, which produces an additional supporting evidence for the relation between knowledge and behavior in the health communication literature.

For practical implications, our findings suggest that health practitioners should focus on the major roles that news attention, elaboration, and interpersonal communication could play in the process of learning and inducing preventive behaviors, and use these findings to develop effective information dissemination strategies. Creative strategies such as skits and online viral campaigns can be used to garner audience attention. Elaborative processing among the audience could be stimulated by checklists, quizzes, and contests with prizes. In the new media landscape, there are many ways to generate discussion and interaction among target audiences, such as online forums and social networking mediums. Strategies such as discussion circles at local community centers could encourage the public to engage in interpersonal discussion to promote learning and adoption of protective measures. In

conclusion, understanding the mechanisms behind the CMM can help health communication professionals disseminate information during health crises and boost the level of knowledge and behavioral intentions among the public.

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Table 1. Bivariate correlations among all variables ($N = 1,055$)

	1	2	3	4	5	6	7	8	9	10	11	12
1. Age	—											
2. Gender	-.19**											
3. Education	-.28***	-.09**										
4. Household income	.01	-.05	.48***									
5. Surveillance gratifications	.05	.06	.05	.03								
6. Anticipated interaction	.03	.05	.03	-.01	.34***							
7. Guidance	.04	.05	.04	.02	.72***	.67***						
8. Need for cognition	-.12***	-.09**	.20***	.17***	.31***	.34***	.30***					
9. News attention	-.10**	.01	.29***	.19***	.41***	.35***	.41***	.30***				
10. Elaboration	.05	.05	.01	-.02	.67***	.65***	.65***	.36***	.40***			
11. Interpersonal communication	.01	.01	.08*	.04	.46***	.49***	.46***	.34***	.40***	.53***		
12. Knowledge	-.03	-.01	.16***	.16***	.17***	.18***	.19***	.06	.21***	.18***	.19***	
13. Behavioral Intention	.18***	.09**	.00	-.02	.42***	.43***	.40***	.20***	.24***	.46***	.41***	.20***

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

Figure(s)

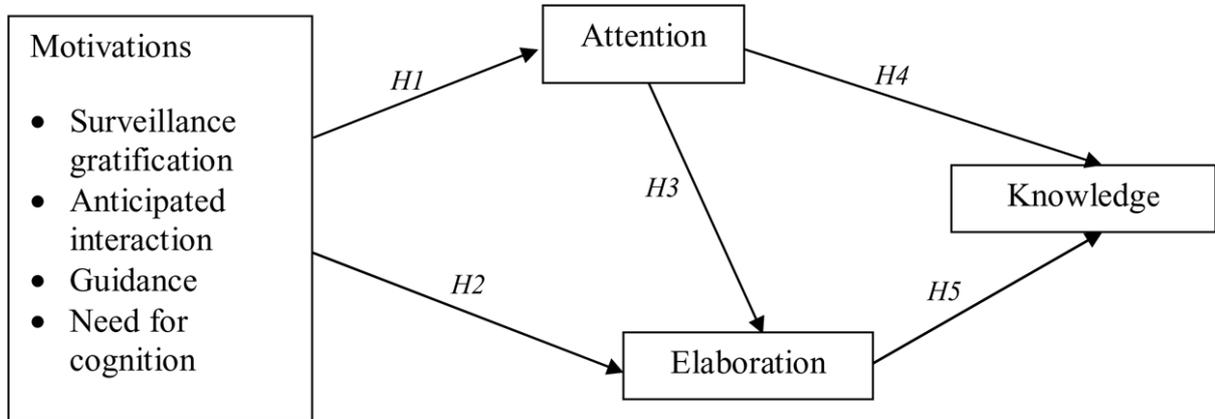


Figure 1. Original cognitive mediation model (Eveland, 2001). H1–H5 = Hypotheses 1–5.

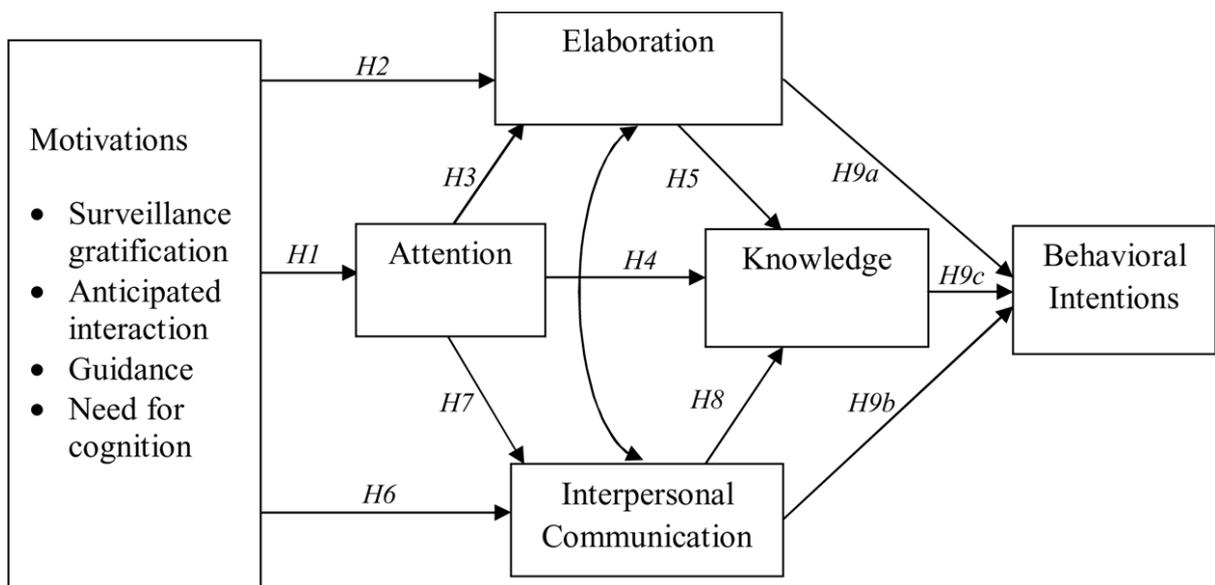


Figure 2. Hypothesized expanded cognitive mediation model. H1–H9c = Hypotheses 1–9c.

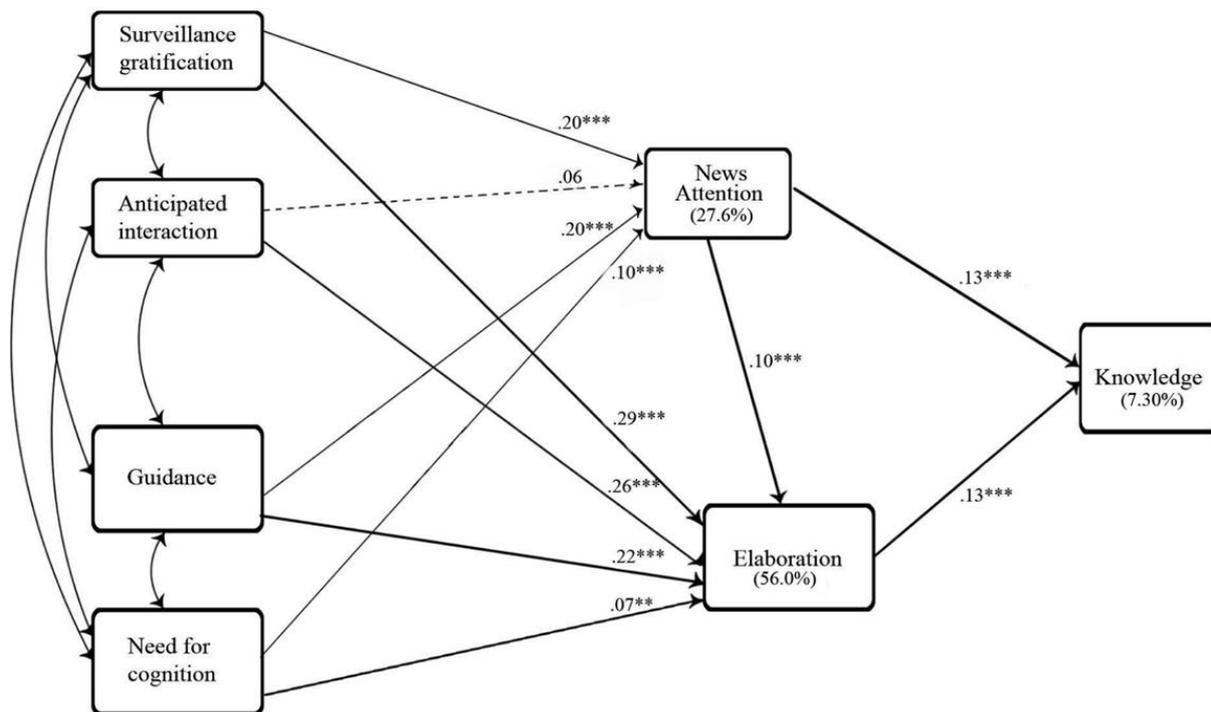


Figure 3. Final structural model for the original cognitive mediation model. Demographic variables are controlled for in this model (not shown here). The coefficients in the figure are directional standardized beta coefficients. Entries in parentheses are R^2 (%). The relations among the motivation variables are controlled for by psi coefficients that are not reported here. Significant paths are indicated by solid lines. Nonsignificant paths are indicated by dotted lines. * $p < .05$; ** $p < .01$; *** $p < .001$.

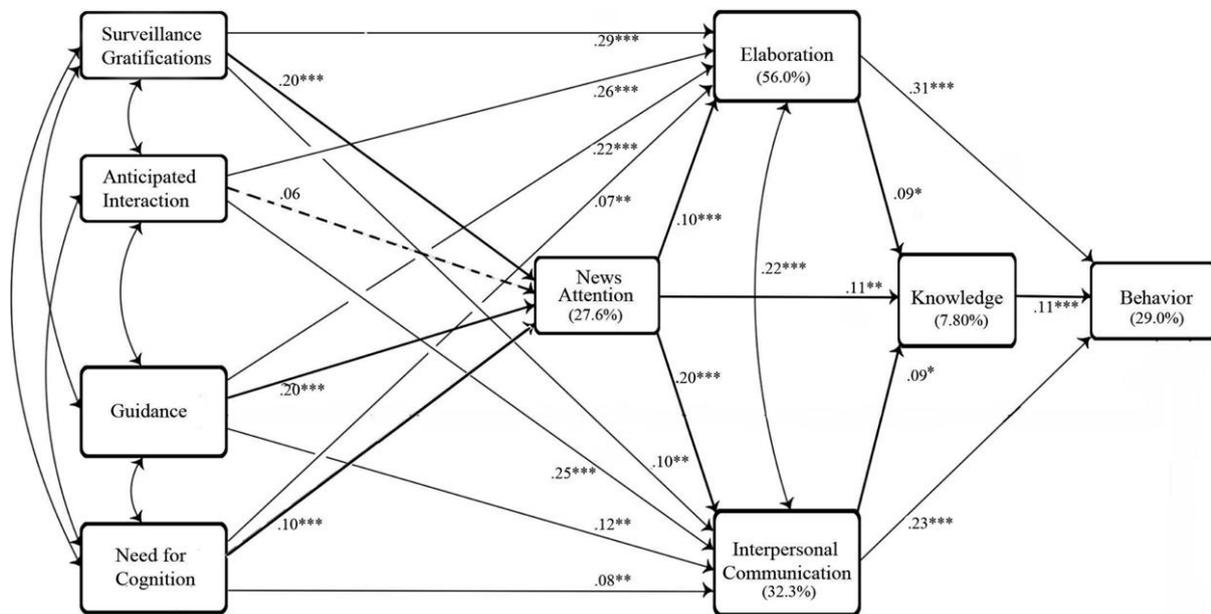


Figure 4. Final structural model for the extended cognitive mediation model. Demographic variables are controlled for in this model (not shown here). The coefficients in the figure are directional standardized beta coefficients. Entries in parentheses are R^2 (%). The relations among the motivation variables are controlled for by psi coefficients that are not reported here. Significant paths are indicated by solid lines. Nonsignificant paths are indicated by dotted lines. * $p < .05$; ** $p < .01$; *** $p < .001$.