

Singapore Management University

Institutional Knowledge at Singapore Management University

Research Collection College of Integrative
Studies

College of Integrative Studies

6-2014

Seeking information about climate change: effects of media use in an extended PRISM

Shirley S. HO

Benjamin H. DETENBER

Sonny ROSENTHAL

Singapore Management University, srosenthal@smu.edu.sg

Edmund W. J. LEE

Follow this and additional works at: https://ink.library.smu.edu.sg/cis_research



Part of the [Communication Technology and New Media Commons](#), and the [Environmental Sciences Commons](#)

Citation

HO, Shirley S.; DETENBER, Benjamin H.; ROSENTHAL, Sonny; and LEE, Edmund W. J.. Seeking information about climate change: effects of media use in an extended PRISM. (2014). *Science Communication*. 36, (3), 270-295.

Available at: https://ink.library.smu.edu.sg/cis_research/199

This Journal Article is brought to you for free and open access by the College of Integrative Studies at Institutional Knowledge at Singapore Management University. It has been accepted for inclusion in Research Collection College of Integrative Studies by an authorized administrator of Institutional Knowledge at Singapore Management University. For more information, please email cherylds@smu.edu.sg.

Seeking Information About Climate Change: Effects of Media Use in an Extended PRISM

Science Communication
2014, Vol. 36(3) 270–295
© 2014 SAGE Publications
Reprints and permissions:
sagepub.com/journalsPermissions.nav
DOI: 10.1177/1075547013520238
scx.sagepub.com


Shirley S. Ho¹, Benjamin H. Detenber¹,
Sonny Rosenthal¹, and Edmund W. J. Lee¹

Abstract

This study replicates and extends the planned risk information seeking model (PRISM) in the context of impersonal risk by incorporating media use as an antecedent of risk information seeking intention. Results indicate that the model applies equally well to Singaporeans' climate change information seeking intention as it does in the context of personal health information, suggesting that the model is generalizable across different risk and cultural contexts. Findings suggest that media use is an important source of perceived knowledge and, indirectly, sufficiency threshold, which clarifies the role of actual information seeking in risk perceptions and future information seeking.

Keywords

risk information seeking, climate change, Singapore, media, information insufficiency

Generally, people use media to meet hedonic and utilitarian information needs. The latter engagement speaks to instrumental features of media use, which relate to information seeking and knowledge acquisition. Such

¹Nanyang Technological University, Singapore

Corresponding Author:

Shirley S. Ho, Wee Kim Wee School of Communication and Information, Nanyang Technological University, Singapore, 31 Nanyang Link, Room 03-50, Singapore 637718.
Email: tsyho@ntu.edu.sg

instrumental features tend to influence goal-oriented media users more strongly than experience-oriented users (Sanchez-Franco & Roldan, 2005), and people who view their media use as serving more instrumental than experiential needs tend to have better knowledge of relevant issues (Kahlor & Rosenthal, 2009). In the context of risk, people may seek information to learn about how best to manage or avoid a risk (Witte, 1992, 1994), and it is worthwhile to clarify factors that motivate risk information seeking intention.

Specifically, this study replicates and extends the planned risk information seeking model (PRISM), which researchers have tested in contexts of both personal risks (e.g., health information; Kahlor, 2010) and impersonal risks (e.g., climate change; Kahlor, 2007; Z. J. Yang & Kahlor, 2013). The PRISM describes antecedents of information seeking intention, but it does not consider the role of media use. Although information seeking often involves media use, the extent to which media use directly predicts information seeking intention is unclear. As media use can be a source of people's perceived knowledge and perceived risk—which, according to the PRISM, predict information seeking intention—indirect effects may gain prominence. We examine such mediational pathways and also consider the direct relationship between media use and information seeking intention. While a significant direct pathway might suggest habitual features of information seeking (Ajzen, 1991), significant indirect pathways may indicate informational fulfillment, affective processes, or other outcomes of media use. Media use can both satisfy information needs and heighten alarm, which may have opposing effects on information sufficiency and, consequently, information seeking intention. This model extension may clarify how the media can affect public perceptions of climate change and information seeking intentions through different pathways.

Study Context: Climate Change

Since the industrial revolution, human activities have led to higher atmospheric concentrations of carbon dioxide (CO₂), and there is scientific consensus that anthropogenic CO₂ emissions are affecting the global climate (Oreskes, 2004). Predicted climate effects will vary regionally, with some areas experiencing heat waves and drought, while other areas will experience increased precipitation and flooding or rising temperature and sea level (Intergovernmental Panel on Climate Change [IPCC], 2007). The potential negative consequences of climate change are significant, and international organizations have taken steps to mitigate the human causes. Outcomes of these efforts include the IPCC—a scientific body dedicated to the study of climate change—and the Kyoto Protocol—an international environmental treaty to stabilize atmospheric greenhouse gas concentrations.

Climate Change in Singapore

Climate change poses a clear threat to regions of the world that have limited natural resources and those that lie near sea level (Ng & Mendelsohn, 2005). Singapore, a low-lying island city-state, possesses these vulnerabilities. Over roughly the past two decades, tide gauges around Singapore have shown a 3-mm annual mean sea level rise (National Climate Change Secretariat [NCCS], 2011). In response to the threat of a potential 59-cm rise in sea level by the end of the 21st century (IPCC, 2007), the Singapore government has mandated that new land reclamation projects be at least 2.25 meters (7.4 feet) above the highest recorded tide (Ministry of the Environment and Water Resources [MEWR], 2013). The Singapore government has considered a variety of strategies that address flooding, water resource scarcity, disease resurgence, heat stress, effects on biodiversity, and changes in energy demand (MEWR, 2008). In 2006, Singapore joined the Kyoto Protocol and extended its ongoing commitment to address the challenges of climate change (MEWR, 2006).

A recent survey of 1,005 Singaporeans reported general public concern about climate change and support of individual and government efforts to mitigate climate change impacts (NCCS, 2012). According to the report, 74% of Singaporeans express concern about climate change, and 63% believe that climate change will have severe effects on Singapore. Notably, 58% of Singaporeans believe that Singapore should take steps to reduce climate change even if the economic cost of action is high, and 56% believe that it is mainly individuals' responsibility to take action on climate change. Fifty percent of Singaporeans said they would like to receive information about climate change and especially information about its causes, its effects, and steps individuals can take toward its mitigation (NCCS, 2012). Since Singaporeans want to know more about climate change, it is worthwhile to explore antecedents of risk information seeking among Singaporeans.

Theoretical Background

As the PRISM was initially guided by the theory of planned behavior (TPB; Ajzen, 1991) and the risk information seeking and processing model (RISP; Griffin, Dunwoody, & Neuwirth, 1999), we will discuss each of the models, followed by our PRISM extension.

Theory of Planned Behavior

If people are to engage in a behavior, they generally have the behavioral intention and the ability to engage in the behavior. These conditions mark the terminus of

the TBP (Ajzen, 1985, 1991), which seeks to explain sociopsychological antecedents of behavior. The TPB is an extension of the theory of reasoned action (Fishbein, 1963; Fishbein & Ajzen, 1975), which views behavioral intention as the result of attitude toward the behavior and subjective norms.

Attitudes are learned predispositions toward an object that reflect the degree of like or dislike of the object and guide consistent behaviors related to the object (Fishbein & Ajzen, 1975; Gross & Niman, 1975). Attitudes can reflect qualities of a behavior that are instrumental (e.g., usefulness) or experiential (e.g., pleasantness; Ajzen & Driver, 1992). Subjective norms are perceptions of social favor for the behavior that often describe the observation of others' behavior and perceived social pressure to engage in the behavior.

The theory of reasoned action assumes that people have volitional control over behaviors. The TPB extends this model with the addition of perceived behavioral control as an antecedent of behavioral intention and a correlate of actual behavioral control. The concept of perceived behavioral control is similar to Bandura's (1982) notion of perceived self-efficacy, which refers to individuals' assessments of their own capability to perform actions that are required to handle future situations. Research on intention and behavior can use the TPB as a good starting point.¹ The TPB has been integrated into the area of risk information seeking behaviors, as the next section elaborates.

Risk Information Seeking and Processing Model

The RISP model (Griffin et al., 1999) integrates the TPB concepts of subjective norms and perceived behavioral control, as well as the concepts of perceived hazard characteristics and affective response, relevant channel beliefs, and information insufficiency to predict risk information seeking and processing. People tend to seek out and systematically process risk information when they experience social pressure to seek information, perceive that they have control over seeking and the capacity to process the information, worry about the risk, have positive beliefs about the information sources, and feel that they lack judgmental confidence (Griffin et al., 1999; Griffin, Neuwirth, Giese, & Dunwoody, 2002; Kahlor, Dunwoody, Griffin, & Neuwirth, 2006; Kahlor, Dunwoody, Griffin, Neuwirth, & Giese, 2003). The model describes factors that should motivate information processing, and these factors translate equally well as antecedents of information seeking.

One important concept in the RISP model is information insufficiency, which serves as an assessment point for risk information seeking and processing. This concept was derived from the heuristic-systematic model of information processing (Chaiken, 1980). When people evaluate a message, their effort to decode its meaning can vary considerably. If the message is

inconsequential or the recipients are otherwise unmotivated to attend to it thoroughly, the recipients tend to employ mental shortcuts, or heuristics, to create meaning. Conversely, when motivation is high, recipients tend to engage in more effortful, systematic processing of message contents. An important factor that can influence the depth of information processing is information sufficiency. Chen and Chaiken (1999) describe a sufficiency principle of the heuristic-systematic model in which people will engage in systematic information processing to the extent that they feel sufficiently confident to pass judgment on an issue. Sufficiency occurs when the level of perceived knowledge matches the level of desired knowledge, but when perceived knowledge falls short of that level, *information insufficiency* results.

In addition, Griffin, Dunwoody, and Yang (2013) highlighted that informational subjective norms could be a possible direct as well as indirect motivator of information seeking and processing, especially for impersonal risks. The scholars pointed out the need to examine the direct, independent relationship of subjective norms with information seeking, in addition to their indirect relationship via information sufficiency.

The RISP model also proposes antecedents of affective response to perceived risks. Negative emotional states in response to risks are reactions to perceived hazard characteristics. The psychometric paradigm of risk perception describes basic perceptual factors that guide people's responses to risks (Slovic, 1987; Slovic, Finucane, Peters, & MacGregor, 2004). People might perceive a hazard as posing a threat, which can trigger feelings of fear, anxiety, tension, and cognitive discomfort (Mewborn & Rogers, 1979). Consequently, people might seek to engage in behaviors that may reduce those negative emotions. In the RISP model, negative affective response amplifies feelings of information insufficiency, which in turn, influences seeking intention. In addition to this indirect effect, affect could also have a direct effect on information seeking intention (Griffin et al., 2013).

Planned Risk Information Seeking Model

Kahlor (2010) developed the PRISM by expanding the RISP model to include attitudes, norms, and affective response as direct predictors of seeking intention, and to evaluate the TPB antecedents of information insufficiency. The latter consideration assumes that people's perceived knowledge derives from past seeking behavior, which may include media use, and should thus share TPB antecedents with seeking intention. Kahlor tested the PRISM in the context of health information seeking that reflects personal risk, since people have relatively high involvement in decisions about their own health. With regard to impersonal risks such as climate change, three studies may provide

some insight. First, Kahlor et al. (2006) tested the RISP model in the context of threatened ecosystems, which reflects a highly impersonal risk. They found that while seeking-related subjective norms were significantly related to information insufficiency, and norms and insufficiency were significantly associated with seeking intention, none of the other RISP variables were significantly associated with either information insufficiency or seeking intention. Second, Kahlor (2007) tested an augmented RISP model—which is the immediate predecessor of the PRISM—in the context of climate change. Regarding effects of norms, results were similar to those of Kahlor et al. (2006). However, Kahlor (2007) found that attitude toward seeking, but not perceived seeking control, was significantly associated with seeking intention. Recently, Z. J. Yang and Kahlor (2013) further supported the model in the context of climate change. However, these studies were mostly conducted in the United States, and their applicability to other cultural contexts such as Singapore is unclear. Thus, we propose the following research question:

Research Question 1: To what extent does the PRISM generalize to the Singapore public in the context of climate change?

Media Use in PRISM

In addition to replicating the PRISM in a different context, we will extend the model to account for media use. According to Slater's (2007) reinforcing spirals framework, media use is the result of several factors that may include demographics, traits, states, social influences, and ideology. Media use, in turn, affects various cognitive and behavioral outcomes. Therefore, its inclusion in models of risk information seeking can be illuminating. At least one study has supported this mediational property of media use in the context of environmental concern (Zhao, 2012).

However, as much as media use can influence cognitive and behavioral outcomes, it may also be the result of cognitions and behaviors. For example, information seeking generally involves media use. If information seeking intention is related to information seeking behavior, then both the RISP model and the PRISM suggest that media use is a behavioral result of certain cognitions. In combination, these two properties of media use establish a series of reinforcing spirals, where media use at an initial time influences cognitions and behaviors and, consequently, media use at a subsequent time. Zhao (2009) examined the reinforcing spirals framework in the context of information seeking about climate change and found that media use influenced perceived knowledge, which subsequently influenced information seeking both directly and indirectly via environmental concern.

The key feature of this framework is that it describes media use in relation to beliefs and attitudes over time; both current and future media use may reflect current cognitions.² The PRISM depicts attitude toward seeking, seeking-related subjective norms, and perceived seeking control as antecedents of seeking intention. We extend the PRISM with the following hypothesis:

Hypothesis 1: (a) Attitude toward seeking, (b) seeking-related subjective norms, and (c) perceived seeking control will be positively related to media use.

Consistent with the reinforcing spirals framework, we are also interested in cognitive outcomes of media use that subsequently affect seeking intention. We are specifically interested in the effects of media use on knowledge, perceived risk, and affective response.

Effects of Media Use on Knowledge

If risk information seeking is mainly an instrumental behavior that reduces information insufficiency, it follows that people seek risk information because they gain knowledge as a behavioral outcome. Thus, we propose that the utility of information seeking is in the acquisition of knowledge. Kahlor and Rosenthal (2009) examined antecedents of the complexity and accuracy of people's knowledge about climate change, which they measured using quantitative content analysis of short text descriptions of global warming. Their results suggest that people who use a greater variety of media to learn about climate change have more complex and accurate issue-specific knowledge. This finding comports somewhat with the intermedia interaction effect, which posits that using similar media produces diminishing returns on knowledge gain, but using dissimilar media amplifies knowledge gain (Shen & Eveland, 2010).

In addition to the variety of sources people use for information, the kinds of sources they use can affect knowledge acquisition. A growing body of research suggests that people have a better understanding of an issue when they use sources of information that require more active engagement (e.g., newspapers and the Internet) than those whose use is more passive (e.g., magazines and television). These studies have examined media-specific effects on knowledge in such varied domains as politics (Eveland & Scheufele, 2000; Kwak, 1999), current events (Vincent & Basil, 1997; J. Yang & Grabe, 2011), health (Ho, 2012; Mueller et al., 2012; Niederdeppe, Fowler, Goldstein, & Pribble, 2010), and science (Brewer & Ley, 2010). Zhao (2009) found that use of newspapers and the Internet was positively

related to perceived knowledge about climate change but that television use was unrelated.

Media use may influence perceived knowledge and account for the effects of attitude toward seeking, seeking-related subjective norms, and perceived seeking control on perceived knowledge, which the PRISM contains. Specifically, people gain knowledge not as a direct result of their attitudes, norms, and perceived control but because attitudes, norms, and perceived control influence media use, which results in knowledge gain. Such a proposition is consistent with Slater's (2007) reinforcing spirals framework.

Hypothesis 2: Media use will mediate the relationship between perceived knowledge and (a) attitude toward seeking, (b) seeking-related subjective norms, and (c) perceived seeking control.

Effects of Media Use on Perceived Risk and Affective Response

This study also explores how media use may affect risk perception and affective response. Risk perception is distinct from risk knowledge; however, it represents an important basis of how people understand risk. In fact, research suggests that risk perception and the derivative emotional responses to risk are powerful drivers of behaviors that can reduce negative emotion (Russell, 2003; Witte, 1994), and specifically of risk information seeking intention (Kahlor, 2010; Z. J. Yang et al., 2011).

Studies have examined the relationship between media use and risk perception across a range of contexts. For example, Slater and Jain (2011) found an association between media use (e.g., crime and emergency television shows) and perceptions of alcohol-related risks among adolescents. Other studies found that the relationship depends on the nature of the topic and how the media cover it. Ackerson and Viswanath (2010) compared health media use with risk perceptions related to cancer and Eastern equine encephalitis—two diseases that differ dramatically in terms of actual health impacts—and received significant amounts of media coverage where the study was conducted. Results of this study suggest that media use promotes risk perception. However, the authors note that media coverage of the two diseases was qualitatively different, and the perceptions of risk also varied. The authors attribute distorted perceptions of risk for encephalitis to media portrayals of the disease as novel and unpredictable, in contrast to more routine cancer coverage. In the context of nanotechnology risk, Ho, Scheufele, and Corley (2011) found that science media use—specifically, the amount of attention paid to science topics in various media—was unrelated to perceived risk when controlling for individual differences. In general, news coverage of nanotechnology risk is quite sparse (Friedman & Egolf, 2011), and this may explain the

lack of a significant relationship in this particular context. In contrast, media coverage of climate change is fairly common nowadays. Although the topic of climate change differs in a number of ways from those mentioned above—the risk is largely perceived as impersonal (Leiserowitz, 2005)—it seems likely that media coverage of it will also affect risk perceptions, emotions, and desire to learn more.

Research Question 2: To what extent will media use be related to (a) perceived risk, (b) negative affect, and (c) seeking intention?

Furthermore, the PRISM depicts perceived risk as an indirect antecedent and affective response as a direct antecedent of both information insufficiency and seeking intention. If media use is an important source of perceived risk and affective response, then it could be an indirect source of information insufficiency and seeking intention.

Research Question 3: To what extent will perceived risk and negative affect mediate the relationship between media use and (a) information insufficiency and (b) seeking intention?

Method

We collected data using a random-digit-dial telephone survey of 902 Singaporeans aged 21 years and older over one week in June 2011, using a computer-assisted telephone interview facility at a large public university in Singapore. Given the diversity of languages in Singapore, trained undergraduate students conducted the interviews in English, Mandarin, or Malay. Interviews lasted approximately 20 minutes. The survey response rate was 35.9% (based on AAPOR Formula 3).

Respondents ranged in age from 21 to 82 years (*Mdn.* = 40, *M* = 40.59, *SD* = 14.37). For gender, 52.8% of the sample was female. The majority of the sample was Chinese (76.4%), followed by Malay (10.4%), Indian (8.9%), Other (2.9%), and Eurasian (1.2%). Median educational attainment was “Diploma” (equivalent to an associate’s degree in the United States), and median monthly household income was in the range of “S\$3,001 to S\$4,000.”³

Measures

Except where we note otherwise, we adapted scale items from Kahlor (2010). Table 1 displays factor loadings, means, standard deviations, skewness, and kurtosis for the scale items. Factor loadings reflect the measurement model.

Table 1. Summary of Measurement Items.

Variable (range)	Factor loading	M	SD	Skewness	Kurtosis
Attitude toward seeking (0-10)					
att1	.91	6.43	2.47	-0.68	0.43
att2	.87	6.41	2.53	-0.78	0.41
att3	.78	6.40	2.51	-0.74	0.37
Seeking-related subjective norms (1-5)					
norm1	.81	2.97	0.98	-0.03	-0.84
norm2	.85	2.98	1.01	0.05	-0.84
norm3	.62	3.03	0.98	-0.14	-0.89
Perceived seeking control (1-5)					
psc1	.73	3.62	0.99	-0.68	-0.32
psc2	.62	3.88	0.88	-1.14	1.46
psc3	.78	3.70	0.88	-0.78	0.25
Affective response (0-10)					
aff1	.87	6.39	2.51	-0.73	0.32
aff2	.81	5.50	2.60	-0.35	-0.22
aff3	.77	5.24	2.62	-0.29	-0.32
Perceived risk (1-5)					
risk1	.71	3.56	1.03	-0.38	-0.31
risk2	.76	3.32	1.03	-0.17	-0.35
risk3	.76	3.62	1.01	-0.46	-0.19
Media use (1-7)					
med1	.61	4.37	1.64	-0.40	-0.33
med2	.58	4.45	1.66	-0.42	-0.54
med3	.63	3.80	1.97	-0.04	-1.20
Information seeking intention (1-5)					
seek1	.86	3.60	0.91	-0.81	0.19
seek2	.95	3.55	0.93	-0.78	0.06
seek3	.88	3.49	0.95	-0.63	-0.28

Note: For reference, items appear in this table in the same order as in the Method section.

All our composite measures have Cronbach's alpha greater than or equal to .70, indicating good reliabilities (DeVellis, 1991).

Attitude Toward Seeking. Three 11-point items measured respondents' agreement that seeking information is "valuable," "beneficial," and "helpful" (0 = *not at all* and 10 = *very much*; Cronbach's $\alpha = .91$).

Seeking-Related Subjective Norms. Three five-point Likert-type items measured respondents' agreement with the following statements: "People who are close to you expect you to seek information about climate change," "Most people who are important to you think that you should seek information about climate change," and "The people you spend most of your time with are likely to seek information related to climate change" (Cronbach's $\alpha = .77$).

Perceived Seeking Control. Three five-point Likert-type items measured respondents' agreement with the following statements: "It is easy to find information about climate change," "You are not afraid to find information about climate change," and "You are able to find information about climate change effectively" (Cronbach's $\alpha = .75$).

Affective Response. Three 11-point scale items asked respondents to indicate the extent to which climate change makes them feel "worried," "tense," and "anxious" (0 = *not at all* and 10 = *very much*; Cronbach's $\alpha = .89$).

Perceived Risk. Three 5-point items from Kellstedt, Zahran, and Vedlitz (2008) measured respondents' perceptions of risk related to climate change (1 = *no risk at all* and 5 = *a lot of risk*) using the following questions: "What is the risk of climate change exerting a significant impact on public health in Singapore?" "What is the risk of climate change exerting a significant impact on economic development in Singapore?" and "What is the risk of climate change exerting a significant impact on the environment in Singapore?" (Cronbach's $\alpha = .79$).

Media Use. Three 7-point items adapted from Brossard and Nisbet (2007) asked respondents to indicate how much attention they have paid to print, television, and online news coverage of climate change (1 = *very little attention*, 7 = *very close attention*; Cronbach's $\alpha = .70$).

Information Insufficiency. Information insufficiency reflects two concepts: perceived knowledge ($M = 51.11$, $SD = 20.85$) and sufficiency threshold ($M = 66.76$, $SD = 20.54$). The measurement of perceived knowledge asked respondents,

Rate your perceived knowledge about climate change on a scale of 0 to 100, where zero means knowing nothing and 100 means knowing everything you could possibly know about this topic.

The measurement of sufficiency threshold asked respondents,

Think of that same scale again. This time, we would like you to estimate how much knowledge you would need in order to achieve a comfortable understanding of climate change. You might feel you need the same, more, or possibly even less information about this topic. Using a scale of zero to 100, how much information would be sufficient for you?

Consistent with prior research, we use the regressed change approach to compute information insufficiency (e.g., Griffin, Neuwirth, Dunwoody, & Giese, 2004; Hovick, Freimuth, Johnson-Turbes, & Chervin, 2011; Z. J. Yang et al., 2010). When information insufficiency is endogenous, the regression of sufficiency threshold first on perceived knowledge results in residual variance that corresponds with information insufficiency. Second, predictors of interest are added to the model and their paths to sufficiency threshold approximate their relationship with information insufficiency. When information insufficiency is exogenous, the dependent variable (e.g., seeking intention) is regressed first on perceived knowledge. When the residual variance is then regressed on sufficiency threshold, the path is approximately equivalent to the regression of seeking intention on information insufficiency. These analyses are a special case of the analysis of partial variance that Cohen and Cohen (1983) describe. However, in either analysis, if there is a moderate-to-strong correlation between perceived knowledge and any additional predictor variables, the effects of multicollinearity bias the results unacceptably (Rosenthal, 2013). In our analyses, the average zero-order correlation between perceived knowledge and other predictors of sufficiency threshold was .23. Rosenthal (2013) suggests that this degree of multicollinearity may be tolerable.

Information Seeking Intention. Three five-point Likert-type items measured respondents' agreement with the following statements: "You plan to seek more information about climate change in the future," "You intend to find out more about climate change," and "In the future, you will try to seek as much information as you can about climate change" (Cronbach's $\alpha = .92$).

Analytical Approach

We imputed missing values in the data using expectation-maximization (EM).⁴ Using maximum likelihood estimator in Mplus Version 6.11, we evaluated the paths and statistical fit of the measurement model, followed by the full structural model. We tested for indirect effects using the default delta method and 1,000 bootstrap samples in Mplus. The model input was raw data, which included age, gender, education, and income as control variables

in the structural model. We requested in the model output a Lagrange multiplier test to indicate additional paths that would reduce chi-square significantly at one degree of freedom, and we added theoretically consistent modifications. We determined good model fit per Hu and Bentler's (1999) recommended joint criteria of root mean square error of approximation close to or less than .06, and comparative fit index and Tucker–Lewis index close to or greater than .95. For the chi-square value, the p value has to be more than .05 for the model to be considered a good fit (Barrett, 2007), and the normed chi-square value should lie between 1 and 5 (Wheaton, Muthen, Alwin, & Summers, 1977).

Results

The measurement model, which freely estimated paths among latent factors, had good fit. Based on modification index recommendations and theoretical considerations, we allowed three error terms to covary, which improved fit (Table 2). Error covariances occurred between items within factors (i.e., there was no cross-loading). All factor loadings of the measurement model exceeded .5, and most exceeded .7 (Table 1). Graphical representations of the structural model exclude the measurement portion for visual simplicity. The PRISM replication had good fit, and the extended PRISM had very good fit (Table 2). All models had significant chi-square values. However, as the sample size of our study is considerably large ($N = 894$), it is within expectation that chi-square would be significant (Bentler & Bonett, 1980; Kline, 2005).

Replicated PRISM

We tested the hypotheses with reference to the extended PRISM. However, we compare the results of the replicated PRISM (Figure 1) with those of Kahlor's (2010) PRISM to address Research Question 1. Except where noted, the relationships of the replicated PRISM match in direction those of Kahlor's PRISM.

First, attitude toward information seeking ($\beta = .33, p < .001$), seeking-related subjective norms ($\beta = .24, p < .001$), and perceived seeking control ($\beta = .17, p < .001$) were associated with seeking intention. Second, attitude toward information seeking ($\beta = .23, p < .001$), seeking-related subjective norms ($\beta = .15, p < .001$), and perceived seeking control ($\beta = .21, p < .001$) were significantly associated with perceived knowledge. Third, perceived risk was significantly related to negative affect ($\beta = .42, p < .001$). Finally, negative affect was significantly associated with sufficiency threshold ($\beta = .13, p < .01$) and seeking intention ($\beta = .20, p < .001$). The model explained 41.0% of

Table 2. Measurement and Structural Model Fitness.

Model	χ^2	df	χ^2/df	CFI	TLI	RMSEA (p close)
Measurement	405.13	168	2.41	.97	.97	.04 (1.00)
Modified measurement	296.07	165	1.79	.99	.98	.03 (1.00)
PRISM	614.15	201	3.06	.96	.94	.05 (.77)
Extended PRISM	584.95	260	2.25	.97	.96	.04 (1.00)

Note: df = degrees of freedom; CFI = comparative fit index; TLI = Tucker–Lewis index; RMSEA = root mean square error of approximation; PRISM = planned risk information seeking model.

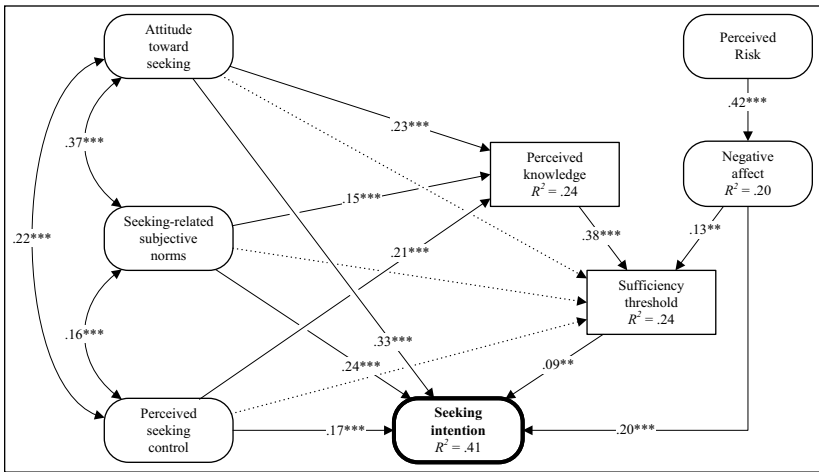


Figure 1. Replicated PRISM, paths with standardized estimates.

Note: Dotted lines denote nonsignificant paths. Explained variance includes effects of control variables, which are not displayed.

* $p < .05$. ** $p < .01$. *** $p < .001$.

the variance in seeking intention. Notably, attitude toward seeking, seeking-related subjective norms, and perceived seeking control were not related to sufficiency threshold, while they were significant positive predictors in Kahlor’s PRISM.

Extended PRISM

First, attitudes toward information seeking ($\beta = .58, p < .001$), seeking-related subjective norms ($\beta = .17, p < .001$), and perceived seeking control ($\beta = .16,$

$p < .001$) were positively associated with media use, supporting Hypotheses 1a, 1b, and 1c. Second, the relationship between attitude toward seeking and perceived knowledge ($\beta = .23, p < .001$) diminished to nonsignificance ($\beta = .02, p > .05$) when controlling for media use, but attitude toward seeking had a significant indirect effect on perceived knowledge via media use ($\beta = .21, p < .001$), which suggests complete mediation in support of Hypothesis 2a. Third, the relationship between seeking-related subjective norms and perceived knowledge ($\beta = .15, p < .001$) diminished ($\beta = .09, p < .05$) when controlling for media use, and seeking-related subjective norms had a significant indirect effect on perceived knowledge via media use ($\beta = .06, p < .05$), which suggests partial mediation in support of Hypothesis 2b. Fourth, the relationship between perceived seeking control and perceived knowledge ($\beta = .21, p < .001$) diminished ($\beta = .15, p < .001$) when controlling for media use, and perceived seeking control had a significant indirect effect on perceived knowledge via media use ($\beta = .06, p < .05$), which suggests partial mediation in support of Hypothesis 2c.

To answer Research Question 3, media use was positively associated with perceived risk ($\beta = .34, p < .001$) and negative affective response ($\beta = .68, p < .001$). However, media use was not associated with seeking intention.

With regard to Research Question 4, media use was indirectly associated with sufficiency threshold via affective response ($\beta = .09, p < .05$) and via affective response through perceived risk ($\beta = .01, p < .05$). Finally, media use was indirectly associated with seeking intention via affective response ($\beta = .13, p < .01$) and through perceived risk ($\beta = .01, p < .05$). Figure 2 summarizes these results.

Discussion

Our findings comport well with previous research of risk information seeking (e.g., Griffin et al., 2008; Kahlor, 2007, 2010; Z. J. Yang et al., 2010), and several novel hypotheses demonstrate useful additions to the RISP model and PRISM. Consistent with previous models, we found that attitudes toward seeking, seeking-related subjective norms, and perceived seeking control were associated with seeking intention. In contrast to the original PRISM study (Kahlor, 2010), our study found that the three TPB variables were not significantly associated with information insufficiency. However, a more recent application of the theory to the context of climate change (Z. J. Yang & Kahlor, 2013) also did not find a significant relationship between most of the TPB variables and information insufficiency (only attitude toward seeking was positively related). Thus, in the context of climate change, subjective norms and perceived control may be truly unrelated. Second, we found that

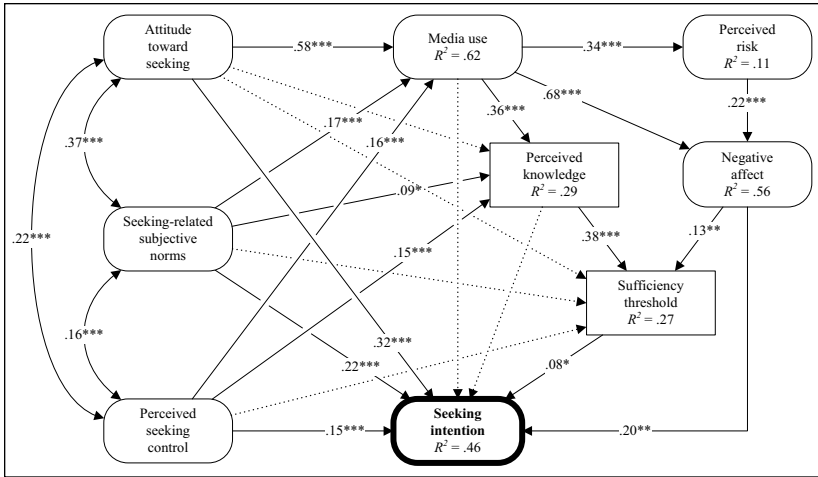


Figure 2. Extended PRISM, paths with standardized estimates.

Note: Dotted lines denote hypothesized nonsignificant paths. Explained variance includes effects of control variables, which are not displayed.

* $p < .05$. ** $p < .01$. *** $p < .001$.

negative affect was positively associated with both information insufficiency and seeking intention and that information insufficiency was positively associated with seeking intention. These findings point to the value of the PRISM as a theoretical framework for examining how perceived climate change risk affects people’s cognitions and behavioral intentions, and demonstrate the applicability of the model to Singapore.

An important contribution of the present study is that we extended the PRISM by examining the role of media use as a direct and indirect predictor of seeking intention. First, we proposed that media use would affect perceptions of risk, affective response, and seeking intention. The results suggest that media use can be a valuable model addition. Most notably, media use was more strongly associated with negative affective response to climate change than was perceived risk. We explain this finding with two related lines of research. First, personal risks are generally more visceral than are impersonal risks (Bronfman & Cifuentes, 2003), and the risk of climate change is highly impersonal: People tend to perceive risks to distant people and places but not direct personal threats (Leiserowitz, 2005, 2006). Thus, perception of climate change risk should not yield as strong an emotional response as would perception of a more personal risk. This interpretation fits

within the impersonal impact hypothesis, which suggests that media exposure affects perceptions of impersonal, society-wide risks but not perceptions of personal risks (Tyler & Cook, 1984). However, a plausible explanation suggests the opposite causal order: People who are worried about climate change might pay more attention to climate change news in the media (Zhao, 2009). These explanations are likely not mutually exclusive. Future research might seek to parse out their relative effects and reciprocity.

Another feature of media use in the current study is its reflection of attitudes, norms, and perceived control in a pattern similar to that of seeking intention. On the surface, this finding suggests that media use and seeking intention are two sides of the same coin, and lends support to Ajzen's (1991) assertion that past behavior simply creates a ceiling effect in behavioral models. However, we did not find a significant direct path linking media use to seeking intention. Rather, several other model variables—namely, perceived risk, affective response, perceived knowledge, and information insufficiency—wholly mediate their association, whose zero-order correlation was significant (from the measurement model; $r = .37, p < .001$). This mediation points to the instrumental features of risk information seeking: Media use shapes feelings of worry, tension, and anxiety in response to climate change, and future seeking can resolve those feelings. This is analogous to the extended parallel process model (Witte, 1994), often applicable to impersonal health risks, in which fearful people would attend to information about a fear-inducing risk if they feel that they can do something about the risk, thus lowering their state of fear. Otherwise, without a sense of efficacy, people would avoid further information about the risk. Given that people's own actions may or may not be perceived as efficacious for mitigating an impersonal risk such as climate change, trust in managing agencies may substitute for that sense of personal efficacy. Future studies may explore how perceptions of other stakeholders such as government and industry may influence risk perceptions and risk information seeking.

We situated this portion of our analysis within the reinforcing spirals framework, which suggests that cognitions and behaviors influence subsequent media use, which influences subsequent cognitions and behaviors (Slater, 2007). A proper test of this framework would require cognitions and behaviors to be temporally separate from media use. However, our measurement of attitude toward seeking, seeking-related subjective norms, and perceived seeking control—which we describe as cognitive antecedents of media use—were not temporally distinct from our measurement of media use. Both measurements reflect ongoing, as opposed to past or future, processes. From a theoretical standpoint, we would have been equally justified in evaluating media use as a predictor of attitude toward seeking, perceived seeking control,

and seeking-related subjective norms. However, such a structural arrangement would not have allowed us to test to what extent media use accounts for the relationship between the TPB variables and perceived knowledge. Thus, this study did not adequately test the reinforcing spirals framework. An adequate test would require a longitudinal survey design that teases out the temporal dimension. In this regard, our study was limited.

Another noteworthy set of findings relates to the direct effects of attitude toward seeking, seeking-related subjective norms, and perceived seeking control on seeking intention. Our findings are consistent with Griffin et al.'s (2013) recent proposition that factors such as subjective norms can have direct impacts on seeking intention above and beyond the indirect effects stated in the RISP model. In addition, our findings show that seeking-related subjective norms have a stronger direct relationship with seeking intention than does sufficiency threshold, which is consistent with Griffin et al.'s argument that seeking-related subjective norms are stronger motivators of seeking intention when evaluated in the context of impersonal risk, while information insufficiency plays a stronger role in motivating seeking intention when the context relates to personal risks. These findings suggest that the direct effects of attitude toward seeking, seeking-related subjective norms, and perceived seeking control on seeking intention are important factors in the PRISM that may generalize to a variety of risks.

In general, our cross-sectional data imposed limitations as they did not permit us to establish causal ordering among the variables. Although our model describes the variance of endogenous variables as dependent on the variance of exogenous variables, we would likely find significant relationships if the paths were reversed or if we made a more drastic model respecification. As Griffin et al. (2013) note, although the PRISM model assumes that people with higher perceived seeking control will acquire more knowledge, this relationship may be reversed, in which current knowledge may further enhance individuals' information seeking capacity, and thus enable future seeking. This line of argument is consistent with other established theories such as the knowledge gap model (Tichenor, Donohue, & Olien, 1970) which indicates that knowledge enhances people's ability to gather new knowledge. Nevertheless, the RISP model assumes a cyclical process (e.g., past seeking and processing affect current knowledge, risk perceptions, and the like) but does not depict it explicitly (Griffin et al., 2013).

Next, we have three limitations related to our TPB measurements. First, our measurement of attitude toward seeking did not clearly reference the self, and so respondents may have based their responses on a perceived generic attitudes and beliefs. For example, believing that seeking information about climate change is helpful might reflect the belief that it is helpful to society

and not necessarily that it is helpful to the self. Second, our TPB variables did not specify a time frame for engaging in the behavior. For example, the study design would have been improved had we asked for respondents to agree with the statement that “the people you spend time with are likely to seek information about climate change in the next month.” Third, our study did not attempt to tap into the behavioral beliefs that underlie the TPB variables. In its divergence from the RISP model, the PRISM excluded relevant channel beliefs. However, it is useful to understand how people’s beliefs about relevant information channels may influence their attitudes toward seeking. Future research may parse out additional behavioral beliefs that form the foundation of the TPB component of the PRISM.

A related limitation was that the survey could not measure actual seeking behavior but used intention as a proxy of actual behavior. The benefit of studying antecedents of seeking intention is that it gives some indication of actual seeking behavior. In general, the connection between intention and actual behavior is consistently positive, but intention does not always bear accurately on behavior (Gollwitzer, Sheeran, Michalski, & Seifert, 2009; Gross & Niman, 1975). However, numerous studies of intention and behavior report, on average, a moderately strong association (e.g., Armitage & Conner, 2001; Webb & Sheeran, 2006), and the relationship between intention and behavior is generally stronger for behaviors over which people perceive having volition (Ajzen, 1991). To gauge whether people felt like they had control over the relevant behavior, we ran one-sample *t* tests on the three items that measured perceived seeking control. The means for all three items were significantly higher than the middle value ($p < .001$ for all three tests), which suggests that our sample perceived having volition over seeking information about climate change.

Future research might also examine the trait and statelike features of affective response as they predict seeking intention. The significant association between media use and affective response suggests that media messages related to climate change influence affective states. Although risk information seeking can reflect such personality traits as openness to experience, need for cognition, and desire for control (Rosenthal, 2011), use of news media is largely unrelated to neuroticism (Shim & Paul, 2007). Negative affect related to such traits as neuroticism can confound the association between affective response and seeking intention, and additional research can address the extent of this process.

Our results suggest some practical implications. Climate change communication strategies should not focus entirely on building knowledge. Instead, they should make the personal threat of climate change salient. Such salience can promote climate change information seeking. Our findings show that risk

perception and emotions can be powerful driving forces of seeking intention. If seeking intention translates to actual seeking, then the outcome will be knowledge gain. Our results suggest that media use is an important antecedent of perceived knowledge about climate change. Communication strategists might also seek to emphasize the importance of learning from multiple information sources rather than relying on the potentially limited knowledge of a social circle. Messages from multiple, integrated media sources can provide valuable structure for building knowledge. Finally, accessible and user-friendly presentations of climate change information can make its interpretation a simpler task and improve perceptions of seeking control, which can have positive effects on knowledge gain.

In conclusion, this study presents an extended PRISM, which makes significant theoretical contributions to how researchers can examine climate change risk information seeking. This study differs from many previous analyses of risk information seeking by considering multiple pathways through which risk-related media use influences risk information seeking intention. Specifically, results suggest that media are an important source of climate change risk perceptions and relevant emotions. Media are also an important source of knowledge. In some ways, these pathways may compete, and in other ways they may have synergistic effects. Future research can distinguish additional factors that may mediate or moderate the relationship between media use and seeking intention. Finally, we have shown that the extended PRISM is applicable to the context of climate change in Singapore. Additional work should test the applicability of the extended PRISM in other sociocultural contexts.

Declaration of Conflicting Interests

The author(s) declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

Funding

The author(s) disclosed receipt of the following financial support for the research, authorship, and/or publication of this article: This work was supported by the Cluster Research Grant (Grant No. M4081082) from the Wee Kim Wee School of Communication and Information at Nanyang Technological University.

Notes

1. To be clear, the current study examines intention and not actual behavior. We provide justification for this approach and discuss its conceptual shortcomings in the limitations section at the end of this article.

2. Arguably, cognitions and behaviors can reflect both current and past media use. However, such relationships are not easily integrated into the PRISM, which is largely interested in future media use.
3. According to census figures from the Singapore Department of Statistics (2012), the ethnic breakdown in Singapore is 74.1% Chinese, 13.4% Malays, 9.2% Indians, and 3.3% others. The median monthly household income in Singapore is \$5,264, the median age is 38.0 years, and 50.7% of the population is female. With the exception of household income, the current sample closely resembles the population.
4. We handled missing data in two steps. First, we excluded from analysis eight respondents who failed to answer at least 30% of the items, yielding a final sample size of 894. Second, we conducted missing value analysis in SPSS. Missingness on 24 items of interest ranged from 0% to 4.4%. Little's missing completely at random (MCAR) test returned a significant estimate ($p < .001$), which suggests data are not MCAR. It is a difficult task to determine whether the data are missing not at random (MNAR). However, we can assume missingness is MNAR and impute missing values using EM. The EM algorithm employs maximum likelihood estimation in multiple iterations to impute missing values. At least two studies support EM estimation when data are MNAR. Graham, Hofer, and MacKinnon (1996) demonstrated that the EM algorithm performs equally well when data are either MCAR or MNAR with up to 12% missingness. Collins, Schafer, and Kam (2001) recommend including ancillary variables in the EM model, which they found reduces bias of MNAR data to an acceptable level.

References

- Ackerson, L. K., & Viswanath, K. (2010). Media attention and public perceptions of cancer and Eastern equine encephalitis. *Journal of Community Health, 35*, 409-416.
- Ajzen, I. (1985). From intentions to actions: A theory of planned behavior. In J. Kulh & J. Beckman (Eds.), *Action control: From cognition to behavior* (pp. 11-40). New York, NY: Springer Berlin Heidelberg.
- Ajzen, I. (1991). The theory of planned behavior. *Organizational Behavior and Human Decision Processes, 50*, 179-211.
- Ajzen, I., & Driver, B. L. (1992). Application of the theory of planned behavior to leisure choice. *Journal of Leisure Research, 24*, 207-224.
- Armitage, C. J., & Conner, M. (2001). Efficacy of the theory of planned behaviour: A meta-analytic review. *British Journal of Social Psychology, 40*, 471-499.
- Bandura, A. (1982). Self-efficacy mechanism in human agency. *American Psychologist, 37*, 122-147.
- Barrett, P. (2007). Structural equation modeling: Adjudging model fit. *Personality and Individual Differences, 42*, 815-824.
- Bentler, P. M., & Bonett, D. G. (1980). Significance tests and goodness of fit in the analysis of covariance structures. *Psychological Bulletin, 88*, 588-606.

- Brewer, P. R., & Ley, B. L. (2010). Media use and public perceptions of DNA evidence. *Science Communication, 32*, 93-117.
- Bronfman, N. C., & Cifuentes, L. A. (2003). Risk perception in a developing country: The case of Chile. *Risk Analysis, 23*, 1271-1285.
- Brossard, D., & Nisbet, M. C. (2007). Deference to scientific authority among a low information public: Understanding US Opinion on agricultural biotechnology. *International Journal of Public Opinion Research, 19*, 24-52.
- Chaiken, S. (1980). Heuristic versus systematic information processing and the use of source versus message cues in persuasion. *Journal of Personality and Social Psychology, 39*, 752-766.
- Chen, S., & Chaiken, S. (1999). The heuristic-systematic model in its broader context. In S. Chaiken & Y. Trope (Eds.), *Dual-process theories in social psychology* (pp. 73-96). New York: Guilford Press.
- Cohen, J., & Cohen, P. (1983). *Applied multiple regression/correlation analysis for the behavioral sciences*. Hillsdale, NJ: Lawrence Erlbaum.
- Collins, L. M., Schafer, J. L., & Kam, C. M. (2001). A comparison of inclusive and restrictive strategies in modern missing data procedures. *Psychological Methods, 6*, 330-351.
- DeVellis, R. F. (1991). *Scale development: Theory and applications*. Newbury Park, CA: Sage.
- Eveland, W. P., & Scheufele, D. A. (2000). Connecting news media use with gaps in knowledge and participation. *Political Communication, 17*, 215-237.
- Fishbein, M. (1963). An investigation of the relationships between beliefs about an object and the attitude toward that object. *Human Relations, 16*, 233-239.
- Fishbein, M., & Ajzen, I. (1975). *Belief, attitude, intention, and behavior: An introduction to theory and research*. Reading, MA: Addison-Wesley.
- Friedman, S. M., & Egolf, B. P. (2011). A longitudinal study of newspaper and wire service coverage of nanotechnology risks. *Risk Analysis, 31*, 1701-1717.
- Gollwitzer, P. M., Sheeran, P., Michalski, V., & Seifert, A. E. (2009). When intentions go public: Does social reality widen the intention-behavior gap? *Psychological Science, 20*, 612-618.
- Graham, J. W., Hofer, S. M., & MacKinnon, D. P. (1996). Maximizing the usefulness of data obtained with planned missing value patterns: An application of maximum likelihood procedures. *Multivariate Behavioral Research, 31*, 197-218.
- Griffin, R. J., Dunwoody, S., & Neuwirth, K. (1999). Proposed model of the relationship of risk information seeking and processing to the development of preventive behaviors. *Environmental Research, 80*, S230-S245.
- Griffin, R. J., Dunwoody, S., & Yang, Z. J. (2013). Linking risk messages to information seeking and processing. *Communication Yearbook, 36*, 323-361.
- Griffin, R. J., Neuwirth, K., Dunwoody, S., & Giese, J. (2004). Information sufficiency and risk communication. *Media Psychology, 6*, 23-61.
- Griffin, R. J., Neuwirth, K., Giese, J., & Dunwoody, S. (2002). Linking the heuristic-systematic model and depth of processing. *Communication Research, 29*, 705-732.

- Griffin, R. J., Yang, Z., ter Huurne, E., Boerner, F., Ortiz, S., & Dunwoody, S. (2008). After the flood: Anger, attribution, and the seeking of information. *Science Communication, 29*, 285-315.
- Gross, S. J., & Niman, C. M. (1975). Attitude-behavior consistency: A review. *Public Opinion Quarterly, 39*, 358-368.
- Ho, S. S. (2012). The knowledge gap hypothesis in Singapore: The roles of socioeconomic status, mass media, and interpersonal discussion on public knowledge of the H1N1 flu pandemic. *Mass Communication and Society, 15*, 695-717.
- Ho, S. S., Scheufele, D. A., & Corley, E. A. (2011). Value predispositions, mass media, and attitudes toward nanotechnology: The interplay of public and experts. *Science Communication, 33*, 167-200.
- Hovick, S. R., Freimuth, V. S., Johnson-Turbes, A., & Chervin, D. D. (2011). Multiple health risk perception and information processing among African Americans and Whites living in poverty. *Risk Analysis, 31*, 1789-1799.
- Hu, L., & Bentler, P. M. (1999). Cutoff criteria for fit indexes in covariance structure analysis: Conventional criteria versus new alternatives. *Structural Equation Modeling, 6*, 1-55.
- Intergovernmental Panel on Climate Change. (2007). *Climate change 2007: Synthesis report. Contribution of Working Groups I, II and III to the fourth assessment of the Intergovernmental Panel on Climate Change*. Retrieved from http://www.ipcc.ch/pdf/assessment-report/ar4/syr/ar4_syr.pdf
- Kahlor, L. (2007). An augmented risk information seeking model: The case of global warming. *Media Psychology, 10*, 414-435.
- Kahlor, L. (2010). PRISM: A planned risk information seeking model. *Health Communication, 25*, 345-356.
- Kahlor, L., Dunwoody, S., Griffin, R. J., & Neuwirth, K. (2006). Seeking and processing information about impersonal risk. *Science Communication, 28*, 163-194.
- Kahlor, L., Dunwoody, S., Griffin, R. J., Neuwirth, K., & Giese, J. (2003). Studying heuristic-systematic processing of risk communication. *Risk Analysis, 23*, 355-368.
- Kahlor, L., & Rosenthal, S. (2009). If we seek, do we learn? Predicting knowledge of global warming. *Science Communication, 30*, 380-414.
- Kellstedt, P. M., Zahran, S., & Vedlitz, A. (2008). Personal efficacy, the information environment, and attitudes toward global warming and climate change in the United States. *Risk Analysis, 28*, 113-126.
- Kline, R. B. (2005). *Principles and practice of structural equation modeling*. New York: Guilford Press.
- Kwak, N. (1999). Revisiting the knowledge gap hypothesis: Education, motivation, and media use. *Communication Research, 26*, 385-413.
- Leiserowitz, A. A. (2005). American risk perceptions: Is climate change dangerous? *Risk Analysis, 25*, 1433-1442.
- Leiserowitz, A. A. (2006). Climate change risk perception and policy preferences: The role of affect, imagery, and values. *Climatic Change, 77*, 45-72.
- Mewborn, C. R., & Rogers, R. W. (1979). Effects of threatening and reassuring components of fear appeals on physiological and verbal measures of emotion and attitudes. *Journal of Experimental Social Psychology, 15*, 242-253.

- Ministry of the Environment and Water Resources. (2006). *Singapore accedes to the Kyoto Protocol*. Retrieved from <http://app.mewr.gov.sg/web/Contents/Contents.aspx?Yr=2006&ContId=832>
- Ministry of the Environment and Water Resources. (2008). *Singapore's national climate change strategy*. Retrieved from http://www.elaw.org/system/files/Singapore_Full_Version.pdf
- Ministry of the Environment and Water Resources. (2013). *Parliament Q&As: Speech by Dr. Vivian Balakrishnan, Minister for the Environment and Water Resources, Committee of Supply debate, 12 March 2013 (Part 2)*. Retrieved from <http://app.mewr.gov.sg/web/Contents/Contents.aspx?ContId=1797>
- Mueller, N. T., Noone, A. M., Luta, G., Wallington, S. F., Huerta, E. E., & Mandelblatt, J. S. (2012). Information channels associated with awareness of human papillomavirus infections and vaccination among Latino immigrants from safety net clinics. *Journal of Immigrant and Minority Health, 14*, 183-188.
- National Climate Change Secretariat. (2011). *What is climate change?* Retrieved from <http://app.nccs.gov.sg/page.aspx?pageid=44>
- National Climate Change Secretariat. (2012). *NCCS public perception survey 2011 finds strong public support for climate change action in Singapore*. Retrieved from <http://app.nccs.gov.sg/data/resources/docs/AnnexB.pdf?AspxAutoDetectCookieSupport=1>
- Ng, W. S., & Mendelsohn, R. (2005). The impact of sea level rise on Singapore. *Environment and Development Economics, 10*, 201-215.
- Niederdeppe, J., Fowler, E. F., Goldstein, K., & Pribble, J. (2010). Does local television news coverage cultivate fatalistic beliefs about cancer prevention? *Journal of Communication, 60*, 230-253.
- Oreskes, N. (2004). Beyond the ivory tower: The scientific consensus on climate change. *Science, 306*, 1686-1686.
- Rosenthal, S. (2011, August). *Self-identity and past behavior in risk information seeking intention: An augmented PRISM*. Paper presented at the annual meeting of the Association for Education in Journalism and Mass Communication, St. Louis, MO.
- Rosenthal, S. (2013). Measuring differentials in communication research: Issues with multicollinearity in three methods. *Communication Methods and Measures, 7*, 105-125.
- Russell, J. A. (2003). Core affect and the psychological construction of emotion. *Psychological Review, 110*, 145-172.
- Sanchez-Franco, M. J., & Roldan, J. L. (2005). Web acceptance and usage model: A comparison between goal-directed and experiential web users. *Internet Research, 15*, 21-48.
- Shen, F., & Eveland, W. P. (2010). Testing the intramedia interaction hypothesis: The contingent effects of news. *Journal of Communication, 6*, 364-387.
- Singapore Department of Statistics. (2012). *Population trends 2012*. Retrieved from http://www.singstat.gov.sg/Publications/population.html#population_and_population_structure

- Shim, J. W., & Paul, B. (2007). Effects of personality types on the use of television genre. *Journal of Broadcasting & Electronic Media*, 51, 287-304.
- Slater, M. D. (2007). Reinforcing spirals: The mutual influence of media selectivity and media effects and their impact on individual behavior and social identity. *Communication Theory*, 17, 281-303.
- Slater, M. D., & Jain, P. (2011). Teens' attention to crime and emergency programs on television as a predictor and mediator of increased risk perceptions regarding alcohol-related injuries. *Health Communication*, 26, 94-103.
- Slovic, P. (1987). Perception of risk. *Science*, 236, 280-285.
- Slovic, P., Finucane, M. L., Peters, E., & MacGregor, D. G. (2004). Risk as analysis and risk as feelings: Some thoughts about affect, reason, risk, and rationality. *Risk Analysis*, 24, 311-322.
- Tichenor, P. J., Donohue, G. A., & Olien, C. N. (1970). Mass media flow and differential growth in knowledge. *Public Opinion Quarterly*, 34, 159-170.
- Tyler, T. R., & Cook, F. L. (1984). The mass media and judgments of risk: Distinguishing impact on personal and societal level judgments. *Journal of Personality and Social Psychology*, 47, 693-708.
- Vincent, R. C., & Basil, M. D. (1997). College students' news gratifications, media use, and current events knowledge. *Journal of Broadcasting & Electronic Media*, 41, 380-392.
- Webb, T. L., & Sheeran, P. (2006). Does changing behavioral intentions engender behavior change? A meta-analysis of the experimental evidence. *Psychological Bulletin*, 132, 249-268.
- Wheaton, B., Muthen, B., Alwin, D. F., & Summers, G. (1977). Assessing reliability and stability in panel models. *Sociological Methodology*, 8, 84-136.
- Witte, K. (1992). Putting the fear back into fear appeals: The extended parallel process model. *Communication Monographs*, 59, 329-349.
- Witte, K. (1994). Fear control and danger control: A test of the extended parallel process model (EPPM). *Communication Monographs*, 61, 113-134.
- Yang, J., & Grabe, M. E. (2011). Knowledge acquisition gaps: A comparison of print versus online news sources. *New Media & Society*, 13, 1211-1227.
- Yang, Z. J., & Kahlor, L. (2013). What, me worry? The role of affect in information seeking and avoidance. *Science Communication*, 35, 189-212.
- Yang, Z. J., McComas, K., Gay, G., Leonard, J. P., Dannenberg, A. J., & Dillon, H. (2010). Motivation for health information seeking and processing about clinical trial enrollment. *Health Communication*, 25, 423-436.
- Yang, Z. J., McComas, K. A., Gay, G., Leonard, J. P., Dannenberg, A. J., & Dillon, H. (2011). Information seeking related to clinical trial enrollment. *Communication Research*, 38, 856-882.
- Zhao, X. (2009). Media use and global warming perceptions: A snapshot of the reinforcing spirals. *Communication Research*, 36, 698-723.
- Zhao, X. (2012). Personal values and environmental concerns in China and the US: The mediating role of information use. *Communication Monographs*, 79, 137-159. doi:10.1080/03637751.2012.672999

Author Biographies

Shirley S. Ho (PhD, University of Wisconsin–Madison, 2008) is an assistant professor in the Wee Kim Wee School of Communication and Information at Nanyang Technological University, Singapore. Her research focuses on media effects and public opinion in the contexts of science, environmental, and health issues.

Benjamin H. Detenber (PhD, Stanford University, 1995) is chair of the Wee Kim Wee School of Communication and Information at Nanyang Technological University, Singapore. He is a media psychologist who also has interests in political communication and public opinion research.

Sonny Rosenthal (PhD, University of Texas at Austin, 2011) is an assistant professor in the Wee Kim Wee School of Communication and Information at Nanyang Technological University, Singapore. His research focuses on public understanding of environmental risks.

Edmund W. J. Lee (Bachelor of Communication Studies, Nanyang Technological University, 2011) is a doctoral student in the Wee Kim Wee School of Communication and Information at Nanyang Technological University, Singapore. His research focuses on health communication and public perception of science and emerging technologies.