

Communication and knowledge as motivators : understanding Singaporean womens perceived risks of breast cancer and intentions to engage in preventive measures

Lee, Edmund Wei Jian; Ho, Shirley S.; Chow, Josephine K.; Wu, Ying Ying; Yang, Zixin

2013

Lee, E. W. J., Ho, S. S., Chow, J. K., Wu, Y. Y., & Yang, Z. (2013). Communication and knowledge as motivators : understanding Singaporean womens perceived risks of breast cancer and intentions to engage in preventive measures. *Journal of Risk Research*, 16(7), 879-902. doi:10.1080/13669877.2012.761264

<https://hdl.handle.net/10356/141439>

<https://doi.org/10.1080/13669877.2012.761264>

This is an Accepted Manuscript of an article published by Taylor & Francis in *Journal of Risk Research* on 11 Feb 2013, available online: <http://www.tandfonline.com/10.1080/13669877.2012.761264>

Downloaded on 25 Nov 2020 20:04:48 SGT

**Communication and Knowledge as Motivators: Understanding Singaporean Women's
Perceived Risks of Breast Cancer and Intentions to Engage in Preventive Measures**

Edmund W.J. Lee

Shirley S. Ho

Josephine K. Chow

Ying Ying Wu

Zixin Yang

Wee Kim Wee School of Communication and Information,
Nanyang Technological University, Singapore

Author Note

Correspondence concerning this article should be addressed to Edmund W. J. Lee, Wee Kim Wee School of Communications and Information, Nanyang Technological University, Singapore 637718. Email addresses: elwj88@gmail.com; LEEW0117@e.ntu.edu.sg.

This is the final version of a manuscript that appears in *Journal of Risk Research*. The APA citation for the published article is:

Lee, E. W. J., Ho, S. S., Chow, J. K., Wu, Y. Y., & Yang, Z. (2013). Communication and knowledge as motivators: Understanding Singaporean women's perceived risks of breast cancer and intentions to engage in preventive measures. *Journal of Risk Research*, 16(7), 879-902. DOI: 10.1080/13669877.2012.761264

Acknowledgment

This work was supported by the Nanyang Technological University Research Grant [grant number M4080259.060].

Abstract

As breast cancer is the most prevalent cancer among women in Singapore, encouraging them to engage in preventive measures becomes increasingly important. This study aims to take a closer look at the influence of attention to media, interpersonal communication, news elaboration, and knowledge on women's (aged between 30 and 70) perceived risks of breast cancer and their intentions to engage in preventive measures in Singapore. Attention to media, frequency of interpersonal communication, fatalistic belief, and knowledge structure density were found to be associated with risk perception of breast cancer among Singaporean women. Findings also showed that frequency of interpersonal communication, risk perception, elaboration, and factual knowledge were positively associated with women's intentions to take up preventive measures such as breast self-examination, clinical breast examination, and mammography. Implications for theory and practice were discussed.

Keywords: breast cancer; mass media; interpersonal communication; elaboration; knowledge; Singapore

Communication and Knowledge as Motivators: Understanding Singaporean Women's Perceived Risks of Breast Cancer and Intentions to Engage in Preventive Measures

Breast cancer is a major public health problem for women worldwide. It is the most common cancer found among women in both developed and developing countries (World Health Organization 2009) and the second most prevalent cancer globally (Ferlay et al. 2010). One in every 10 new cases of cancer diagnosed worldwide is breast cancer (Ferlay et al. 2010), accounting to more than 1.1 million new cases each year.

In Singapore, breast cancer has been the most prevalent cancer among the female population for the past 30 years. Accounting for almost a third of all female cancers, the problem continues to persist with nearly 1100 new cases diagnosed annually (Lazaro, Thilagaratnam, and Puay 2009). It is also the most fatal cancer among female patients with the highest mortality rate of 17.1% between 2004 and 2008 in Singapore (Singapore Cancer Registry 2010). Since breast cancer is curable when detected at the early stage, screening becomes an important way of reducing mortality. Women aged 50–69 are strongly encouraged to go for mammography once every two years while women aged 40–49 are encouraged to go for screening once a year (National Cancer Centre [NCC] 2008).

Despite much publicity and encouragement from the local health authorities, a survey conducted by Leong, Heng, and Emmanuel (2007) found that close to half of the female respondents aged between 40 and 65 have not had any mammography screenings. The Breast Cancer Foundation (BCF) also released figures that 80% of women aged 50–59 years old in Singapore were aware of breast cancer screening and out of the 80%, only 41% of them actually went for screening in the last two years (Low 2010).

Therefore, this study aims to examine the potential factors, such as attention to media, interpersonal communication, elaboration, fatalism, factual knowledge, and knowledge structure density (KSD) that could influence women's risk perceptions of breast cancer and

their intentions to undertake breast cancer preventive measures. It is pertinent to understand what factors would motivate women to undertake preventive measures as it is unclear if perceived risk alone is enough to garner action on women's part (Lipkus and Klein 2006). Looking into other possible factors that may influence a woman's risk perception and behavioral intention may help health communicators to develop a more comprehensive and effective campaign strategy.

Behavioral intentions

One of the dependent variables examined in this study is women's behavioral intention to engage in breast cancer preventive measures. Studies have shown that behavioral intention is highly predictive of individuals' actual health behavior (Ashing-Giwa 1999; Jones et al. 2005; Griva, Anagnostopoulos, and Madoglou 2009). Furthermore, breast cancer research has demonstrated that behavioral intent is positively related to actual preventive behaviors (e.g. Manstead, Profitt, and Smart 1983; Ajzen 1991) such as breast self-examination, clinical breast examination, and mammography screening (Katapodi et al. 2009), which are crucial in putting breast cancer mortality rate under control. Since breast cancer is curable when detected at an earlier stage, it is therefore vital to examine what factors are associated with women's intention to take up breast cancer preventive measures.

Risk perception

Many theories of health behavior change have highlighted the pertinent role of risk perception (Rosenstock 1974; Rogers 1975; Janz and Becker 1984; Weinstein 1988). In this study, risk perception is examined as both an independent and a dependent variable. Risk perception of a particular health issue can be defined as the risk judgment about the probability that the individual will face the health issue in his or her lifetime (Katapodi et al. 2009). Risk perception in this study specifically refers to women's perception of the probability of contracting breast cancer.

Past studies have shown that the level of risk perception is associated with potential behavioral intent as well as with threat appraisal, where individuals' intention to adopt a healthy behavior increases in line with the belief that they are susceptible to a health threat (Rimal, Flora, and Schooler 1999). Individuals with a greater perceived risk were found to be more likely to go for cancer screening than those with lower perceived risk (Janz and Becker 1984; Weinstein 1999; Rimal 2001).

In other words, high-risk perception steers individuals away from acts that will increase their health risk (McCusker et al. 1989; van der Pligt, Otten, and Richard 1993; Bengel, Bel-Merk, and Farin 1996) and toward acts that will decrease their health risk (Weinstein and Nicolich 1993; Katapodi et al. 2009). Empirical studies in the context of breast cancer have shown that perceived risk is positively related instead of negatively related to mammography screening. In a meta-analytic review of studies on breast cancer screening and risk, McCaul et al. (1996) concluded that perceived risk is mostly positively associated with women's intention to go for mammography screening. They found that out of 19 studies, only one showed a negative relationship. Similarly, Katapodi et al. (2004) found 11 out of 13 empirical studies reported positive relationship between adherence to mammography and risk perception.

Since perceived risk was found to be a significant predictor of mammography (Lerman and Schwartz 1993; McCaul et al. 1996; Katapodi et al. 2009), and that health communicators have attempted to promote breast cancer awareness and uptake of preventive measures by highlighting the risks of breast cancer (Katapodi et al. 2004), we hypothesize the following:

H1: Risk perception will be positively associated with women's behavioral intention to engage in breast cancer preventive measures.

Attention to media

The mass media is often considered the most efficient tool for information dissemination (Carelli et al. 2007), especially in the context of health message propagation. Framing is a process through which the mass media could have an impact on individuals' perceptions and behaviors (Scheufele 2000; Scheufele and Tewksbury 2007; Wallington et al. 2010). Framing, as defined by Entman, is 'to select some aspects of a perceived reality and make them more salient in a communicating text, in such a way as to promote a particular problem definition, causal interpretation, moral evaluation, and/or treatment recommendation for the item described' (1993, 52). In other words, the frames in the media enhance certain aspects of a propagated idea and make it seem more important than other aspects of the information, thus priming schemas that lead audiences to think about a certain issue in a particular way (e.g. Price, Tewksbury, and Powers 1997; Gross and D'Ambrosio 2004).

With the potential persuasive slant coupled with the building of associations between concepts, frames can be powerful in influencing opinion and attitude (Tewksbury and Scheufele 2009). This is especially so if attention to media is often relied upon as an important source of general health information (Lebow and Arkin 1993; Clark 2004; Carelli et al. 2007). Past studies on media frames research have shown that media has significant influence on women's perceptions of breast cancer (Moyer et al. 1995; Condit 1999; Henderson and Kitzinger 1999; Donelle, Hoffman-Goetz, and Clarke 2005). In Singapore, the mass media is widely used for disseminating breast cancer messages, especially during October which is designated as the Breast Cancer Awareness Month (BCF 2012a). Studies in health communication have found that attention to media was positively associated with individuals' level of risk perception (Agha 2003; Tchuenche et al. 2011). For example, Agha (2003) found that individuals who have given more attention to media information on AIDs tend to indicate higher perceptions of risk.

The impersonal impact hypothesis posits that the media primarily influence individuals' societal rather than personal judgment of risks (Tyler and Cook 1984). Personal risk is the perceived vulnerability that a person has and societal risk is the estimated level of risk posed to society (Snyder and Rouse 1995). One of the underlying assumptions of impersonal impact hypothesis is that people rely on the mass media to understand risks to society, but tap on interpersonal communication with others when considering personal risks (Park, Scherer, and Glynn 2001). However, Tyler and Cook (1984) pointed out that media can have an impact on risk judgments at the personal level especially when individuals perceive the problem to be of relevance to the self and when the occurrence of the problem in the population is high. With breast cancer as the most prevalent cancer among women in Singapore (Lazaro, Thilagaratnam, and Puay 2009), women may be able to identify with the problem as depicted in the media, and may perceive breast cancer as a potential risk to themselves.

Apart from having influences on risk perception, there have been instances where media messages have been shown to influence individual behaviors (Liu, Wu, and Zhu 2007). Specifically, mass communication has been shown to encourage mammography-seeking behavior (Yanovitzky and Blitz 2000). Jones, Denham, and Springston (2007) found that participants generally rely on news media as a source of information for screening practices. Previous studies have also demonstrated that news coverage of health issues were effective in promoting healthy behaviors (e.g. Yanovitzky and Bennett 1999). Despite this, the conclusion on how attention to media relates to individual's behavioral outcome is often mixed in the existing literature. For example, the media system dependency theory posits that the effects of the media on individuals are largely determined by the extent to which they depend on it (Ball-Rokeach and Defleur 1976). This view holds that media use is goal-directed, in which individuals will actively seek out media to meet certain information needs.

Individuals who have a high dependence on the media will tend to change their behaviors according to what the media advocates. As paying attention to media messages about breast cancer suggests active seeking of information, rather than passive exposure to information, we can reasonably argue that media attention will be positively related to women's intention to engage in breast cancer preventive measures. We posit the following hypotheses:

H2: Attention to media will be positively associated with women's (a) risk perception and positively associated with women's (b) behavioral intention to engage in breast cancer preventive measures.

Interpersonal communication

Interpersonal communication plays an important role in health communication (Thompson et al. 2003) and is the most commonly utilized tool for individuals to seek information on health topics (Baxter, Egbert, and Ho 2008). Some scholars argued that compared to mass media, interpersonal communication can be more effective in persuading individuals to adopt healthier behaviors (Dunwoody and Neuwirth 1991; Yanovitzky and Blitz 2000). In particular, interpersonal communication has a strong association with risk perception (Morton and Duck 2001; Jones, Denham, and Springston 2007), where it plays a significant role in shaping individuals' perceptions about breast cancer (Jones, Denham, and Springston 2007). This study will examine two aspects of interpersonal communication – frequency of communication and network size. The two dimensions are of interest as past research have shown that frequency of communication and network size are two factors that determine the effectiveness of a discussion (e.g. Thompson et al. 2003; Baxter, Egbert, and Ho 2008).

Frequency of discussion has often been highlighted as an important dimension of interpersonal communication. In political studies, frequent discussion of political content often leads to more informed and participative citizens (Kwak et al. 2005; Eveland and

Thomson 2006). Valente, Poppe, and Merritt (1996) argued that mass media is effective at generating awareness; but it is interpersonal communication that can affect behavioral change. This is in line with the traditional two-step flow model which posits that media effects are not ultimately widespread, but influences a few key opinion leaders (Katz and Lazarsfeld 1955; Katz 1957, 1987). These opinion leaders will then influence people in their network, which is linked to how behavior change progresses through stages of change (Valente, Poppe, and Merritt 1996).

As individuals try to make decision regarding health issue, they may turn to their network for information (Birkel and Reppucci 1983; Rakowski et al. 1990). Morton and Duck (2001) found that people who discussed issues regarding skin cancer with others were more likely to believe that they were at risk of contracting the cancer. Husaini et al. (2001) found that individuals who frequently converse with friends have a greater tendency to go for mammography.

Network size is defined as the number of people with whom an individual discussed a topic with (Eveland and Hively 2009). It is a concept examined in political studies (e.g. Eveland and Hively 2009; Hively and Eveland 2009). The concept of network size looks at whether individual's network heterogeneity or homogeneity influences the attitude toward a particular political candidate or hot-buttoned issue. The concept of network size can be introduced into health studies as well, considering that members of close friends and family members of women are important sources of information regarding breast cancer (e.g. Richards et al. 1995; Green et al. 1997; Clark et al. 2000; Cline 2003). There are indications that interpersonal communication among family members exerts a strong influence on individuals (Mazur and Hall 1990). Apart from family and friends, studies have shown that interpersonal communication between a woman and her healthcare provider influences whether she would go for screening (e.g. Fox et al. 1998; Rajaram and Rashidi 1999; Royak-

Schaler et al. 2002; Nekhlyudov, Ross-Degnan, and Fletcher 2003). Therefore, we hypothesize the following:

H3: Frequency of discussion on issues related to breast cancer with others (family members, friends, colleagues, and healthcare providers) will be positively associated with women's (a) risk perception and (b) behavioral intention to engage in breast cancer preventive measures.

H4: Network size of discussion on issues related to breast cancer with others (family members, friends, colleagues, and healthcare providers) will be positively associated with women's (a) risk perception and (b) behavioral intention to engage in breast cancer preventive measures.

Elaboration

Elaboration is defined as 'the process of connecting new information with other pieces of information stored in memory, including prior knowledge, personal experiences or the connection of two new bits of information together in new ways' (Eveland 2001, 573). Greenwald and Leavitt (1984) posited that elaboration is the highest involvement an audience can have in processing messages among three other levels of cognitive processing of pre-attention, focal attention, and comprehension, as it uses the greatest amount of mental capacity to integrate message content to a person's current knowledge. Elaboration is essentially a cognitive effort in which individuals link new information with what they already know and find ways to put the information to use (Eveland 2002).

Studies have shown that women expend cognitive effort to think about issues related to breast cancer (e.g. Taleghani, Yekta, and Nasrabadi 2006). The likelihood of an individual engaging in elaborative processing is dependent upon the extent of active thinking about the message and the relevance of the message to the individual (Berry, Wharf-Higgins, and Naylor 2007). As breast cancer is a highly relevant issue for women, the likelihood of them

processing news about breast cancer is higher. This is especially so with local media in Singapore taking an active role in information dissemination about breast cancer (BCF 2012a). If the relevancy of the topic to the individual is high and the more the individual thinks about the issue, his or her risk perception toward the issue will be high (Oltedal et al. 2004). In this case, thinking more about breast cancer and linking the thought of breast cancer to the possibility of contracting it can lead to high stress (Taleghani, Yekta, and Nasrabadi 2006), thus increasing the perception of the risk.

Nenkov, Inman, and Hulland (2008) found that individuals' tendency to process potential outcomes of behavior significantly predicted their actual behavior. For instance, by mentally processing the potential outcomes of lifelong smoking habits such as cancer and lung diseases, an individual would be more likely to quit smoking (Nenkov, Inman, and Hulland 2008). This could partially be due to the processing and understanding the risk involved should the individual continue in an unhealthy behavior or not adopt a particular healthy behavior. In health sciences research, elaboration was found to be significantly associated with individuals' intention to engage in H1N1 preventive behaviors (Ho, Peh, and Soh 2013). As such, we posit the following hypotheses:

H5: Elaboration will be positively associated with women's (a) risk perception and (b) behavioral intent to engage in breast cancer preventive measures.

Fatalism

Cancer fatalism has been defined as the belief that death is unavoidable when an individual contracts cancer (Powe and Finnie 2003; Orna, Friedman, and Lernau 2009). It is also a belief that individuals cannot dictate their health as it is primarily subjected to chance and fate (Straughan and Seow 2000; Orna, Friedman, and Lernau 2009) and nothing can be done to prevent death if it was predestined (Orna, Friedman, and Lernau 2009). As explained by Orna, Friedman, and Lernau (2009), fatalism takes the form of external forces and

survivorship. Fatalism in the form of external forces refers to the belief that health is in God's hands or fate and thus it is an issue of luck and unpredictability, while fatalism in the form of survivorship takes the view that nothing can be done to prevent death.

The relation between fatalism and risk perception has not been widely examined (Marris, Langford, and O'Riordan 1998). However, studies found that higher perceived risk may be associated with fatalistic thinking (Salazar and Walsh 2006; Kim and Wang 2009). Fatalistic belief can serve to raise an individual's perceived risk (Niederdeppe and Levy 2007).

If individuals believe that it is not possible to prevent themselves from contracting diseases, they will not go for screening or adopt healthy behavior (Powe 1995; Mayo, Ureda, and Parker 2001; Orna, Friedman, and Lernau 2009). Women who have lower levels of fatalism were more likely to embrace preventive health behaviors (Straughan and Seow 2000). On the other hand, those who are more fatalistic are less likely to participate in preventive behaviors such as mammography screening (Powe 1995; Champion and Miller 1996; Straughan and Seow 2000; Mayo, Ureda, and Parker 2001). As such, we posit that:

H6: Fatalistic belief will be (a) positively associated with women's risk perception and (b) negatively associated with their behavioral intention to engage in preventive measures.

Factual knowledge

The concept of knowledge has been widely classified into four main categories: factual, awareness, belief, and the combination of two or more of the above dimensions (Hwang and Jeong 2009). This study will focus on factual knowledge as it has been found to have a significant impact on individuals' risk perception (Oltedal et al. 2004; Fagerlin, Zikmund-Fisher, and Ubel 2005). Factual knowledge is often measured by asking respondents to recall or identify facts, while awareness measures how conscious a person is

regarding a particular issue (Cortese 2007). Studies found that factual information helps individuals gain a better understanding of their susceptibility to a threat (Facione 2002). Fagerlin, Zikmund-Fisher, and Ubel (2005) found that after receiving accurate risk information from the clinicians, patients tend to experience higher risk perception. In a heart disease study, Radcliffe and Klein (2002) demonstrated that when respondents were given more information about the threat of heart attack, their risk perception increases. For breast cancer risks and knowledge, Dillard et al. (2011) found that knowledge about breast cancer is positively correlated with risk perception.

A woman with extensive factual information about her breast cancer risk tends to maintain an appropriate level of screening (Weinstein and Nicolich 1993; Champion and Miller 1996). Evidence has shown that public knowledge of risks will increase one's consciousness of the negative consequences, which can ultimately lead to adoption of healthy behavior (Hornik 2002). Some research found that knowledge is not a sufficient driving force to influence screening uptake in certain cancers, such as colorectal cancer (e.g. Guerra, Dominguez, and Shea 2005) and breast cancer (Schlueter 1982). However, other studies have shown that awareness and knowledge of mammography-related health benefits are important in influencing women's participation, and a lack of knowledge impedes intention to screen (Pearlman et al. 1999; Muthoni and Miller 2010). Pearlman et al. (1999) argued that a lack of knowledge is one of the reasons why women do not go for cancer screening. Knowledge is ultimately an important antecedent for adoption of healthy behavior of any kind (Pearlman et al. 1999; Viswanath et al. 2006). If women have low level of knowledge about breast cancer, the uptake of screening will be lower (Gwarzo, Sabitu, and Idris 2009). We hypothesize the following:

H7: Factual knowledge will be positively associated with women's (a) risk perception and (b) behavioral intention to engage in breast cancer preventive measures.

Knowledge structure density

Apart from examining factual knowledge, this study will also examine the structural dimension of knowledge, as it is very relevant in the breast cancer context. The importance of both knowledge of facts (*factual knowledge*) and knowledge of relationship among facts (*structural knowledge*) has been noted by scholars (Fiske, Kinder, and Carter 1983; McGraw and Pinney 1990). It is thus important to make a clear distinction between the two dimensions of knowledge.

Structural knowledge is defined as the organization and connection of related nodes of information (Jonassen, Beissner, and Yacci 1993). Dorsey et al. (1999) argued that the structure or organization of knowledge is empirically distinct from factual knowledge. According to Cortese (2007), KSD can be helpful in understanding knowledge structure. Density is the ‘degree of connectedness of a network’s nodes’ (Astleitner and Leutner 1995, 292). It is calculated by counting the number of linkages between concepts in the system and dividing this number by the total sum of all the possible links (Cortese 2007). KSD is defined as ‘the extent which individuals see relationships or connections between concepts’ (Eveland and Hively 2009, 212). According to Eveland and Thomson (2006), the structural aspect of knowledge in political communication is measured by respondent’s knowledge of a political party and the party’s ideology.

However, studies conducted on KSD were mostly applied to the context of political communication (Eveland, Seo, and Marton 2002; Eveland et al. 2004; Eveland, Marton, and Seo 2004) and not many to health-related research in general and the area of breast cancer in particular. The inclusion of KSD to expand on the definition of knowledge will allow us to expand the current literature and to fill up the research gaps in this area. As this concept is relatively new to health sciences, it will be worthwhile to examine whether there is a relationship between KSD and risk perception, and whether a relationship exists between

KSD and behavioral intention. We posit the following research questions in an attempt to investigate the potential relationships:

RQ1: How will KSD be associated with women's (a) risk perception and (b) behavioral intent to engage in breast cancer preventive measures?

Methods

Our data came from a nationally representative random-digit-dial telephone survey of 802 women aged 30–70 years old who are Singapore citizens and permanent residents. The BCF encourages women older than 20 years old to start performing monthly breast self-examination (BCF 2012b). In addition, the BCF and the NCC from Singapore placed women aged 40–69 under the high-risk groups and encourage these women to go for mammography. As people's knowledge contributes to behavioral choices, the process of information gathering should begin much earlier than the time when people are at high risk of encountering a disease, so that they will have sufficient time to go through a logical series of decision stages on their way to adopting a new behavior (Vahabi 2005). Based on these considerations, only women aged between 30 and 70 years old were selected for our study.

The fieldwork for our study was conducted from 19 to 29 January 2011 at a Computer Assisted Telephone Interviewing laboratory located at the Wee Kim Wee School of Communication and Information in Nanyang Technological University. Each telephone interview lasted for an average length of 20 min. The last birthday selection technique was used to ensure that there was randomization within households. This technique is reported to be 'an adequate, noninvasive, probability procedure' (O'Rourke and Blair 1983, 432) for randomization purpose. To ensure a representative sample, we conducted our interviews in English, Mandarin, and Malay, the three main languages in Singapore. Significant efforts were put in for call-backs and refusal conversions to reduce potential systematic non-response. The overall response rate for this survey was 33.2%, calculated based on AAPOR

response rate formula 3. The margin of error was approximately $\pm 3\%$ at the 95% confidence level.

Analytical approach

Hierarchical ordinary least squares (OLS) regression analysis was used to examine the relationships between the independent variables and the two dependent variables (risk perception and behavioral intention). The variables were entered into the regression model predicting risk perception based on their assumed causal order: the control variables were entered in the first block (i.e. demographics such as age, marital status, income, race, etc.), followed by attention to media, interpersonal communication, fatalistic belief, factual knowledge, and KSD. For the regression model predicting behavioral intention, the control variables were first entered, followed by other predictor variables such as attention to media, interpersonal communication, risk perception, fatalistic belief, factual knowledge, and KSD.

Measures

Demographic variables were treated as control variables, which included *age* ($M = 47.3$, $SD = 9.71$) and *marital status* (1 = 'not married' and 2 = 'married,' 83.4% married). *Monthly household income* ranged from 1 ('SGD1,000 and below') to 11 ('above SGD10,000') ($Median = 4.00$ or '\$3001 to \$4000,' $SD = 3.19$). Other demographic variables included *whether or not one has children* (1 = 'Yes,' 2 = 'No,' 78.6% indicated they have children), the *number of children* ($M = 1.72$, $SD = 1.21$), *health insurance coverage* (1 = 'Yes' and 2 = 'No,' 81.4% indicated they have health insurance coverage), *women-related diseases insurance coverage* (1 = 'Yes' and 2 = 'No,' 50.9% with no women-related diseases insurance coverage), *personal history of cancer* (1 = 'Yes' and 2 = 'No,' 95.6% did not have history of cancer), *family history of cancer* (1 = 'Yes' and 2 = 'No,' 65.0% indicating no family history of cancer), and *working status* (1 = 'not working' and 2 = 'working,' 60.7% working).

The racial distribution in our sample was 76.7% Chinese, 10.2% Malays, 8.35% Indians, 1.00% Eurasians, and 3.6% from other races. For racial groups, four dummy variables were created: Malay Singaporeans, Indian Singaporeans, Eurasian Singaporeans, and other ethnic groups. Chinese Singaporeans were defined as the ethnic majorities (i.e. the baseline group) and the others were regarded as ethnic minorities.

Independent variables

Attention to media

To obtain a measure of the level of attention paid to health and breast cancer news on television, newspapers, and the Internet, respondents were asked on a 11-point scale (0 = ‘no attention at all,’ 10 = ‘very close attention’): please tell me how much attention you pay to the following on television: (a) ‘News stories related to health or medical topics’; (b) ‘News stories related to breast cancer prevention’; and (c) ‘Breast cancer prevention campaigns.’ Questions (a), (b), and (c) were repeated for attention to content on newspaper and the Internet. The nine items were averaged to create a composite index for attention to media ($M = 4.00$, $SD = 2.27$, *Cronbach’s* $\alpha = 0.87$).

Interpersonal communication

To measure the extent of interpersonal communication, questions relating to frequency of communication and network size were asked. *Frequency of interpersonal communication* was measured using three items adapted from Ho, Scheufele, and Corley (2010). In our study, respondents were asked on a 10-point scale (1 = ‘least frequent,’ 10 = ‘most frequent’): ‘How frequently do you discuss issues related to breast cancer with your family members?’ This question was also asked for the category of ‘friends,’ ‘colleagues,’ and ‘healthcare providers.’ Responses were averaged to form a scale, with higher scores indicating higher levels of interpersonal discussion ($M = 1.31$, $SD = 1.69$, *Cronbach’s* $\alpha = 0.75$).

For *network size*, the respondents were asked to indicate the number of (a) family members, (b) friends, (c) colleagues, and (d) healthcare providers, with whom they regularly discuss issues related to breast cancer. These were adapted from a study by Moy and Gastil (2006). The four-item measures were averaged to create a composite index ($M = 1.11$, $SD = 6.93$, *Cronbach's* $\alpha = 0.62$).

Elaboration

This was measured with a series of questions that serve to explore respondents' elaborative processing regarding news. Respondents were asked to rate on a 10-point scale (1 = 'strongly disagree,' 10 = 'strongly agree'), the extent to which they agree with the following statements: (a) 'After I encounter news on health and medical topics, I am likely to stop and think about it'; (b) 'I often relate what I learnt from the news on health and medical topics to other things I know'; (c) 'When reading or watching the news, I carefully analyze the information given about breast cancer in the news'; (d) 'After I encounter news on breast cancer, I am likely to stop and think about it'; and (e) 'I often relate what I learnt from the news on breast cancer to other things I know.' The five items were averaged to form a composite scale ($M = 6.50$, $SD = 2.00$, *Cronbach's* $\alpha = 0.88$). All the questions were adapted from Ho, Peh, and Soh (2013).

Fatalistic belief

Fatalism was measured by three statements on a scale of 1 to 5 (1 = 'Strongly Disagree,' 5 = 'Strongly Agree'): (a) 'It seems like almost everything causes breast cancer'; (b) 'There's not much people can do to lower their chances of getting breast cancer'; and (c) 'There are so many recommendations about preventing breast cancer, it's hard to know which ones to follow.' All of the statements were adapted from a study by Niederdeppe and Levy (2007). The items were averaged to create a composite index ($M = 2.70$, $SD = 0.94$, *Cronbach's* $\alpha = 0.54$).

Factual knowledge

A total of seven statements which were adapted from the Singapore Cancer Society (Singapore Cancer Society [SCS] 2010) and BCF were used to measure factual knowledge. Respondents were asked to choose either one of the following options for each statement: ‘1= Definitely True,’ ‘2 = Likely True,’ ‘3 = Likely False,’ ‘4= Definitely False’ or in the case when respondents do not know or refuse to answer, ‘12 = Don’t Know’ and ‘13 = Refused.’ The responses were recoded into ‘1 = incorrect’ and ‘2 = correct.’ Respondents who indicated ‘Don’t know’ or ‘Refused’ were recoded as incorrect. The level of difficulty for this section varies with a good mix of easy and tough statements.

The seven knowledge statements were: (a) ‘The risk of breast cancer increases with age’; (b) ‘Women with no children have a slightly higher risk of getting breast cancer’; (c) ‘Breast cancer can be inherited’; (d) ‘A woman with cancer in one breast has a greater chance of getting a new cancer in the other breast or in another part of the same breast’; (e) ‘Mammography is an X-ray examination of the breast’; (f) ‘Women from age 40 onwards are encouraged to go for annual mammography’; and (g) ‘Women from aged 40 onwards are encouraged to go for annual clinical breast examination.’ Responses from the seven items were summed into a composite scale for knowledge, in which the higher scores indicate higher levels of breast cancer knowledge ($M = 1.45$, $SD = 1.78$, *Cronbach’s* $\alpha = 0.63$).

Knowledge structure density

To measure respondents’ KSD, we used a formula taken from Eveland et al. (2004). As stated earlier, density is the ‘degree of connectedness of a network’s nodes’ (Astleitner and Leutner 1995, 292) which is calculated by counting the number of links in the system and dividing this number by the sum of all possible links (Cortese 2007). The formula is as follows:

$$\text{Density} = \frac{\sum kv}{n(n-1)/2}$$

where k is a given link in the network, v is the value (from 1 to 5) attached to the k th link, and n is the number of concepts provided. All concepts were taken from SCS and BCF. Using a 5-point scale (1 = 'Not related at all' and 5 = 'Very closely related'), respondents were asked to indicate the extent to which the following concepts were related: (a) 'Breast cancer and smoking'; (b) 'Breast cancer and alcohol consumption'; (c) 'Breast cancer and race'; (d) 'Breast cancer and eating habits'; (e) 'Smoking and alcohol consumption'; (f) 'Smoking and race'; (g) 'Smoking and eating habits'; (h) 'Alcohol consumption and race'; (i) 'Alcohol consumption and eating habits'; and (j) 'Race and eating habits.' KSD was calculated based on the abovementioned formula, in which higher scores indicated greater degree of connectedness among the concepts ($M = 2.78$, $SD = 0.86$).

Dependent variables

Risk Perception was measured by using the questions adapted from Shim (2008). Respondents were asked to rate the following statements on a scale of 1 to 5 (1 = 'Least likely,' 5 = 'Most likely'): (a) 'How likely do you think it is that you will develop breast cancer in the future' and (b) 'How likely do you think it is that you will develop breast cancer, as compared to the average woman your age.' The two-item measures were averaged to create a composite index ($M = 2.31$, $SD = 1.02$, $r = 0.65$, $p < 0.001$).

Behavioral Intention was measured using a 5-point Likert scale (1 = 'Strongly Disagree' and 5 = 'Strongly Agree'). Respondents have to answer how much they agree with the following statements adapted from a study conducted by Godin et al. (2001): (a) 'I intend to go for clinical breast examination yearly if I am 40 years old and above' and (b) 'I intend to go for mammography yearly if I am 40 years old and above.' The two items were averaged to create a scale, with higher values indicating a higher likelihood that the respondent will take part in breast cancer preventive behavior ($M = 4.03$, $SD = 1.11$, $r = 0.65$, $p < 0.001$).

Results

Risk perception as dependent variable

Table 1 shows the hierarchical OLS regression analysis for factors predicting breast cancer risk perception among women in Singapore between the ages of 30 and 70.

[Insert Table 1 about here.]

With regard to the control variables, women who are married ($\beta = 0.10, p < 0.05$) and who have children ($\beta = 0.10, p < 0.05$) indicated higher risk perception than women who are single and have no children. Chinese Singaporeans were used as a baseline variable for race, and results indicate that only Indian women ($\beta = 0.10, p < 0.01$) were likely to indicate higher risk perceptions compared with the baseline group.

Overall, having a history of cancer was positively associated with risk perception. After taking the other variables into account, women with a personal history ($\beta = 0.06, p < 0.05$) and family history of cancer ($\beta = 0.17, p < 0.001$) displayed higher risk perception than those with no history of cancer. The demographic block accounted for 6.80% of the variance in the model. Results showed that attention to media was positively associated with risk perception ($\beta = 0.09, p < 0.05$). Hence, *H2a* was supported by our results. The attention to media block accounted for 2.40% of the variance in the model.

At the zero-order level, interpersonal communication in terms of frequency of discussion and network size was positively correlated with risk perception. However, after other variables were subsequently entered into the regression model, only frequency of communication ($\beta = 0.11, p < 0.05$) remains significant. Hence, *H3a* was supported while *H4a* was not supported. Results also indicated that elaboration was not significantly associated with risk perception. Hence, *H5a* was not supported. The interpersonal communication and elaboration block accounted for 2.50% of the variance in the model. Fatalistic belief was positively associated with risk perception ($\beta = 0.12, p < 0.01$). This

shows that individuals with fatalistic belief regarding breast cancer are more likely to perceive a higher risk, thus lending support to *H6a*. This block accounted for 1.40% of the variance in the model.

Finally, in block 5, positive beta coefficients showed significant association between KSD and risk perception ($\beta = 0.12, p < 0.01$). Thus, individuals who scored high on the KSD scale had higher levels of risk perception, addressing *RQ1a* that there is association between KSD and risk perception. On the other hand, factual knowledge had no significant association with the risk perception. Thus, *H7a* was not supported. The knowledge block accounted for 1.20% of the variance in the model. In sum, all factors explained 12.10% of the total variance in risk perception.

Behavioral intention as dependent variable

Table 2 shows the hierarchical OLS regression analysis for factors predicting behavioral intentions among women in Singapore between the ages of 30 and 70.

[Insert Table 2 about here.]

The first block of final standardized beta coefficients indicates the role of the demographic variables. The initial significant results for married women, Indian women, women with children, and those who have both general health insurance and women-related insurance were explained away when other variables were added into the regression model. The demographic block accounted for a total of 4.80% of the total variance in our dependent variable. At the zero-order level, results show that attention to media was positively associated with behavioral intent. However, all the significant results were explained away when other variables were subsequently introduced into the regression model. Thus *H2b* was not supported. Block 2 attention to media accounted for 2.80% of the total variance in the model.

Frequency of interpersonal communication ($\beta = 0.14, p < 0.01$) was significantly

associated with the level of behavioral intent, lending support to *H3b*. Although network size was significantly associated with behavioral intent at zero-order level, the significance was explained away by other variables which were subsequently included into the regression model, thus *H4b* was not supported. Elaboration ($\beta = 0.19, p < 0.001$) was positively associated with behavioral intent, lending support to *H5b*. The interpersonal communication and elaboration block accounted for 7.90% of variance in the model.

Individuals with a high level of risk perception ($\beta = 0.08, p < 0.05$) were more likely to engage in preventive behaviors. On the other hand, fatalistic belief ($\beta = 0.09, p < 0.01$) was positively associated with behavioral intent at the zero-order level, but the significance was explained away with the inclusion of other variables. Thus *H1* was supported but not *H6b*. Together, risk perception and fatalism accounted for 1.10% of the variance in the model. Factual knowledge ($\beta = 0.15, p < 0.001$) was significantly associated with behavioral intent. Thus, *H7b* was supported. As for KSD ($\beta = 0.15, p < 0.001$), results were significant only at the zero-level. To answer *RQ1b*, the final results did not show that there is an association between KSD and behavioral intent. The knowledge block accounted for 2.30% of the total variance in the model. In total, all factors explained 18.90% of the variance in the model.

Discussion

Overall, this study showed that the variables that have significant relationships with women's risk perception of breast cancer may not be statistically significant with their intention to take up preventive measures. This study yielded a number of key findings. Apart from risk perception, other communication variables were found to have significant associations with women's intention to take up screening. Media attention predicted risk perception but not behavioral intent. Findings also suggest that frequency of communication was a better predictor of the two dependent variables as compared with individuals' network

size. If individuals engaged in elaborative processing, the more likely they are in wanting to take up breast cancer preventive measures. Fatalistic beliefs were associated with risk perception, but not behavioral intent. Finally, a noteworthy finding is that women's factual knowledge about breast cancer was significantly related with their behavioral intention, while their KSD was significantly related with their risk perception of breast cancer.

This study showed that Singaporean women's attention to media had a positive association with risk perception, lending further support to previous studies (Agha 2003; Slater, Goodall, and Hayes 2009; Bults et al. 2011). When women pay attention and learn about breast cancer from media messages, they may perceive themselves as being more at risk. However, results did not support past research linking attention to media with behavioral intention (e.g. McCaul et al. 1996; Yanovitzky and Blitz 2000). This null finding is consistent with the conclusion of some previous research on the effects of media campaigns – that media is effective in generating awareness of a health issue, while interpersonal communication plays a more vital role in changing intention or adoption of a practice (Valente, Poppe, and Merritt 1996; Valente and Saba 1998). Another possible explanation could be that media attention on behavior may be an indirect one, where media attention influences cognition and attitudes, which in turn, affect behavioral outcomes (Lopez-Guimera et al. 2010; Ward et al. 2011).

Frequency of interpersonal communication was found to be positively associated with risk perception. Frequency of communication served as a consistent reminder that an individual is susceptible to certain risks and hence the positive association between the two variables. Network size was neither significantly significant with women's level of risk perception nor their intention to go for breast cancer screening. One possible reason may be due to the sensitive nature of the topic, the number of people with whom women speak with regarding the issue is small; where only close friends, family members, or trusted health care

providers were consulted for advice. Individuals with higher elaborative skills indicated a higher behavioral intent, consistent with previous studies (Nenkov, Inman, and Hulland 2008; Ho, Peh, and Soh 2013). People who elaborate on the potential outcomes of a decision or action are more likely to self-regulate their behaviors when promoting a healthy lifestyle (Nenkov, Inman, and Hulland 2008). Thus, individuals who elaborate on breast cancer issues such as its risks are thus more likely to undertake precautionary measures.

Factual knowledge was found to have no significant association with risk perception. Breast cancer news receives substantial media coverage in Singapore, providing most audience with facts about breast cancer. Thus, knowing *about* the dangers of breast cancer may lose its novelty in raising women's risk perception (Lazaro, Thilagaratnam, and Puay 2009), contributing to a self-serving optimistic bias. Future research can determine if a case of optimistic bias exists in Singapore in the context of breast cancer. While knowledge was not found to influence risk perception, knowing *about* the dangers of breast cancer does encourage women to take preventive actions. Our study showed that factual knowledge was found to have association with behavioral intent, lending further support to what previous studies found, that a high level of factual knowledge on breast cancer would increase the incidence of screening (e.g. Weinstein and Nicolich 1993; Champion and Miller 1996).

The distinction between factual and KSD should be noted as well. Results showed that there was a positive relationship between KSD and risk perception. While factual knowledge consists of accurate and concrete information regarding breast cancer, KSD relies on a network of related concepts. As such, when an individual thinks that more health concepts are related to one another, the health risks involved in the health concepts are coagulated, hence amplifying the risks involved.

Limitations and directions for future research

There are some limitations in the study that should be addressed. First, this study is

cross-sectional in nature in which causal order cannot be established. For example, we stated that communication variables such as attention to media, interpersonal communication, elaboration, risk perceptions, and fatalism predict risk perception. However, it may be the reverse – where it is risk perception predicting each of these communication variables. Therefore, future studies should use longitudinal designs in which causality can be established.

The low reliability of some composite measures (e.g. breast cancer factual knowledge and fatalism) may have contributed to some of the null findings in the study. Future studies should attempt to develop better measures with higher level of internal consistencies. While our study measured the behavioral intent of Singaporean women, it did not tap the actual behavior of women going for annual or biannual mammography, clinical breast examinations, and whether they do breast self-examination monthly. This can be seen as a limitation, although previous studies have found that behavioral intentions are often good indicators of actual behaviors (e.g. Manstead, Profitt, and Smart 1983; Ajzen 1991).

This study did not take into account the concept of self-efficacy, which is a key determinant of behavioral intention (see Ajzen 1991), and a strong predictor of women's intention to go for screening (see Godin et al. 2001; Mason and White 2008). Future studies should investigate the effect of self-efficacy on breast cancer prevention in Singapore.

This study seeks to expand on the dimensions of knowledge to include the structural aspects of the concept. Even though this study has shown that factual knowledge and KSD are associated with risk perception and behavioral intention in different ways, the understanding of structural knowledge in health communication is still in the nascent stage. Future research can further investigate the differences between factual knowledge and KSD in other aspects of health communication.

Theoretical and practical implications

There are several important theoretical and practical implications that could be drawn from the study. First, this study supports previous research that stated the importance of differentiating knowledge of facts and knowledge of relationships (Fiske, Kinder, and Carter 1983; McGraw and Pinney 1990). For example, KSD was significantly associated with risk perception but not behavioral intent while factual knowledge was significantly associated with behavioral intent but not risk perception. This suggests the intrinsic differences between the two kinds of knowledge.

One practical implication of our findings is that policymakers and health communicators should recognize the differences in the roles of media and interpersonal communication when encouraging women to go for regular breast screening (Morton and Duck 2001). While the media is useful for increasing women's risk perception, interpersonal communication is key when encouraging women to go for screening. This suggests that health communicators should be more strategic when leveraging on the strengths of mass media and interpersonal communication channels when developing breast cancer prevention campaigns.

Specifically, communication practitioners should focus on using the mass media to run campaigns to raise public perception of risk toward breast cancer, instead of detracting from this main purpose by directing people's attention to the campaign or the events and activities surrounding the campaign. An event-centric approach to raise awareness for breast cancer may be self-defeating, as it may raise people's awareness about the breast cancer-related events but may not enhance the knowledge of risks associated with breast cancer. Thus, media planners ought to structure the campaigns in such a way that women are informed about the risks of contracting breast cancer and the consequences of not going for screening, rather than distracting people from the issue at hand.

Apart from the emphasis on breast cancer risk, health campaigns can also target the general public by encouraging them to proactively discuss with women among their family members and close friends about issues related to breast cancer. This is in line with the traditional two-step flow model, in which the media influences opinion leaders who can, in turn, influence the rest of the people in their social network (Katz 1957, 1987).

Besides this, the relevant health authorities could hold breast cancer awareness talks and seminars so that healthcare providers could interact with and disseminate the necessary information to the public. During these seminars, organizers can leverage on interactive activities such as live quizzes to trigger elaborative processing from the audience. This may be worthwhile as our results show that elaboration is a significant predictor of women's intention to engage in breast cancer preventive measures.

In conclusion, the findings from this study are especially useful to health organizations and media practitioners in assessing where women are in terms of their understanding of breast cancer and their intention to take preventive measures. This understanding can help media practitioners and policymakers to fine-tune strategies via various platforms to engage women to combat breast cancer more effectively.

References

- Agha, S.S. 2003. The impact of a mass media campaign on personal risk perception, perceived self-efficacy and on other behavioural predictors. *AIDS Care* 15, no. 6: 749–62.
- Ajzen, I. 1991. The theory of planned behavior. *Organizational Behavior and Human Decision Processes* 50, no. 2: 179–211.
- Ashing-Giwa, K. 1999. Health behavior change models and their socio-cultural relevance for breast cancer screening in African American women. *Women & Health* 28, no. 4: 53–71.
- Astleitner, H., and D. Leutner. 1995. Learning strategies for unstructured hypermedia: A framework for theory, research, and practice. *Journal of Educational Computing Research* 13, no. 4: 387–400.
- Ball-Rokeach, S.J., and M.L. Defleur. 1976. A dependency model of mass-media effects. *Communication Research* 3, no. 1: 3–21.
- Baxter, L., N. Egbert, and E. Ho. 2008. Everyday health communication experiences of college students. *Journal of American College Health* 56, no. 4: 427–36.
- Bengel, J., M. Belz-Merk, and E. Farin. 1996. The role of risk perception and efficacy cognitions in the prediction of HIV-related preventive behaviour and condom use. *Psychology and Health* 11, no. 4: 505–25.
- Berry, T.R., J. Wharf-Higgins, and P.J. Naylor. 2007. SARS wars: An examination of the quantity and construction of health information in the news media. *Health Communication* 21, no. 1: 35–44.
- Birkel, R.C., and N.D. Reppucci. 1983. Social networks, information-seeking, and the utilization of services. *American Journal of Community Psychology* 11, no. 2: 185–205.

Breast Cancer Foundation (BCF). 2012a. Awareness and education.

<http://www.bcf.org.sg/awarenessEducation/awarenessEducation.html>.

Breast Cancer Foundation. 2012b. Breast Self-Examination.

<http://www.bcf.org.sg/awareness-Education/breastSelfExamination.html>.

Bults, M., D.A. Beaujean, O. de Zwart, G. Kok, P. van Empelen, J.E. van Steenbergen, J.H.

Richardus, and H.M. Voeten. 2011. Perceived risk, anxiety, and behavioural responses of the general public during the early phase of the Influenza A (H1N1) pandemic in the Netherlands: Results of three consecutive online surveys. *BMC Public Health* 11, no. 1: 1–13.

Carelli, I., L.M. Pompei, C.S. Mattos, H.G. Ferreira, R. Pescuma, C.E. Fernandes, and S.

Peixoto. 2007. Knowledge, attitude and practice of BSE in a female population of metropolitan Sao Paulo. *The Breast* 17, no. 3: 270–4.

Champion, V., and A.M. Miller. 1996. Recent mammography in women aged 35 and older:

Predisposing variables. *Health Care for Women International* 17, no. 3: 233–45.

Clark, J.N. 2004. A comparison of breast, testicular and prostate cancer in mass print media

(1996–2001). *Social Science & Medicine* 59, no. 3: 541–51.

Clark, S., L.G. Bluman, N. Borstelmann, K. Regan, E.P. Winer, B.K. Rimer, and C.S.

Skinner. 2000. Patient motivation, satisfaction, and coping in genetic counseling and testing for BRCA1 and BRCA2. *Journal of Genetic Counseling* 9, no. 3: 219–35.

Cline, R.J.W. 2003. Everyday interpersonal communication and health. In *Handbook of*

health communication, ed. T.L. Thompson, A.M. Dorsey, K.I. Miller, and R. Parrott, 285–313. Mahwah, NJ: Erlbaum.

Condit, C.M. 1999. How the public understands genetics: Non-deterministic and non-

discriminatory interpretations of the ‘blueprint’ metaphor. *Public Understanding of Science* 8, no. 3: 169–80.

- Cortese, J. 2007. *Internet learning and the building of knowledge*. Youngstown, NY: Cambria Press.
- Dillard, A., P.A. Ubel, D.M. Smith, B.J. Zikmund-Fisher, V. Nair, H.A. Derry, A. Zhang, et al. 2011. The distinct role of comparative risk perceptions in a breast cancer prevention program. *Annals of Behavioral Medicine* 42, no. 2: 262–8.
- Donelle, L., L. Hoffman-Goetz, and J.N. Clarke. 2005. Ethnicity, genetics, and breast cancer: Media portrayal of disease identities. *Ethnicity & Health* 10, no. 3: 185–97.
- Dorsey, D.W., G.E. Campbell, L.L. Foster, and D.E. Miles. 1999. Assessing knowledge structures: Relations with experience and post-training performance. *Human Performance* 12, no. 1: 31–57.
- Dunwoody, S., and K. Neuwirth. 1991. Coming to terms with the impact of communication on scientific and technological risk judgments. In *Communicating issues of science, risk and public policy*, eds. L. Wilkins and P. Patterson, 11–31. New York: Greenwood Press.
- Entman, R.M. 1993. Framing: Toward clarification of a fractured paradigm. *Journal of Communication* 43, no. 4: 51–8.
- Eveland, W.P. 2001. The cognitive mediation model of learning from the news: Evidence from nonelection, off-year election, and presidential election contests. *Communication Research* 28, no. 5: 571–601.
- Eveland, W.P. 2002. News information processing as mediator of the relationship between motivations and political knowledge. *Journal Mass Communication Quarterly* 79, no. 1: 26–40.
- Eveland, W.P., Jr., J. Cortese, H. Park, and S. Dunwoody. 2004. How web site organization influences free recall, factual knowledge, and knowledge structure density. *Human Communication Research* 30, no. 2: 208–33.

- Eveland, W.P., and M.H. Hively. 2009. Political discussion frequency, network size, and 'heterogeneity' of discussion as predictors of political knowledge and participation. *Journal of Communication* 59, no. 2: 205–24.
- Eveland, W.P., Jr., K. Marton, and M. Seo. 2004. Moving beyond 'just the facts': The influence of online news on the content and structure of public affairs knowledge. *Communication Research* 31, no. 1: 82–108.
- Eveland, W.P., Jr., M. Seo, and K. Marton. 2002. Learning from the news in campaign 2000: An experiment comparison of TV news, newspapers and online news. *Media Psychology* 4, no. 4: 352–78.
- Eveland, W.P., and T. Thomson. 2006. Is it talking, thinking, or both? A lagged dependent variable model of discussion effects on political knowledge. *Journal of Communication* 56, no. 3: 523–42.
- Facione, N.C. 2002. Perceived risk of breast cancer. *Cancer Practice* 10, no. 5: 256–61.
- Fagerlin, A., B. Zikmund-Fisher, and P. Ubel. 2005. How making a risk estimate can change the feel of that risk: Shifting attitudes toward breast cancer risk in a general public survey. *Patient Education and Counseling* 57, no. 3: 294–9.
- Ferlay, J., C. Hery, P. Autier, and R. Sankaranarayanan. 2010. Global burden of breast cancer. In *Breast cancer epidemiology*, ed. C. Li, 1–19. New York, NY: Springer.
- Fiske, S.T., D.R. Kinder, and W.M. Carter. 1983. The novice and the expert: Knowledge based strategies in political cognition. *Journal of Experimental Social Psychology* 19, no. 4: 381–400.
- Fox, S.A., K. Pitkin, S. Carson, and N. Duan. 1998. Breast cancer screening adherence: Does church attendance matter? *Health Education and Behavior* 25, no. 6: 742–58.
- Godin, G., C. Gagne, J. Maziade, L. Moreault, D. Beaulieu, and S. Morel. 2001. Breast cancer: The intention to have a mammography and a clinical breast examination-

- application of the theory of planned behavior. *Psychology and Health* 16, no. 4: 423–41.
- Green, J., M. Richards, F. Murton, H. Statham, and N. Hallowell. 1997. Family communication and genetic counseling: The case of hereditary breast and ovarian cancer. *Journal of Genetic Counseling* 6, no. 1: 45–60.
- Greenwald, A.G., and C. Leavitt. 1984. Audience involvement in advertising: Four levels. *Journal of Consumer Research* 11: 581–92.
- Griva, F., F. Anagnostopoulos, and S. Madoglou. 2009. Mammography screening and the theory of planned behavior: Suggestions toward an extended model of prediction. *Women and Health* 49, no. 8: 662–81.
- Gross, K., and L. D’Ambrosio. 2004. Framing emotional response. *Political Psychology* 25, no. 1: 1–29.
- Guerra, C.E., F. Dominguez, and J.A. Shea. 2005. Literacy and knowledge, attitudes, and behavior about colorectal cancer screening. *Journal of Health Communication* 10, no. 7: 651–63.
- Gwarzo, U.M., K. Sabitu, and S.H. Idris. 2009. Knowledge and practice of breast self-examination among female undergraduate students of Ahmadu Bello University Zaria, North-western Nigeria. *Annals of African medicine* 8, no. 1: 55–8.
- Henderson, L., and J. Kitzinger. 1999. The human drama of genetics: ‘Hard’ and ‘soft’ media representations of inherited breast cancer. *Sociology of Health & Illness* 21, no. 5: 560–78.
- Hively, M.H., and W. Eveland. 2009. Contextual antecedents and political consequences of adolescent political discussion, discussion elaboration, and network diversity. *Political Communication* 26, no. 1: 30–47.
- Ho, S.S., D.A. Scheufele, and E.A. Corley. 2010. Making sense of policy choices:

- Understanding the roles of value predispositions, mass media, and cognitive processing in public attitudes toward nanotechnology. *Journal of Nanoparticle Research* 12, no. 8: 2703–15.
- Ho, S.S., X.H. Peh, and V.W.L. Soh. 2013. The cognitive mediation model: Factors influencing public knowledge of the H1N1 pandemic and intention to take precautionary behaviors. *Journal of Health Communication*. DOI: 10.1080/10810730.2012.743624.
- Hornik, R. 2002. *Public health communication: Evidence for behavior change*. New York, NY: Lawrence Erlbaum.
- Husaini, B.A., D.E. Sherkat, R. Bragg, R. Levine, J.S. Emerson, C.M. Menten, and V.A. Cain. 2001. Predictors of breast cancer screening in a panel study of African American women. *Women and Health* 34, no. 3: 35–51.
- Hwang, Y., and S. Jeong. 2009. Revising the knowledge gap hypothesis: A meta-analysis of thirty-five years of research. *Journalism & Mass Communication Quarterly* 86, no. 3: 513–32.
- Janz, N.K., and M.H. Becker. 1984. The health belief model: A decade later. *Health Education & Behavior* 11, no. 1: 1–47.
- Jonassen, David H., K. Beissner, and M. Yacci. 1993. *Structural knowledge: Techniques for representing, conveying and acquiring structural knowledge*. Hillsdale, NJ: Erlbaum.
- Jones, L.W., K.S. Courneya, A.S. Fairey, and J.R. Mackey. 2005. Does the theory of planned behavior mediate the effects of an oncologist's recommendation to exercise in newly diagnosed breast cancer survivors? Results from a randomized controlled trial. *Health Psychology* 24, no. 2: 189–97.
- Jones, K., B.E. Denham, and J.K. Springston. 2007. Differing effects of mass and interpersonal communication on breast cancer risk estimates: An exploratory study of

- college students and their mothers. *Health Communication* 21, no. 2: 165–75.
- Katapodi, M.C., M.J. Dodd, K.A. Lee, and N.C. Facione. 2009. Underestimation of breast cancer risk: Influence on screening behavior. *Oncology Nursing Forum* 36, no. 3: 306–14.
- Katapodi, M.C., K.A. Lee, N.C. Facione, and M.J. Dodd. 2004. Predictors of perceived breast cancer risk and the relation between perceived risk and breast cancer screening: A meta-analytic review. *Preventive Medicine* 38, no. 4: 388–402.
- Katz, E. 1957. The two-step flow of communication: An up-to-date report on an hypothesis. *Public Opinion Quarterly* 21, no. 1: 61–78.
- Katz, E. 1987. Communications research since Lazarsfeld. *Public Opinion Quarterly* 51, no. 4 Part 2: S25–45.
- Katz, E., and P.F. Lazarsfeld. 1955. *Personal influence: The part played by people in the flow of mass communications*. New York, NY: Free Press.
- Kim, S.S., and J.J. Wang. 2009. Three competing paradigms: Vertical and horizontal integration of safety culture research. *International Review of Public Administration* 14, no. 2: 63–82.
- Kwak, N., A.E. Williams, X. Wang, and H. Lee. 2005. Talking politics and engaging in politics: An examination of the interactive relationship between structural features of political talk and discussion engagement. *Communication Research* 32, no. 1: 87–111.
- Lazaro, J.A.R., S. Thilagaratnam, and H.T. Puay. 2009. Breast cancer in Singapore: Some perspectives. *Breast Pathology in Asia* 17, no. 1: 23–8.
- Lebow, M., and E.B. Arkin. 1993. Women's health and the mass media: The reporting of risk. *WHI* 3, no. 4: 181–90.
- Leong, H.S.S., R. Heng, and S.C. Emmanuel. 2007. Survey on mammographic screening among women aged 40 to 65 years old at polyclinics. *Singapore Medical Journal* 48,

no. 1: 34–40.

Lerman, C., and M. Schwartz. 1993. Adherence and psychological adjustment among women at high risk for breast cancer. *Breast Cancer Research and Treatment* 28, no. 2: 145–55.

Lipkus, M.I., and W.M. Klein. 2006. Effects of communicating social comparison information on risk perceptions for colorectal cancer. *Journal of Health Communications* 11, no. 4: 391–407.

Liu, R., J. Wu, and H. Zhu. 2007. Media/psychological impact on multiple outbreaks of emerging infectious diseases. *Computational and Mathematical Methods in Medicine* 8, no. 3: 153–64.

Lopez-Guimera, G., M.P. Levine, D. Sanchez-Carracedo, and J. Fauquet. 2010. Influence of mass media on body image and eating disordered attitudes and behaviors in females: A review of effects and processes. *Media Psychology* 13, no. 4: 387–416.

Low, Elizabeth. 2010. BCF launches breast cancer campaign. *Marketing Interactive*, September 2. <http://www.marketing-interactive.com/news/21846>.

Manstead, A.S.R., C. Profitt, and J.L. Smart. 1983. Predicting and understanding mothers' infant-feeding intentions and behavior: Testing the theory of reasoned action. *Journal of Personality and Social Psychology* 44, no. 4: 657–71.

Marris, C., I.H. Langford, and T. O'Riordan. 1998. A quantitative test of the cultural theory of risk perceptions: Comparison with the psychometric paradigm. In *Environmental decision making and risk management: Selected essays by Ian Langford*, eds. R. K. Turner, S. Georgiou, and I. J. Bateman, 103–15. Williston, Vermont: Edward Elgar Publishing.

Mason, T., and K.M. White. 2008. Applying an extended model of the theory of planned behaviour to breast self-examination. *Journal of health psychology* 13, no. 7: 946–55.

- Mayo, R., J. Ureda, and V. Parker. 2001. Importance of fatalism in understanding mammography screening in rural elderly women. *Journal of Women and Aging* 13, no. 1: 57–72.
- Mazur, A., and G.S. Hall. 1990. Effects of social influence and measured exposure level on response to radon. *Sociological Inquiry* 60, no. 3: 274–84.
- McCaul, K.D., A.D. Branstetter, D.M. Schroeder, and R.E. Glasglow. 1996. What is the relationship between breast cancer risk and mammography screening? A meta-analytic review. *Health Psychology* 15, no. 6: 423–9.
- McCusker, J., A.M. Stoddard, J.G. Zapka, M. Zom, and K.H. Mayer. 1989. Predictors of AIDS-preventive behavior among homosexually active men: A longitudinal study. *Official Journal of the International AIDS Society* 3, no. 7: 411–76.
- McGraw, K.M., and N. Pinney. 1990. The effects of general and domain-specific expertise on political memory and judgment. *Social Cognition* 8, no. 1: 9–30.
- Morton, T.A., and J.M. Duck. 2001. Communication and health beliefs: Mass and interpersonal influences on perceptions of risk to self and others. *Communication Research* 28, no. 5: 602–26.
- Moy, P., and J. Gastil. 2006. Predicting deliberative conversation: The impact of discussion networks, media use, and political cognitions. *Political Communication* 23, no. 4: 443–60.
- Moyer, A., S. Greener, J. Beauvais, and P. Salovey. 1995. Accuracy of health research reported in the popular press: Breast cancer and mammography. *Health Communication* 7, no. 2: 147–61.
- Muthoni, A., and A.N. Miller. 2010. An exploration of rural and urban Kenyan women's knowledge and attitudes regarding breast cancer and breast cancer early detection measures. *Health Care for Women International* 31, no. 9: 801–16.

- National Cancer Centre Singapore. 2008. Breast cancer awareness month (BCAM) 2008 Singapore. <http://www.nccs.com.sg/news/2008/articles/081004.htm>.
- Nekhlyudov, L., D. Ross-Degnan, and S.W. Fletcher. 2003. Beliefs and expectations of women under 50 years old regarding screening mammography. *Journal of General Internal Medicine* 18, no. 3: 182–9.
- Nenkov, G.Y., J. Inman, and J. Hulland. 2008. Considering the future: The conceptualization and measurement of elaboration on potential outcomes. *Journal of Consumer Research* 35, no. 1: 126–41.
- Niederdeppe, J., and A.G. Levy. 2007. Fatalistic beliefs about cancer prevention and three prevention behaviors. *Cancer Epidemiology, Biomarkers & Prevention* 16, no. 5: 998–1003.
- O'Rourke, D., and J. Blair. 1983. Improving random respondent selection in telephone surveys. *Journal of Marketing Research* 20, no. 4: 428–32.
- Oltedal, S., B.E. Moen, H. Klempe and T. Rundmo. 2004. Explaining risk perception. An evaluation of cultural theory. *Rotunde* 85: 11–16.
http://www.svt.ntnu.no/psy/Torbjorn.Rundmo/Cultural_theory.pdf.
- Orna, B.E., N. Friedman, and O. Lernau. 2009. Fatalism and mammography in a multicultural population. *Oncology Nursing Forum* 36, no. 3: 353–61.
- Park, E., C.W. Scherer, and C.J. Glynn. 2001. Community involvement and risk perception at personal and societal levels. *Health, Risk & Society* 3, no. 3: 281–92.
- Pearlman, D.N., M.A. Clark, W. Rakowski, and B. Ehrich. 1999. Screening for breast and cervical cancers: The importance of knowledge and perceived cancer survivability. *Women & health* 28, no. 4: 93–112.
- Powe, B.D. 1995. Fatalism among elderly African Americans: Effects on colorectal screening. *Cancer Nursing* 18, no. 5: 385–92.

- Powe, B.D., and R. Finnie. 2003. Cancer fatalism: The state of the science. *Cancer Nursing* 6, no. 6: 454–66.
- Price, V., D. Tewksbury, and E. Powers. 1997. Switching trains of thought: The impact of news frames on readers' cognitive responses. *Communication Research* 24, no. 5: 481–506.
- Radcliffe, N.M., and W.M.P. Klein. 2002. Dispositional, unrealistic, and comparative optimism: Differential relations with the knowledge and processing of risk information and beliefs about personal risk. *Personality and Social Psychology Bulletin* 28, no. 6: 836–46.
- Rajaram, S.S., and A. Rashidi. 1999. Asian-Islamic women and breast cancer screening: A socio-cultural analysis. *Women and Health* 28, no. 3: 45–58.
- Rakowski, W., A.R. Assaf, R.C. Lefebvre, T.M. Lasater, M. Niknian, and R.A. Carleton. 1990. Information-seeking about health in a community sample of adults: Correlates and associations with other health-related practices. *Health Education Quarterly* 17, no. 4: 379–93.
- Richards, M.P., N. Hallowell, J.M. Green, F. Murton, and H. Statham. 1995. Counseling families with hereditary breast and ovarian cancer: A psychosocial perspective. *Journal of Genetic Counseling* 4, no. 3: 219–33.
- Rimal, R.N. 2001. Perceived risk and self-efficacy as motivators: Understanding individuals' long-term use of health information. *Journal of Communication* 51, no. 4: 633–54.
- Rimal, R.N., J.A. Flora, and C. Schooler. 1999. Achieving improvements in overall health orientation: Effects of campaign exposure, information seeking, and health media use. *Communication Research* 26, no. 3: 322–48.
- Rogers, R.W. 1975. A protection motivation theory of fear appeals and attitude change. *Journal of Psychology* 91, no. 1: 93–114.

- Rosenstock, I.M. 1974. Historical origins of the health belief model. *Health Education Monogram 2*: 1–8.
- Royak-Schaler, R., C.N. Klabunde, W.F. Greene, D.R. Lannin, B. DeVellis, K.R. Wilson, and B. Cheuvront. 2002. Communicating breast cancer risk: Patient perceptions of provider discussions. *Medscape Women's Health 7*, no. 2.
- Salazar, R., and J. Walsh. 2006. Breast cancer screening is risky business. *JGIM: Journal of General Internal Medicine 21*, no. 4: 393–4.
- Scheufele, D.A. 2000. Agenda-setting, priming, and framing revisited: Another look at cognitive effects of political communication. *Mass Communication & Society 3*, no. 2: 297.
- Scheufele, D.A., and D. Tewksbury. 2007. Framing, agenda setting, and priming: The evolution of three media effects models. *Journal of Communication 57*, no. 1: 9–20.
- Schlueter, L.A. 1982. Knowledge and beliefs about breast cancer and breast self-examination among athletic and nonathletic women. *Nursing Research 31*, no. 6: 348–53.
- Shim, M. 2008. Connecting internet use with gaps in cancer knowledge. *Health Communication 23*, no. 5: 448–61.
- Singapore Cancer Registry. 2010. Trends in cancer incidence in Singapore. Singapore Health Promotion Board, National Registry of Diseases Office.
http://www.nrdo.gov.sg/uploadedFiles/./Cancer_Trends_Report0408_web_v2.pdf.
- Singapore Cancer Society. 2010. Breast cancer risk factors.
<http://www.singaporecancersociety.org.sg/lac-fcb-risk-factors.shtml>.
- Slater, M.D., C.E. Goodall, and A.F. Hayes. 2009. Self-reported news attention does assess differential processing of media content: An experiment on risk perceptions utilizing a random sample of U.S. local crime and accident news. *Journal of Communication 59*, no. 1: 117–34.

- Snyder, L.B., and R.A. Rouse. 1995. The media can have more than an impersonal impact: The case of AIDS risk perceptions and behavior. *Health Communication* 7, no. 2: 125–45.
- Straughan, P.T., and A. Seow. 2000. Attitudes as barriers in breast screening: A prospective study among Singapore women. *Social Science & Medicine* 51, no. 2000: 1695–705.
- Taleghani, F., Z.P. Yekta, and A.N. Nasrabadi. 2006. Coping with breast cancer in newly diagnosed Iranian women. *Journal of Advanced Nursing* 54, no. 3: 265–72.
- Tchuenche, J.M., N. Dube, C.P. Bhunu, R.J. Smith, and C.T. Bauch. 2011. The impact of media coverage on the transmission dynamics of human influenza. *BMC Public Health* 11, (Suppl 1), 1–14.
- Tewksbury, D., and Dietram Scheufele. 2009. News framing theory and research. In *Media effects: Advances in theory and research*, ed. J. Bryant and M. B. Oliver, 3rd ed., 17–33. New York, NY: Routledge.
- Thompson, T.L., A. Dorsey, K. Miller, and R. Parrott. 2003. *Handbook of health communication*. Mahwah, NJ: Lawrence Erlbaum Associates.
- Tyler, T.R., and F.L. Cook. 1984. The mass media and judgments of risk: Distinguishing impact on personal and societal level judgments. *Journal of Personality and Social Psychology* 47, no. 4: 693–708.
- Vahabi, M. 2005. Knowledge of breast cancer and screening practices. *Health Education Journal* 64, no. 3: 218–28.
- Valente, T.W., P.R. Poppe, and A.P. Merritt. 1996. Mass-media-generated interpersonal communication as sources of information about family planning. *Journal of Health Communication* 1, no. 3: 247–65.
- Valente, T.W., and W.P. Saba. 1998. Mass media and interpersonal influence in a reproductive health communication campaign in Bolivia. *Communication Research*

- 25, no. 1: 96–124.
- van der Pligt, J., W. Otten, and R. Richard. 1993. Perceived risk of AIDS: Unrealistic optimism and self-protective action. In *The social psychology of HIV infection*, eds. B.J. Pryor and G.D. Reeder, 39–58. Hillsdale, NJ: Lawrence Erlbaum Associates.
- Viswanath, K., N. Breen, H. Meissner, R. Moser, B. Hesse, W.R. Steele, and W. Rakowski. 2006. Cancer knowledge and disparities in the information age. *Journal of Health Communication* 11, no. 1: 1–17.
- Wallington, S., K. Blake, K. Taylor-Clark, and K. Viswanath. 2010. Antecedents to agenda setting and framing in health news: An examination of priority, angle, source, and resource usage from a national survey of US health reporters and editors. *Journal of Health Communication* 15, no. 1: 76–94.
- Ward, L.M., M. Epstein, A. Caruthers, and A. Merriwether. 2011. Men’s media use, sexual cognitions, and sexual risk behavior: Testing a mediational model. *Developmental Psychology* 47, no. 2: 592–602.
- Weinstein, N.D. 1988. The precaution adoption process. *Health Psychology* 7, no. 4: 355–86.
- Weinstein, N.D. 1999. What does it mean to understand a risk? Evaluating risk comprehension. *Journal of the National Cancer Institute* 1999, no. 25: 15–20.
- Weinstein, N.D., and M. Nicolich. 1993. Correct and incorrect interpretations of correlations between risk perceptions and risk behaviors. *Health Psychology* 12, no. 3: 235–45.
- World Health Organisation. 2009. Cancer key fact sheet 2009.
<http://www.who.int/mediacentre/factsheets/fs297/en/index.html>.
- Yanovitzky, I., and C. Bennett. 1999. Media attention, institutional response, and health behavior change: The case of drunk driving, 1978–1996. *Communication Research* 26, no. 4: 429–53.
- Yanovitzky, I., and C.L. Blitz. 2000. Effect of media coverage and physician advice on

utilization of breast cancer screening by women 40 years and older. *Journal of Health communication* 5, no. 2: 117–34.

Tables

Table 1. Hierarchical OLS regression analysis for women's risk perception of breast cancer.

	<i>Zero- Order</i>	<i>Model 1</i>	<i>Model 2</i>	<i>Model 3</i>	<i>Model 4</i>	<i>Model 5</i>
<i>Block 1: demographic variables</i>						
Age	-0.03	-0.06	-0.06	-0.06	-0.06	-0.06
Marital status	0.01	0.12*	0.11*	0.12*	0.11*	0.10*
Income	-0.04	-0.08*	-0.11**	-0.11*	-0.08	-0.08
Children	-0.06	-0.11*	-0.10	-0.11*	-0.11*	-0.10*
<i>Racial Groups</i>						
Malay	-0.01	-0.00	0.01	0.03	0.04	0.02
Indian	0.10**	0.09*	0.09*	0.11**	0.10**	0.10**
Eurasian	-0.01	-0.01	-0.01	0.00	0.01	0.01
Other races	0.02	0.05	0.05	0.06	0.06	0.06
Health Insurance	0.04	0.01	-0.01	-0.01	-0.00	0.01
Women related insurance	0.04	0.03	0.01	-0.02	-0.02	-0.03
Personal history of cancer	0.01**	0.09**	0.09*	0.07*	0.07*	0.06*
Family history of cancer	0.17***	0.19***	0.18***	0.18***	0.17***	0.17***
Incremental R^2 (%)		6.80				
<i>Block 2: media attention</i>						
Attention to media	0.16***	–	0.16***	0.09*	0.10*	0.09*
Incremental R^2 (%)			2.40			
<i>Block 3: interpersonal communication</i>						
Network size	0.17***	–	–	0.02	0.03	0.03
Frequency of communication	0.20***	–	–	0.15**	0.12*	0.11*
Elaboration	0.11**	–	–	0.05	0.04	0.02
Incremental R^2 (%)				2.50		
<i>Block 4: motivation</i>						
Fatalistic belief	0.17***	–	–	–	0.13***	0.12**
Incremental R^2 (%)					1.40	
<i>Block 5: knowledge</i>						
Factual knowledge	0.03	–	–	–	–	-0.00
KSD	0.17***	–	–	–	–	0.12**
Incremental R^2 (%)						1.20
Total R^2 (%)						12.10

Note. $N = 802$; Cell entries for all models are final standardized regression coefficients for all blocks; Chinese Singaporeans was used as a reference category among the dummy variables of racial groups; * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$. For marital status, (1 = Not married, 2 = Married); For Health insurance, women-related health insurance, personal history of cancer and family history of cancer, (1= No, 2 = Yes).

Table 2. Hierarchical OLS regression analysis for breast cancer prevention behavioral intent

	<i>Zero-Order</i>	<i>Model 1</i>	<i>Model 2</i>	<i>Model 3</i>	<i>Model 4</i>	<i>Model 5</i>
<i>Block 1: demographic variables</i>						
Age	-0.06	-0.04	-0.04	-0.04	-0.03	-0.02
Marital status	0.07*	-0.01	-0.01	-0.01	-0.02	-0.02
Income	0.05	0.02	-0.01	-0.01	-0.01	-0.01
Children	0.08*	0.10	0.11*	0.07	0.09	0.08
Racial Groups						
Malay	-0.07	-0.08*	-0.07	-0.03	-0.03	-0.03
Indian	-0.08*	-0.09*	-0.08*	-0.06	-0.07	-0.06
Eurasian	-0.06	-0.07	-0.07	-0.04	-0.04	-0.04
Other races	-0.03	-0.05	-0.05	-0.03	-0.04	-0.03
Health Insurance	0.11**	0.03	0.01	0.02	0.03	0.04
Women related insurance	0.12**	0.11**	0.09*	0.06	0.06	0.05
Personal history of Cancer	0.04	0.07	0.07	0.04	0.03	0.03
Family history of Cancer	-0.01	-0.01	-0.02	-0.02	-0.04	-0.05
Incremental R^2 (%)		4.80				
<i>Block 2: attention to media</i>						
Attention to Media	0.20***	–	0.17***	0.04	0.04	0.05
Incremental R^2 (%)			2.80			
<i>Block 3: interpersonal communication</i>						
Network size	0.20***	–	–	-0.02	-0.02	-0.02
Frequency of communication	0.27***	–	–	0.18***	0.16**	0.14**
Elaboration	0.32***	–	–	0.23***	0.22***	0.19***
Incremental R^2 (%)				7.90		
<i>Block 4: motivation</i>						
Risk perception	0.14***	–	–	–	0.09*	0.08*
Fatalistic Belief	0.09**	–	–	–	0.06	0.05
Incremental R^2 (%)					1.10	
<i>Block 5: knowledge</i>						
Factual knowledge	0.25***	–	–	–	–	0.15***
KSD	0.15***	–	–	–	–	0.04
Incremental R^2 (%)						2.30
Total R^2 (%)						18.90

Note. $N = 802$; Cell entries for all models are final standardized regression coefficients for all Blocks; Chinese Singaporeans was used as a reference category among the dummy variables of racial groups; * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$. For marital status, (1 = Not married, 2 = Married); For Health insurance, women-related health insurance, personal history of cancer and family history of cancer, (1 = No, 2 = Yes).