

# Psychosocial Factors Predicting SARS-Preventive Behaviors in Four Major SARS-Affected Regions

CECILIA CHENG<sup>1</sup>

*Division of Social Science*

*Hong Kong University of Science and Technology*

*Kowloon, Hong Kong*

AIK-KWANG NG

*Department of Education*

*Nanyang Technological University*

*Singapore*

This multinational study examined intended and actual adoption of SARS-preventive behaviors in major SARS-affected regions: Guangdong (China), Hong Kong, Singapore, and Toronto (Canada). The theory of reasoned action (TRA) and the theory of planned behavior (TPB) were adopted as theoretical frameworks. A measure was constructed to assess attitude, subjective norm, perceived behavioral control (PBC), knowledge of SARS, and SARS-preventive behaviors. Seventy-five working adults were recruited from each region. They completed the new measure in an initial study, and reported their actual behaviors 2 weeks later. Results provided cross-cultural generalizability of the TRA by showing that attitude and subject norm predicted SARS-preventive behaviors for all the groups. PBC was a statistically significant predictor for all participants except those from Guangdong, indicating that the TPB is applicable only to people from Hong Kong, Singapore, and Toronto. Knowledge of SARS also was found to be an independent predictor.

Severe acute respiratory syndrome (SARS) has plagued the international community since March 2003. In November 2002, this unknown disease was reported initially in Guangdong, China. The first case was reported in Hong Kong in early March 2003. In this age of globalization and frequent travel, SARS has since swept rapidly through parts of Asia and around the world.

As reported by the World Health Organization (WHO, 2003a), there were 32 countries with probable cases of SARS in the world. More than 8,400 people have been infected by SARS, and more than 800 cases of death have been reported. China is the country with the highest number of probable cases of SARS, followed by Hong Kong, Singapore, and Canada (Table 1). Local transmission has been reported in these affected regions.

The present study was conducted to compare the practice of SARS-preventive behaviors by people from these four areas most severely affected

<sup>1</sup>Correspondence concerning this article should be addressed to Cecilia Cheng, Division of Social Science, Hong Kong University of Science and Technology, Clear Water Bay, Kowloon, Hong Kong. E-mail: c.cheng@ust.hk

Table 1

*Characteristics of Samples by SARS-Affected Region*

	Guangdong, China ( <i>n</i> = 75)	Hong Kong ( <i>n</i> = 75)	Singapore ( <i>n</i> = 75)	Toronto, Canada ( <i>n</i> = 75)
Sex <sup>a</sup> ( <i>n</i> ; male/female)	41/33	31/44	30/45	38/35
Age <sup>a</sup> (in years)	<i>M</i> = 28.56 <i>SD</i> = 6.68	<i>M</i> = 29.11 <i>SD</i> = 4.87	<i>M</i> = 27.60 <i>SD</i> = 4.23	<i>M</i> = 28.94 <i>SD</i> = 4.08
Age group <sup>a</sup> ( <i>n</i> )				
18–25 years	36	16	27	21
26–30 years	18	40	34	28
31–35 years	8	11	8	15
36–40 years	9	7	6	11
Marital status <sup>a</sup> ( <i>n</i> )				
Never married/single	36	50	52	28
Married/cohabitating without children	18	12	15	18
Married/cohabitating with children	20	13	8	28
Number of infected cases <sup>b</sup>	5,327	1,755	206	250
Number of deaths <sup>b</sup>	348	298	32	38
Death rate <sup>b</sup>	6.5%	17.0%	15.5%	15.2%

*Note.* SARS = severe acute respiratory syndrome. <sup>a</sup>Some participants did not provide the requested information. <sup>b</sup>For the entire country, as of July 11, 2003 (World Health Organization, 2003a).

by SARS. Health behavior change models were used to examine how people from major SARS-affected regions cope with this novel, unknown disease.

### Models Predicting Performance of Preventive Behaviors

The theory of reasoned action (TRA; Ajzen & Fishbein, 1980) and the theory of planned behavior (TPB; Ajzen, 1991) are two leading models for explaining health behavioral change. The TRA highlights two elements that influence the performance of preventive behaviors. The personality factor of *attitude* refers to individuals' estimation of possible positive or negative

outcomes resulting from performing preventive behaviors, and the likelihood that such outcomes will occur. The social factor of *subjective norm* refers to support from other people in performing preventive behaviors, and individuals' motivation to comply with the views of others.

Although these two factors are related in certain ways, the strength of the relationship is modest (e.g., Motl et al., 2002; Sutton, McVey, & Glanz, 1999). The TRA postulates four conditions that enhance individuals' probability of instituting preventive behaviors: (a) Individuals judge that performance of some preventive behaviors will lead to positive outcomes, (b) they think that the positive outcomes are likely to occur, (c) other people think that they should perform the behaviors, and (d) they are motivated to conform to others' opinions.

The TRA is most appropriate in the study of behaviors that are under individuals' volitional control. The TPB adds the new component of perceived behavioral control (PBC), which refers to individuals' perceptions of the ease of performing a behavior and confidence in their ability to perform it (Ajzen, 1991). In the TPB, PBC was proposed as an independent predictor of behavioral intention and actual behavior. This variable was found to be marginally correlated with attitude, but unrelated to subjective norm (e.g., Motl et al., 2002; Sutton et al., 1999).

Perceived control has been regarded as a central criterion in the appraisal process underlying coping (e.g., Cheng, 2001; Lefcourt, 1992). Some comparative studies on the TRA and TPB (e.g., Sideridis, Kaissidis, & Padelidiadu, 1998; Zint, 2002) have revealed that the inclusion of PBC provided significant improvement in behavioral predictions over the TRA, whereas others (e.g., Levin, 1999; Sutton et al., 1999) revealed that both theories accounted for a similar amount of variance in predicting behaviors.

When applying these models to the context of coping with SARS, the TRA maintains that individuals may undertake SARS-preventive behaviors if they consider that performing these behaviors can lead to positive outcomes and if they believe that such positive outcomes are likely to occur. They also may perform preventive behaviors if they expect that their referent groups will approve the performance of those behaviors and if they have strong motivations to comply with these people's wishes. The set of predictions of the TPB is the same as that of the TRA, except for the additional condition that individuals are likely to perform preventive behaviors if they perceive they have control over the behaviors.

### Cultural Differences in Application of the Models

This study investigates the cross-cultural generalizability of the TRA and TPB by testing them in both independent-based (i.e., Canada) and inter-

dependent-based (i.e., China, Hong Kong, and Singapore) cultures. Kitayama and Markus (1994) posited that individuals from Western cultures are characterized by an independent self-concept, which emphasizes personal goals and recognition of one's differences from other people. By contrast, individuals from Asian cultures are characterized by an interdependent self-concept (Kitayama & Markus, 1994), which emphasizes group goals and appreciation of commonalities with others.

Triandis (1994) posited that attitudes versus norms is an important attribute distinguishing individualistic (independent-based) from collectivistic (interdependent-based) cultures. The influence of attitudes and norms has a distinct impact on people's behaviors in different cultural contexts. Specifically, attitudes, personal needs, and perceived rights exert a strong influence on the behaviors of people from individualistic cultures. These individuals place considerable weight on their thoughts, needs, and rights when deciding how to react. However, social norms, duties, and obligations exert a strong influence on the behaviors of people from collectivistic cultures. These people place greater weight on what others think and do when planning how to react.

Taking these two cultural perspectives into consideration, the explanatory power of the two health behavior change models is hypothesized to differ when applied to individuals from different cultural backgrounds. The TRA, which addresses the importance of subjective norm on health behavior change, may apply more fully to people from collectivistic cultures (i.e., China, Hong Kong, and Singapore). Expectations of significant others and cultural values of conformity constitute the subjective norms that may contribute to health behavior change among Asians. The TPB, with its emphasis on the effects of PBC on health behavior change, may apply more fully to people from an individualistic culture (i.e., Canada). Beliefs about personal control and cultural values of independence may contribute to personal attitudinal influence on health behavior change among Canadians.

### Knowledge of SARS: An Additional Component in the Models

Both the TRA and the TPB are parsimonious models containing few, but powerful constituents in predicting a vast array of preventive behaviors, such as breast self-examination (e.g., Lierman, Young, Kasprzyk, & Benoit, 1990) and sunscreen use (e.g., Abroms, Jorgensen, Southwell, Geller, & Emmons, 2003). Despite their parsimony, Ajzen (1991) admitted that the models are still open to new components to improve the predictive power of a specific behavior. Incorporating elements from other theoretical models may make such an improvement.

The information–motivation–behavioral skills (IMB) model (Fisher & Fisher, 1993) is another model explicating preventive behaviors. In this model, information, motivation, and behavioral skills are fundamental determinants of preventive behaviors. Consistent with the TRA and the TPB, this model also recognizes the impact of motivational and normative components in the performance of preventive behaviors. The IMB model is unique in including information as a major component influencing behavioral change. Information related to a disease is proposed as a prerequisite for performing behaviors to prevent that disease. Such information may directly foster initiation and maintenance of preventive behaviors, or it may indirectly promote preventive behaviors through strengthening behavioral skills.

Information related to a disease, a major component of the IMB model, is examined in this study in addition to the components of the TRA and the TPB. The IMB model was proposed originally as a behavior change model to explain AIDS-preventive behaviors. This model is deemed applicable to this study because AIDS and SARS share certain similarities. Both are life-threatening infectious diseases, and there are considerable controversies on the treatment of these diseases (for a discussion, see Cheng, 2004; Larkin, 2003). Hence, some people may be motivated to prevent themselves from being infected by these diseases through seeking information on prevention measures. Moreover, SARS is a novel, unknown disease. The obscurities surrounding it may elicit anxiety among people, especially those in the SARS-affected regions. Information about an unknown disease may be especially important to reduce the uncertainty and to alleviate worries.

Behavioral decision theories (Einhorn & Hogarth, 1988; Janis & Mann, 1977) proposed that information constitutes an important element in decision-making processes. However, information is useful only when it is processed accurately. Knowledge, which reflects acquisition of accurate information, increases both self-efficacy (e.g., Lorig, Gonzalez, Laurent, Morgan, & Laris, 1998; Samuelson & Ahlmen, 2000) and the tendency to institute health-related behaviors (e.g., Fan, 1999; Williams et al., 2002). In this light, knowledge of SARS is incorporated in this study to supplement the TRA and the TPB in predicting SARS-preventive behaviors.

### Overview of the Present Study

This study examines how people from major SARS-affected regions cope with SARS, an unknown but highly contagious and rapidly progressive disease. Two major models of health behavior change—the TRA and the TPB—are adopted to explicate people's performance of SARS-preventive behaviors.

The cross-cultural generalizability of these models is evaluated in both independent-based (i.e., Canada) and interdependent-based (i.e., China, Hong Kong, and Singapore) cultural contexts. Apart from the components originally proposed in the models, knowledge of SARS is also included as a possible factor influencing SARS-preventive behaviors. This variable is tested together with the components of the TRA and the TPB.

Because SARS is a new disease, no current measures were available to assess the model components, knowledge, and preventive behaviors related to it. A series of elicitation and pilot studies (see the Method section) was conducted to construct and validate a measure before it was used in the main study. The main study comprised two phases. In the initial phase, participants' attitude, subjective norm, PBC, knowledge, and intention to perform SARS-preventive behaviors were assessed. In the follow-up phase conducted 2 weeks later, participants' actual performance of SARS-preventive behaviors was assessed. The date of onset for each region and the assessment period of the two phases are listed in Table 2.

## Method

### *Participants*

Data were collected from four samples, each from a SARS-affected region. A SARS-affected region is defined by the WHO (2003a) as "a region at the first administrative level where the country is reporting local transmission of SARS" (p. 1). For this study, 75 adults were recruited from commercial organizations in each of the regions: (a) Guangdong, China; (b) Hong Kong; (c) Singapore; and (d) Toronto, Canada. Participants from Guangdong, Hong Kong, and Singapore were all Asians. In the Canadian sample, 72% were Caucasians, 9% were Afro-Canadians, and 19% were Asian Canadians. There were no statistically significant differences in any psychosocial variables among the three groups of Canadians. All participants took part voluntarily. Table 1 summarizes the characteristics of these four samples.

Working adults were recruited as target participants in all of the studies (i.e., elicitation, pilot, and main studies) because they inevitably meet many people coming from different areas in the work setting. Hence, working adults may be more susceptible to a SARS infection than are students (there were school closures in China, Hong Kong, and Singapore) and adults who do not work. Because some of the participants did not receive much formal education, 4-point scales were adopted in relevant items because these scales are easy to comprehend in making ratings.

Table 2

*Onset of Outbreak of Four SARS-Affected Regions and Assessment Periods of the Two-Phase Study*

Date	SARS-related event/phase of study
February 11, 2003	305 cases and 5 deaths reported in Guangdong province, China <sup>a</sup>
February 21, 2003	First case reported in Hong Kong <sup>a</sup>
March 1, 2003	First case reported in Singapore <sup>a</sup>
March 5, 2003	First case reported in Toronto, Canada <sup>a</sup>
March 30-April 18, 2003	Initial phase of study conducted in all four regions
April 13-May 10, 2003 <sup>b</sup>	Follow-up phase of study conducted in all four regions

*Note.* SARS = severe acute respiratory syndrome.<sup>a</sup>World Health Organization (2003b).<sup>b</sup>There is an overlap in the period between the two phases because some participants completed the questionnaire earlier than others. In the second phase, all the participants completed the follow-up questionnaire 2 weeks after the date on which they completed the initial one.

*Development and Validation of a Measure for Model Testing*

In this multinational study, cultural differences should be considered in the derivation of a standardized measure assessing the model components. An elicitation study was conducted in each target region to identify culturally meaningful and relevant items for the main study. The procedures involved in item development, as described by Ajzen and Fishbein (1980), were followed.

A group of working adults from each target region voluntarily completed an open-ended questionnaire to empirically identify their (a) knowledge (both correct information and myths) about SARS, (b) salient beliefs about the consequences of carrying out SARS-preventive behaviors, (c) salient referents that may influence the performance of SARS-preventive behaviors, and (d) SARS-preventive behaviors actually adopted. Within each of these categories, items with the highest frequency were compiled to form a sub-scale in the preliminary version of the questionnaire. The psychometric properties of the preliminary questionnaire were examined in pilot studies carried out in the target regions. Working adults voluntarily took part in the elicitation or pilot studies. All of the items that had adequate range and

variance and that demonstrated internal consistency within the subscale were included.

The final questionnaire used in this multinational study had two versions: one in English, and the other in Chinese. The English version of the questionnaire was given to participants from Singapore and Toronto, whose native language is English. The Chinese version was given to participants from Guangdong and Hong Kong, whose native language is Chinese. The questionnaire was first set in English, and then was back-translated (Brislin, 1986). The major purpose of the back-translation is to ensure that the items have equivalent meanings (i.e., conceptual equivalence). A translator translated the items from English into Chinese. Another translator back-translated the Chinese items into English. As recommended by Brislin, these two translators worked independently, and then discussed the translated work together with the author in a post hoc meeting. The two English versions were reviewed and compared for equivalence.

Apart from conceptual equivalence, cultural equivalence of the questionnaire also should be ensured (Varricchio, 1997). Several judges from Singapore and Toronto reviewed the English items, and judges from China and Hong Kong reviewed the Chinese items. The judges independently commented on the meaning, clarity, and choice of words for all of the items. Both the edited English and the Chinese versions of the questionnaire were then given to 30 bilingual Hong Kong and 30 bilingual Canadian participants. Half of these bilinguals were selected randomly to complete the English version first, and then the Chinese version after a 30-min break. The other half completed the Chinese version first and then the English version after the break. Scores yielded by the two versions were highly similar ( $r_s > .93$ ).

### *Measures*

*Intention to perform SARS-preventive behaviors.* Intention was measured by respondents' perceived likelihood of instituting a set of SARS-preventive behaviors. Respondents were instructed to read the following paragraph:

[The health authority of the participants' region] announced on [date of administration] that the cumulative number of probable cases of SARS has reached [cumulative probable cases of the region to that date]. Among these people, [cumulative number of deaths of the region to that date] have died from it. How likely are you in undertaking the following preventive measures?

Included in this measure were 15 SARS-preventive behaviors that were endorsed most frequently by participants in the elicitation study: (a) wear a



facemask, (b) wash hands with soap before eating, (c) wash hands after sneezing, coughing, or cleaning the nose, (d) wash clothes immediately after going out, (e) clean the house with disinfectant or a diluted bleach, (f) eat a nutritious diet, (g) exercise regularly, (h) get an adequate amount of sleep and rest, (i) watch, listen to, or read news reports, (j) avoid going out to eat, (k) avoid going shopping, (l) avoid shaking hands with people, (m) avoid meeting people who have a cough, sneeze, or have just been back from a SARS-affected region; (n) seek information/advice from healthcare workers, and (o) search for information over the Internet.

Respondents rated the extent of intention to institute each of these measures on a 4-point bipolar scale ranging from 1 (*very unlikely*) to 4 (*very likely*). An option of "will not undertake it under any circumstances" was also included. A score of 0 was given if respondents endorsed this option. Respondents were reminded to refer to this set of preventive measures when they gave ratings to subsequent items in the questionnaire.

An intention score was generated from aggregating the ratings of the 15 items. Intention scores ranged from 0 to 60. A higher intention score indicates greater perceived likelihood of performing the SARS-preventive behaviors.

*Attitude.* Following the standard procedures commonly adopted by studies on TRA and TPB (e.g., Millstein, 1996; Sutton et al., 1999), a score of attitude toward SARS-preventive behaviors was derived from multiplying the perceived outcome score by the perceived likelihood score. A higher attitude score reflects a greater tendency to evaluate the performance of SARS-preventive behaviors as having more benefits and fewer barriers, as well as a greater likelihood of the benefits to occur.

*Perceived outcome.* Perceptions of the consequences of instituting SARS-preventive behaviors comprise both perceived benefit (positive consequence) and perceived barrier (negative consequence). *Perceived benefit* was measured by three items: (a) "If I adopt the preventive measures, I will be less vulnerable to a SARS infection"; (b) "If I adopt the preventive measures, it is less likely that I will contract SARS in a public area"; and (c) "If I adopt the preventive measures, I will become less anxious about contracting SARS." *Perceived barrier* was measured by three items: (a) "If I adopt the preventive measures, they will cause inconvenience to me"; (b) "If I adopt the preventive measures, I will have to break my usual life habits"; and (c) "If I adopt the preventive measures, my daily schedule will be disrupted."

Respondents gave a rating to each item on a 4-point bipolar scale ranging from 1 (*strongly disagree*) to 4 (*strongly agree*). The perceived outcome score is computed by a summation of the perceived benefit ratings and the perceived barrier ratings (perceived barrier items were reverse scored).

Perceived outcome scores ranged from 6 to 24. The higher the perceived outcome score, the greater the tendency to perceive such outcomes as desirable. Both the pilot study and the main study reveal that this subscale had high internal consistency ( $\alpha = .86$  and  $.83$  for the pilot study and the main study, respectively).

*Perceived likelihood of outcome occurrence.* Appraisal of the likelihood of outcome occurrence refers to the same items used in assessing perceived benefits and barriers of performing SARS-preventive behaviors. Respondents rated the aforementioned six items on a 4-point bipolar scale ranging from 1 (*very unlikely*) to 4 (*very likely*). Perceived likelihood scores ranged from 6 to 24, with a higher score indicating greater perceived likelihood that such outcomes will take place. The pilot and main studies show that this subscale was reliable ( $\alpha = .89$  and  $.84$  for the pilot and the main study, respectively).

*Subjective norm.* Similar to the calculation of the attitude score, a subjective norm score was generated from multiplying the normative belief score by the motivation to comply score. A higher subjective norm score indicates the perception of greater social pressure to perform SARS-preventive behaviors.

*Normative belief.* The views of other people regarding the performance of SARS-preventive behaviors were operationalized by four items. The same item (i.e., "My [XXX] think(s) that I should undertake the preventive measures") was asked in regard to family members, close friend/dating partner, friends, and coworkers. Participants in the elicitation study mentioned these four referent groups most frequently when they were asked to identify people who are important in their lives.

Respondents rated the items on a 4-point bipolar scale ranging from 1 (*strongly disagree*) to 4 (*strongly agree*). Normative belief scores ranged from 4 to 16, with higher scores indicating a greater tendency for other people to support the performance of SARS-preventive behaviors. This subscale was found to exhibit high internal consistency ( $\alpha = .93$  and  $.91$  for the pilot and the main study, respectively).

*Motivation to comply.* Motivation to comply with each referent group was measured by four items. The same item (i.e., "I am motivated to adopt the health actions according to what my [XXX] think/thinks") was asked with reference to family members, close friend/dating partner, friends, and coworkers.

Respondents gave ratings to the items on a 4-point bipolar scale ranging from 1 (*strongly disagree*) to 4 (*strongly agree*). Motivation to comply scores ranged from 4 to 16. A higher score reflects greater motivation to comply with one's referent groups regarding the performance of SARS-preventive behaviors. The reliability of this subscale was good ( $\alpha = .95$  and  $.91$  for the pilot and the main study, respectively).

*Perceived behavioral control.* Perceptions of the extent of control one had over the performance of SARS-preventive behaviors were measured by three items: (a) "I can adopt the preventive measures if I want to"; (b) "I am confident that I have the ability to perform the preventive behaviors"; and (c) "It is difficult for me to carry out the preventive measures" (reverse scored). Respondents rated each of the items on a 4-point bipolar scale ranging from 1 (*strongly disagree*) to 4 (*strongly agree*). PBC scores ranged from 3 to 12. A higher score indicates a greater level of PBC. This subscale displayed high internal consistency ( $\alpha = .85$  and  $.88$  for the pilot and the main study, respectively).

*Knowledge of SARS.* Eight items were derived to assess knowledge about SARS. Three of them are correct statements about SARS ("Fever is a major symptom of SARS"; "A vaccine is not yet available for preventing SARS"; and "The incubation period of SARS can be 14 days"). The other five are incorrect statements about SARS ("Transmission of SARS is mainly by air/airborne transmission"; "SARS is caused by a kind of bacteria called *streptococcus*"; "SARS can be transmitted through handling dollar notes [bills] and coins"; "Children are most vulnerable to SARS"; and "SARS cannot be treated by any drugs").

Participants chose one of three options (*True*, *False*, or *Don't know*) for each of the items. In calculating the knowledge score, a score of 1 was given to a correct answer, while a 0 indicated an incorrect or a *Don't know* answer. The itemscores were aggregated to form a composite knowledge score, which ranged from 0 to 8. A higher score indicates more accurate knowledge about SARS.

*Actual performance of SARS-preventive behaviors.* The same 15 items as were used in the measurement of behavioral intention were used to assess actual performance of SARS-preventive behaviors. Respondents rated the frequency of instituting each behavior for the past week on a 5-point scale ranging from 0 (*never*) to 2 (*3 to 4 days*) to 4 (*every day*). A composite score was created by summing the ratings for all of the items. The actual performance scores ranged from 0 to 60. A higher score indicates the performance of a greater number and frequency of SARS-preventive behaviors.

*Time lapse between onset of outbreak and assessment period.* Because the date of onset of the SARS outbreak for the four regions and the date of questionnaire administration were different for each participant, the time lapse between the onset of the outbreak and the assessment date was calculated for each participant. For instance, SARS was first reported in Singapore on March 1, 2003 (World Health Organization, 2003b). The time lapse for a Singaporean participant who completed the questionnaire on April 1, 2003, is 32 days.

### *Procedure*

A description of the study was posted in some organizations, and interested individuals were invited to participate. In the initial phase of the study, participants completed a questionnaire at the site at which they were recruited. All participants had to provide informed consent before the study began.

In the follow-up phase 2 weeks later, the scale assessing actual performance of SARS-preventive behaviors was sent to participants via e-mail or fax. Upon completion of the tasks, a debriefing note was sent or faxed to the participants. Response rates of the follow-up phase ranged from 79% to 87% for the four regions. The protocol of this study obtained approval from the Human Subject Research Panel of the Hong Kong University of Science and Technology.

### *Statistical Analyses*

MANOVA was performed to examine between-participant effects of group (i.e., SARS-affected region), sex, age group, and marital status on elements of the TRA and TPB (attitude, subjective norm, PBC), knowledge of SARS, intention to perform SARS-preventive behaviors, and actual performance of SARS-preventive behaviors. If any of the main or interaction effects were found to be statistically significant, post hoc Bonferroni tests were conducted to identify the source of differences in the statistically significant effect.

Hierarchical multiple regression analysis was then performed to test the efficacy of the TRA and TPB in explaining intention to perform SARS-preventive behaviors and actual behaviors. A direct comparison between these theories is feasible because the TRA is nested within the TPB. In the final section, paired-sample *t* tests were performed to examine the strength of the relationship between behavioral intention and actual performance of SARS-preventive behaviors.

## Results

This study examined the cross-cultural generalizability of the TRA and TPB in explicating the adoption of SARS-preventive behaviors among people from four affected regions. The MANOVA results reveal a statistically significant main effect of group,  $F(24, 618) = 15.45, p < .0001$ . However, all other main or interaction effects were not statistically significant,  $F_s < 1.32, ns$ . The demographic variables thus were omitted in all subsequent analyses.

Table 3 shows the descriptive statistics of the variables and summarizes the post hoc Bonferroni tests for the four groups.

### *Predictors of Intention to Perform SARS-Preventive Behaviors*

Because the MANOVA results reveal a statistically significant group difference, regression analysis was performed separately for each of the groups. The TRA variables of attitude (i.e., Perceived Outcome  $\times$  Perceived Likelihood) and subjective norm (Normative Belief  $\times$  Motivation to Comply) were derived by multiplying their respective components and then linearly partialing out each component from the product. The components were centered before they were multiplied. Hierarchical multiple regression was employed because this statistical method allows for the testing of interactions by partialing out main effects (Aiken, West, & Reno, 1991; Cohen & Cohen, 1983).

For each group, the variable of time lapse between the onset of outbreak and the assessment method was entered into the regression model in the first step to partial out its possible confounding effects. The variable of knowledge of SARS was entered next. Both attitude and subjective norm were entered in the third step. The TRA is supported if these two variables can account for a statistically significant portion of variance ( $R^2$ ) in intention to perform SARS-preventive behaviors.

In the last step, the TPB component of PBC was entered as a test of the TPB over the TRA. The TPB is supported if this additional variable can increase the  $R^2$  by a statistically significant amount (i.e., a statistically significant change in  $R^2$ ). Alternative models with the components entered in different orders at each step did not alter significantly the resultant parameter estimates. Other models including the components of attitude and subjective norm were examined also, and the pattern of results was largely similar to the present results.<sup>2</sup> Table 4 summarizes the standardized beta coefficients ( $\beta$ ),  $R^2$  of the model, and  $R^2$  change at each step for the four groups.

For the Guangdong group, knowledge of SARS contributed 8% of the explained variance,  $F(1, 72) = 6.71, p = .01$ . Of the variance in intention to

<sup>2</sup>Both attitude and subjective norm are interactive terms derived by multiplication of their respective component variables. Another set of hierarchical regression analyses including the components was conducted to examine whether the interaction terms could predict behavioral intention and actual performance over and above the effects of their components. The  $\Delta R^2$  reported in the step with the interaction terms entered was statistically significant (i.e., .03 for Guangdong; .05 for Hong Kong; .04 for Singapore; and .05 for Toronto,  $ps < .05$ ). Such results indicate that the interactive effects were statistically significant over and above the main effects of their respective components.

Table 3

*Descriptive Statistics for the Four Groups*

Variable	Guangdong, China (n = 75)		Hong Kong (n = 75)		Singapore (n = 75)		Toronto, Canada (n = 75)	
	M	SD	M	SD	M	SD	M	SD
Attitude	269.39 <sub>b</sub>	116.25	274.09 <sub>b</sub>	94.45	207.43 <sub>a</sub>	80.15	210.68 <sub>a</sub>	84.84
Perceived outcome	16.28 <sub>b</sub>	4.13	15.53 <sub>b</sub>	3.58	14.56 <sub>a</sub>	2.98	14.48 <sub>a</sub>	3.24
Perceived likelihood	16.44 <sub>b</sub>	5.20	17.48 <sub>b</sub>	3.89	14.23 <sub>a</sub>	4.42	14.43 <sub>a</sub>	4.32
Subjective norm	122.55 <sub>c</sub>	42.57	114.77 <sub>c</sub>	39.59	76.31 <sub>b</sub>	36.29	40.65 <sub>a</sub>	24.01
Normative belief	11.05 <sub>b</sub>	2.46	10.60 <sub>b</sub>	2.78	6.95 <sub>a</sub>	2.84	6.92 <sub>a</sub>	2.67
Motivation to comply	11.13 <sub>b</sub>	3.12	10.80 <sub>b</sub>	2.51	10.92 <sub>b</sub>	2.34	5.73 <sub>a</sub>	2.44
Perceived behavioral control	6.52 <sub>a</sub>	1.29	8.69 <sub>b</sub>	1.04	8.11 <sub>b</sub>	1.58	7.97 <sub>b</sub>	1.94
Knowledge of SARS	3.76 <sub>a</sub>	1.33	5.89 <sub>b</sub>	1.30	5.75 <sub>b</sub>	1.49	5.40 <sub>b</sub>	1.58
Intention	43.80 <sub>b</sub>	14.54	44.60 <sub>b</sub>	13.72	28.40 <sub>a</sub>	15.12	24.40 <sub>a</sub>	15.63
Actual performance	42.56 <sub>b</sub>	12.51	43.81 <sub>b</sub>	11.56	30.00 <sub>a</sub>	10.63	27.37 <sub>a</sub>	12.97

*Note.* SARS = severe acute respiratory syndrome. Within each row, means that do not share a common subscript differ from each other by the post hoc Bonferroni tests at  $p < .05$ .

Table 4  
 Summary of Hierarchical Regression Models Explicating Intention to Perform SARS-Preventive Behaviors

	Guangdong, China (n = 75)				Hong Kong (n = 75)				Singapore (n = 75)				Toronto, Canada (n = 75)			
	$\beta$	R <sup>2</sup>	$\Delta R^2$	$\Delta R^2$	$\beta$	R <sup>2</sup>	$\Delta R^2$	$\Delta R^2$	$\beta$	R <sup>2</sup>	$\Delta R^2$	$\Delta R^2$	$\beta$	R <sup>2</sup>	$\Delta R^2$	$\Delta R^2$
Step 1		.01	.01	.01		.01	.01	.01		.00	.00	.00		.02	.02	.02
Time lapse	-.08				-.10				-.02				-.15			
Step 2		.09*	.08*	.25***		.26***	.25***	.18***		.18***	.18***	.18***		.35***	.33***	.33***
Time lapse	-.12				-.03				-.08				-.13			
Knowledge of SARS	.29*				.51***				.43***				.57***			
Step 3		.44***	.35***	.18***		.34***	.18***	.34***		.52***	.34***	.34***		.50***	.15***	.15***
Time lapse	-.16				-.09				-.03				-.15			
Knowledge of SARS	.37***				.37***				.38***				.40***			
Attitude	.34***				.34**				.22*				.28**			
Subjective norm	.51***				.24*				.50***				.25**			
Step 4		.45***	.01	.09***		.54***	.09***	.04*		.56***	.04*	.04*		.56***	.06**	.06**
Time lapse	-.16				-.09				-.01				-.12			
Knowledge of SARS	.35***				.25**				.35***				.32***			
Attitude	.30**				.30**				.20*				.25**			
Subjective norm	.47***				.25**				.43***				.20*			
Perceived behavioral control	.12				.33***				.23*				.27**			

Note. SARS = severe acute respiratory syndrome. \*p < .05. \*\*p < .01. \*\*\*p < .001.

perform SARS-preventive behaviors, 35% could be explained by the TRA,  $F(2, 70) = 21.68, p < .0001$ . The TPB, which includes PBC, accounted for a greater amount (45%) of variance than did the TRA. However, the 1% increment in variance was not statistically significant,  $F(1, 69) = 1.59, ns$ .

For the Hong Kong group, knowledge of SARS accounted for a statistically significant portion of variance ( $DR^2 = 25\%$ ),  $F(1, 72) = 24.21, p < .0001$ . The TRA could account for 18% of the variance in intention to perform SARS-preventive behaviors,  $F(2, 70) = 11.36, p < .0001$ . The explained variance was significantly increased to 54% after the variable of PBC was added  $F(1, 69) = 13.98, p < .0001$ .

For the Singapore group, knowledge of SARS explained 18% of the variance,  $F(1, 72) = 15.54, p < .0001$ . The TRA explained 34% of the variance in intention to perform SARS-preventive behaviors,  $F(2, 70) = 24.93, p < .0001$ . The explained variance significantly increased by 4% when PBC was added to the regression equation,  $F(1, 69) = 6.78, p = .01$ .

For the Toronto group, knowledge of SARS contributed 33% of the explained variance,  $F(1, 72) = 36.39, p < .0001$ . Of the variance in intention to perform SARS-preventive behaviors, 15% could be accounted for by the TRA,  $F(2, 70) = 10.31, p < .0001$ . PBC contributed an additional 6% to the explained variance,  $F(1, 69) = 9.16, p = .003$ .

To summarize, these results indicate that both the TRA and the TPB were adequate in explaining intention to perform SARS-preventive behaviors for participants from Hong Kong, Singapore, and Toronto. In addition to attitude, subjective norm, and PBC, knowledge of SARS explained intention to perform SARS-preventive behaviors. However, only the TRA could explicate intention to perform SARS-preventive behaviors for participants from Guangdong. Knowledge of SARS, in addition to attitude and subjective norm, was a statistically significant predictor of intention to perform SARS-preventive behaviors for these participants.

### *Predictors of Actual Performance of SARS-Preventive Behaviors*

The same procedures were conducted to examine the TRA and TPB in predicting actual performance of SARS-preventive behaviors. Table 5 summarizes the results of the hierarchical regression analyses for the four groups.

For the Guangdong group, knowledge of SARS explained a statistically significant portion of variance (11%),  $F(1, 72) = 8.79, p = .004$ . The TRA explained 28% of the variance in actual performance of SARS-preventive behaviors,  $F(2, 70) = 16.31, p < .0001$ . The explained variance increased by 2% when the variable of PBC was added to the regression equation, which was not statistically significant,  $F(1, 69) = 2.89, ns$ .



Table 5  
 Summary of Hierarchical Regression Models Explicating Actual Performance of SARS-Preventive Behaviors

	Guangdong, China (n = 75)				Hong Kong (n = 75)				Singapore (n = 75)				Toronto, Canada (n = 75)			
	$\beta$	R <sup>2</sup>	$\Delta R^2$	$\beta$	R <sup>2</sup>	$\Delta R^2$	$\beta$	R <sup>2</sup>	$\Delta R^2$	$\beta$	R <sup>2</sup>	$\Delta R^2$	$\beta$	R <sup>2</sup>	$\Delta R^2$	
Step 1		.02	.02		.01	.01		.01	.01		.01	.01		.03	.03	
Time lapse	-.12			-.08			-.10						-.17			
Step 2		.12*	.11**		.24***	.23***		.10*	.09*					.22***	.19***	
Time lapse	-.17			-.01			-.03						-.16			
Knowledge of SARS	.33**			.49***			.30*						.44***			
Step 3		.40***	.28***		.40***	.16***		.40***	.30***					.38***	.16***	
Time lapse	-.11			-.07			-.07						-.17			
Knowledge of SARS	.41***			.37***			.15						.28*			
Attitude	.25*			.28**			.28**						.23*			
Subjective norm	.49***			.26*			.50***						.30**			
Step 4		.43***	.02		.48***	.08**		.44***	.04*					.42***	.04*	
Time lapse	-.09			-.07			-.11						-.16			
Knowledge of SARS	.39***			.26*			.14						.21*			
Attitude	.20*			.25**			.24*						.21*			
Subjective norm	.44***			.27**			.43***						.26*			
Perceived behavioral control	.17			.31**			.22*						.21*			

Note. SARS = severe acute respiratory syndrome. \*p < .05. \*\*p < .01. \*\*\*p < .001.

For the Hong Kong group, knowledge of SARS accounted for 23% of the variance,  $F(1, 72) = 22.67, p < .0001$ . Of the variance in actual performance of SARS-preventive behaviors, 16% could be accounted for by the TRA,  $F(2, 70) = 9.03, p < .0001$ . PBC significantly increased explained variance by 8%,  $F(1, 69) = 10.65, p = .002$ .

For the Singapore group, knowledge of SARS accounted for 9% of the variance, but such an increment was not statistically significant,  $F(1, 72) = 6.94, p = .01$ . The TRA accounted for 30% of the variance in actual performance of SARS-preventive behaviors,  $F(2, 70) = 17.69, p < .0001$ . The explained variance was significantly increased to 44% after the variable of PBC was added,  $F(1, 69) = 5.05, p = .03$ .

For the Toronto group, knowledge of SARS contributed 19% of the explained variance,  $F(1, 72) = 17.96, p < .0001$ . Of the variance in actual performance of SARS-preventive behaviors, 16% could be explained by the TRA,  $F(2, 70) = 8.95, p < .0001$ . The inclusion of PBC significantly increased variance by 4%,  $F(1, 69) = 4.35, p = .04$ .

These results indicate that both the TRA and the TPB predicted actual performance of SARS-preventive behaviors for participants from Hong Kong, Singapore, and Toronto. Apart from the components of these two models, knowledge of SARS can also predict actual performance of SARS-preventive behaviors for these participants. Again, only the TRA was adequate in predicting actual performance of SARS-preventive behaviors for participants from Guangdong. Knowledge of SARS was a statistically significant predictor, in addition to attitude and subjective norm for this group of participants.

#### *Relationship Between Intended and Actual Adoption of SARS-Preventive Behaviors*

The pattern of results regarding actual performance of SARS-preventive behaviors was similar to the results regarding intention to perform SARS-preventive behaviors. Results from the paired-sample  $t$  test reveal that participants' behavioral intention did not differ significantly from their actual performance,  $t(299) = -1.17, ns$ . Moreover, the paired-sample correlation between behavioral intention and actual performance was .84 ( $p < .0001$ ). Such results indicate that participants' intentions to perform SARS-preventive behaviors were largely consistent with their actual behaviors 2 weeks later.

### Discussion

The present study examined the efficacy of the TRA and the TPB in explaining and predicting SARS-preventive behaviors in four major SARS-

affected regions. The results provide support for the TRA in all four SARS-affected regions, suggesting a universal trend of both attitudinal and normative influences on people's performance of SARS-preventive behaviors. The TPB was valid in explicating SARS-preventive behaviors for all of the groups except China. The influential role of PBC was confined to the adoption of SARS-preventive behaviors for people from Hong Kong, Singapore, and Canada.

In studies involving both independent- and interdependent-based cultures, the individualistic versus collectivistic perspective has been adopted frequently to explain behaviors of people from different countries. From a cultural perspective, people from China, Hong Kong, and Singapore should be more similar because their behaviors are more "group minded" than are the behaviors of those from the West (Ekblad, 1996; Triandis, 1994). When the behaviors of people from these regions were examined within the same study, however, subcultural differences were not found.

The influential role of PBC was found among people from Hong Kong and Singapore, but not among people from China. Compared to people from Singapore, people from Hong Kong should be more similar to those from China in terms of ethnicity and geographical proximity. Also, the number of probable cases of SARS for Hong Kong and China was far greater than that of Singapore (Table 1). Although similar levels of intention and actual performance of SARS-preventive behaviors were found between people from Hong Kong and their counterparts from China, the psychological mechanisms underlying the performance of these behaviors were different. It is possible that the political and economic systems of Hong Kong and Singapore are distinct from those of China. These results suggest that subcultural influences can be stronger than cultural influences per se, at least in the context of coping with SARS.

#### *Role of Subjective Norms in Behavioral Predictions*

Apart from subcultural differences, this study yielded two major findings that also warrant discussion. One major finding is related to the TRA component of subjective norm. A myriad of studies (e.g., Fishbein et al., 1995; Sparks, Shepherd, & Frewer, 1995; Sutton et al., 1999; Trafimow, 1994) have revealed that the predictive power of attitude is greater than that of subjective norm (for a review, see Godin & Kok, 1996). Meta-analytical studies (Armitage & Conner, 2001; Sheppard, Hartwick, & Warshaw, 1988) also have revealed that subjective norm is a weak component for predicting behavioral intention. Contrary to these findings, the present study revealed that subjective norm is an important predictor of SARS-preventive behaviors among people from four major SARS-affected regions.

A possible explanation for this inconsistency lies in the characteristics of the target behaviors under inquiry. It is possible that attitude and subjective norm are both important determinants of behaviors, but the relative importance attached to each TRA component varies as the target behavior changes. The study by Trafimow and Finlay (1996) provided some evidence for this proposition. They examined the relative importance of attitude and subjective norm in 30 target behaviors. Attitude exerted a greater influence on some of the behaviors (e.g., eat vegetables regularly, keep my room clean), whereas subjective norm exerted a greater influence on other behaviors (e.g., pick an occupation my parents will approve of, go into debt on my credit card). The number of behaviors under normative control is far smaller than that of behaviors under attitudinal control, which may explain in part why attitude generally is found to exert a stronger influence on behavioral intention than is subjective norm. In light of these findings, the present results imply that the influence of subjective norm may be particularly strong for SARS-preventive behaviors.

Another possible explanation lies in the psychological meaning of SARS for people from major SARS-affected regions. The number of countries with reported probable cases of SARS has escalated since its outbreak in February 2003. There are many obscurities surrounding this disease, including its causal agents, mode of transmission, and treatment methods. This unknown global epidemic has perplexed governments, healthcare professionals, and the general public around the world (Cheng & Tang, 2004). In social psychology, classical (Asch, 1955; Sherif, 1936) and contemporary (e.g., Corson & Quistebert, 2000; Levine, Higgins, & Choi, 2000) experiments have documented that social norms govern individuals' behavior in ambiguous situations. The influence of social norms is a function of the extent of ambiguity in situations. Consistent with these findings, people from different cultures similarly may turn to social others as references on how to cope with this disease, which has been perceived unanimously as an unknown by people worldwide.

The present study may have contributed to extend the literatures on TRA and on social norms. In studies on TRA, subjective norm generally is considered less efficacious than attitude in predicting behavioral intention. This study suggests that subjective norm can be influential when the context or behavior under inquiry is ambiguous. Contextual or behavioral ambiguity can moderate the weight of subjective norm in behavioral predictions. In studies on social norms, the phenomenon of normative influence in ambiguous situations has been demonstrated in experimental settings only. This study suggests that this phenomenon also exists in a real-life setting, thus providing ecological validity for the link between normative influence and situational ambiguity.

*Role of Perceived Behavioral Control and Knowledge in Behavioral Predictions*

Another finding is related to the TPB component of PBC. Despite the universality of the TRA, the TPB was supported only among people from Hong Kong, Singapore, and Canada, but not among people from China. This finding seems to parallel the results from meta-analyses (Albarracín, Johnson, Fishbein, & Muellerleile, 2001; Sheeran & Taylor, 1999), which have provided extensive support for the TRA, but only partial support for the TPB. Ajzen (1991) maintained that the more accurate or realistic the perception of behavioral control, the more effective this variable was in predicting behavior. The accuracy of PBC is constrained by two factors: amount of information about a behavior, and availability of resources (Ajzen, 1991). Knowledge also can be considered a resource. Taken together, the predictive power of PBC can be attenuated as a result of lack of information and knowledge about a behavior.

In light of Ajzen's (1991) propositions, it is possible that the practice of preventive measures by people from China may be limited by informational resources available to them. This study showed that people from China have lower levels of knowledge about SARS than do people from Hong Kong, Singapore, and Canada. Their lower knowledge level may be attributable to the limited amount of information available to them. In April 2003, experts from the WHO noted the underreporting of SARS cases of China (Benitez, 2003). Between its outbreak in November 2002 and the cover-up disclosure in April 2003, the media in China were ignoring the SARS epidemic (Benitez, 2003). By contrast, the SARS outbreak was featured extensively as the lead item in Hong Kong, Singapore, and Canada since its outbreak in February and March 2003.

Information about SARS has been disseminated extensively through the mass media and through health-authority Web sites. People from these three regions have been exposed to abundant information that may increase their knowledge about SARS. The impact of TPB—or, more specifically, PBC—thus may play a more influential role in predicting behaviors of people from regions with richer informational resources.

*Practical Implications*

The present study highlights the importance of subjective norm and knowledge of SARS in the performance of SARS-preventive behaviors. These findings may have practical implications. Although the WHO has cleared the list of SARS-affected regions and lifted all travel warnings by July 5, 2003, there is no evidence that SARS will be eliminated. The WHO

(2003b) forewarned possible outbreaks of SARS and avian influenza in future influenza seasons (Fleck, 2003; Larkin, 2005).

The present findings have implications for healthcare workers and policymakers to handle possible future incidents of the SARS, avian influenza A (HSN1), or other novel, unknown viruses. Because the present results have revealed a positive link between knowledge about an unknown disease and the performance of preventive behaviors, motivation to perform preventive behaviors may be greater if the general public's level of knowledge about the disease is increased. Public seminars about the disease and preventive measures may be organized by government and community organizations to enhance knowledge. The underlying goal of these seminars is to change participants' attitudes and behaviors in adopting the recommended measures.

Although seminars are generally useful for enhancing public knowledge, the ultimate goal of attitudinal and behavioral change in real life is largely unknown. This study demonstrated that although knowledge is important for performing SARS-preventive behaviors, social norm is also an important factor. Even if individuals have gained knowledge about the preventive measures, they are less likely to carry out the measures when their significant others do not share their concerns and support their actions. In this light, the basis of such seminars should be expanded from an individual level to a social level. Specifically, participants should be encouraged to bring significant others to the seminar. Moreover, special-topic seminars may be more effective when all or most members of a reference group are involved. The effectiveness of these activities will be enhanced if members of a referent group share the same knowledge and attitude on the recommended preventive measures.

In conclusion, the SARS outbreak has alerted the world that public health is no longer a local issue, but can also be a global issue. In today's world of globalization, not only people and information, but also viruses can flow freely across borders. The treatment and prevention of novel, unknown diseases requires the joint efforts of governments and healthcare professionals from different countries. Multinational studies are instructive in providing information on the similarities and differences in disease prevention among people from different affected regions.

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