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The 'Typhoon Eye Effect': determinants of distress during the SARS epidemic

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This study examined the effect of the SARS crisis on the level of distress in people both in and around epidemic areas of China during the time of the crisis. We designed a questionnaire to measure personality factors, beliefs regarding SARS, behavioral responses to SARS, and distress levels. The level of exposure to SARS was not a primary determinant of experienced anxiety; indeed, nearness to the center of the epidemic was negatively related to anxiety levels. Instead, more subjective interpretations of the situation were the primary determinants of distress. We propose a 'Typhoon Eye Effect' metaphor to describe the spread of psychological distress.

Keywords: SARS crisis; risk perception; distress; anxiety

1. Research background

Perhaps no one could have predicted accurately how the public would react when the SARS virus first appeared. SARS caused psychological panic among the public (*Shanghai Star* 2003, 8 May; Wu et al. 2009), which spread across China at the same rapid speed as the virus did. In Beijing, for example, most working units were at a standstill, schools stopped classes, the public rushed to scare buying, college students returned from campus, and many people delayed treatment of their other diseases because they didn't dare go to hospitals. Although tragic in many ways, this occurrence of SARS provided a unique opportunity to witness the public's response to such a huge event.

The SARS crisis left us many questions that deserve our deliberate speculations. From the finding of the first case (16 December 2002) to bringing it under complete control (20 June 2003), there were altogether 8461 confirmed cases of SARS worldwide, with 804 people dead, among which there were 2521 confirmed cases in Beijing, with 191 people dead (*ChinaNews* 2003, 21 June). However, during only the period from January to April 2003, there were 221,914 cases of roadway accidents in China, with 32,387 people dead. Beijing accounted for 6409 of these cases, with 464 people dead (*ChinaNews* 2003, 9 June). The statistics above clearly demonstrate that – from an objective standpoint – the risk of driving far exceeded the risk of SARS. Yet, the level of panic that accompanied SARS was much greater than that associated with driving.

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Hence, people's responses to these events appear to be due to much more than the probability of occurrence or of fatal consequences (see, e.g., Sjöberg 2000; Slovic 1987).

The goal of this research was twofold. The first was to determine the extent to which people's experienced anxiety was due to objective characteristics of the situation, in particular, to exposure to SARS. From a rational perspective, it would be expected that as people become closer to the 'center' of the epidemic that their perceived chances of contracting SARS would increase, which would in turn increase their anxiety levels. However, the above example suggests that the situation is not this simple, that the relationship between the objective characteristics of the situation and anxiety may be small or non-existent. Second, to the extent that these objective characteristics of the situation were not the primary determinants of anxiety and other elements of distress, what were the main determinants of the public's response? To answer these questions, we conducted a survey in both infected and uninfected areas of China during 1–8 May 2003, when the crisis was at a peak.

1.1. Determinants of the public response to SARS

For those living in China at the time, it was obvious that the public was highly affected by the SARS outbreak. This distress took many forms, but two of the most noticeable were a strong sense of anxiety (Leung et al. 2003) and imitative behavior (Syed et al. 2003).

Not surprisingly, anxiety is a measure of distress that has been associated with a large number of traumatic events (see, e.g., Alvarez and Hunt 2005; Marshall et al. 2007). As an event such as SARS progresses, the public becomes progressively more and more aware of the unfolding event. This awareness can be due either to direct exposure or to indirect exposure, such as the media. Further, these indirect exposures can affect anxiety levels as much or more than do actual exposure levels (Griffin, Dunwoody, and Zabala 1998; Schlenger et al. 2002). Thus, it is important to understand the various factors that contribute to a heightened state of anxiety within a society.

A second indication of distress is the existence of imitative behavior on the part of the society. For example, Syed et al. (2003) suggested that decisions to wear masks in Thailand in response to the SARS crisis were due less to official guidance and more to conformity. This behavior can be considered similar to the chameleon effect (Chartrand and Bargh 1999), whereby people unconsciously mimic the mannerisms and other behaviors of those in one's environment. Although this type of imitation behavior appears to occur generally, it may be particularly prevalent in Chinese culture, as East Asian cognition has been shown to be more holistic and field dependent than Western culture (Ji, Peng, and Nisbett 2000). As field dependence has been tied to imitation behavior (van Baaren et al. 2004), these findings suggest that imitative behavior would be a particularly important factor in China during the SARS crisis.

In sum, anxiety and imitative behavior were evident to some extent throughout Chinese society. Nonetheless, there were of course differences in the extent to which each individual manifested them. The goal of this project is to further our understanding of why some people exhibited these characteristics to a greater extent than others.

1.1.1. Exposure to SARS

An obvious candidate for why some people would be more anxious than others is the extent to which they are surrounded by SARS cases in their daily lives. For example,

those people living in epidemic areas were confronted with the SARS virus in virtually all aspects of their lives. Thus, it seems plausible that they would live in a heightened state of anxiety, constantly ruminating on the possibility of becoming the next SARS victim. This result would be in keeping with what Marshall et al. (2007) refer to as the traditional 'bull's eye' model of disaster, where distress is stronger the closer one is to the center of the disaster. In support of this possibility, Wu et al. (2009) found that exposure to the SARS outbreak at work, being quarantined, and having a relative or friend contract SARS were positively associated with posttraumatic stress symptoms in 2006, three years after the crisis ended. Similarly, Fischhoff et al. (2003) found that closeness to the World Trade Center was predictive of future terror-related risk judgments, although this relationship only held for certain sub-groups. Note that this proximity effect could be due either to a cognitive mechanism (e.g., via the availability heuristic people perceive the risk to be greater when exposed to more cases; see Fischhoff et al. 2005; Lichtenstein et al. 1978) or to a shared emotional response (such as worry not due to cognitive considerations; see Fischhoff et al. 2004).

Conversely, however, there are at least two reasons to think that there would not be a positive relationship between exposure to SARS and anxiety. First, the SARS outbreak had a major influence throughout China, and even those people who were not directly affected by it were exposed to SARS via more indirect channels (e.g., the news media). In a study examining reactions to terrorism in Israel, Bleich, Gelkopf, and Solomon found that the level of exposure (operationalized as actual exposure to terrorist attacks, and as being vulnerable to terrorist attacks due to objective characteristics such as living in an urban vs. a rural place) was not related to posttraumatic stress disorder or to other measures of distress. They hypothesized that this lack of relationship was due to 'the pervasive traumatic reality in Israel' (2003, 619), which was spread in part by media coverage. This role of the media has been documented in a number of different studies (see Marshall et al. 2007); for example, in their study of reactions to the 9/11 terrorist attacks, Schlenger et al. (2002) found that, of the factors they studied (including direct exposure to the attacks), number of hours of television watched in the days after 9/11 was the only significant predictor of general distress.

Second, research suggests that under some circumstances people who have been exposed to a risky event view the associated risk as lower than do people who have not been exposed to the risk. For example, Halpern-Felsher et al. (2001) found that individuals who have experienced a natural hazard perceive the associated risk as less than do people who have not been exposed to the hazard. Similar results were found in a study by Maderthaner et al. (1978) who found that participants living very near a nuclear reactor rated the risk of living near a nuclear reactor as less than did participants living an intermediate distance away. To the extent these results generalize to the SARS epidemic, then living in the direct presence of SARS might serve to reduce the experienced anxiety, rather than increase it.

1.1.2. Determinants of state anxiety and imitative behavior

Regardless of the precise effects of exposure level, it seems clear that the level of distress is determined by more than just exposure level (Marshall et al. 2007). One's personality (e.g., Sjöberg 2000) as well as beliefs regarding the risky event (e.g., Slovic 1987) should both affect the amount of distress one feels. Moreover, the precise way that people react to the risk should also influence their eventual distress levels. Although we made no effort to measure these elements in a comprehensive manner,

we attempted to include aspects of each of these dimensions that we expected would contribute to the level of distress experienced. We will discuss each of these in turn.

1.1.2.1. Personality attributes. Of course, one's distress levels are based in part on one's personality. The idea is that some people just respond more strongly to negative events than do others (Sjöberg 2000). Those who are particularly sensitive to negative events will thus experience more distress regarding them, independent of any other factors.

For this study, we investigated the extent to which our respondents generally displayed an optimistic or pessimistic tendency. Both of these attributes have been associated with distress in other situations (e.g., David, Montgomery, and Bovbjerg 2006; Schou et al. 2004), so they seemed a good choice for investigation here.

1.1.2.2. Beliefs regarding SARS. Although one's distress level is determined in part by one's personality, the risky event itself also obviously has an impact. As evident in research on risk perception, however, what is relevant is not the event itself but instead the beliefs surrounding the event. A number of theoretical models or frameworks have been devised to help explain how risk information is processed, risk perceptions are formed, and eventual decisions are made (Covello et al. 2001). Of particular relevance to the present discussion is the psychometric paradigm.

The basic goal of the psychometric paradigm (e.g., Fischhoff et al. 1978; Slovic 1987; Slovic, Fischhoff, and Lichtenstein 1985) is to uncover the elements of a hazard or event that leads people to view it as risky. For example, Slovic, Fischhoff, and Lichtenstein (1985, Study 1) asked their participants to rate a number of risk characteristics (e.g., the extent to which exposure to the risk is voluntary) as well as to provide overall risk ratings. Via factor analysis, they found that the risk characteristics could be well described by two dimensions, dread risk (the extent to which the risk is dreaded) and unknown risk (the extent to which the risk is unknown). Other research (e.g., Slovic, Fischhoff, and Lichtenstein 1985, Studies 2 and 3) suggested that a third dimension related to the number of people exposed to the risk is important as well.

In addition to one's risk perceptions, an additional factor that may be related to experienced distress is perceived knowledge. For example, Neuwirth, Dunwoody, and Griffin (2000) suggested that people are particularly concerned with determining how a threat influences their particular situation. If people fail to obtain this information, it seems reasonable to expect that they will be anxious and experience other types of distress. In support of this hypothesis, Baron, Hershey, and Kunreuther (2000) found that perceived lack of knowledge was one factor that was related to whether their respondents worried about a particular risk.

For this study, we thus asked a number of questions regarding respondents' perceived knowledge as well as their perceptions regarding SARS. We attempted to include a broad range of questions in order to see what factor structure would emerge regarding their risk perceptions.

1.1.2.3. Behavioral responses. In many cases, personality attributes and perceptions directly influence experienced distress, but in other cases the effects are less direct. That is, personality and risk perceptions may influence the behaviors one exhibits in response to SARS, which in turn influence distress. For example, the belief that SARS has a high perceived impact may directly cause distress. At the same time, however,

this belief may lead to disturbance in one's life, and those life changes may increase one's distress levels.

Thus, we measured a number of potential reactions in response to SARS that we thought would be predictive of eventual distress level. All of these responses were ones that appeared, informally to the first author, to be reactions to the SARS epidemic. In particular, SARS appeared to cause disturbances in terms of how people went about their daily lives, a tendency to rely on one's family, as well as a willingness to participate in volunteer activities. We asked questions regarding each of these behaviors to determine the extent to which these did result from respondents' personality attributes and beliefs regarding SARS, and whether they were predictive of eventual distress levels.

1.2. The present research

SARS was a traumatic event that produced a great deal of suffering throughout China as well as in other countries. Nonetheless, the crisis provided a unique opportunity to explore the relationships among personality attributes, beliefs, behaviors, and resultant distress levels. To do this, we surveyed a number of Chinese residents both at the center of the infected areas as well as outside them. We then examined the relationships among the measured variables to determine the primary factors that were responsible for experienced distress levels.

2. Method

2.1. Participants

We collected data via questionnaires distributed on the Internet (n = 142), via emails to acquaintances (n = 30), and through data collected in person at various universities (n = 475), for a total of 647 participants. All data were collected from 1 May to 8 May 2003. There were 419 males and 225 females (three participants are missing gender information), and the average age was 23.78 years.

To provide as broad a range of data as possible, we collected data in both infected areas (quarantined and unquarantined) and in uninfected areas. The data from the infected quarantined areas (n = 30) were collected from Beijing Jiaotong University and the University of Central Finance and Economics, both in Beijing. The data from the infected unquarantined areas (n = 307) were from other areas of Beijing and other non-quarantined but infected areas (e.g., Guangdong and Shanxi). The data from the uninfected areas (n = 304; we have missing area information from six respondents) came from 19 different provinces, including Chongqing, Tianjin, Hunan, etc.

2.2. Materials

Our survey consisted of a combination of existing scales and questionnaires designed for this study. Broadly, the measures fall into five categories: demographic information, personality attributes, beliefs regarding SARS, behavioral responses to SARS, and distress measures. Since we asked a number of questions in each of the categories, and since these categories often included constructs that were multi-dimensional, we conducted factor analyses to determine the structure of the constructs when appropriate. Specifically, we randomly selected 30% of the data and applied exploratory structural

analysis, and then ran confirmatory structural analysis and structural equation modeling on the remaining 70% of the data. We report the results of the factor analyses in this section since it is relevant to the construction of the materials, and discuss the results of the structural equation modeling in the results section.

2.2.1. Demographic information

We asked questions about the date of filling out the form, gender, age, education, occupation, and the location of working units. In addition, we asked about participants' exposure to SARS. Specifically, these questions were: 'Have any SARS patients been found around you?' and 'Have any suspicious cases been found around you?' Participants answered 'yes' or 'no' to both items.

2.2.2. Personality attributes

We measured participants' optimism and pessimism tendencies via the 'Sensation Inventory' (Scheier, Carver, and Bridges 1994). The questionnaire is made up of 12 items, for example, 'I always look on the bright side of things' and 'I seldom expect everything will go smoothly in my future.' Previous research with this scale in China has found a stable structure with two factors, which were labeled 'optimistic tendency' and 'pessimism tendency' (Xie 2003). In keeping with this result, after the deduction of three poorly loaded items, confirmatory factor analysis also revealed these two dimensions (CMIN/DF = 3.83; GFI = 0.94; AGFI = 0.89; CFI = 0.89; RMSEA = 0.09(0.068–0.104)).

2.2.3. Beliefs regarding SARS

We constructed two questionnaires to measure participants' perceived knowledge about and perceptions regarding SARS.

The first questionnaire asked six items regarding participants' perceived knowledge regarding SARS, including questions on its current condition, recent scientific development, etc. Example questions are 'I know very well the symptoms of SARS' and 'I know very well the current situation regarding SARS.' Participants rated how each of these statements described themselves on a seven-point scale, with '1 = totally disagree, 4 = not sure, 7 = totally agree.' An exploratory factor analysis showed that one factor could be extracted from the six items (53.2% of total variance explained, loadings greater than .30 on each item), and this result was confirmed via confirmatory factor analysis (CMIN/DF = 6.94; GFI = 0.95; AGFI = 0.88; CFI = 0.92; RMSEA = 0.13(0.096–0.155)).

The second questionnaire asked 11 questions about participants' perceptions regarding SARS. Questions covered a broad range of issues, including participants' perceptions regarding the impact of SARS on themselves and society, participants' perceptions regarding their chances of contracting SARS, and beliefs about how much control they have over whether they are infected. All questions were answered on a seven-point scale, anchored at each end of the potential belief. For example, the question asking about whether SARS was controllable was anchored at 1 = totally controllable and 7 = totally uncontrollable. On the basis of exploratory factor analysis, we constructed three factors, which we called perceived impact, perceived likelihood, and perceived control. After the deduction of two double-loaded items, this factor structure

explained 56.5% of the total variance, with loadings greater than .30 on each item, and this structure was confirmed via confirmatory factor analysis (CMIN/DF = 3.83; GFI = 0.95; AGFI = 0.91; CFI = 0.86; RMSEA = 0.09(0.068–0.105)).

It is worth noting that, although generally consistent with previous work on the psychometric paradigm (e.g., Fischhoff et al. 1978; Slovic 1987; Slovic, Fischhoff, and Lichtenstein 1985), there were some important differences in the results of our factor analysis as well. 'Perceived impact' is most similar to *dread risk*, except that it also includes a question regarding whether the risk is immediate or postponed, an item that is generally associated with *unknown risk*. Further, 'perceived control,' which is typically associated with *dread risk* although sometimes with *unknown risk* as well (Slovic, Fischhoff, and Lichtenstein 1985), formed its own factor in our study. Our final factor, 'perceived likelihood,' is very similar to *societal and personal exposure*. The difference in results is most readily attributable to the difference in the goal of our research. Whereas work in the psychometric paradigm has examined a range of hazards on a number of dimensions, we were only interested in reactions to SARS. Thus, our factor analysis used as the unit of analysis individuals, rather than hazards; as a result, a factor consisted of dimensions that individuals judged similarly, rather than dimensions that grouped together in multiple hazards. Further, because we were interested in SARS per se, the dimensions we asked about were not identical to those used in previous studies, because not all of the dimensions were particularly meaningful in this study.

2.2.4. Behavioral responses

We asked a number of questions designed to access participants' reactions to SARS. In particular, we measured the amount of disturbance in participants' lives, dependence on family, and willingness to participate in voluntary activities to help combat SARS.

Perceived disturbance was measured by a self-made questionnaire asking participants about how SARS has affected them. Sample items include 'I can't concentrate on study and work,' and 'I'm more cautious of contacting others, for it will increase the probability of getting infected.' The questionnaire consisted of eight items, which respondents answered on a seven-point scale indicating how well each of the statements described themselves. An exploratory factor analysis generated two factors, which we labeled disturbance in work and study and SARS-related vigilance (59.5% of total variance explained, loadings greater than .30 on each item), which was confirmed via confirmatory factor analysis (CMIN/DF = 3.64; GFI = 0.96; AGFI = 0.92; CFI = 0.95; RMSEA = 0.08(0.062–0.104)).

Family dependence was measured by two items indicating the extent to which participants felt dependent on their family during SARS. Specifically, participants indicated the extent to which each of the following statements described themselves on a seven-point scale: 'During such a period, only home is safe, so I miss home very much,' and 'During such a period, my parents hope I could be back home.' Since there were only two items, we averaged the responses to these two questions.

Willingness to participate in voluntary activities was measured by three items indicating the extent to which participants were willing to help out against SARS. Specifically, participants indicated the extent to which each of the following statements described themselves on a seven-point scale: 'I'm willing to work with the government,' 'I'm willing to help out on voluntary jobs,' and 'I'm willing to help

comfort people who are in fear.' An exploratory factor analysis indicated that one factor could be extracted from the three items (64.5% of total variance explained, loadings greater than .30 on each item). We did not conduct a confirmatory factor analysis due to the small number of items.

2.2.5. Distress measures

For reasons discussed previously, our primary outcome measures were anxiety felt in the moment and imitative behavior regarding SARS.

Anxiety was measured via the state portion of the Chinese version of the STAI-Form Y (Speilberger 1983). The scale consists of 20 statements and requires the participant to rate on a four-point scale the extent to which the statement applies to them. The reliability and validity of the Chinese version of the STAI was demonstrated by Zheng, Shu, and Zhang (1993). Since the structure of this scale has been demonstrated in much previous research, we only conducted a confirmatory factor analysis on this questionnaire. After eliminating the effect of positive and negative items, the confirmatory factor analysis validated this scale as a single-factor construct (CMIN/DF = 2.65; GFI = 0.91; AGFI = 0.87; CFI = 0.93; RMSEA = 0.07(0.058–0.073)).

Participants' imitative behavior regarding SARS was measured by a self-made questionnaire including four items asking about the extent to which their SARS-related behaviors were determined by what those around them were doing. Sample items include 'People around me are taking medicine against SARS, so am I,' and 'I put aside some food, for people around me are, too.' The items were answered on a seven-point scale indicating how well each of the statements described themselves. An exploratory factor analysis showed that one factor could be extracted from the four items (51.8% of total variance explained, loadings greater than .30 on each item), and this result was confirmed via confirmatory factor analysis (CMIN/DF = 5.90; GFI = 0.99; AGFI = 0.93; CFI = 0.96; RMSEA = 0.11(0.057–0.179)).

3. Results

Our analyses had two primary goals. First, we examined the extent to which objective characteristics of the situation (whether there were confirmed or suspicious cases of SARS around and whether people lived in an epidemic area) were related to the amount of experienced anxiety. Second, through structural equation modeling, we examined the extent to which more subjective, psychological elements were related to both the experience of anxiety and imitative behavior.

3.1. Effects of exposure to SARS on state anxiety

3.1.1. Presence of confirmed or suspicious cases of SARS

Since the probability of finding confirmed patients was slim in uninfected areas (<1/100,000), we only took samples from infected areas for this analysis. Among the participants from infected areas, 99 people (29.5%) reported that SARS patients had been found around them, and 235 people (69.9%) reported no SARS patients around. Somewhat more respondents reported seeing suspicious cases; specifically, 133 people (39.6%) reported that suspicious cases of SARS had been found around them, and 201 people (59.8%) reported that there were no suspicious cases found around them.

We next tested whether there were differences in state anxiety depending on participants' exposure to SARS. There was no effect of exposure to confirmed cases of SARS on anxiety levels, t (330) = 0.49, p = .62, or of exposure to suspicious cases of SARS on anxiety levels, t (330) = 0.88, p = .38. Thus, it appears that anxiety was not caused by the (perceived) presence of SARS patients.

3.1.2. Comparison of infected vs. uninfected areas

Although the previous analysis suggests that the presence of cases of SARS is not an important factor in provoking anxiety, it relies on a self-report measure of whether there were confirmed cases of SARS around. Thus, for the next analysis, we focused on the location of the respondents to our questionnaire.

'Epidemic areas' was an extremely important concept during the critical period in the prevalence of SARS, because it indicated the extent to which the public was put under direct threat. As previously discussed, some of these epidemic, or infected, areas were under quarantine (n = 30), whereas others were not (n = 307). In addition, we assumed that the nearness to the quarantined areas would have a special effect upon people in nearby quarantined areas, so we distinguished those in nearby areas (n = 144) from those not in nearby areas (n = 163). Thus, we had four separate groups of participants in total: infected quarantined, infected nearby quarantine, infected not nearby quarantine, and uninfected.

To ensure that our characterization of areas was meaningful, we began by examining the effect of location area on disturbance in work and study, on the assumption that if our characterization is meaningful those in or nearby quarantined areas should have their lives most disrupted. In keeping with this assumption, results of a one-way ANOVA showed a significant difference among the groups in terms of their disturbance level in work and study, F (3, 633) = 9.83, p < .001. As shown in Figure 1, there

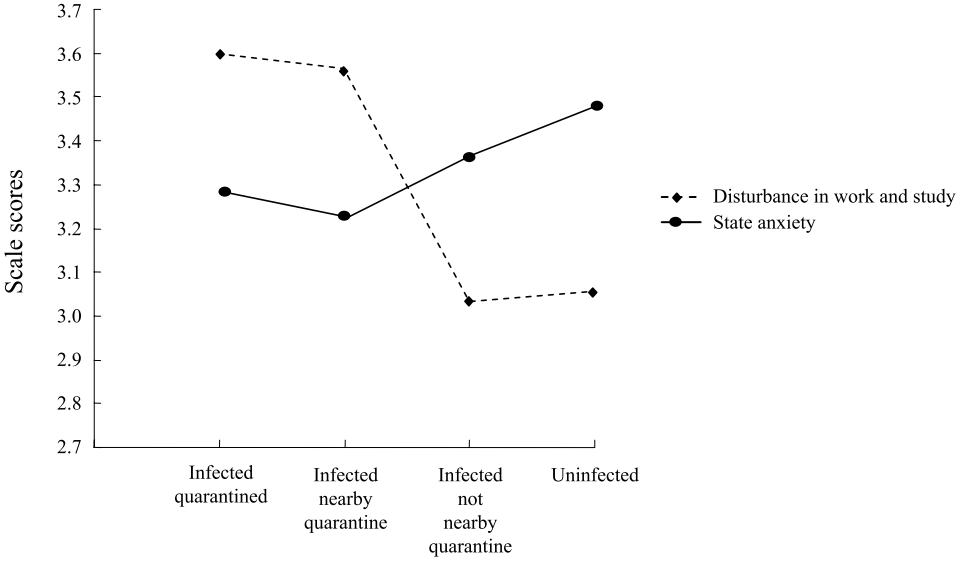

Figure 1. Comparison of infected and uninfected samples on state anxiety and disturbance in work and study.

was considerably more disturbance in the infected quarantined and infected nearby quarantine areas than in the other two areas.

This difference in disturbance did not, however, translate into a difference in anxiety levels. Results of a one-way ANOVA showed a significant difference among the groups in terms of state anxiety, F (3, 597) = 9.19, $p < .001$. However, as shown in Figure 1, there was *less* anxiety in the quarantined and nearby quarantined areas, not more. Tukey's *post hoc* test showed that respondents from non-infected areas had the highest level of state anxiety, followed by respondents from infected not nearby quarantine areas, followed by respondents from quarantined and nearby quarantined areas.

3.1.3. Summary

The results from our analysis of the objective characteristics associated with SARS suggest that anxiety is not just a response to the objective features of the situation. In fact, anxiety appears to be greater in situations that appear from the outside to be objectively better. Thus, it is important to examine the role of more subjective interpretations of the situation to understand the development of the high level of distress that appeared to be associated with SARS.

3.2. Determinants of state anxiety and imitative behavior

Our next analysis used structural equation modeling to determine the level of support for a variety of links among the measured variables. The general structure of the model (see Figure 2) was that beliefs regarding SARS (perceived knowledge, control, impact, and likelihood) and personality attributes (optimistic and pessimistic tendency) would influence state anxiety and imitative behavior regarding SARS and that these effects would be mediated by how participants reacted to SARS (willingness to participate in voluntary activities, family dependence, SARS-related vigilance, and disturbance in work and study).

3.2.1. Model specification

We formed four models to test various pathways among the variables. The following aspects were taken into account in model specification. First, Model 1 included all potential links that seemed reasonable given our past research on this topic (Xie et al. 2003). That work showed that beliefs regarding SARS and personality dimensions can have a direct influence on people's anxiety levels, as well as indirect effects through a variety of behavioral responses. We included only those links that seemed most reasonable given the previous research.

Models 2–4 were each embedded within Model 1. Previous research using the psychometric paradigm has generally found that, of the risk dimensions, *dread risk* is the dimension most associated with people's desire to see the risk reduced (Slovic 1987). In our work, we uncovered three dimensions related to participants' perceptions regarding SARS: perceived impact, perceived control, and perceived likelihood. Of these dimensions, perceived impact is the dimension most similar to *dread risk*. Thus, for Model 2, we deleted all the pathways from perceived likelihood and perceived control that were included in Model 1 (indicated as **a** in Figure 2), in order to determine whether eliminating those pathways would reduce the fit of the model.

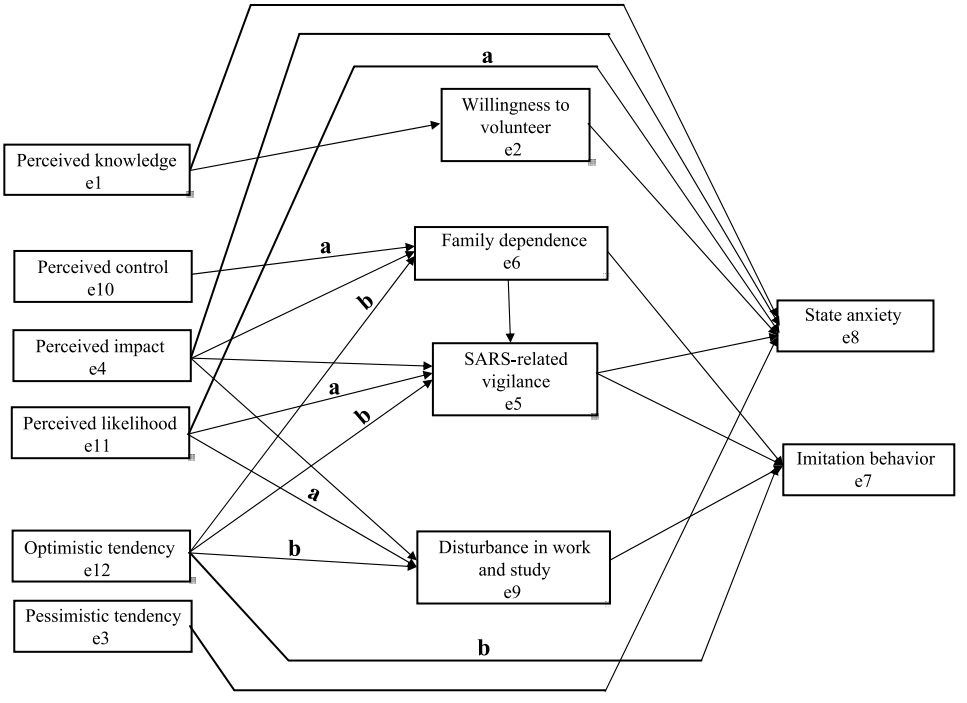

Figure 2. The structural equations model for predicting state anxiety and imitative behavior. Pathways indicated with an **a** were eliminated in Models 2 and 4; pathways indicated with a **b** were eliminated in Models 3 and 4.

Additionally, some previous research (e.g., Robinson-Whelen et al. 1997; Schulz et al. 1996; see also Baumeister et al. 2001) suggests that pessimism, but not optimism, significantly predicts psychological and physical health. Thus, we investigated whether optimistic tendency was necessary in our model. Specifically, we formed Model 3 by eliminating all of the pathways from optimistic tendency that were included in Model 1 (indicated as **b** in Figure 2). Finally, Model 4 was also embedded within Model 1, and excluded all of the pathways that were eliminated in Models 2 and 3.

3.2.2. Model comparison and evaluation

The fit indices for the four models (see Table 1) indicate that Model 4 has the best indices, with GFI, AGFI, NFI, ILI, and CFI all above or nearly above 0.9, RMSEA below 0.08, and CMIN/DF less than 3.0. Thus, eliminating pathways from perceived likelihood and perceived control, as well as from optimistic tendency, did not appear to reduce the predictive validity of the model. We thus interpret the results from Model 4 for the remainder of this section.

Figure 3 provides the standardized path coefficients for each of the pathways in Model 4. As is evident in that figure, there were a number of factors associated with both state anxiety and with imitative behavior regarding SARS. These will be discussed in turn.

Table 1. Fit indices for Models 1–4.

	CMIN	DF	CMIN/DF	GFI	AGFI	NFI	IFI	CFI	RMSEA (90% confidence interval)
Model 1	366.30	45	8.14	0.86	0.77	0.54	0.58	0.57	0.14(0.12–0.15)
Model 2	212.17	28	7.58	0.91	0.83	0.66	0.70	0.69	0.13(0.12–0.15)
Model 3	217.27	38	5.72	0.90	0.83	0.66	0.71	0.70	0.11(0.10–0.13)
Model 4	64.19	23	2.80	0.96	0.93	0.87	0.91	0.91	0.07(0.05–0.09)

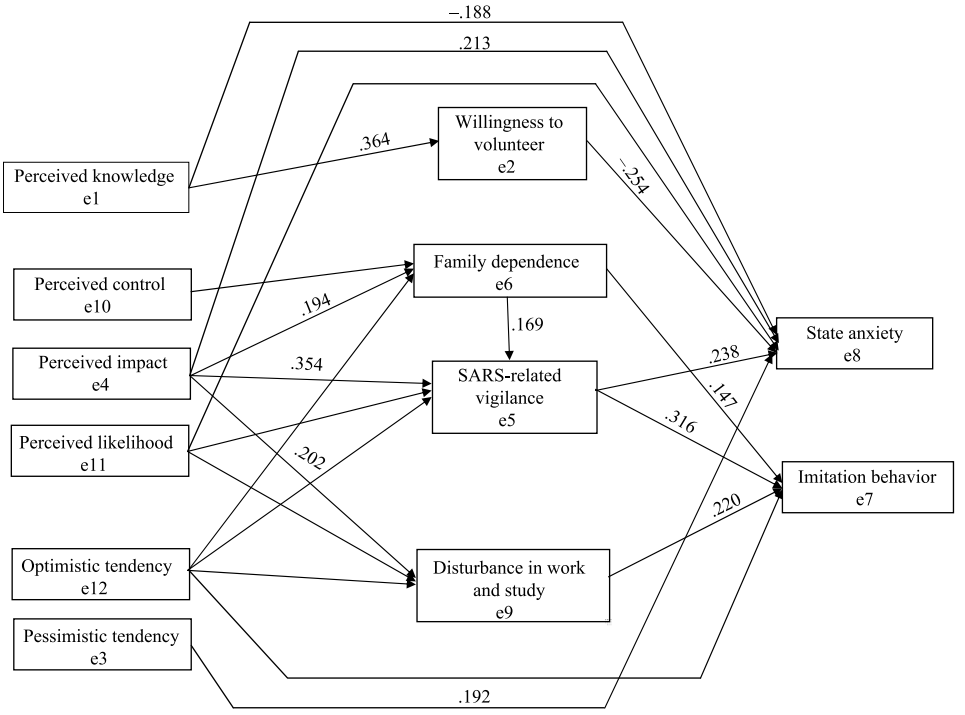

Figure 3. The structural equations model with standardized path coefficients estimated from Model 4.

3.2.2.1. State anxiety. As evident in Figure 3, the way participants reacted to SARS influenced their anxiety levels. In particular, SARS-related vigilance was positively related to the experience of anxiety, and a willingness to participate in voluntary activities regarding SARS was negatively related to the experience of anxiety. The latter result is in keeping with the finding of Wu et al. (2009) that altruistic acceptance of SARS-related risks was negatively associated with developing posttraumatic stress.

In addition, personality factors and respondents' beliefs regarding SARS also influenced state anxiety levels, both directly as well as through the aforementioned variables. In particular, having a pessimistic tendency had a positive direct association with anxiety. Additionally, the perceived impact of SARS had a positive direct relationship with anxiety, as well as a positive indirect relationship due to its strong positive relationship with SARS-related vigilance. Similarly, perceived knowledge had a

negative direct relationship with anxiety, as well as a negative indirect relationship due to its strong positive association with willingness to participate in voluntary activities.

3.2.2.2. Imitative behavior regarding SARS. As with state anxiety, the way participants reacted to SARS influenced their imitative behavior. SARS-related vigilance, disturbance in work and study, and family dependence all had positive direct associations with imitative behavior, although the relationship with family dependence was relatively weak. Family dependence also had a weak indirect relationship with imitative behavior through SARS-related vigilance.

In addition, the perceived impact of SARS had an indirect effect on imitative behavior. In particular, a high perceived impact of SARS was positively associated with SARS-related vigilance, a disturbance in work and study, and with family dependence, all of which were in turn positively associated with imitative behavior.

3.2.3. Summary

In contrast to the results with the more objective characteristics associated with SARS, participants' beliefs and responses to SARS were highly predictive of their eventual anxiety levels, as well as to their levels of imitative behavior. Although we did not attempt to evaluate every potential pathway, we also tested the extent to which perceived likelihood and control, as well as optimistic tendency, were necessary elements of the model. The results demonstrate that even without those predictor variables our model achieved a good fit.

4. Discussion

The goal of this paper was twofold. First, we tested whether objective characteristics of the situation (e.g., being in a quarantined area) was a major determinant of experienced anxiety. In contrast to the 'bull's eye' model of disaster, we found that, if anything, anxiety appears to be greater in situations that appear from the outside to be objectively better. We then examined the factors that were predictive of state anxiety and imitative behavior by means of structural equation modeling. Of these factors, the two most consistently related to distress (as seen both via anxiety and imitative behavior) were SARS-related vigilance and perceived impact of SARS (the latter of which operated at least in part via its effect on vigilance). We now discuss each of these findings in more detail.

4.1. The 'Typhoon Eye Effect' in risk transmission

As stated previously, those respondents in epidemic areas were generally less anxious than were those in non-epidemic areas. We suggest, then, that as opposed to a 'Bull's Eye' characterization of the SARS crisis, a more accurate characterization is that of a typhoon eye. When winds around the center of a typhoon are sufficiently strong, an 'eye' develops, which is relatively calm and free of clouds. Similarly, there was a great deal of distress experienced throughout China, but there were fewer signs of distress in the center of the epidemic.

Why would those in the eye of the epidemic feel less distress than those in surrounding areas? One possibility is suggested by the work of Halpern-Felsher et al. (2001). In their study, they found that participants who had not actually experienced a risky

event (e.g., being in a lightning storm) overestimated the risks involved, whereas participants who had experienced the event had a more accurate estimate of the risks. Halpern-Felsher et al. suggested this finding occurred because most of those people who experienced a risky event did not experience a negative outcome, thus leading to reduced (and more accurate, in their study) estimates of the risks. Similarly, in our study, those respondents in the center of the epidemic – although their experiences would have been unpleasant and even compelling – would have gained the objective information to attenuate the experienced distress (see also Kasperson et al. 1988).

Conversely, those outside the center of the epidemic would have developed their feelings via information from mass media, relatives, and friends. Although in theory these sources of information could either increase or decrease distress, in practice these sources, especially the media, have been associated with increases in distress (see, e.g., Kasperson et al. 1988; Marshall et al. 2007; Schlenger et al. 2002). One explanation for this effect of the media is the disproportionate attention placed on reporting cases of SARS (a person who contracts SARS is more news worthy than is someone who does not contract SARS). However, as discussed by Kasperson et al. (1988), even if the media made a conscientious effort to provide balanced coverage, it would still likely increase overall levels of distress, as it is much easier to increase anxiety than to decrease anxiety.

In addition to increasing or decreasing anxiety directly through fear-inducing or reducing messages, the media also served as a source of knowledge regarding SARS. That in general people's knowledge regarding SARS was lacking in many ways was documented by Leung et al. (2003). Thus, living in the center of the epidemic would have provided a method for obtaining more SARS-related knowledge than would obtaining information only from media reports. Since perceived knowledge is related to decreases in anxiety, being in the eye of the epidemic may have indirectly reduced anxiety by providing ready access to more SARS-related information.

Note on the surface our findings conflict with those of Wu et al. (2009), who found that exposure to SARS cases was positively associated with the development of post-traumatic stress symptoms. There are at least two important differences between the studies, however. First, all of the participants in Wu et al.'s studies were workers in a Beijing hospital that had been strongly affected by the SARS outbreak. Thus in their study, all of the respondents would have had similar levels of media exposure, knowledge about SARS, etc. In contrast, in our study these factors varied systematically with exposure to SARS patients given our inclusion of many areas of China. Second, Wu et al. measured posttraumatic stress symptoms three years after the SARS outbreak. It is plausible that being at the center of the epidemic reduced immediate distress but led to increased stress once the crisis was over. Future research should investigate this possibility.

It is also worth emphasizing that it is unclear to what extent these results will generalize to other disasters and populations. For example, the World Trade Center attack was a one-time event that occurred at one location. Although the risk of future terrorist attacks persists and is not specific to New York City, the event was qualitatively different from the SARS crisis in many ways. Further, the work of Fischhoff et al. (2003) suggests that proximity will have different effects on varying subgroups. In particular, they found that whites, males, and Republicans' risk judgments were influenced by proximity, whereas the complementary groups were not. It is thus quite possible that, in a similar situation, other populations would react differently to the SARS crisis than the Chinese people did.

4.2. The role of psychological and behavioral factors in distress

The primary goal of this study was not to determine definitively what all of the psychological and behavioral factors were that lead to distress, but instead to show that there are a number of factors related to distress above and beyond more objective factors such as actual exposure levels. Nonetheless, this study did provide some insight into what many of the primary determinants of distress were.

One factor that was strongly predictive of both state anxiety and imitative behavior was SARS-related vigilance. This scale consisted of items stating that the participant didn't feel well more often than normal, suspected themselves of SARS symptoms and hence felt nervous, was more cautious interacting with others than normal, and would talk about SARS with other people. These items all indicate a person who is constantly thinking about whether or not they may contract SARS, leading to disturbances in their normal life patterns as they somewhat obsessively try to ensure that they do not contract SARS. That such a pattern of behavior could lead to anxiety and imitative behavior is not surprising. For example, Chang and Sivam (2004) showed that vigilance over one's condition during the SARS outbreak increased preventative behavior but also increased SARS-related fears and anxiety. More generally, hypervigilance is one of the primary indicators of pathological anxiety (see, e.g., Rosen and Schulkin 1998). And finally, certain characteristics of SARS-related vigilance, such as avoiding others out of a fear of becoming infected, may in turn reduce social support, thereby increasing distress (Alvarez and Hunt 2005) and potentially illness (Cohen et al. 1997). Thus, reacting to the SARS virus by increasing one's level of vigilance may have had the unfortunate by-product of adding to the amount of distress experienced.

One variable that was highly related to SARS-related vigilance was the perceived impact of SARS. Not surprisingly, thinking that SARS had a large impact on themselves and on society led people to be more vigilant regarding SARS. In addition to its relationship to SARS-related vigilance, perceived impact was positively related to disturbance in work and family and family dependence (both of which were positively related to imitative behavior), as well as positively related to state anxiety directly. Given the design of our study, we do not make any strong claims that perceived impact is *more* predictive of distress than are other risk perceptions. Nonetheless, the results do clearly show that the impact one associated with SARS was related to experienced distress.

5. Conclusions

The overarching goal of this research was to determine why people experienced distress regarding the outbreak of SARS. The results of the study demonstrated that, in contrast to a 'Bull's Eye' model of distress, objective features of the situation played only a small role in the actual amount of distress that was experienced. Instead, the manner in which people interpreted the outbreak, and their resulting behaviors, seemed to be the primary determinants of distress.

Without a doubt, all disasters provoke their own unique patterns of response. Nonetheless, the results of this study are very much in line with the conclusions reached by Marshall et al. (2007) regarding terrorist attacks. As they argue, the recognition that distress is caused by more than actual exposure level can help refine our theoretical models of distress as well as lead to more adaptive responses to help those in need.

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