

# SARS Knowledge, Perceptions, and Behaviors: a Comparison between Finns and the Dutch during the SARS Outbreak in 2003

A.-M. Vartti · A. Oenema · M. Schreck · A. Uutela ·  
O. de Zwart · J. Brug · A. R. Aro

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## Abstract

**Background** The SARS outbreak served to test both local and international outbreak management and risk communication practices.

**Purpose** The study compares SARS knowledge, perceptions, behaviors, and information between Finns and the Dutch during the SARS outbreak in 2003.

**Method** The participants of the study, who used a modified SARS Psychosocial Research Consortium survey, were drawn from Internet panels in Finland ( $n=308$ ) and the Netherlands ( $n=373$ ) in June 2003. Multiple logistic regression analyses were used to calculate odds ratios (with

95% confidence intervals) to compare Finns with the Dutch for various levels of perceptions and behaviors.

**Results** Adjusted for age, education, and income, Finns were more likely to be knowledgeable and worried about SARS as well as to have low perceived comparative SARS risk and poor personal efficacy beliefs about preventing SARS. Finns were also more likely than the Dutch to have high confidence in physicians on SARS issues but less likely to have received information from the Internet and have confidence in Internet information.

**Conclusions** The study shed light on how two European populations differed substantially regarding lay responses to SARS. Understanding these differences is needed in formulating and executing communication and outbreak management.

**Keywords** SARS · Lay knowledge · Perception · Behavior · Information sources · Culture

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A.-M. Vartti (✉) · M. Schreck · A. Uutela  
Department of Health Promotion and Chronic Disease Prevention,  
National Institute for Health and Welfare (THL),  
Mannerheimintie 166,  
FIN-00300 Helsinki, Finland  
e-mail: anne-marie.vartti@thl.fi

A. Oenema · O. de Zwart · J. Brug  
Department of Public Health, Erasmus MC,  
Rotterdam, The Netherlands

O. de Zwart · J. Brug  
Division of Infectious Disease Control,  
Municipal Public Health Service,  
Rotterdam-Rijnmond, The Netherlands

A. R. Aro  
Unit for Health Promotion Research,  
University of Southern Denmark,  
Esbjerg, Denmark

A.-M. Vartti  
Centre for Biothreat Preparedness, Cntr Military Medicine,  
The Finnish Defence Forces,  
Helsinki, Finland

## Introduction

Severe acute respiratory syndrome (SARS) outbreak caused by a new coronavirus had the potential to have global impact in 2003. Although the outbreak was contained relatively quickly, SARS spread from China and other regions in Asia, reaching 29 countries altogether and causing over 8,400 cases of infection resulting in more than 900 deaths [1]. The Netherlands, with a population of 16.2 million, neither reported nor confirmed probable cases of SARS. In Finland, with 5.3 million, two people were initially treated as probable SARS cases, but neither was finally classified as such according to the WHO criteria [1, 2]. These two candidates for probable SARS cases, and especially the death from SARS of a Finnish citizen in Asia, attracted intense media attention in Finland.

Effective infectious disease management and preparedness require international cooperation. At the same time, it is also important to understand local realities such as lay

perceptions, immediate reactions and planned behaviors, as well as cultural ways of communication, and people's trust in the information and its sources.

No comparative European population data on lay perceptions and reactions to these new epidemics have been published so far, although [3] have summarized studies on the public's response and precautionary actions related to the SARS outbreak both in Canada and the USA. In addition, a small-scale study comparing Chinese and Canadian students stated that both groups overestimated their chances of getting SARS compared to the actual infection rates in Beijing and Toronto. The Chinese, however, were less pessimistic and expressed a stronger optimistic bias—belief in being personally less at risk than others in general [4]—than Canadians [5].

Reports from the unaffected countries [6, 7] indicate that people were quite well aware of SARS; they were not very worried but had taken some precautionary and diagnostic actions. The Finnish respondents showed relatively great trust in the ability of health officials to control the SARS epidemic [7]. Studies from the countries seriously affected by SARS reported higher figures for precautionary actions, but not of worry, whereas reports on risk perceptions have been variable [8–10]. Lee-Baggley et al. [9] noticed that optimistic thinking in response to SARS was related to the avoidance of public places and lots of people but not to adaptive health behaviors such as use of disinfectants and hand washing. On the other hand, those who had a more empathetic response to the SARS threat were more likely to report engagement in effective health behaviors and less likely to report avoidance.

Unlike the chronic lifestyle diseases, there are very few studies on illness perceptions of infectious diseases [11], including HIV, hepatitis, and influenza [12, 13]. As communicable diseases caused by invisible microbes have been major causes of death in history, one might assume that they are perceived as less controllable than chronic life-style related diseases.

Knowledge, perceptions, and precautionary behaviors among the population are important in the control of epidemics, as has been learned regarding SARS [14]. As briefly mentioned above, people tend to perceive their disease risk optimistically, especially regarding familiar risks as under volitional control, being more pessimistic in relation to less-controllable risks [15–18]. Both cognitive and emotional matters such as worry and fear have an important bearing on coping with health threats [19]. Trust in information and disease management is essential in outbreak management [20–23].

Lessons learned from the SARS outbreak may help to prepare for future infectious disease threats more adequately, to understand public's responses to bio-threats and develop adequate communication protocols for future outbreaks.

## Purpose

The present study is founded on the premise that, since to be effective, the outbreak management, harm reduction, and risk communication protocols must take into consideration psychological and social aspects of the outbreak or bio-threat incidence, it is important to explore possible differences between countries. The aim of the present study was to compare the SARS knowledge, risk perceptions, precautionary and diagnostic behaviors, as well as the SARS information sources and confidence in them among Finns and the Dutch.

## Methods

### Sample

National samples both in Finland and the Netherlands were drawn from the respective consumer panels using online survey technology. Potential respondents were invited via email to complete the SARS questionnaire on the research companies' website between June 19 and June 26 in 2003. A random sample ( $n=500$ ) was drawn from the pool of 10,000 members of an Internet-research panel in both countries (Taloustutkimus in Finland and Flycatcher in the Netherlands). The final Finnish sample consisted of 308 respondents (data gathering was finished after 300 had replied), and the Dutch sample of 373. Table 1 gives the background characteristics of the samples.

### Survey

The survey was based on the Psychosocial SARS Research Consortium study, extended by questions on the perceived risk of SARS, other infectious diseases, and some chronic diseases, efficacy beliefs—perception of one's ability to control things such as SARS, and to prevent both SARS and infectious diseases in general (see Table 2 for the individual items). Leventhal et al.'s Illness Perceptions and Self-Regulation Models formed the psychological framework of the study [24, 25].

*Knowledge* of SARS was measured by 13 items (ever hearing of SARS, what SARS is, cause (etiology), mortality, symptoms, and treatment). The respondents were asked to tick the items they thought were correct, and a sum score (theoretical range 0–13, general reliability coefficient 0.65 [26]) was used for the descriptive analysis. The dimensions were divided into quartiles for the logistic regression analyses.

*Risk perceptions.* Subjects were asked to rate their personal risk of getting SARS (1 very low, 5 very high) and their comparative risk (compared to the risk of a person of the same

**Table 1** Background characteristics of the respondents by country, Finns  $n=308$ , the Dutch  $n=373$ 

Background factor	Finns $n$ (%)	Dutch $n$ (%)	Chi square/ $p$
Female	166 (53.9)	192 (51.5)	0.40
Male	142 (46.1)	181 (48.5)	$P=0.529$
Age <35 years	138 (44.8)	114 (30.6)	15.16
Age 36–45	84 (27.3)	137 (36.7)	$p<0.001$
Age 46+	86 (27.9)	122 (32.7)	
Education <high school	64 (20.8)	145 (38.9)	35.63
Education = high school or equivalent	124 (40.3)	148 (39.7)	$p<0.001$
Education = higher professional or university	120 (39.0)	80 (21.4)	
Cross monthly income <2000 €	62 (20.1)	119 (34.8)	19.62
2001–4000 €	141 (45.8)	143 (41.8)	$p<0.001$
4000 € +	105 (34.1)	80 (23.4)	

gender and age living in the same country: 1 much lower–5 much higher). In addition, personal and comparative beliefs in the ability to prevent SARS and infectious diseases in general were probed (=efficacy beliefs).

Worry about one's own risk of SARS, the family risk, and risk in the region were asked about using the scale: 1 not at all worried–5 very worried. The variables were re-coded so that 0 indicated no worry and 1 indicated at least some worry, and a sum score (theoretical range 0–3, reliability coefficient 0.73) was used for the descriptive analysis and the quartiles for the logistic regression analyses.

Precautionary behaviors were measured by 18 items, each tick bringing a numerical value of one, giving a

theoretical range of 0–18, and a sum score (general reliability coefficient 0.72) was used in the analyses. The items were: avoidance of traveling to affected areas, eating in restaurants or food courts, shaking hands, travel on airplanes, taxis, trains or subways, avoiding going to gatherings, avoiding going to work or school, having worn a mask, having washed hands, having taken extra care of cleanliness, having used disinfectants, having eaten a balanced diet, exercise, taking herbal supplements, sleeping enough, and having done something else.

Diagnostic actions (taking one's temperature, going to a doctor, paying close attention to coughing, sneezing, feelings of fatigue, headaches, and calling the SARS hotline) were measured by eight items similarly to the

**Table 2** Risk perceptions related to SARS and infectious diseases in general, differences between the distributions, Finns ( $n=308$ ) and the Dutch ( $n=373$ ) (unadjusted)

Variable	Finns $n$ (%)	Dutch $n$ (%)	Chi square/ $p$
Personal SARS risk			
Low	290 (94.2)	314 (84.9)	15.26
Intermediate	16 (5.2)	46 (12.4)	$p<0.001$
High	2 (0.6)	10 (2.7)	
Comparative SARS risk			
Lower than others	206 (66.9)	124 (33.3)	77.45
Same as others	95 (30.8)	219 (58.9)	$p<0.001$
Higher than others	7 (2.3)	29 (7.8)	
Personal efficacy beliefs to prevent SARS			
Well	6 (1.9)	46 (12.3)	166.6
Reasonably well	29 (9.4)	176 (47.2)	$p<0.001$
Poorly	273 (88.6)	151 (40.5)	
Comparative efficacy beliefs to prevent SARS			
Better than others	12 (3.9)	20 (5.4)	39.33
Same as others	180 (58.4)	290 (78.2)	$p<0.001$
Poorer than others	116 (37.7)	61 (16.4)	
Personal infectious disease risk			
Low	227 (73.7)	177 (47.5)	49.15
Intermediate	69 (22.4)	156 (41.8)	$p<0.001$
High	12 (3.9)	40 (10.7)	
Comparative infectious disease risk			
Lower than others	160 (41.9)	141 (37.9)	27.89
Same as others	138 (44.8)	181 (48.7)	$p<0.001$
Higher than others	10 (3.2)	50 (13.4)	

precautionary behaviors, and a sum score (theoretical range 0–8, general reliability coefficient 0.75) was used for the descriptive analysis and quartiles for logistic regression analyses.

*SARS information sources* and confidence in them were canvassed (see Table 3 for the items) using the response categories: 1 not at all/very little–5 very much. For the descriptive analysis, the answers were dichotomized so that the original values 1–3 were taken to mean “little” and the values 4–5 “a lot.”

### Statistical Analyses

Distributions (frequencies, percentages) were used to describe the Finnish and Dutch samples, and chi-square tests (for dichotomous variables), and two-sided *t*-tests (continuous variables) were used to test differences between the samples on significant characteristics. Univariate logistic regression analyses were used to find significant differences ( $p < 0.05$ ). Multivariate forward stepwise logistic regression analysis was used to compare the Finns with the Dutch. Odds ratios [with 95% confidence intervals (CI)] were calculated for levels of knowledge, perceptions, worry, behaviors, information sources, and trust (see Table 4).

Variables significantly associated with the country ( $p < 0.05$ ) in the univariate analysis were entered in a forward

stepwise multiple logistic regression analysis in order of descending magnitude of the coefficient/SE, using a  $p$  value of  $\leq 0.025$  as the criterion [27] for the inclusion or exclusion of the variable. Since the samples differed in background factors such as age, educational level, and income level, the logistic regression analyses were adjusted for these variables. The analyses were done with the SURVO software [28].  $P$  values less than or equal to 0.05 were considered statistically significant.

### Results

In the Finnish sample, a significantly greater proportion of the respondents than in the Dutch had higher educational and income level, and the average age of the Finnish sample was lower.

#### Descriptive (Unadjusted) Results

The Finns had a significantly higher average SARS knowledge sum score than the Dutch [means 8.03 (SD 1.90) vs 6.70 (2.55), *t* test,  $-7.563$ ,  $p < 0.001$ ]. The between-country differences in the individual knowledge items were relatively consistent: 37% of Finns and 13% of the Dutch ( $p < 0.001$ ) knew the mortality among SARS cases (10%), and 95% of the Finns and 73% of the Dutch ( $p < 0.001$ )

**Table 3** Amount of SARS information received (*n*, %, little and much) from various sources, and confidence in the sources (*n*, %, little, much), Finns  $n=308$ , the Dutch  $n=373$  (unadjusted)

Source	Received		Chi square/ <i>p</i>	Confidence		Chi square/ <i>p</i>
	Finns <i>n</i> (%)	Dutch <i>n</i> (%)		Finns <i>n</i> (%)	Dutch <i>n</i> (%)	
<b>Newspapers</b>						
Little	102 (33.1)	167 (44.9)	9.772	93 (30.2)	182 (49.2)	25.15
Much	206 (66.9)	205 (55.1)	$p=0.002$	215 (69.8)	188 (50.8)	$p < 0.001$
<b>Magazines</b>						
Little	264 (85.7)	311 (87.4)	0.385	207 (67.2)	278 (74.5)	10.35
Much	44 (14.3)	45 (12.6)	$p=0.535$	101 (32.8)	95 (25.5)	$p < 0.001$
<b>TV</b>						
Little	48 (15.6)	104 (28.0)	15.01	93 (30.2)	162 (43.9)	13.44
Much	260 (84.4)	267 (72.0)	$p < 0.001$	215 (69.8)	207 (56.1)	$p < 0.001$
<b>Internet</b>						
Little	271 (88.0)	273 (76.5)	14.73	235 (76.3)	235 (63.0)	7.007
Much	37 (12.0)	84 (23.5)	$p < 0.001$	73 (23.7)	138 (37.0)	$p=0.008$
<b>Health officials</b>						
Little	284 (92.2)	343 (95.8)	3.897	46 (14.9)	182 (48.8)	98.80
Much	24 (7.8)	15 (4.2)	$p=0.048$	262 (85.1)	191 (51.2)	$p < 0.001$
<b>Doctor</b>						
Little	293 (95.1)	354 (98.9)	8.413	48 (15.6)	190 (50.9)	107.6
Much	15 (4.9)	4 (1.1)	$p=0.004$	260 (84.4)	183 (45.4)	$p < 0.001$
<b>Friends</b>						
Little	293 (95.1)	338 (94.4)	0.171	266 (86.4)	305 (87.4)	0.152
Much	15 (4.9)	20 (5.6)	$p=0.680$	42 (13.6)	44 (12.6)	$p < 0.696$

**Table 4** Multivariate forward stepwise logistic regression analysis: odd ratios (ORs, 95% confidence intervals) of different levels of SARS knowledge, worry, perceptions, behaviors, and information among Finns ( $n=308$ ) compared with the Dutch ( $n=373$ ), controlled for age, education, and income level. The reference category of each variable/scale is the one with OR=1.00

Variable	Finns $n$ (%)	Dutch $n$ (%)	OR	95% CI	$p$
SARS knowledge					
1st quartile	60 (19.5)	203 (54.4)	1.00		
2nd quartile	67 (21.8)	68 (18.2)	3.65	1.70–7.85	0.009
3rd quartile	131 (42.5)	59 (15.8)	5.95	2.91–12.20	<0.001
4th quartile	50 (16.2)	43 (11.5)	3.65	1.54–8.65	0.003
SARS worry					
1st quartile	28 (9.1)	144 (38.6)	1.00		
2nd quartile	171 (55.5)	42 (11.3)	14.22	6.25–32.33	<0.001
3rd quartile	53 (17.2)	26 (7.0)	9.33	3.37–25.81	<0.001
4th quartile	56 (18.2)	161 (43.2)	3.28	1.38–7.80	0.007
Precautionary behaviors					
No	154 (50.0)	219 (58.7)	1.00		
Yes	154 (50.0)	154 (41.3)	1.52	0.84–2.73	0.166
Personal SARS risk					
Moderate/high	18 (5.8)	56 (15.1)	1.00		
Low	290 (94.2)	314 (4.9)	2.23	0.82–6.07	0.117
Comparative SARS risk					
Lower/same as others	301 (97.7)	343 (92.2)	1.00		
Higher than others	7 (2.3)	29 (7.8)	0.17	0.08–0.34	<0.001
Personal efficacy beliefs to prevent SARS					
(Reasonably) well	35 (11.3)	222 (59.5)	1.00		
Poorly	273 (88.7)	151 (40.5)	6.86	3.48–13.52	<0.001
Comparative efficacy beliefs to prevent SARS					
Better than others	116 (37.7)	63 (16.9)	1.00		
Same/poorer than others	192 (62.3)	310 (83.1)	1.50	0.72–3.13	0.280
Personal risk infectious disease					
Low	296 (96.1)	333 (89.3)	1.00		
Moderate/high	12 (3.9)	40 (10.7)	0.52	0.17–1.54	0.237
Perceived health					
Good–very good	278 (90.3)	268 (71.8)	1.00		
Moderate–poor	30 (9.7)	105 (28.2)	1.76	0.83–3.73	0.142
Information health officials					
Little	284 (92.2)	343 (92.0)	1.00		
Much	24 (7.8)	30 (8.0)	1.48	0.47–4.65	0.505
Confidence health officials					
Little	46 (14.9)	182 (48.8)	1.00		
Much	262 (85.1)	191 (51.2)	1.28	0.47–3.54	0.625
Confidence in doctor's information					
Little	48 (15.6)	190 (50.9)	1.00		
Much	260 (84.4)	183 (49.1)	6.50	2.33–18.17	<0.001
Information from Internet					
Little	271 (88.0)	273 (73.2)	1.00		
Much	37 (12.0)	100 (26.8)	0.30	0.14–0.63	0.002
Confidence in Internet information					
Little	235 (76.3)	235 (63.0)	1.00		
Much	73 (23.7)	138 (37.0)	0.29	0.14–0.59	<0.001
Confidence information magazines					
Little	207 (67.2)	278 (74.5)	1.00		
Much	101 (32.8)	95 (25.5)	0.67	0.34–1.32	0.248

knew fever as a common symptom of SARS. Further, 80% of the Finns and 9% of the Dutch ( $p < 0.001$ ) knew that breathing problems were common SARS symptoms.

In the descriptive analysis, a significantly higher proportion of the Finns perceived both their personal and comparative SARS risk as low compared to the Dutch (Table 2). Both personal and comparative efficacy beliefs about preventing SARS were also lower among the Finns. Similar differences appeared in the personal and comparative risk perceptions of infectious diseases in general, although slightly less markedly so.

Although the sum scores of the worry items (in the descriptive analysis) were similar among the Finns and the Dutch (mean 4.44 (SD 0.89) vs mean 4.54 (SD 1.38),  $t$  test 1.060,  $p = 0.290$ ), the Finns worried more about SARS in their region (91% vs 52%,  $p < 0.001$ ), and the Dutch more about their own risk (49% vs 29%,  $p < 0.001$ ), and family risk (54% vs 25%,  $p < 0.001$ ).

Similarly, although the sum scores of the precautionary behaviors did not differ between the Finns and the Dutch [means 0.76 (SD 1.07) vs 0.73 (SD 1.33),  $t$  test  $-0.234$ ,  $p = 0.815$ ], the differences in individual items such as wearing a face mask (10% of Finns vs 4% of Dutch,  $p < 0.001$ ), and washing hands more frequently (6% vs 2%,  $p = 0.02$ ), and trying to sleep more (3% vs 8%,  $p = 0.003$ ) suggest some differences in the forms of behavior between the countries. In the diagnostic behaviors, Finns had consulted a doctor about the possibility of SARS infection somewhat less often than the Dutch (1% vs 3%,  $p = 0.05$ ), and paid less attention to coughing (1% vs 4%,  $p = 0.03$ ), but the scale sum scores did not differ significantly between them (means 0.05 (SD 0.35) vs 0.12 (SD 0.60),  $t$ -test  $-1.856$ ,  $p = 0.640$ ).

The Finns reported more often than the Dutch that they had received a lot of information from newspapers and TV, but less from the Internet (Table 3). Percentages of information received from health officials and doctors were small overall, but somewhat higher among the Finns, who seemed to have confidence in the information from TV and the print media significantly more often than the Dutch, but not in the information received from the Internet. Finns were also more likely than the Dutch to express confidence in doctors.

### Multivariate (Adjusted) Results

In the multivariate analysis adjusted for age, education, and income, the Finns were more likely to have higher than the lowest level of SARS knowledge and higher than the lowest level of SARS worry (Table 4). They were also more likely to have low comparative perceived SARS risk and poor personal efficacy beliefs about preventing SARS. The Finns also were more likely to have high confidence in

physicians on the SARS issues than the Dutch. On the other hand, the Finns were less likely to have received information from the Internet and have confidence in Internet information than the Dutch.

### Discussion

In this comparative study, we found that the Finns were more likely to be knowledgeable and worried about SARS than the Dutch. They were also more likely to have low perceived comparative SARS risk and poor personal efficacy beliefs. The Finns also were more likely to have high confidence in physicians on SARS issues than the Dutch. On the other hand, the Finns were less likely to have received information from the Internet and to have confidence in the Internet information than the Dutch.

In the absence of comparative Finnish–Dutch research about the level of health knowledge, only a hypothetical interpretation of the difference found in the SARS knowledge can be advanced. Potentially extremely active media coverage on SARS in Finland provides one explanation. Weekly magazines, tabloids, and national TV channels devoted frequent stories to the issue during the outbreak. The media coverage was largely related to two probable SARS cases in Finland as well as the publicity around the death from SARS of a high-level Finnish official in Asia.

Surely these “human faces” brought SARS closer to Finns and thus perhaps invoked interest in following SARS-related news more attentively. No Dutch people were lost nor even suspected of having SARS, which probably meant lower profile media coverage. The knowledge level might also be related to significantly higher percentages of Finns than the Dutch reporting having received SARS information from the media except for the Internet and magazines, as well as from health officials. The Finns also trusted the sources more than the Dutch, except for the Internet.

Earlier studies have suggested that the media is the most useful source of information about SARS, with the Internet being quite seldom used, especially in Asia [8, 10, 29]. In general, however, about half of the Finnish adults have reported using the web to get information about health and medicine [30, 31]. We know that the Finns trust the health information received from the official sources, both the media and the authorities in general [31–33]. We have already reported that Finns trusted the potential of health officials to manage a SARS epidemic in the country [7].

Finns rank as the third most active newspaper buyers in the world with 522 copies per thousand sold daily [34]. The percentages of the population with access to and using the Internet are at the same high level in Finland and

the Netherlands [35–37]. There were also differences in public communication about the outbreak management between Finland and the Netherlands during the SARS epidemic. In Finland, the communication was centralized so that there was one designated spokesperson, whereas in the Netherlands, various spokespersons were handling the communication on the epidemic (A. Timen, personal communication). The Netherlands has since decided to use the centralized communication policy. Results concerning the Nordic way of communication and risk perception offer an alternative explanation. [38] have reported that the media shapes public perception of risk in the Nordic countries by delivering more factual information about events such as accidents abroad than in other countries.

Finns being somewhat more likely to report higher levels of concern over SARS might be related to the salience of the SARS threat because of the death of a Finn, which was of compelling interest in the media at the time of the survey. National item-level differences in preventive behavior suggest culturally interesting hypotheses. A typical Finnish feature, for instance, is to prompt people actively and daily to increase hand hygiene during epidemics—this was also done during the SARS epidemic—but there might also be cultural differences in coping with disease threats in general.

The fact that the Finns were more likely to perceive both their comparative SARS risk and personal efficacy in preventing SARS as low or similar to others is not unique to SARS. It has also been found in other health contexts that Finns are more pessimistic in their evaluations than many other Europeans (e.g., [39]. There are established cultural differences in SARS-related optimism (e.g., [40, 41, 5, 42]. The culture defines illness representations in two ways: (a) providing linguistic labels for differentiating and categorizing the events forming illness cases and ensuring culturally shared views of diseases by creating expectations as well as directing attention; (b) providing personal contacts strengthening the illness schema development and giving social models for acquisition of the specific procedures for threat management [24, 25].

The Nordic media with its emphasis on external and international affairs may have downplayed the level of the risk perception [38]. One wonders whether what was seen was also related to the symbolic and cultural values of risk estimation in general [43, 44], general national, and culture-specific approaches to health, or the way the SARS outbreak management communication was managed in these two countries.

The panel surveys were carried out in the second half of June 2003; that is, after the peak of the SARS outbreak, during the period when people were already relatively knowledgeable, and had had time to formulate their emotional and perceptual stance to the SARS epidemic and its potential impact in their respective countries.

Although the samples were drawn from national poll agency panels, we cannot exclude selection bias. However, we did the analyses adjusted for the background factors of the samples. The difference in education between the samples is in line with the published figures for educational attainments in Finland and the Netherlands [35–37]. Although the survey instrument was developed rapidly and without piloting in response to the emerging international SARS outbreak, it was based on a well-known illness perception framework [25] established to function in different cultures [45].

Our findings point to the need of contextual, culture-sensitive, and multisector analyses as the basis for international outbreak management policies and risk communication. Local knowledge, topics of worry, risk perception, information sources, and trust in them are all important aspects of the preparedness planning for epidemics and pandemics.

## Conclusion

It is interesting from the psychological and behavioral perspective that two nonaffected European countries have such different levels of SARS knowledge, risk perception, and use of and confidence in the information received. There is an urgent need to study further cultural, societal, and epidemic control aspects affecting lay people's perceptions and behaviors relevant to planning and implementation of national and international outbreak management policies.

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## References

1. World Health Organization. Summary of probable SARS cases with onset of illness from 1 November 2002 to 31 July 2003 Based on data as of the 31 December 2003. [Computer software]. [http://www.who.int/csr/sars/country/table2004\\_04\\_21/en/index.html](http://www.who.int/csr/sars/country/table2004_04_21/en/index.html); 2004.
2. Ruutu P, Lyytikäinen O, Kuusi M, Nuorti P, Lappalainen M, Siikamäki H, et al. SARS—yhteistyöryhmä. SARS—Uusiin uhkiin valmistautumista. (SARS—preparing for new threats). Suomen Lääkärilehti. 2004;14:1533–8.
3. Blendon RJ, Benson JM, DesRoches CM, Raleigh E, Taylor-Clark K. The public's response to severe acute respiratory syndrome in Toronto and the United States. *Clin Infect Dis*. 2004;38:925–31.
4. Klein WM, Weinstein ND. Social comparison and unrealistic optimism about personal risk. In: Buunk BP, Gibbons FX, editors. *Self, coping and well-being: perspectives from social comparison theory*. Mahwah (NJ): Lawrence Erlbaum; 1997. p. 25–61.
5. Li-Jun J, Zhiyong Z, Osborne E, Yanjun Guan E. Optimism across cultures: In response to the severe acute respiratory syndrome outbreak. *Asian J Soc Psychol*. 2004;7:25–34.

6. Brug J, Aro AR, Oenema A, Richardus JH, De Zwart O, Bishop GD. SARS Risk Perception, Knowledge, Precautions, and Information Sources, the Netherlands. *Emerg Infect Dis.* 2004;10:1486–9.
7. Varti A-M, Aro A, Schreck M, Uutela A. SARS ja suomalaisten tyytyväisyys viranomaisiin ja mielipiteet tarpeellisista kontrollitoimista. (Lay confidence in Finnish health authorities and opinions of control measures regarding the SARS outbreak). *Suomen Lääkärilehti.* 2004;47:4629–33.
8. Lau JTF, Yang X, Tsui H, Kim JH. Monitoring community responses to the SARS epidemic in Hong Kong: from day 10 to day 62. *J Epidemiol Commun Health.* 2003;57:864–70.
9. Lee-Baggley D, DeLongis A, Greenglass E, Voorhoeve P. Coping with the threat of severe acute respiratory syndrome: Role of threat appraisals and coping responses in health behaviors. *Asian J Soc Psychol.* 2004;7:9–23.
10. Leung GM, Lam TH, Ho LM, Ho SY, Chan BHY, Wong IOL, et al. The impact of community psychological responses on outbreak control for severe acute respiratory syndrome in Hong Kong. *J Epidemiol Commun Health.* 2003;57(11):857–63.
11. Walton AJ, Eves F. Exploring drugs users' illness representations of HIV, Hepatitis B and Hepatitis C using repertory grids. *Psychol Health.* 2001;16:489.
12. Brewer NT, Weinstein ND, Cuite CL, Herrington JE. Risk perceptions and their relation to risk behavior. *Ann Behav Med.* 2004;27:125–30.
13. Brewer NT, Chapman GB, Gibbons FX, Gerrard M, McCaul KD, Weinstein ND. Meta-analysis of the relationship between risk perception and health behavior: the example of vaccination. *Health Psychol.* 2007;26:136–45.
14. Bell DM. Public health interventions and SARS spread, 2003. *Emerg Infect Dis.* 2004;10:1900–6.
15. Sjöberg L. Factors in risk perception. *Risk Anal: An Int J.* 2000;20:1–12.
16. Slovic P, Fischhoff B, Lichtenstein S. Rating risk. In: Slovic P, editor. *The perception of risk.* London, UK: Earthscan; 2000.
17. Weinstein ND. Why it won't happen to me: perceptions of risk factors and susceptibility. *Health Psychol.* 1984;3:431–57.
18. Weinstein ND. The precaution adoption process. *Health Psychol.* 1988;7:355–86.
19. Leventhal H. Findings and theory in the study of fear communication. In: Berkowitz L, editor. *Advances in experimental social psychology;* 1970. pp. 119–86.
20. Freimuth V, Linnan HW, Potter P. Communicating the threat of emerging infections to the public. *Emerg Infect Dis.* 2000;6:337–47.
21. Glass TA, Schoch-Spana M. Bioterrorism and the people: how to vaccinate a city against panic. *Clin Infect Dis.* 2002;34:217–23.
22. Jacob M, Hellström T. Policy understanding of science, public trust and the BSE-CJD crisis. *J Hazard Mater.* 2000;78:303–17.
23. Richmond JK, Baglole DJ. Lassa fever: epidemiology, clinical features, and social consequences. *BMJ* 2003;327:1271–5.
24. Leventhal H, Diefenbach M. The active side of illness. In: Skelton J, Croyle R, editors. *Mental representation of health and illness.* New York: Springer Verlag; 1991. p. 247–72.
25. Leventhal H, Diefenbach M, Leventhal E. Illness cognition: Using common sense to understand treatment adherence and affect cognition interactions. *Cogn Ther Res.* 1992;16:143–63.
26. Tarkkonen L, Vehkalahti K. Measurement errors in multivariate measurement scales. *J Multivar Anal.* 2005;96:172–89.
27. Mickey J, Greenland S. A study of the impact of confounder-selection criteria on effect estimation. *Am J Epidemiol.* 1989;129:125–37.
28. Mustonen S. Survo. An integrated Environment for Statistical Computing and Related Areas. Helsinki: Survo Systems [Computer software]. <http://www.survo.fi/english/>; 1992.
29. Seng SL., Lim PS, Ng MY, Wong HB, Emmanuel SC. A study on SARS awareness and health-seeking behaviour—findings from a sampled population attending National Healthcare Group Poly-clinics. *Ann Acad Med, Singapore.* 2004;33:623–9.
30. Eriksson-Backa K. In sickness and in health: How information and knowledge are related to health behaviour. Turku, Finland: Åbo Akademi University Press; 2003.
31. Finnish Centre for Health Promotion. Terveysttiedon edistävän viestinnän suuntaviivat (Trends in health promoting communication). Helsinki, Finland: Finnish Centre for Health Promotion; 2005.
32. European Commission. Europarameter 66 Public Opinion in European Union, National Report - Finland; 2006.
33. Suhonen P. Suomalaisten arvot ja politiikka (Values and Politics among Finns). Helsinki: Tammi; 1997.
34. World Association of Newspapers. World Press Trends: Newspaper Circulation and Advertising Up Worldwide. World Association of Newspapers; 2005, May 30.
35. Statistics Finland. ICT used less in Finland than in other Nordic countries. [http://www.stat.fi/ajk/tiedotteet/v2005/tiedote\\_073\\_2005-12-15.html](http://www.stat.fi/ajk/tiedotteet/v2005/tiedote_073_2005-12-15.html); 2005.
36. Statistics Netherlands. Average household incomes [Computer software]. <http://www.cbs.nl/en-GB/menu/themas/inkomen-bestedingen/nieuws/default.htm>; 2007a.
37. Statistics Netherlands. Internet users [Computer software]. <http://www.cbs.nl/en-GB/menu/methoden/toelichtingen/alfabet/f/frequent-internet-users.htm>; 2007b.
38. Mullet E, Lazreg C, Cereza C, Neto F. The Scandinavian way of perceiving societal risks. *J Risk Res.* 2005;8:19–30.
39. Manderbacka K, Lundberg O, Martikainen P. Do risk factors and health behaviours contribute to self-ratings of health. *Soc Sci Med.* 1999;48:1713–20.
40. Chang WC, Sivam RW. Constant vigilance: Heritage values and defensive pessimism in coping with severe acute respiratory syndrome in Singapore. *Asian J Soc Psychol.* 2004;7:35–53.
41. Kim-Pong Tam FM, Lau IY-M, Chi-Yue C. Biases in the perceived prevalence and motives of severe acute respiratory syndrome prevention behaviors among Chinese high school students in Hong Kong. *Asian J Soc Psychol.* 2004;7:67–81.
42. Yiqun G, Ying L, Yiling Zhang FM. Flexible coping responses to severe acute respiratory syndrome-related and daily life stressful events. *Asian J Soc Psychol.* 2004;7:55–66.
43. Douglas M. Purity and danger: An analysis of the concepts of pollution and taboo. London: Routledge and Kegan Paul; 1966.
44. Douglas M, Wildavsky A. Risk and culture. An essay on the selection of technological and environmental dangers. Berkeley, Los Angeles and London: University of California Press; 1983.
45. Schober R, Lacroix J. Lay illness models in the Enlightenment and the 20th century: Some historical lessons. In: Skelton J, Croyle R, editors. *Mental representation in health and illness.* New York: Springer-Verlag; 1991. p. 11–59.