# Exploring Risk Perceptions of Emerging Infectious Diseases

**Onno de Zwart**

Colofon
Exploring risk perceptions of emerging infectious diseases. De Zwart, Onno
Thesis Erasmus MC, University Medical Center Rotterdam
ISBN 978-90-9023845-6


Lay out: Astrid de Ronde, Onno de Zwart
Coverphoto: Jan Groot

Printed by Print Partners Ipskamp, Enschede

The research projects were financed by the European Commission with the Sixth Framework Programme, Thematic Priority Scientific Support to Policies, the National Institute for Public Health and the Environment and the Municipal Public Health Service Rotterdam-Rijnmond.

The printing of this thesis was financially supported by the Municipal Public Health Service Rotterdam-Rijnmond and the Erasmus University Rotterdam.

# Exploring Risk Perceptions of Emerging Infectious Diseases.

# Verkenning van risicopercepties ten aanzien van opkomende infectieziekten.

Proefschrift
ter verkrijging van de graad van doctor aan de
Erasmus Universiteit Rotterdam
op gezag van de
rector magnificus

prof.dr. S.W.J. Lamberts

en volgens besluit van het College voor Promoties.

De openbare verdediging zal plaatsvinden op
woensdag 11 februari 2009 om 15.45 uur

door

**Onno de Zwart**

geboren te Amstelveen

Promotiecommissie:

| | |
|---|---|
| Promotor: | Prof.dr.ir. J. Brug |
| Overige leden: | Prof.dr. G. Kok<br>Prof.dr. M.G. Koopmans<br>Prof.dr. H.T. van der Molen |
| Co promotor: | Dr. J.H. Richardus |

| Chapter | Contents | Page |
|---|---|---|
| 1. | General introduction | 9 |
| 2. | Perceived threat, risk perception and efficacy beliefs related to SARS and other (emerging) infectious diseases. Results of an international survey. | 35 |
| 3. | Avian Flu Risk Perception: Europe and Asia | 53 |
| 4. | Risk perception of human avian influenza infections in the Netherlands: strong feeling of risk but limited confidence in protective measures | 63 |
| 5. | Monitoring of risk perceptions and preventive behaviour related to human avian influenza during 2006 – 2007 in the Netherlands: results of seven consecutive surveys. | 73 |
| 6. | Correlates of precautionary behaviours related to avian influenza in 2006 – 2007 in the Netherlands | 85 |
| 7. | SARS-related risk perceptions and precautionary actions in a Chinese community in the Netherlands: cross sectional survey | 101 |
| 8. | Sources of information and health beliefs related to SARS and avian influenza among Chinese communities in the United Kingdom and the Netherlands, as compared to the general population in these countries | 113 |
| 9. | General discussion | 127 |
| | Summary | 155 |
| | Samenvatting | 159 |
| | Dankwoord | 165 |
| | Curriculum Vitae | 169 |
| | Publications | 171 |
| | PhD Portfolio Summary | 175 |

“If men define situations as real, they are real in their consequences.”

W.I. Thomas, 1928

# 1.

# General introduction

This thesis is about risk perception of infectious diseases, with a special focus on the emerging infections SARS and avian influenza, and explores potential determinants of risk perception and the relation of risk perception with precautionary behaviours. In this first chapter I discuss the context of emerging diseases, the theoretical framework, relevant studies on risk perception and infectious diseases, and the research questions addressed in this thesis.

## 1.1. Emerging infectious diseases in a risk society

Early 2003 the world was confronted with a new infectious disease that spread rapidly around the world. For the first time in many years the World Health Organization (WHO) issued an emergency alert on March 15, 2003 (1). Although SARS (Severe Acute Respiratory Syndrome), as this infectious disease was named, had originated in mainland China in November 2002, the WHO alert heralded the 'official' beginning of the SARS epidemic. Many considered this SARS epidemic as an example of the new risks that emerging infectious diseases pose to the world. The SARS epidemic clearly illustrated that such emerging infectious diseases can spread easily throughout the world – because of the swift and extensive jet-based global mobility – and can have large consequences for individual and public health, as well as the (international) economy (2-5). The SARS epidemic is also an example of how risks can be amplified in the public and policy arenas. Others have indeed criticized the fact that SARS received so much public attention while other health issues with much larger consequences for population health, such as the strengthening of health systems or improving the coverage of vaccination for the regular winter influenza, received much less attention (6).

The wearing of a mouth mask became the symbol of the SARS epidemic in the media, as shown on the cover of Time Magazine May 5, 2003. Questions were raised whether people reacted rationally and took sensible measures to protect their health, or whether people overreacted and even panicked and took measures while there were actually no or very low risks (7). It became apparent that in the control of infectious diseases, especially emerging diseases, there was little insight of how risks are perceived and what the impact might be of risk perception of infectious diseases. Traditionally, infectious disease control has focused on medical interventions, with less attention given to non-medical interventions, with the exception of HIV/STI prevention. This situation formed the starting point for the studies described in this thesis.

The emergence of new diseases takes place in what is considered a risk society (8, 9). Beck's main thesis is that modern society has technologically become very complex, and because of this complexity certain risks have become uncontrollable with a potential major impact. While in Western societies people live on average longer than ever before in great affluence, the potential for major crises with large impact on health and society in general has increased (8). The increasing possibilities of risks related to complex technological developments have contributed to the development of the 'precaution principle' (10, 11). The precaution principle focuses on the prevention of risks and dictates that for such prevention, precautionary measures should be taken until it is positively proven that the presumed risky activity or circumstance poses no actual risk anymore. Related to the notion of the risk society is the concept of the safety utopia developed by Boutellier (9). The safety utopia describes the hope to combine vitality and safety; the wish to live life to its full potential while at the same time being assured that there are no risks. The government is supposed to play a key role in preventing such risks.

New emerging diseases like SARS and avian influenza and the possibility of an influenza pandemic occur in this specific context. Whereas in the nineteenth century infectious diseases were the most feared diseases, this changed to cancer in the fifties of the twentieth century (12). With the introduction of HIV/Aids, infectious diseases were again perceived as an important and relevant medical problem, but only for specific population groups. A difference however, between HIV and diseases as SARS and avian influenza is the mode of transmission (sexual versus respiratory) and thus the potentially more rapid and random spread of these diseases. The public sees the prevention of such respiratory spread diseases as a collective (societal) rather than a personal responsibility (13). Therefore, prevention and control of infectious diseases is not just a medical or even public health problem, but it is directly related to the functioning of local authorities, states and international organizations, especially in the current societal context.

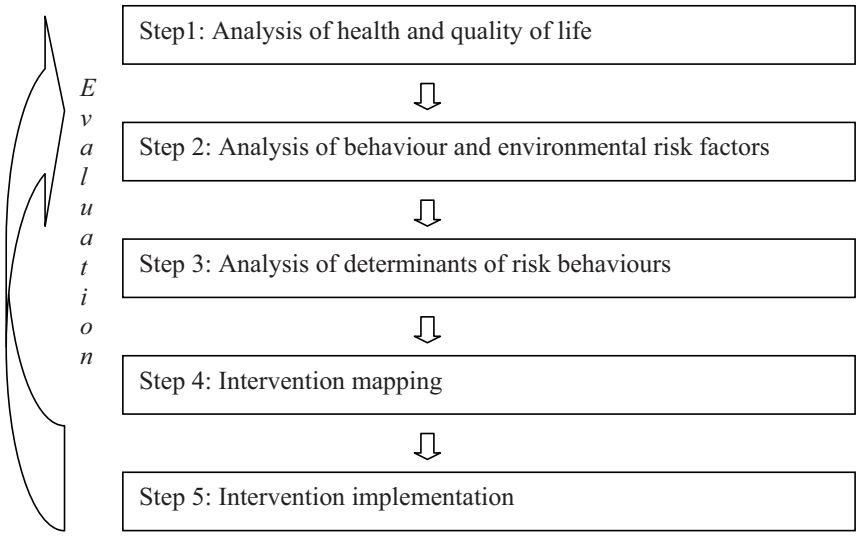
The effectiveness of the control of outbreaks of new emerging infectious diseases will be largely dependent on the behaviour of the population and their willingness to adhere to recommended preventive measures. For promotion of adequate precautionary behaviour among the population, public health authorities need to know how people perceive risks, how they perceive the effectiveness and acceptance of interventions and whether they will trust and be willing and able to use the information from public health authorities. Based on earlier outbreaks of infectious diseases, there is only limited information on these issues. In this thesis I will address this challenge by means of a number of explorative studies into risk perception of SARS and avian influenza. Hopefully these studies can form the starting point of more in-depth studies focusing on establishing casual relationships and evaluating interventions to stimulate precautionary behaviour.

### 1.2. A model for planned health education and health promotion

To develop successful public health interventions a planned approach has proven to be of crucial importance. Several models have been developed, with the Precede – Proceed model by Green & Kreuter and the Intervention Mapping protocol proposed by Bartolomew and colleagues (14, 15) as the most influential examples. Brug and colleagues have integrated such insights in the importance of careful evidence-based planning into a simple six-phase model for planned health education and health promotion (16) (Figure 1). According to this planning model, the first step in health promotion planning is the identification of a health problem that is serious and prevalent enough to justify spending time, money and other resources on developing and implementing an intervention. In the second step, the specific behavioural and environmental risk factors for the health problem of interest should be identified, as well as population groups who are exposed to these risk factors. The third step in planned health promotion is to investigate the individual and environmental determinants of exposure to risk factors. This planning phase should identify as precisely as possible why people in the population at risk engage in risk behaviour and what determinants could instigate behaviour change towards more healthy habits. This phase of identifying the determinants of engaging in risk behaviours has long been disregarded in the development of health promotion interventions. Health educators assumed, and some still do, that it is enough to know what the problem is and that certain behaviour puts you at risk for this problem. Merely telling people that their behaviour is putting them at risk was supposed to make people change their habits. Nowadays, however, a large body of empirical evidence shows that health beliefs or knowledge of risk behaviours are amongst many other possible ‘determinants’ that predict or drive people’s health-related behaviour, and are often not amongst the most crucial.

It is therefore necessary to conduct a more thorough inventory of behavioural determinants as part of the development of planned health education. In the fourth step, interventions should be developed that target as close and specific as possible the most important and best modifiable behavioural determinants. In the fifth and final step, interventions should be implemented and disseminated after effectiveness has been established.

**Figure 1: A model for planned health education and health promotion.**




The research described in this thesis focuses mostly on the determinant analysis phase in the model, and more specifically on an exploration of the role of risk perceptions. In this introduction I describe step 1: the analysis of health and quality of life, and step 2: the analysis of behaviour and environment risk factors. The research described in this thesis may contribute to development of interventions (step 4), which then could be implemented and disseminated (step 5). In the general discussion section (*chapter nine)*, some preliminary suggestions for step 4 will be made based on the studies presented in this thesis. Evaluation and research should inform all phases of the model, i.e. each step should be evidence-based, and interventions should be evaluated on implementation success, and changes in determinants, behaviours and health.

### 1.3. Analysis of health

In step 1 of the model for planned health education we focus on the analysis of the health problem and how it may affect population groups. In the studies in this thesis the focus is on SARS, avian influenza and an influenza pandemic, of which some important aspects will be described.

### *1.3.1. SARS*

After the travel alert of the WHO in March 2003, major international efforts led to the control of the SARS epidemic. SARS originated in China and was caused by the SARS coronavirus (17). During 2002 and 2003 a total of 8,098 cases of SARS were identified in 20 countries, with 774 fatalities. Most cases were identified in China, 5327, with 349 fatalities. By the end of February 2003, SARS had already spread to nine other countries including Canada, Ireland and the United States. At the start of the SARS outbreak many people worried whether SARS could have the same effects as an influenza pandemic. Fortunately SARS was controlled quickly and had a limited public health impact (18). In July 2003 the epidemic was over and while surveillance was intensified no new outbreak has been reported (in late 2003 and 2004 there were a number of incidental cases in China, Singapore and Taiwan, some related to laboratory based infections) (19).

However, the societal and economical impact of SARS was large. Some studies estimate the macro-economic impact at 100 billion US dollars, with tourism and travel sectors being the most affected, although in retrospect such estimations seem too high (2, 20, 21). SARS also received widespread attention in the media (2, 22-24). Smith concluded that media coverage of SARS followed the pattern for reporting on infectious diseases described by Ungar, which includes two phases (25). In the first phase reporting focuses on the frightening aspects of the outbreak, the new type of virus and the risks it poses to mankind. The new outbreak is characterized by using terms which accentuate the risks (e.g. deadly virus) and there is a pessimistic outlook. In the second phase a process starts whereby the outbreak is considered a risk that affects mostly others, a process of 'othering' (see also paragraph 1.7.2.). The outbreak is largely limited to other (far away) countries, other people are at risk who belong to different subgroups than one's own, and the outbreak becomes more abstract.

### *1.3.2. Avian influenza*

Since 2003 the attention for avian influenza has sharply increased because of outbreaks among birds and an increasing number of human infections, and the possible risk that avian influenza poses for a new potentially devastating influenza pandemic. Type A strains of the influenza virus lead to avian influenza among birds. While some birds, especially poultry, fall ill because of infection with avian influenza, many wild birds are carrier of the virus but do not seem to be affected by it (26). While all 16 HA (haemagluttinin) and 9 NA (neuraminidase) subtypes of influenza viruses can infect wild birds, only some of these are highly pathogenic, the H5 and H7 subtypes. These subtypes are very contagious when introduced among birds or poultry and can also be easily transmitted across farms or through migrating birds. The virus can also survive for a very long time in faeces of birds.

Most influenza viruses are specific for one species, and only rarely human infections with avian influenza have been documented. In the Netherlands in 2003 there was a large epidemic of H7N7 avian influenza infecting poultry at 255 locations (27). All poultry at all these locations was culled. In addition, preventive culling took place at 1.094 other locations. In total 30.7 million animals were killed, 30% of all Dutch poultry. Not only poultry was affected, an estimated 1.000 persons who were closely involved (either in the control of the outbreak or poultry farmers and their families) were infected with H7N7 avian influenza. The outbreak led to one fatality, a veterinarian who died of pneumonia caused by the infection (28).

Since 2003 there are ongoing outbreaks of H5N1 avian influenza, first among birds and poultry, but later also among humans. Two earlier outbreaks were reported in Hong Kong, in 1997 (with 18 human cases and six fatalities) and in 2003 (two cases with one death). The current ongoing outbreak was first reported in December 2003 with an outbreak of H5N1 avian influenza among poultry in South-Korea (29). Retrospectively already on November 25, 2003, a fatal human case took place in Beijing (29). Since 2003 the epidemic has spread among birds and poultry in 63 countries. The epidemic among birds reached Russia in July 2005 and Turkey and mainland Europe in October 2005. In February 2006 the first infections among birds in Africa were reported in Nigeria. The Americas have not seen outbreaks among birds or poultry yet, although H5N1 has been reported in wild swans in the United States in August 2006.

Spread of H5N1 avian influenza among humans has been limited to 14 countries with 382 cases and 241 fatalities by May 1, 2008 (30). Human cases were first identified early January 2004 in Vietnam and in the same year in Thailand. Outside South-East Asia cases were reported in Turkey, Iraq, Azerbaijan and Egypt in the first half of 2006, and since then also in Djibouti and Nigeria. Most human cases, 133, have been reported in Indonesia, with 108 fatalities. The fatality rate in Vietnam has been lower, with 106 cases and 52 fatalities. Most human cases have been linked to being in close contact with infected birds or poultry. Limited human-to-human infection has taken place among (extended) families of those infected with avian influenza (31).

Although outbreaks amongst birds and poultry have been controlled in most countries, ongoing transmission is reported in both Indonesia and Vietnam. In other countries, including European countries like Germany and the United Kingdom, sporadic outbreaks among birds or poultry or individual infections in birds have been reported.

### *1.3.3. Influenza pandemic*

An important reason why H5N1 avian influenza has received so much attention is because it may develop into a virus that can spread easily from human-to-human and start an influenza pandemic, i.e. a world-wide epidemic caused by a new subtype of virus to which humans have no natural resistance. Other influenza viruses can also develop into a new virus either through re-assortment, when genetic materials are exchanged between human and avian virus during a co-infection in a human, or through adaptive mutation, which is a more gradual process of adapting to humans.

In the twentieth century there were three influenza pandemics. The most notorious was the Spanish influenza from 1918-1919, which caused the death of an estimated 40 – 50 million people. The Asian influenza in 1957 caused 2 million deaths and the Hong Kong influenza in 1968 caused 1 million deaths. Because pandemics have taken place with 30 year intervals in the past, it is considered likely that a new pandemic may occur in the near future (32, 33). The WHO global influenza preparedness plan defines six alert phases. Currently (July 2008) the world is on a pandemic alert phase 3, meaning that there is no or very limited human-to-human transmission (34).

Different scenarios have been developed describing what can happen during a new influenza pandemic. The Netherlands national government departments of Internal Affairs and Health have recently published a report outlining two possible scenario's, a so-called mild scenario

with the availability of antiviral drugs and a serious scenario without antiviral drugs (35). In the mild scenario 5 million people would be infected (30% of the population), leading to 5.000 fatalities and a peak of 100.000 people becoming ill on one day. In the serious scenario also 5 million would be infected, but with a much higher case fatality rate (0.47%) leading to 80.000 deaths, and a peak in new cases of 170.000 on one day. In total 0.7 – 1.6 million (mild scenario) to 1.6 – 4.8 million people (serious scenario) would stay at home either because they are ill or need to take care for people who are ill. Currently the Dutch department of Internal Affairs considers an influenza pandemic the most serious safety risk for the country because of its high likelihood and very serious impact (36).

Two general categories of influenza pandemic control strategies are distinguished: pharmaceutical and non-pharmaceutical (37, 38). Pharmaceutical strategies include the development and distribution of both vaccines and antiviral drugs. Although some progress in the development of vaccines has been made, the development of a vaccine will probably take at least three months after the virus has been identified and thus cannot stop an influenza pandemic in time. (31, 39). For a number of antiviral drugs it has been proven that they are effective in reducing the consequences of influenza-like illnesses. Strategies have therefore been developed whereby antiviral drugs can be given either to those who are infected and ill, or as a prophylactic measure to those who are at risk for contracting the virus. Some countries have acquired a stockpile of antiviral drugs. However, in 2008 it was reported that some resistance against one of antiviral drugs had developed in France and Norway (40).

Non-pharmaceutical measures include isolating people with an influenza infection and reducing contact between people. Isolation of patients and quarantine of those possibly infected are only effective in the very early stages of a pandemic when the virus has not yet spread widely. In later stages of a pandemic such measures will not be effective, because too many people will already have been infected. Measures which are considered useful in all stages of the pandemic include hand hygiene, respiratory etiquette, use of masks by patients and health care workers, and voluntary self isolation (41). The effectiveness of non-pharmaceutical measures has been proven historically in an analysis of the effects of the Spanish influenza in cities in the United States (42). Also model-based analyses have shown the effectiveness of non-pharmaceutical measures, which largely rely on the co-operation of the public (43).

## 1.4. Analysis of behaviour

The aforementioned non-pharmaceutical measures largely rely on co-operation, i.e. behaviour, of the public. The focus of the second step of the model for planned health education and health promotion is on the analysis of the behavioural risk factors. In this paragraph I discuss the specific behaviours which may increase or decrease the risk of contracting an emerging infectious disease, or promote or help to prevent the spreading of the disease.

### *1.4.1. Behavioural risks and emerging infectious diseases*

Avian influenza and SARS are both caused by viruses. Even in the case of SARS, a new disease, it was already clear within weeks that the disease was caused by a previously unknown coronavirus (44, 45). Even before a virus is identified, analysis of the spread of such

an infectious disease can give insight into the most important modes of transmission. SARS, human influenza and avian influenza all have in common that transmission is primarily through the respiratory tract by means of droplet infection. Infectivity of viruses, however, can differ considerately resulting in different attack rates.

While the main mode of transmission is usually identified soon, specific situations often lead to questions about other unidentified modes of transmission. An example is the initially unexplained transmission of SARS in the housing complex Amoy Gardens in Hong Kong. Abraham described in detail the events related to Amoy Gardens (1). In March 2003 more than 130 people from this apartment complex were hospitalized with SARS within a few days. It became clear that people had not met each other or met in gatherings and it was questioned whether SARS was indeed only transmitted by droplets. After an isolation order and the evacuation of the residents, painstaking research started into the cause of infections in this specific building. Eventually it became clear that the droplet infection took place through the vertical plumbing system between bathrooms. The fact that transmission modes will not always be immediately clear might influence risk perception.

Identifying modes of transmission is a first step, the second step is to analyse how such modes of transmission are linked to individual and collective behaviour. Specific individual behaviour can prevent both oneself from becoming infected and transmitting the infection to others. Such preventive individual behaviours include technical protection (e.g. protective wear in hospitals and using a mouth mask), personal hygiene (e.g. washing hands), limiting contacts with (potentially) infected persons and using pharmaceutical interventions (e.g. prophylaxis with antiviral drugs).

Collective behaviour and preventive measures can also influence the spread of emerging infectious diseases. Traditional measures to control the spread of infectious diseases, such as isolation and quarantine, proved their effectiveness during the SARS outbreak (18). Such measures are only effective when a limited number of people is infected. Only then it is realistic to isolate those who are already ill or infected or quarantine those who are possible infected. During a pandemic such measures will not be very effective. Nevertheless, it is possible that limiting contacts between people (e.g. by travel restrictions, limiting large events or temporal closure of schools) might reduce the impact of a pandemic to some extent (43). A specific element of outbreaks of emerging infectious diseases like SARS and pandemic influenza is that risks are related to day-to-day and often social behaviours, which will probably make changing such behaviours more complicated (13).
For future outbreaks two specific issues warrant attention. Firstly, it is necessary to establish what the casual agent is and what the modes of transmission are, and how long possible alternative modes of transmission will feature in the public discussion. Secondly, it should be established to which extent the specific behaviours related to the mode of transmissions are part of day-to-day functioning. This probably influences whether people feel that they can control and possibly change their behaviour.

As SARS and influenza are transmitted by droplet infection the following behaviours can be risky (whereby of course the level of infectivity of the specific virus will influence the chances of transmission):

- being in close contact with those who have clinical signs of SARS (infection can take place through talking, sneezing and coughing)
- getting in touch with bodily fluids of someone with clinical signs of SARS (e.g. in taking care of someone who is ill)

- being in close contact with birds or poultry who are infected with H5N1 avian influenza (possible through direct contact with animals, infected faeces or aerogenic)
- being in contact with someone infected with (regular) influenza. As someone infected with influenza will cough or sneeze droplets with the virus will spread and only a very a small amount is necessary for infection. Transmission is more likely indoors than outdoors where the virus will be quickly diluted.
- shaking hands or touching doorknobs, phones and keyboards has a limited risk as more infected virus is necessary than via areogenic infection (46-48).

To prevent infections with SARS and (avian) influenza and to control the spread of these diseases the following possible non-pharmaceutical and pharmaceutical measures have been identified:

- hand hygiene (washing hands, avoiding shaking hands) and respiratory etiquette (covering mouth and nose with a tissue and refraining from spitting)
- using masks by patients, health care workers and possibly the general population
- isolation of the sick and quarantine of those exposed
- social distancing measures, like closing schools and cancelling public gatherings (37, 38, 41).

Two measures are important for the public health sector:

- surveillance and case reporting as to be able to take swift action
- rapid viral diagnosis, to establish whether indeed someone is infected with influenza in order to decide whether someone should be isolated (41).

Pharmaceutical measures include vaccination and antiviral drugs. As discussed, both strategies have limitations because currently no effective vaccine is available and globally there are certainly not enough antiviral drugs.

## 1.5. Analysis of determinants of behaviour

The third step of the model of planned health education and health promotion deals with the determinants of exposure to risk factors, behavioural determinants in particular. In general two categories can be distinguished. Firstly, personal determinants (sometimes called internal determinants) which include determinants like knowledge, risk perception and attitude and perceived self efficacy. The second category includes contextual or external determinants, like social pressure or support and barriers for behaviour. Behavioural theories and models can help to explain risk and preventive behaviours, and to indentify potential behavioural change strategies as well as help to direct further research into behavioural determinants.

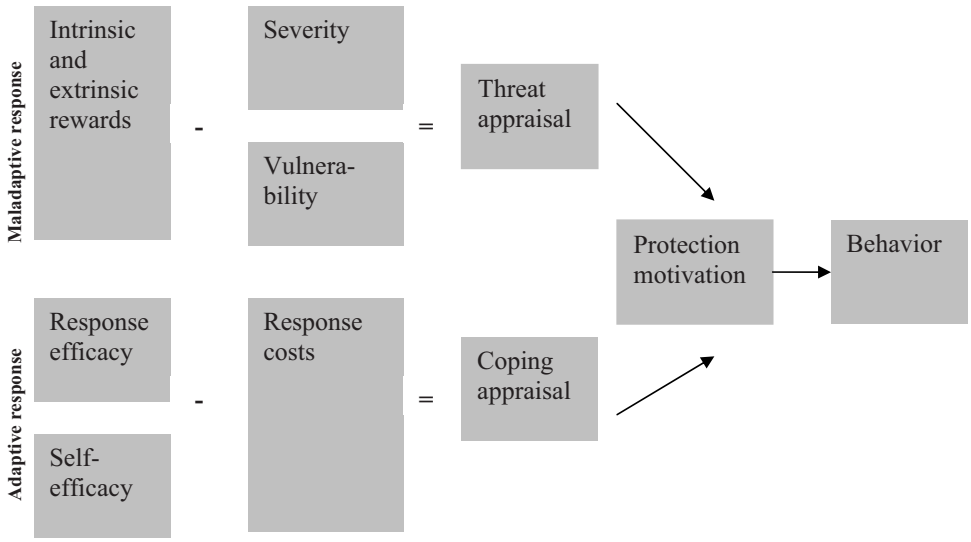
### *1.5.1. Behavioural models and the role of risk perception*

Within the social sciences and health psychology several theories and models have been developed to explain behaviour and behavioural change (see Conner & Norman for a good overview (49). Theories focus on different aspects and determinants of behaviour and behavioural change. Risk perception is a central element in the Health Belief Model as well as the Protection Motivation Theory (PMT). The basic hypothesis of the Health Belief Model is that whether people will engage in healthy behaviour is related to how they evaluate the health threat, sometimes defined as risk perception, and how they evaluate the recommended behaviour (50). In the evaluation of the health problem two psychological variables are important. The *perceived susceptibility* is the perception of the risk the individual has that he or she will contract the disease (51). The *perceived severity* can be defined as the belief of the

individual on how serious contracting the illness would be for himself. The evaluation of the recommended behaviour is based upon two elements: the perceived benefits and the perceived barriers for that behaviour.

Rogers has developed the Protection Motivation Theory as part of a research tradition which focused on how fear influenced people in taking precautionary actions (52, 53). Two possible strategies can be distinguished: the adaptive response (the behaviour which protects one's health) and the maladaptive response (behaviour which does not protect one's health). The perception of the severity of a health risk as well as the perceived vulnerability of one self for that particular health risk are important factors in establishing the level of threat and the motivation to change that behaviour.

**Figure 2: Protection Motivation Theory**




Protection Motivation Theory suggests that, apart from risk perception, response efficacy and self efficacy are two key determinants of precautionary behaviour. *Response efficacy* relates to the belief of people in the effectiveness of the available protective actions, for example hygienic measures. *Self efficacy* relates to a person's perception of their ability to engage in such protective actions, e.g. that they are able to carry out the proposed hygienic measures. Several reviews and meta-analyses focusing on the effects of fear, risk perception and fear appeals on health behaviours have suggested that higher risk perception will only predict precautionary behaviour when people believe that effective protective actions are available (in case of sufficient response efficacy) and when they have confidence that they have the opportunities and abilities to engage in such protective actions (sufficient self efficacy) (54, 55).

For the studies reported in this thesis the PMT was used as a general theoretical framework. In defining risk perceptions, we therefore distinguish between the perceived severity of a disease, described by Brewer et al. as the extent of harm a hazard would cause, and the

perceived vulnerability (often also described as perceived likelihood or risk perception as such), described as the probability that one will be harmed by the hazard (51, 53). In the studies described, other important variables from PMT, such as response efficacy and self-efficacy, and the interrelationships with risk perceptions, were also explored.

Additionally, the issue of 'optimistic bias' is very relevant to risk perception explorations, with a focus on a social comparative perspective (13, 56-59). Comparative vulnerability can be defined as the probability that one will be harmed by a hazard compared to others of the same age and gender. Risk perceptions are often biased. A low comparative vulnerability, i.e. a person's perception that he is less vulnerable than others of the same age and sex, which indicates unrealistic optimism, is regularly observed towards familiar risks that are perceived to be largely under volitional control. The opposite possibility, when people perceive their comparative vulnerability to be higher than others of the same sex and age, may indicate a pessimistic bias, which is more likely for new and unfamiliar risks that are perceived as uncontrollable. The latter might be the case with new emerging infectious diseases, like avian influenza or an influenza pandemic

## 1.6. From intervention development to evaluation

The next steps of the model of planned health education and health promotion are step 4, the development of interventions; step 5, the implementation and dissemination of interventions; and finally step 6, the evaluation of interventions. Although these steps are not part of the research described in this thesis I will briefly describe step 4 here and its relation to the control of SARS, avian influenza and an influenza pandemic.

In different national and local plans that are currently developed in preparation for possible future outbreaks of emerging infectious diseases several interventions are foreseen. Non-pharmaceutical interventions include contact tracing and isolation in a situation with limited spread. Other possible interventions include information campaigns to stimulate hygienic behaviours and reducing social contacts between people (e.g. by closing public buildings and preventing social gatherings) and early recognition of possible symptoms of these diseases. While such interventions have proven to be effective, it is likely that adherence and thus effectiveness can be enhanced if based more on empirical evidence regarding risk perception, efficacy beliefs, precautionary behaviour and use of and trust in specific sources of information. Based on our studies suggestions will be made for the development of interventions in the discussion of this thesis.

## 1.7. The study of risk perception

### *1.7.1. Traditions in the study of risk perception*

While studies into risk perception of (emerging) infectious diseases are relatively new, there is a body of knowledge on risk perception especially related to technological and environmental risks and other health risks. Following the analysis of Smith two main approaches related to risk can be distinguished, firstly a 'realistic' approach using mostly a psychometric perspective and secondly a 'social constructionist' approach (2). Next to this distinction, Fischoff described the development of the field of risk perception and risk

communication in an informative and helpful overview of eight stages focusing on how risks have been communicated (60):

- "All we have to do is get the numbers right
- All we have to do is to tell them the numbers
- All we have to do is explain what we mean by the numbers
- All we have to do is show them that they've accepted similar risks in the past
- All we have to do is show them that it's a good deal for them
- All we have to do is treat them nice
- All we have to do is make them partners
- All of the above."

The main focus of the realistic approach is to measure the 'objective' risk of a specific danger or threat (61, 62). While experimental studies using game-theory, especially in the field of economics, has focused on the way people should make decisions under uncertain circumstances (62), the development of new and potentially risky technologies led to further questions and more observational research about risk and risk communication. Studies within the so-called psychometric paradigm have developed a taxonomy for risks and hazards to explain why people value risks differently (57, 63). Slovic has developed two main dimensions for measuring risk: dread risk and unknown risk (57). Dread factors include among others uncontrollability, global catastrophic, fatal consequences, not equitable, a high risk for future generations, not easily reduced and an involuntary risk (57, 62, 64). Unknown risk factors include: not observable, unknown to those exposed, effect delayed, a new risk and a risk unknown to science. Although these factors indeed have been identified in many studies (see Lion for an overview (62)) the psychometric paradigm has been criticized because no casual links have been established.

The main element of the 'social constructionist' approach is that risks and threats are constructed through social and cultural processes and cannot be studied in isolation (2, 13, 62, 65). Factors which have been indentified as important include worldviews, affects and especially trust (66). The amount of trust in an organisation or an individual that communicates or is related to the risk, affects how risks are perceived. For (health) authorities social trust is especially important. Do people trust authorities especially when confronted with new risks? In non-controversial cases health authorities are deemed trustworthy, while in other cases, with the Food and Mouth Crisis in the UK as a noteworthy example, authorities were often not trusted (67-71). In the social constructionist approach risk is not just an objective factor which can be measured but also a social cultural concept. Different people and groups may value similar risks differently, and may differ in their interpretation and weighing of specific information and types of knowledge related to the risk (72, 73)

Part of the social constructionist tradition is the social amplification of the risk framework as developed by Kasperson et al. (74, 75). This framework focuses on the process of how the interaction of specific risks and psychological, social, institutional and cultural processes can either attenuate or intensify perception of risks and, through this, shape behaviour and can lead to secondary effects, for example social-political or economical. The theory has been used to successfully study different situations, including the 'oral contraceptive pill scare', genetically modified food, and the BSE-crisis (76-78).

While risk perception is an important element in many theories of health behaviour and there is a longstanding tradition of research into risk perception, the strength of the relationship between risk perception and precautionary behaviour is still debated. In 2007 Brewer et al.

published a meta-analysis on this topic which included a thorough analysis of some of the methodological issues related to the study of risk perception using vaccination as an example (51). They conclude that in overviews often only a small effect size for risk perception on precautionary action is reported, and different relationships between risk perception and behaviour have been reported including negative ones. Brewer distinguished three types of risk perception. The concept most often used is perceived likelihood, often also described as probability, susceptibility or vulnerability, which can be defined as "the probability that one will be harmed by the hazard". Perceived severity is also often used and is defined as "the extent of harm a hazard would cause". A third type of risk perception, namely perceived susceptibility, focuses on "an individual constitutional vulnerability to a hazard". A fourth dimension that can be distinguished is the risk perception after having taken precautionary measures (a concept that was not included in their further analyses).
A second methodological issue Brewer et al. raised is related to conditioned risk questions. Often it is not clear when asked about the perception of a certain hazard, e.g. in a prospective study about getting influenza, that some people respond thinking about their risk if they were not vaccinated, while others may answer the same questions based upon their perception of the risk after being vaccinated. Using unconditioned questions may underestimate or at least obscure the true association between risk perception and behaviour. Brewer et al. further argue that questionnaire items on risk perceptions should be personalised, i.e. refer to personal risks, and include a time frame. They hypothesized that risk perception is more important for behaviours that reduce a specific health threat than for behaviours that may be beneficial for more general health. In their meta-analysis of 34 studies that met their inclusion criteria they showed that risk likelihood, susceptibility and severity all statistically significantly influenced vaccination behaviour.

### *1.7.2. Risk perception and infectious diseases*

In this paragraph I will discuss how some of the most important results in the general discussion on risk perception relate to emerging infectious diseases. Both the realistic and the social constructionist approach are valuable in relation to (emerging) infectious diseases. Traditionally, most infectious disease professionals are trained within the positivistic medical paradigm. In communicating about risks related to infectious diseases this easily leads to communication in which most attention is on getting the numbers right, explaining these numbers and putting them into perspective compared to risk of other diseases or conditions. The development of the studies into risk perception and risk communication as well as behavioural models have shown that such communication is not enough, and more insight in risk perception is needed.

#### *Slovic's dimensions of dread and unknown risk*

Using the two dimensions of Slovic on dread and unknown risk one can easily see that many of these factors hold true for emerging infectious diseases (63). Emerging infectious diseases can seem uncontrollable, can lead to a global catastrophe (the influenza pandemic), can have sometimes fatal consequences if no treatment is available and are – depending on the mode of transmission – considered involuntary risks. As emerging infectious diseases are sometimes not observable in the infectious stage and form a new risk which is unknown or only partly understood by science and the general public, one might hypothesize that emerging infectious

diseases will be perceived as high risks, with a reasonable chance of unrealistic pessimism instead of optimism.

*Trust and social amplification of risks*

The fact that at early stages of an emerging infectious disease often not all knowledge is available and there might be scientific doubt or controversy, makes the issues of trust more important. If not all or no clear information is available, who will people trust in those situations? It is not clear whether governments and public health authorities are considered trustworthy, because in other health related issues this has not always been the case (67-71). Risk perception and consequently behavioural activity might not only intensify a 'crisis', but also lead to secondary effects, of which the economic effects of the SARS outbreak are an example.

*Emerging infectious diseases as a social construct*

Further, emerging infectious diseases are not isolated events, but take place in a socio-political and cultural context. Because of their infectivity the social aspects of risks related to infectious diseases are crucial, not only in the spread of an epidemic but also in preventive measures which can limit social contacts (isolation, quarantine) (13). The 'othering' process which often takes place within the media in reporting on infectious diseases might also have consequences for stigmatization of certain groups because of a higher perceived risk (79, 80).

One might even argue that the whole preparation for an influenza pandemic helps to create the 'societal risk' not so much the pure chance that a pandemic will take place, but the influenza pandemic as a modern (health) crisis. It has been argued based upon the precaution principle by Basili and Franzini that the shortage of lack of antiviral drugs in some countries has to be condemned as a precautionary failure (81).

### *1.7.3. Research into risk perception and SARS*

During the SARS epidemic and its aftermath several studies have been conducted which focused on risk perception of SARS, precautionary behaviour, knowledge of SARS, media attention for SARS and the psychological impact of SARS. Some studies focused on general populations, others on health care workers. Leppin recently published a narrative review of a number of studies, with a specific focus on the theoretical approaches used.

*Trends in risk perceptions close to the outbreak*

Several studies were conducted in Hong Kong, one of the main centres of the outbreak. Lau et al. conducted ten sequential telephone surveys during different phases of the epidemic (82). They showed that risk perception declined in what was called the second phase of the epidemic as the number of new infections also declined. In their study preventive measures in the first phase of the epidemic were associated with a rise in the number of new infections. Perceived efficacy of preventive measures was high. Another study conducted in Hong Kong during the epidemic showed that about 30% of respondents thought it very or somewhat likely

that they would contract SARS during the outbreak (83). A higher risk perception, meaning a higher perceived likelihood to contract SARS oneself, was a significant predictor of engaging in precautionary behaviour.

*Differences and changes in risk perceptions across countries and regions*

Leung et al. compared risk perception and precautionary behaviour between Hong Kong and Singapore and showed large differences between the perceived likelihood of contracting SARS, with 23% in Hong Kong and 11.9% in Singapore (84). In both cities respondents with a higher anxiety and greater risk perceptions took more preventive measures. Another study from Singapore confirmed the relation between a higher level of anxiety and preventive measures, but no significant relation was found between perceived likelihood of SARS and preventive measures (85).

Surveys in Ontario and Toronto, Canada – which were also hit by the outbreak – saw a decrease in the percentage of respondents being concerned from 69% in early April to 37% in late May (86). The level of concern in Ontario was higher than in other parts of Canada. In the USA concern was relatively high at around 30% throughout April and May 2003, with worry about contracting SARS themselves or a family member around the same level as worry about being the victim of a terrorist attack, 35% and 42% respectively. An internet based survey in the Netherlands conducted at the end op the epidemic showed that while 38.9% worried about SARS as a health problem, only 4.9% worried about getting SARS themselves and 8.3% worried about a family member getting SARS (87).

Although risk perception was assessed differently in these studies, risk perception was not necessarily related to the proximity of the outbreak. While both Hong Kong and Singapore were both in the centre of the outbreak, levels of risk perception differed between the two cities. Also, with hardly any cases in both countries, risk perceptions were high in the USA but low in the Netherlands.

*Stigmatization*

As SARS started in South-East Asia and spread through the world by people infected with SARS travelling to other parts of the world, there was the risk that SARS would lead to stigmatisation and discrimination of Asian communities. Stigmatisation of risk groups because of outbreaks of infectious diseases has been witnessed in many such circumstances, examples from the HIV-epidemic are all too clear (12, 79). Results from a study focusing on Asian-American communities showed that many people within these communities were getting most information from Asian sources, sometimes even earlier than news was available through American sources (79). A retrospective study into Chinese communities in the UK and the Netherlands and their experiences with SARS showed that because communities felt that no locally relevant information was available they turned to sources from countries of origin (80). Because members of communities feared stigmatisation when for example they would wear face masks, people adopted more avoidance-based risk reduction strategies. These strategies, whereby people tried to avoid social contacts, may have had negative economic and social impacts within the communities.

*Media coverage and information provision*

Studies into how the media tackled the issues related to risk perception and SARS showed that in the UK after an initial phase during which SARS was portrayed as a frightening threat, soon SARS was being 'contained' and the earlier described process of 'othering' started (2, 24). While media related to other diseases often used militaristic or judgemental discourse for SARS in the UK, this was less the case and people with SARS were not blamed and negative reactions against specific groups were reported less often (22). Studies in New Zealand and the Netherlands show that official information was an important source for the media and that the authorities were considered trustworthy (23, 88).

### *1.7.4. Research into risk perception and avian influenza and an influenza pandemic*

Following up on studies on risk perception and SARS a number of studies have been conducted focusing on risk perception and precautionary behaviour related to avian influenza or an influenza pandemic. Some of these studies were included in the review of the theoretical aspects of risk perception studies by Leppin (13).

*Studies in Europe*

A study in Norway in 2005 showed that almost half of the respondents underestimated the perceived risk compared to the official predictions (89). Asked what they would do if a serious influenza epidemic should break out in Norway, 80% of the respondent reported that they "would be careful about personal hygiene"; while 16% said they would not take special measures. Gupta et al. conducted a street-based survey in London and concluded that 71% of their respondents thought an influenza pandemic (very) likely in the coming ten years, and almost all respondents reported to be willing to wash their hands more than five times per day if requested (90).

Of the respondents in an Italian study carried out in 2005/6, around 20% of respondents felt very much at risk for themselves or their families for contracting avian influenza (91). Risk perception was higher if respondents had a lower socio-economic background, a lower level of education, had less knowledge, thought avian influenza could be transmitted by eating and touching raw eggs and poultry and if they felt they did not need additional information. Of the respondents those with a higher perceived risk, more information about washing hands and using gloves, knew more about the modes of transmission and those who had received information from health professionals were more likely to adhere to hygienic practices.

*Studies in Asia*

Fielding studied risk perception of avian influenza in Hong Kong with a special focus on live chicken sales and reported that 36% considered touching chicken while buying them as risky and 15% considered it (very) likely that they would get sick from buying live chickens (92). Perceived risk was negatively influenced by age, while worry, protective practices, avian influenza anxiety and risk of the production and handling of chicken all increased perceived risk.

Lau and colleagues carried out three studies in Hong Kong on different aspects of human avian influenza (93-95). In a first study substantial unconfirmed beliefs and misconceptions were reported related to avian influenza which were correlated to immediate behavioural responses, such as avoiding visits to hospitals and eating less poultry (93). A second study indicated that if human-to-human transmission would occur in Hong Kong, large proportions of respondents would engage in protective behaviour, like wearing face masks in public venues (74%), increasing the frequency of hand washing (87%) or avoiding eating poultry (64%) (94). A higher level of education, a higher perceived efficacy of face masks and the perception that an outbreak would take place in Hong Kong the next year were associated positively with the anticipated wearing of face masks when having influenza like illness. The results of the third study showed that a large majority, 71.4%, of respondents expected that a bird-to-human transmission would taken place next year, while 52.4% expected human-to-human transmission taking place next year (95). Expectations for these events taking place in Hong Kong were lower than for mainland China or other countries. If 2 to 3 human-to-human transmissions would take place in Hong Kong the next year 41.4% would worry about oneself being affected, 52.9% about family members, 19.7% would experience much panic. Between 71 and 81% of respondents reported to avoid visiting hospitals, crowds, going out or going abroad when there was either bird-to-human transmission or human-to-human transmission.

A study done in Vietnam in 2004 and 2005 showed that during the first peak of the outbreak in January – February 2004 75% of the respondents considered avian influenza a serious threat to Vietnamese consumers, while 59% felt concerned for themselves or their relatives (96). Soon after the first peak of the outbreak in July 2004 half of the respondents considered avian influenza as something from the past. Although during the first crisis 74% stopped eating poultry, in later stages people trusted their own risk reduction or avoidance strategies, like feeling capable to judge the health of chicken when buying them, washing chicken in salted water or having trust in the person where they bought their chicken. In analysing anxiety during the peak of the outbreak and a few months later, Figuié et al. showed that during the peak a low level of anxiety was related to trust in the public authorities, while after the peak those with a high level of perceived self control were less anxious. They also reported that while avian influenza remained being perceived as a very serious risk in qualitative interviews in July 2005, the risk of getting infected was perceived as not high.

*Research into risk perception of other infectious diseases*

Over the years a number of studies have been published into risk perception of other infectious diseases than SARS, avian influenza and HIV/STI. Most of these studies concern research related to vaccination issues. A number of other studies addressed two other infections diseases that have received public attention in recent years: Lyme disease and the West Nile Virus.

Many studies have been published on risk perception of vaccination (97-107). Most of these studies were related to public discussions about possible side effects of vaccination for children, or on decreasing vaccination rates, for example in the United Kingdom after 1998 related to claims that vaccination against measles, mumps and rubella (MMR) could lead to autism (97). Studies show that parents may perceive the severity of childhood illnesses different. An important difference between parents who have their children vaccinated and who do not is the perceived effectiveness of vaccination and the risk the vaccine itself may have (98, 100, 101, 103, 107). In terms of PMT parents disagree mostly about the response

efficacy. Another issue raised in some of the studies is trust and mistrust in (public health) authorities regarding vaccination, which hinders risk communication and dialogue (100-103, 107).

A number of studies from the USA focused on risk perception and precautionary behaviour related to West Nile virus and Lyme disease (108-113). People can be infected with the West Nile virus through mosquitoes, while ticks may carry Lyme disease. For both diseases prevention is primarily focussed on behavioural measures such as using mosquito repellent or mosquito nets for West Nile virus protection, or wearing long sleeved clothes and checking for tick bites, for Lyme disease prevention. Aquino concluded that respondents got most of their information regarding risks and precautionary action related to these infections from television, but respondents doubted the efficacy of some of the protective measures (108). Women and those who worried more about West Nile virus reported more precautionary behaviour (113). In their study on tick avoidance behaviours Shadick and colleagues reported that although Lyme disease was seen as a serious problem and knowledge was relatively high, precautionary behaviour in an area with known risks was far from universal (112). One of the determinants influencing tick avoidance behaviour was self efficacy, i.e. a higher perceived self efficacy in finding a tick oneself was associated with tick avoidance behaviour. Herrington also reported a low uptake of preventive measures; more worry and knowing someone with Lyme disease were associated with taking preventive measures (110). Another study reported high levels of precautionary behaviour, especially among women, while younger age was associated with lower levels of precautionary action (111).

### *1.7.6. Preliminary conclusions on risk perception and emerging infectious diseases*

Taking into account the theoretical work related to risk perception and the studies published on risk perception and (emerging) infections diseased one can draw the following preliminary conclusions:

- The importance of risk perception related to infectious disease management has been confirmed in a recent meta-review with the focus on influenza vaccination.
- Protection Motivation Theory is a useful theoretical framework to study for the role of risk perception related to emerging infectious diseases.
- Although there is a tradition of research into risk perception, empirical studies into risk perception of recent (emerging) infectious diseases are very limited.
- There is little knowledge about factors influencing risk perceptions of new emerging infectious diseases, and how risk perceptions may relate to precautionary actions.

## 1.8. Research questions

The studies included in this thesis originated in the daily practice of infectious diseases control. During the SARS outbreak it became apparent that while SARS received much attention in the Dutch media, not much information was available on how people perceived SARS and what this meant for their behaviour. In response to questions from the Chinese community in Rotterdam, the Municipal Public Health Service Rotterdam-Rijnmond developed an information brochure in Chinese to inform them about SARS. Meetings with community representatives made clear that members of the community perceived some risks differently. Considering possible future outbreaks of either SARS, avian influenza or an influenza pandemic, it became clear that not much was known about risk perception, what

should be the best ways for risk communication to stimulate people to adhere to public health measures, whether risk perception for SARS and avian influenza was different from other diseases or conditions, whether there were differences between countries, how risk was perceived in communities who might be more at risk, and how risk perception might change over time.

Taking into account the tradition of research into risk perception and the largely unexplored issues of risk perception and emerging infectious diseases, we conducted several explorative studies. In these studies we combined a more realistic approach with a social constructionist approach. Being explorative studies, we were interested in describing and mapping risk perceptions for different diseases and conditions in different countries and over time. From a public health practice perspective we were interested in the relationship between risk perception and precautionary behaviour. We were interested in the use of media and trust in (public health) authorities which relates more to the social constructionist approach.

In this thesis I aim to address the following research issues and questions:

1. Exploring risk perceptions for emerging infectious diseases: how are the risks of new emerging infectious diseases like SARS and human avian influenza perceived?
2. Exploring potential determinants of risk perceptions for new emerging infectious diseases: how do risk perceptions of SARS and/or avian influenza
    i. Compare to risk perceptions of other diseases and conditions?
    ii. Differ according to socio-demographic variables such as age, sex, level of education?
    iii. Differ between countries and regions?
    iv. Change over time, possibly related to occurrence of outbreak-related events?
3. Exploring the importance of risk perceptions for management of new emerging infectious diseases: how do risk perceptions relate to precautionary actions and to other potential determinants of such actions?

In addressing these issues and contributing to answering these questions we hope to gain more insight into risk perception, precautionary behaviour and possible consequences for public health interventions

### 1.9. Overview of the research chapters

*Chapter two* of this thesis describes risk perception of SARS and several other diseases in five European and three Asian countries. In a large telephonic survey, which included 3,436 respondents, risk perception for SARS and other diseases was studied together with efficacy beliefs. Differences between diseases and between countries were analyzed.

*Chapters three, four, five and six* deal with avian influenza. In *chapter three* risk perception of avian influenza, efficacy beliefs and preventive behaviour are the main topic. This study used the same sample of respondents as that in chapter two and also made international comparisons. In *chapter four* we describe risk perception, efficacy beliefs, knowledge and preventive behaviour related to human influenza in the Netherlands in March 2006. This study was based on an Internet-survey of 579 respondents. Following this survey, another four surveys were conducted every three months and two extra surveys directly after avian influenza related incidents. In *chapter five* we describe how risk perception, efficacy beliefs and self-reported preventive behaviour related to avian influenza may change or remain stable over a one year period (using the seven surveys conducted from March 2006 to March 2007).

*Chapter six* describes the analyses on risk perception, knowledge, amount of information, thinking about avian influenza and their determinants as well as precautionary behaviour and its determinants. This study included all 3,840 respondents who participated in the surveys from March 2006 to March 207.

*Chapters seven and eight* focus on Chinese communities. In *chapter seven* the results are described of a study among the Chinese community in Rotterdam carried out in September 2003. It focused on risk perception of SARS, possible risky behaviours, precautionary actions as well use of information. In *chapter eight* we describe a study of risk perception of SARS and avian influenza among Chinese communities in the Netherlands and the United Kingdom and compare them with the general population.

*Chapter nine* summarizes the main results and answers the research questions of this thesis. Methodological issues are discussed as well as the implications for research and public health practice.

## References


1. Abraham T. Twenty-First Century Plague. The story of SARS. Baltimore: The John Hopkins University Press; 2004.
2. Smith RD. Responding to global infectious disease outbreaks: lessons from SARS on the role of risk perception, communication and management. Soc Sci Med 2006;63(12):3113-23.
3. Garret L. Coming Plague: Newly emerging diseases in a world out of balance. New York: Farrar, Straus and Giroux; 1994.
4. Garret L. Betrayal of trust. The collapse of global public health. New York: Hyperion; 2000.
5. Goudsmit J. De virusinvasie. Over de overleving van virussen en de menselijke soort. Amsterdam: Contact; 2003.
6. Bonneux L, Van Damme W. An iatrogenic pandemic of panic. Bmj 2006;332(7544):786-8.
7. Menon KU. Risk communications: in search of a pandemic. Ann Acad Med Singapore 2008;37(6):525-10.
8. Beck U. Risk society. Towards a new modernity. London: Sage; 1992.
9. Boutellier H. De veiligheidsutopie. Hedendaags onbehagen en verlangen rondom misdaad en straf. Den Haag: Boom Juridische Uitgeverij; 2002.
10. Kriebel D, Tickner J. Reenergizing public health through precaution. Am J Public Health 2001;91(9):1351-5.
11. Kraaijeveld A, Pieterman R. Risico's van veiligheid. Over de grenzen van preventie en voorzorg bij onze omgang met besmettelijke ziekten. In: Helsloot I, Van Steenbergen JE, editors. Infectieziektebestrijding. Studies naar organisatie en praktijkwerking. Den Haag: Boom Juridische Uitgeverij; 2005. p. 49-83.
12. Bourke J. Fear. A cultural history. London: Virago; 2005.
13. Leppin A, Aro AR. Risk perception related to SARS and avian flu: Theoretical foundations of current empirical research. International Journal of Behavioural Medicine 2009 - in press.
14. Green LW, Kreuter MW. Health promotion planning, an educational and ecological approach. Third Edition ed. Mountain View, California: Mayfield Publishing Company; 1999.
15. Bartholomew LK, Parcel GS, Kok G, Gottlieb NH. Planning health promotion programs; an Intervention Mapping approach. San Francisco: Jossey-Bass; 2006.
16. Brug J, van Assema P, Lechner L. Gezondheidsvoorlichting en gedragsverandering. Een planmatige aanpak. Assen: Van Gorcum; 2007.
17. WHO. Summary of probable SARS cases with onset of illness from 1 November 2002 to 31 July 2003. 2004. Available at: http://www.who.int/csr/sars/country/table2004_04_21/en/index.html.
18. Bell DM. Public health interventions and SARS spread, 2003. Emerg Infect Dis 2004;10(11):1900-6.
19. WHO. Severe acute respiratory syndrome. Archive of SARS updates. 2004. Available at: http://www.who.int/csr/don/archive/disease/severe_acute_respiratory_syndrome/en/index.html
20. Sadique MZ, Edmunds WJ, Smith RD, Meerding WJ, de Zwart O, Brug J, Beutels P. Precautionary behavior in response to perceived threat of pandemic influenza. Emerg Infect Dis 2007;13(9):1307-13.
21. Keogh-Brown MR, Smith RD. The economic impact of SARS: How does the reality match the predictions? Health Policy 2008.
22. Wallis P, Nerlich B. Disease metaphors in new epidemics: the UK media framing of the 2003 SARS epidemic. Soc Sci Med 2005;60(11):2629-39.
23. Wilson N, Thomson G, Mansoor O. Print media response to SARS in New Zealand. Emerg Infect Dis 2004;10(8):1461-4.
24. Washer P. Representations of SARS in the British newspapers. Soc Sci Med 2004;59(12):2561-71.
25. Ungar S. Hot crises and media reassurance. British Journal of Sociology 1998;49:36-56.
26. WHO. Avian influenza (" bird flu") - Fact sheet. 2006. Available at: http://www.who.int/mediacentre/factsheets/avian_influenza/en/index.html.
27. Bosman A, Mulder YM, De Leeuw JRJ, Meijer A, Du Ry van Beest Holle M, Kamst RA, Van der Velden PG, Conyn - van Spaendonck MAE, Koopmans MPG, Ruijetn MWMM. Vogelpest Epidemie 2003: gevolgen voor de volksgezondheid. Bilthoven: RIVM / Instituut voor Psychotrauma; 2004.
28. Fouchier RA, Schneeberger PM, Rozendaal FW, Broekman JM, Kemink SA, Munster V, Kuiken T, Rimmelzwaan GF, Schutten M, Van Doornum GJ, Koch G, Bosman A, Koopmans M, Osterhaus AD. Avian influenza A virus (H7N7) associated with human conjunctivitis and a fatal case of acute respiratory distress syndrome. Proc Natl Acad Sci U S A 2004;101(5):1356-61.
29. WHO. H5N1 avian influenza: Time line of major events. 2008. Available at: http://www.who.int/csr/disease/avian_influenza/Timeline_080418.pdf.

30. WHO. Cumulative Number of Confirmed Human Cases of Avian Influenza A/(H5N1). Reported to WHO. 2008. Available at: http://www.who.int/csr/disease/avian_influenza/country/cases_table_2008_06_19/en/index.html.
31. Gambotto A, Barratt-Boyes SM, de Jong MD, Neumann G, Kawaoka Y. Human infection with highly pathogenic H5N1 influenza virus. Lancet 2008;371(9622):1464-75.
32. Ferguson NM, Fraser C, Donnelly CA, Ghani AC, Anderson RM. Public health. Public health risk from the avian H5N1 influenza epidemic. Science 2004;304(5673):968-9.
33. Smith DJ. Predictability and preparedness in influenza control. Science 2006;312(5772):392-4.
34. WHO. Current WHO phase of pandemic alert. 2008. Available at: http://www.who.int/csr/disease/avian_influenza/phase/en/index.html.
35. Ministerie voor Volksgezondheid Welzijn Sport, Ministerie voor Binnenlandse Zaken en Koninkrijkszaken. Scenario's Grieppandemie. 'Expect the best, prepare for something worse'; 2008.
36. Ministerie voor Binnenlandse Zaken en Koninksrijksrelaties. Voortgangsbrief Nationale Veiligheid 2008, 30 mei 2008; 2008.
37. Bell DM. Non-pharmaceutical interventions for pandemic influenza, national and community measures. Emerg Infect Dis 2006;12(1):88-94.
38. Bell DM. Non-pharmaceutical interventions for pandemic influenza, international measures. Emerg Infect Dis 2006;12(1):81-7.
39. Rumke HC, Bayas JM, de Juanes JR, Caso C, Richardus JH, Campins M, Rombo L, Duval X, Romanenko V, Schwarz TF, Fassakhov R, Abad-Santos F, von Sonnenburg F, Drame M, Sanger R, Ballou WR. Safety and reactogenicity profile of an adjuvanted H5N1 pandemic candidate vaccine in adults within a phase III safety trial. Vaccine 2008;26(19):2378-88.
40. Lackenby A, Hungnes O, Dudman SG, Meijer A, Paget WJ, Hay AJ, Zambon MC. Emergence of resistance to oseltamivir among influenza A(H1N1) viruses in Europe. Euro Surveill 2008;13(5).
41. Aledort JE, Lurie N, Wasserman J, Bozzette SA. Non-pharmaceutical public health interventions for pandemic influenza: an evaluation of the evidence base. BMC Public Health 2007;7(147):208.
42. Markel H, Lipman HB, Navarro JA, Sloan A, Michalsen JR, Stern AM, Cetron MS. Nonpharmaceutical interventions implemented by US cities during the 1918-1919 influenza pandemic. Jama 2007;298(6):644-54.
43. Davey VJ, Glass RJ, Min HJ, Beyeler WE, Glass LM. Effective, robust design of community mitigation for pandemic influenza: a systematic examination of proposed US guidance. PLoS ONE 2008;3(7):e2606.
44. Drosten C, Gunther S, Preiser W, van der Werf S, Brodt HR, Becker S, Rabenau H, Panning M, Kolesnikova L, Fouchier RA, Berger A, Burguiere AM, Cinatl J, Eickmann M, Escriou N, Grywna K, Kramme S, Manuguerra JC, Muller S, Rickerts V, Sturmer M, Vieth S, Klenk HD, Osterhaus AD, Schmitz H, Doerr HW. Identification of a novel coronavirus in patients with severe acute respiratory syndrome. N Engl J Med 2003;348(20):1967-76.
45. Ksiazek TG, Erdman D, Goldsmith CS, Zaki SR, Peret T, Emery S, Tong S, Urbani C, Comer JA, Lim W, Rollin PE, Dowell SF, Ling AE, Humphrey CD, Shieh WJ, Guarner J, Paddock CD, Rota P, Fields B, DeRisi J, Yang JY, Cox N, Hughes JM, LeDuc JW, Bellini WJ, Anderson LJ. A novel coronavirus associated with severe acute respiratory syndrome. N Engl J Med 2003;348(20):1953-66.
46. Centrum Infectieziektebestrijding. Richtlijn influenzae. 2004. Available at: http://www.rivm.nl/cib/infectieziekten-A-Z/infectieziekten/Influenza/index.jsp.
47. Centrum Infectieziektebestrijding. Richtlijn SARS. 2005. Available at: http://www.rivm.nl/cib/infectieziekten-A-Z/infectieziekten/sars/index.jsp.
48. Centrum Infectieziektebestrijding. Richtlijn aviaire influenza. 2007. Available at: http://www.rivm.nl/cib/infectieziekten-A-Z/infectieziekten/aviaire_influenza/index.jsp.
49. Conner M, Norman P. Predicting Health Behaviour. Maidenhead: Open University Press; 2005.
50. Rosenstock IM. Historical origins of the health belief model. Health Education Monographs 1974;2:1-8.
51. 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(2):136-45.
52. Rogers RW. A protection motivation theory of fear appeals and attitude change. Journal of Psychology 1975;91:93-114.
53. Rogers RW. Cognitive and physiological processes in fear appeals and attitude change: A revised theory of protection motivation. New York: Guilford Press; 1983.
54. Rippetoe PA, Rogers RW. Effects of components of protection-motivation theory on adaptive and maladaptive coping with a health threat. J Pers Soc Psychol 1987;52(3):596-604.
55. Ruiter RAC, Abraham C, Kok G. Scary warnings and rational precautions: a review of the psychology of fear appeals. Psychology and Health 2001;16:613-630.

56. Sjoberg L. Factors in risk perception. Risk analysis 2000;20(1):1-11.
57. Slovic P. Perception of risk. Science 1987;236:280-285.
58. Weinstein ND. Why it won't happen to me: perceptions of risk factors and susceptibility. Health Psychol 1984;3(5):431-57.
59. Weinstein ND. The precaution adoption process. Health Psychology 1988;7(4):355-386.
60. Fischhoff B. Risk perception and communication unplugged: twenty years of process. Risk Anal 1995;15(2):137-45.
61. Kahneman D, Slovic P, Tversky A. Judgement under uncertainty. Heuristics and biases. Cambridge: Cambridge University Press; 1982.
62. Lion R. Security or opportunity. The effects of individual and situational factors on risk information preference [PhD]: Universiteit Maastricht; 2001.
63. Slovic P. The Perception of Risk. London: Earthscan; 2000.
64. Bennett P, Calman K. Risk communication and public health. New York: Oxford University Press; 1999.
65. Joffe H. Risk: from perception to social representation. Br J Soc Psychol 2003;42(Pt 1):55-73.
66. Slovic P. Trust, emotion, sex, politics, and science: Surveying the risk-assessment battlefield. Risk Analysis 1999;19(4):689-701.
67. Berg L. Trust in food in the age of mad cow disease: a comparative study of consumers' evaluation of food safety in Belgium, Britain and Norway. Appetite 2004;42(1):21-32.
68. O'Connor RE, Bord RJ, Fisher A. Rating threat mitigators: faith in experts, governments, and individuals themselves to create a safer world. Risk Anal 1998;18(5):547-56.
69. Poortinga W, Bickerstaff K, Langford I, Niewohner J, Pidgeon N. The British 2001 Foot and Mouth crisis: A comparative study of public risk perceptions, trust and beliefs about government policy in two communities. Journal of Risk Research 2004;7(1):73-90.
70. Siegrist M, Cvetkovich G. Perception of hazards: the role of social trust and knowledge. Risk Anal 2000;20(5):713-9.
71. Trumbo CW, McComas KA. The function of credibility in information processing for risk perception. Risk Anal 2003;23(2):343-53.
72. Garvin T. Analytical paradigms: the epistemological distances between scientists, policy makers, and the public. Risk Anal 2001;21(3):443-55.
73. Lupton D. Risk as moral danger: the social and political functions of risk discourse in public health. Int J Health Serv 1993;23(3):425-35.
74. Kasperson RE, Renn O, Slovic P, Brown HS, et al. The social amplification of risk: A conceptual framework. Risk Analysis 1988;8(2):177-187.
75. Pidgeon NF, Henwood K, Maguire B. Public health communication and the social amplification of risks: present knowledge and future prospects. In: Bennett P, Calman K, editors. Risk communication and public health. Oxford: Oxford University Press; 1999. p. 65-77.
76. Barnett J, Breakwell GM. The social amplification of risk and the hazard sequence: The October 1995 oral contraceptive pill scare. Health, Risk and Society 2003;5(3):301-313.
77. Frewer LJ, Miles S, Marsh R. The media and genetically modified foods: evidence in support of social amplification of risk. Risk Anal 2002;22(4):701-11.
78. Raude J, Fischler C, Lukasiewicz E, Setbon M, Flahault A. GPs and the social amplification of BSE-related risk: An empirical study. Health, Risk and Society 2004;6(2):174-185.
79. Person B, Sy F, Holton K, Govert B, Liang A. Fear and stigma: the epidemic within the SARS outbreak. Emerg Infect Dis 2004;10(2):358-63.
80. Jiang X, Elam G, Yuen C, Voeten H, de Zwart O, Veldhuijzen I, Brug J. The impact of SARS on Chinese communities in the United Kingdom and the Netherlands: a qualitative study. International Journal of Behavioural Medicine 2009 - in press.
81. Basili M, Franzini M. Understanding the risk of an avian flu pandemic: rational waiting or precautionary failure? Risk Anal 2006;26(3):617-30.
82. Lau JT, Yang X, Tsui H, Kim JH. Monitoring community responses to the SARS epidemic in Hong Kong: from day 10 to day 62. J Epidemiol Community Health 2003;57(11):864-70.
83. Leung GM, Lam TH, Ho LM, Ho SY, Chan BH, Wong IO, Hedley AJ. The impact of community psychological responses on outbreak control for severe acute respiratory syndrome in Hong Kong. J Epidemiol Community Health 2003;57(11):857-63.
84. Leung GM, Quah S, Ho LM, Ho SY, Hedley AJ, Lee HP, Lam TH. A tale of two cities: community psychobehavioral surveillance and related impact on outbreak control in Hong Kong and Singapore during the severe acute respiratory syndrome epidemic. Infect Control Hosp Epidemiol 2004;25(12):1033-41.

85. Quah SR, Hin-Peng L. Crisis prevention and management during SARS outbreak, Singapore. Emerg Infect Dis 2004;10(2):364-8.
86. 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(7):925-31.
87. Brug J, Aro AR, Oenema A, de Zwart O, Richardus JH, Bishop GD. SARS risk perception, knowledge, precautions, and information sources, the Netherlands. Emerg Infect Dis 2004;10(8):1486-9.
88. Jong W, Petit M, Jochmann J. Overheidscommunicatie als instrument. In: Helsloot I, Van Steenbergen JE, editors. Infectieziektebestrijding. Studies naar organisatie en praktijkwerking. Den Haag: Boom Juridische Uitgevers; 2005.
89. Kristiansen IS, Halvorsen PA, Gyrd-Hansen D. Influenza pandemic: perception of risk and individual precautions in a general population. Cross sectional study. BMC Public Health 2007;7(147):48.
90. Gupta RK, Toby M, Bandopadhyay G, Cooke M, Gelb D, Nguyen-Van-Tam JS. Public understanding of pandemic influenza, United Kingdom. Emerg Infect Dis 2006;12(10):1620-1.
91. Di Giuseppe G, Abbate R, Albano L, Marinelli P, Angelillo IF. A survey of knowledge, attitudes and practices towards avian influenza in an adult population of Italy. BMC Infect Dis 2008;8:36.
92. Fielding R, Lam WW, Ho EY, Lam TH, Hedley AJ, Leung GM. Avian influenza risk perception, Hong Kong. Emerg Infect Dis 2005;11(5):677-82.
93. Lau JT, Tsui H, Kim JH, Griffiths S. Perceptions about status and modes of H5N1 transmission and associations with immediate behavioral responses in the Hong Kong general population. Prev Med 2006;43(5):406-10.
94. Lau JT, Kim JH, Tsui HY, Griffiths S. Anticipated and current preventive behaviors in response to an anticipated human-to-human H5N1 epidemic in the Hong Kong Chinese general population. BMC Infect Dis 2007;7:18.
95. Lau JT, Kim JH, Tsui H, Griffiths S. Perceptions related to human avian influenza and their associations with anticipated psychological and behavioral responses at the onset of outbreak in the Hong Kong Chinese general population. Am J Infect Control 2007;35(1):38-49.
96. Figuie M, Fournier T. Avian influenza in Vietnam: chicken-hearted consumers? Risk Anal 2008;28(2):441-51.
97. Bellaby P. Communication and miscommunication of risk: understanding UK parents' attitudes to combined MMR vaccination. Bmj 2003;327(7417):725-8.
98. Bennett P, Smith C. Parents attitudinal and social influences on childhood vaccination. Health Educ Res 1992;7(3):341-8.
99. Fiebach NH, Viscoli CM. Patient acceptance of influenza vaccination. Am J Med 1991;91(4):393-400.
100. Hobson West P. Understanding vaccination resistance: Moving beyond risk. Health, Risk and Society 2003;5(3):273-283.
101. Kraaijeveld A, Pieterman R. Uiteenlopende zorgen. Hoe ouders onderling en met autoriteiten botsen rondom vaccinatie. In: Helsloot I, Van Steenbergen JE, editors. Infectieziektebestrijding. Studies naar organisatie en praktijkvoering. Den Haag: Boom Juridische Uitgeverij; 2005. p. 353-367.
102. May T. Public communication, risk perception, and the viability of preventive vaccination against communicable diseases. Bioethics 2005;19(4):407-21.
103. Raithatha N, Holland R, Gerrard S, Harvey I. A qualitative investigation of vaccine risk perception amongst parents who immunize their children: a matter of public health concern. J Public Health Med 2003;25(2):161-4.
104. Salmon DA, Moulton LH, Omer SB, Chace LM, Klassen A, Talebian P, Halsey NA. Knowledge, attitudes, and beliefs of school nurses and personnel and associations with nonmedical immunization exemptions. Pediatrics 2004;113(6):e552-9.
105. Taylor JA, Darden PM, Brooks DA, Hendricks JW, Wasserman RC, Bocian AB. Association between parents' preferences and perceptions of barriers to vaccination and the immunization status of their children: a study from Pediatric Research in Office Settings and the National Medical Association. Pediatrics 2002;110(6):1110-6.
106. Timmermans DR, Henneman L, Hirasing RA, van der Wal G. Attitudes and risk perception of parents of different ethnic backgrounds regarding meningococcal C vaccination. Vaccine 2005;23(25):3329-35.
107. Woo EJ, Ball R, Bostrom A, Shadomy SV, Ball LK, Evans G, Braun M. Vaccine risk perception among reporters of autism after vaccination: vaccine adverse event reporting system 1990-2001. Am J Public Health 2004;94(6):990-5.
108. Aquino M, Fyfe M, MacDougall L, Remple V. Protective behavior survey, West Nile virus, British Columbia. Emerg Infect Dis 2004;10(8):1499-501.
109. Armstrong PM, Brunet LR, Spielman A, Telford SR, 3rd. Risk of Lyme disease: perceptions of residents of a Lone Star tick-infested community. Bull World Health Organ 2001;79(10):916-25.

110. Herrington JE, Jr. Risk Perceptions Regarding Ticks and Lyme Disease: A National Survey. American Journal of Preventive Medicine 2004;26(2):135-140.
111. Phillips CB, Liang MH, Sangha O, Wright EA, Fossel AH, Lew RA, Fossel KK, Shadick NA. Lyme disease and preventive behaviors in residents of Nantucket Island, Massachusetts. Am J Prev Med 2001;20(3):219-24.
112. Shadick NA, Daltroy LH, Phillips CB, Liang US, Liang MH. Determinants of tick-avoidance behaviors in an endemic area for Lyme disease. Am J Prev Med 1997;13(4):265-70.
113. McCarthy TA, Hadler JL, Julian K, Walsh SJ, Biggerstaff BJ, Hinten SR, Baisley C, Iton A, Brennan T, Nelson RS, Achambault G, Marfin AA, Petersen LR. West Nile virus serosurvey and assessment of personal prevention efforts in an area with intense epizootic activity: Connecticut, 2000. Ann N Y Acad Sci 2001;951:307-16.

# 2.

# Perceived threat, risk perception and efficacy beliefs related to SARS and other (emerging) infectious diseases. Results of an international survey

Onno de Zwart (1, 2), Irene K. Veldhuijzen (1, 2), Gillian Elam (3), Arja R. Aro (4), Thomas Abraham (5), George D. Bishop (6), Hélène A.C.M. Voeten (2), Jan Hendrik Richardus (1, 2), Johannes Brug (2, 7)

1. Division of Infectious Diseases Control, Municipal Public Health Service Rotterdam-Rijnmond, Rotterdam, the Netherlands
2. Department of Public Health, Erasmus MC, University Medical Center Rotterdam, the Netherlands
3. Health Protection Agency – Centre for Infections, London United Kingdom
4. Unit for Health Promotion Research, University of Southern Denmark, Esbjerg, Denmark
5. Journalism and Media Study Centre, The University of Hong Kong, Hong Kong
6. Department of Psychology, National University of Singapore, Singapore
7. EMGO Institute, VU University Medical Center, Amsterdam, the Netherlands

International Journal of Behavioral Medicine: in press

**Abstract**

Purpose

To study levels of perceived threat, perceived severity, perceived vulnerability, response- and self-efficacy for SARS and eight other diseases in five European and three Asian countries.

Method

A computer-assisted phone survey was conducted among 3,436 respondents. The questionnaire focused on perceived threat, vulnerability, severity, response and self-efficacy related to SARS and eight other diseases.

Results

Perceived threat of SARS in case of an outbreak in the country was higher than that of other diseases. Perceived vulnerability of SARS was at an intermediate level and perceived severity was high compared to other diseases. Perceived threat for SARS varied between countries in Europe and Asia, with a higher perceived severity of SARS in Europe and a higher perceived vulnerability in Asia. Response efficacy and self-efficacy for SARS were higher in Asia as compared to Europe. In multiple linear regression analyses, country was strongly associated with perceived threat.

Conclusions

The relatively high perceived threat for SARS indicates that it is seen as a public health risk and offers a basis for communication in case of an outbreak. The strong association between perceived threat and country and different regional patterns require further research.

**Background**

SARS and avian influenza are two examples of recent emerging infectious diseases that may cause severe threats to population health, large economic losses, as well as fear and dread (1, 2). The behavior of the general population or specific risk groups can play an important role in both the spread and control of infectious diseases. The SARS epidemic showed the impact of world-wide travel on the rapid spread of an epidemic, as well as the possible merits of strict hygiene and quarantine measures in halting that epidemic (3). In case of an infectious disease pandemic, public health authorities will be dependent on the willingness and ability of the general public to adhere to recommendations regarding personal hygiene, vaccination and/or prophylaxis, quarantine, travel restrictions, or closing down of public buildings such as schools (4, 5). Compliance with recommended precautionary behaviors is not self-evident (6). Specific attention to factors influencing behavioral change during outbreaks of infectious diseases is therefore necessary.

One of the factors that may influence willingness and motivation to adopt precautionary behaviors is risk perception (7-10), i.e. the perceived personal vulnerability or likelihood of a disease or health threat. Perceived vulnerability combined with perceived severity, can be regarded as perceived threat. People are expected to have the highest perceived threat of SARS if they think that an infection with SARS is likely and will have serious health consequences. However, risk perception is certainly not the only determinant of protective behavior. Protection Motivation Theory suggests that response efficacy (i.e. when people believe that effective protective actions against SARS are available), and self-efficacy (i.e. that people have the ability to engage in such protective actions) are two other key predictors of protection motivation (8).

Risk perceptions are often biased. Unrealistic optimism about risks is often observed towards familiar risks that are perceived to be largely under volitional control. People perceive their relative risk compared to others of the same gender and age as lower. A pessimistic bias, i.e. perceptions of risk that are (much) higher than actual risk, is more likely for new risks that are perceived as uncontrollable. The latter might be the case with new emerging infectious diseases, like SARS (9-12).

While in some fields such as environmental risks, risk perception has been studied intensively, not much is known about risk perception of recently emerging infectious diseases. Related to emerging infections diseases, first explorative and descriptive studies are needed to increase our insights in perceived threat, risk perception and efficacy beliefs. Such studies can inform more focused and theory-driven investigations. During and in the aftermath of SARS several of such exploration studies have been conducted, but these studies did not include international comparisons across a range of different countries. These studies showed that the risk of SARS was perceived differently across the globe, and was not directly linked to the proximity of the outbreak. Risk perception of SARS in some of the Asian countries was relatively low compared to risk perception in the USA (13-15), but similar to levels reported for the Netherlands (16). One study focused on differences in psychosocial factors predicting preventive behavior in four affected regions (17). Ji and colleagues compared optimism related to SARS in China and Canada and concluded that both groups demonstrated unrealistic optimism, while at the same time they were overly pessimistic about their own chances of getting infected (18). A limited number of studies have looked at risk perception of avian influenza with different results varying from high perceived risks to low risk perception (19-21). A Dutch study showed high levels of risk perception of avian influenza in case of an

outbreak and indicated that almost 40% of respondents had taken some sort of precautionary measures (22).

There are few international comparative studies that analyze differences in perceived threat, risk perception and efficacy beliefs between (infectious) diseases and conditions and differences between countries (23-25). It is generally unknown whether risk perceptions of emerging infectious diseases are perceived in similar ways across countries. Because there was a large difference between how SARS has affected South-East Asia and Europe, one might hypothesize that this would mean a higher risk perception of SARS and possibly other infectious diseases in countries in South-East Asia. If international differences in risk perceptions of SARS exist, the question is whether such differences are specific for SARS, whether we see the same for risk perception of avian influenza (as most cases have also occurred in South-East Asia) or whether they may indicate a more general trend in risk perceptions.

The present study explored perceived threat, risk perception and efficacy beliefs related to SARS in random samples of the population of eight countries in Europe and Asia. To explore if country differences were specific for SARS, perceived threat, risk perception and efficacy beliefs related to avian influenza and other (infectious) diseases were also investigated. This study had the following specific objectives:

- To study levels of perceived threat, vulnerability (or risk perception) and severity, and comparative vulnerability for SARS in Denmark, the Netherlands, Poland, Spain, the United Kingdom, China, Hong Kong and Singapore;
- To compare perceived severity, vulnerability and threat of SARS with other diseases and conditions, i.e. avian influenza, common cold, diabetes, HIV, high blood pressure, tuberculosis, food poisoning and a heart attack;
- To study differences and associations between these factors across the eight countries and between Europe and Asia.

Because data collection for the present study took place in the autumn of 2005, i.e. two years after the SARS epidemic, it was not possible to collect information on specific precautionary behaviors. Furthermore, specific results on risk perception of avian influenza and related efficacy beliefs have been reported elsewhere (22).

## Methods

### *Procedure and respondents*

Data were collected using Computer Assisted Telephone Interviewing (CATI) in the native languages by native speakers of each country, coordinated by a Dutch company that specializes in international telephone survey research, using random digit dialing (RDD). For the Asian countries, the Dutch company was assisted by an Asian agency. If unanswered, numbers were tried again up to five times and when possible call back appointments were made. Interviews were conducted from 20 September to 22 November 2005 in eight different countries, five in Europe representing regions in North, West, South and East Europe (Denmark, the Netherlands, Great Britain, Spain, and Poland) and three regions in East Asia (Singapore, province of Guangdong China and Hong Kong). In China, the survey was conducted in the province of Guangdong. During the period of data collection, no cases of SARS were reported. Respondents aged 18 to 75 years were eligible for participation.

*Questionnaire*

The questionnaire was based on a previously developed SARS risk perception questionnaire (16) and focused on risk perception and severity of SARS, avian influenza and other (infectious) diseases, efficacy beliefs and use of information sources and took on average 16 minutes to complete. The questionnaire was first developed in English, translated into Dutch, and subsequently pre-tested in Great Britain and the Netherlands using cognitive interviewing. Further translations were made into Danish, Spanish, Polish, Mandarin and Cantonese; all translations were conducted by professional translators and checked by native speakers, including members of the project team.

The questionnaire started with basic demographic questions, including urbanization and level of education (see table 1 for categories). Respondents were then presented with the following diseases or conditions: diabetes, a common cold, HIV, high blood pressure, SARS, tuberculosis, heart attack, flu from a new virus, and food poisoning. These illnesses and conditions were included as these are both infectious and non-infectious diseases, some more common and familiar, and some with more serious consequences, thus giving a range of options for comparisons. For SARS and flu, the respondents first received a brief explanation (for SARS: "SARS is a severe acute breathing related illness caused by a previously unknown virus"; for flu "A new type of flu virus can arise from avian flu, it causes serious illness and spreads easily in the population"). Respondents were then asked about

1. Severity ("How serious (on a scale from 1 to 10) would it be for you if you got [*disease*] in the next year?");
2. Vulnerability ("How likely do you think it is that you will develop or contract a [*disease*] in the next year; very unlikely (1) to very likely (5));
3. Comparative vulnerability ("How likely do you think it is that you will develop or contract [*disease*] in the next year compared to other [*women/men*] of your age in [*own country*]; much less likely (1) to much more likely (5));

The questionnaire continued with two questions focusing on knowledge of SARS (name symptoms, whether SARS is a communicable disease).

For SARS, flu from a new virus and common cold the following additional questions were included: response efficacy ("To what extent do you think people can take effective actions to prevent getting SARS/flu from a new virus/common cold in case of an outbreak") (outbreak was included for SARS and flu from a new virus); not at all (1) to very much (4)); self-efficacy ("How confident are you that you can prevent getting SARS/flu from a new virus/common cold in case of an outbreak"); (not confident (1) to very confident (4)). The order of these three diseases was chosen randomly by the computer. The questionnaire continued with questions on use of sources of information during the SARS outbreak, trust in these sources and preferences for ways of communication during future outbreaks. Respondents where then presented with scenarios and asked about possible preventive actions. Results of this have been reported elsewhere (26). The questionnaire concluded with some general background questions on perceived general health, perceived happiness, whether respondent had been vaccinated against influenza, and about employment status, education level and religion. (The questionnaire is available online at http://www2.eur.nl/fgg/mgz/SARSControl/questionnaire_risk_perceptions_survey.htm)

*Statistical analysis*

Respondents indicating they never heard about SARS (1.3%) were excluded from the analyses. Furthermore, "don't know" answers on the questions about risk perception were treated as missing values, and therefore also excluded from the analysis. On average, 4.4% of respondents did not know how to rate SARS severity and 4.3% could not rate their vulnerability to SARS.

For the different countries mean scores and standard deviations (SD) were calculated for severity, risk perception, perceived threat (see below) and comparative vulnerability of eight different diseases or conditions. In line with Protection Motivation Theory one measure was defined as 'perceived threat', it was constructed by multiplication of the measures of perceived severity (scale 1-10) and vulnerability (in case of an outbreak in the country for SARS and flu from a new flu virus) (scale 1-5). To make the scores comparable, the severity score was first divided by two. To normalize the skewed distribution of the new variable, a square root transformation was performed that resulted in a measure of perceived threat on a scale from 1 (low) to 5 (high). A SARS knowledge score (scale 0-2) was calculated based on whether the respondent could name a symptom of SARS and whether the respondent knew SARS was a communicable disease. Differences in background characteristics (gender, age group, area and level of education) and risk perceptions between the samples in Europe and Asia were explored with Chi-square tests or (paired) Students T-tests, of which the p-value and the effect-size *r* are reported. An r below .30 indicates low effect size, .30-.50 indicates medium effect sizes and higher than .50 large effect size.

To test for important correlates of SARS-related risk perceptions, four multiple linear hierarchical regression models were applied with perceived severity, vulnerability, threat and comparative vulnerability as dependent variables. The independent variables were included in blocks, with country (dummy coded) in the first block, sex, age, highest education and urbanization in the second block, and the amount of information during the SARS outbreak and the SARS knowledge score in the last block. As we did not want to choose one country as a reference group, we ran the models by leaving out the intercept. In doing so, the regression coefficients for the countries do not represent the difference in mean compared to the reference group but the actual (corrected) mean value of the respective dependent variable. The $R^2$, a measure of the proportion of variance in the dependent variable that is explained by the independent variables in the model, is given for each hierarchical step in the models. The models were applied to the total population and the model for perceived threat was also applied to the separate countries.

## Results

*Response and general characteristics*

In the European countries, 16% of the numbers created by RDD were non-existent and 26% of the numbers could not be reached after five times. Of the people eligible for participation 40.2% completed the interview and 59.8% refused. Participation rates varied from 21.3 % in the UK to 81.1% in Poland (see table 1).

For the interviews conducted by the Asian agency, no response rates are available. In total, 3,436 respondents were interviewed. Data on background variables in the different

participating countries are provided in table 1. Most respondents in all countries were female (58% in the total group). European respondents were significantly older than Asian respondents ($p<0.001$; $r=.27$). Substantially more respondents in Asia lived in a city, as both Hong Kong and Singapore were included ($p<0.001$; $r=.56$). Asian respondents were higher educated than European respondents ($p<0.001$; $r=.014$).

**Table 1: Participation rates and distribution of general characteristics in the study population**

| | DNK % | POL % | NLD % | GBR % | ESP % | CHN % | HKG % | SGP % | Europe % | Asia % | Total % |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **TOTAL** n | 463 | 488 | 400 | 401 | 425 | 404 | 396 | 426 | 2177 | 1226 | 3403 |
| % | 14 | 14 | 12 | 12 | 12 | 12 | 12 | 13 | 64 | 36 | 100 |
| **Participation rate** | 58 | 81 | 44 | 21 | 34 | - | - | - | 40 | 13 | |
| **Gender** | | | | | | | | | | | |
| Male | 40 | 39 | 42 | 41 | 41 | 47 | 44 | 43 | 40 | 45 | 42 |
| Female | 60 | 61 | 58 | 59 | 59 | 53 | 56 | 57 | 60 | 55 | 58 |
| **Age group** | | | | | | | | | | | |
| 18-30 | 13 | 18 | 10 | 13 | 17 | 43 | 27 | 35 | 14 | 35 | 22 |
| 31-45 | 31 | 31 | 31 | 35 | 34 | 34 | 35 | 31 | 32 | 33 | 33 |
| 44-60 | 36 | 32 | 37 | 31 | 32 | 19 | 27 | 20 | 33 | 22 | 29 |
| 61-75 | 20 | 19 | 24 | 21 | 17 | 4 | 12 | 14 | 20 | 10 | 16 |
| **Area** | | | | | | | | | | | |
| City | 26 | 21 | 9 | 20 | 45 | 86 | 90 | 81 | 24 | 86 | 46 |
| Town | 38 | 25 | 37 | 45 | 42 | 9 | 4 | 16 | 37 | 10 | 27 |
| Village/Countryside | 37 | 54 | 55 | 36 | 13 | 4 | 6 | 2 | 39 | 4 | 26 |
| **Education** | | | | | | | | | | | |
| Primary or lower | 17 | 8 | 5 | 2 | 22 | 4 | 13 | 3 | 11 | 7 | 9 |
| Low | 31 | 22 | 28 | 20 | 9 | 19 | 20 | 11 | 22 | 16 | 20 |
| Intermediate | 38 | 43 | 35 | 35 | 31 | 35 | 32 | 38 | 37 | 35 | 36 |
| High | 13 | 28 | 32 | 43 | 38 | 42 | 35 | 48 | 30 | 42 | 34 |

(DNK = Denmark, POL = Poland, NLD = the Netherlands, ESP = Spain, CHN = China, HKG = Hong Kong, SGP = Singapore)

*Risk perception and severity of SARS and other diseases*

SARS was rated as the third most severe problem among the diseases and conditions included, HIV as the most serious problem and common cold as the least serious (see table 2). Compared to flu from a new flu virus, SARS was rated more serious in all countries (overall: 8.3 (scale 1 – 10) versus 7.0, $p<0.001$; $r=.47$, country specific test results not shown). Perceived vulnerability, risk perception, for common cold was the highest, 3.8, and for HIV the lowest, 1.4 (scale 1 – 5). For SARS the risk perception levels differed in case of an outbreak in, or outside, the country. It was among the highest with 2.7 in case of an outbreak in the country, while in case of an outbreak outside the country it was 2.1 ($p<0.001$; $r=.44$). The vulnerability for an outbreak of flu from a new flu virus was higher than for SARS both in case of outbreak inside the country (3.1 versus 2.7, $p<0.001$; $r=.31$) and outside the country (2.9 versus 2.1, $p<0.001$; $r=.48$). This finding was true for all countries (separate test results not shown).

**Table 2: Mean scores and standard deviations (SD) of severity, vulnerability, perceived threat, of 8 different diseases and conditions, N=3,436.**

| Disease | Severity (scale 1-10) | | Vulnerability (scale 1-5) | | Perceived threat* (scale 1-5) | | Comparative vulnerability (scale 1-5) | |
|---|---|---|---|---|---|---|---|---|
| | Mean | SD | mean | SD | mean | SD | mean | SD |
| SARS. outbreak in country[§] | 8.3 | 2.1 | 2.7 | 1.2 | 3.2 | 0.9 | 2.6 | 1.0 |
| Heart attack | 8.4 | 2.1 | 2.5 | 1.2 | 3.1 | 0.9 | 2.5 | 1.1 |
| Flu from new virus. outbreak in country[§] | 6.9 | 2.5 | 3.1 | 1.2 | 3.1 | 0.9 | 2.8 | 1.0 |
| Flu from a new flu virus[§] | 6.9 | 2.5 | 2.9 | 1.2 | 3.0 | 0.9 | 2.7 | 1.0 |
| SARS. outbreak outside country[§] | 8.3 | 2.1 | 2.1 | 1.1 | 2.8 | 0.9 | 2.2 | 1.0 |
| High blood pressure | 6.4 | 2.2 | 2.4 | 1.2 | 2.7 | 0.9 | 2.4 | 1.1 |
| Tuberculosis | 7.3 | 2.3 | 2.0 | 1.0 | 2.6 | 0.8 | 2.1 | 0.9 |
| Food poisoning | 5.6 | 2.5 | 2.6 | 1.2 | 2.6 | 0.9 | 2.4 | 1.0 |
| Diabetes | 6.8 | 2.5 | 2.0 | 1.1 | 2.5 | 0.9 | 2.2 | 1.0 |
| HIV | 9.1 | 2.1 | 1.4 | 0.8 | 2.4 | 0.7 | 1.6 | 0.8 |
| Common cold | 2.8 | 2.1 | 3.8 | 1.2 | 2.1 | 0.9 | 3.0 | 1.0 |

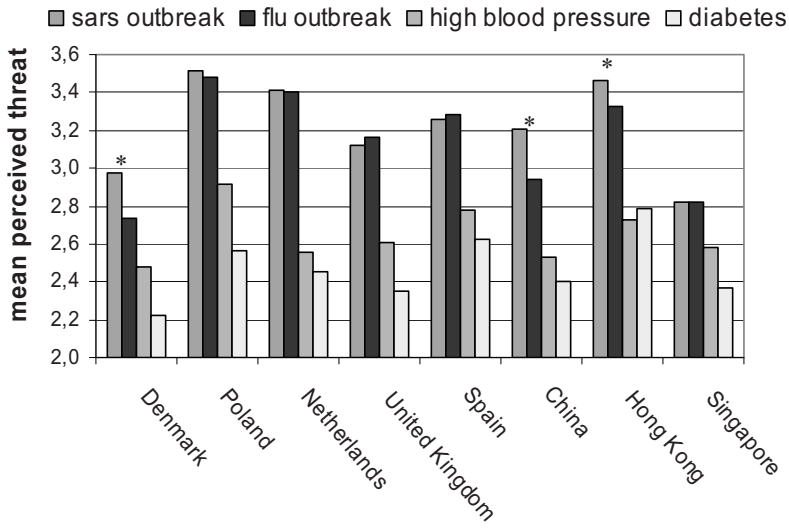
* Perceived threat is the square root of the multiplication of severity/2 and vulnerability
Diseases are ranked by perceived threat score

[§] Severity of SARS and flu from a new virus was asked in general. The mean score is given in the table for both situations (outbreak in or outside country)

Perceived threat of SARS in case of an outbreak in the country was among the highest of the diseases, with a mean score of 3.2 (scale 1 – 5); perceived threat of HIV (2.4) and a common cold (2.1) were the lowest. Perceived threat of SARS and flu from a new flu virus in case of an outbreak were similar in most countries but in Denmark, China and Hong Kong SARS was perceived more threatening than flu from a new flu virus ($p<0.001$; $r=.23$, $p<0.001$; $r=.25$ and $p=0.004$; $r=.15$ respectively).

The level of perceived threat varied across countries. Perceived threat of SARS was the highest in Poland and the lowest in Singapore. In figure 1 the results are presented of perceived threat of SARS, flu from a new virus, high blood pressure and diabetes. Although levels of perceived threat varied between countries, the pattern of perceived threat differences between the different diseases and conditions was the same in all countries with perceived threat of SARS and avian flu being the highest and for diabetes the lowest.

**Figure 1: Mean perceived threat of SARS and flu from a new flu virus in case of an outbreak, high blood pressure and diabetes by country**




* difference in mean perceived threat between SARS and flu is statistically significant

The comparative vulnerability of SARS in case of an outbreak outside the country was 2.6 (scale 1 – 5), indicating that that people thought it slightly less likely that they would contract SARS compared to the average other (Table 2). The much lower value for HIV (1.6, $p<0.001$; $r=.65$) indicates that participants on average thought it much less likely to contact HIV compared to other people of the same age and gender.

*Comparison Europe – Asia*

SARS was perceived as a more severe problem in Europe, 8.42, compared to Asia, 8.02 (on a scale of 1-10 [$p<0.00005$; $r=.09$])), while Asia perceived a higher vulnerability 2.54, 1.86, respectively ($p<0.00005$; $r=.29$) (see table 3). For flu from a new flu virus, perceived severity was higher in Europe, 7.06 to 6.74 in Asia ($p<0.0005$; $r=.06$) as was perceived vulnerability, 3.16 to 2.97 ($p<0.00005$; $r=.08$). In comparing Europe to Asia there is not one pattern for all diseases, some are perceived more severe in Europe (heart attack, HIV), others in Asia (food poisoning, common cold) nor is there for perceived vulnerability.

**Table 3: Mean scores of severity and vulnerability for different diseases and conditions compared for Eu and Asia**

| Disease | Severity (scale 1-10) | | | | | Vulnerability (scale 1-5) | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | EU | Asia | Diff. | T-value[#] | | EU | Asia | Diff. | T-value[#] | |
| SARS, outbreak outside country[§] | 8.42 | 8.02 | 0.40 | 4.8 | *** | 1.86 | 2.54 | -0.68 | 4.8 | *** |
| SARS, outbreak in country[§] | 8.42 | 8.02 | 0.40 | 4.8 | *** | 2.69 | 2.70 | -0.01 | -0.3 | |
| Flu from a new flu virus[§] | 7.06 | 6.74 | 0.32 | 3.6 | ** | 2.89 | 2.82 | 0.07 | 1.5 | |
| Flu from new virus, outbreak in country[§] | 7.06 | 6.74 | 0.32 | 3.6 | ** | 3.16 | 2.97 | 0.19 | 4.5 | *** |
| Heart attack | 8.87 | 7.45 | 1.42 | 18.2 | *** | 2.53 | 2.36 | 0.17 | 3.8 | ** |
| High blood pressure | 6.41 | 6.48 | -0.07 | -0.9 | | 2.45 | 2.36 | 0.10 | 2.1 | |
| Tuberculosis | 7.60 | 6.66 | 0.94 | 10.5 | *** | 1.88 | 2.18 | -0.30 | -7.7 | *** |
| Food poisoning | 5.46 | 5.80 | -0.34 | -3.7 | ** | 2.56 | 2.71 | -0.14 | -3.4 | * |
| Diabetes | 6.88 | 6.59 | 0.28 | 3.1 | * | 1.91 | 2.16 | -0.24 | -6.1 | *** |
| HIV | 9.41 | 8.48 | 0.93 | 10.9 | *** | 1.36 | 1.46 | -0.09 | -3.3 | * |
| Common cold | 2.45 | 3.52 | -1.07 | -13.9 | *** | 3.86 | 3.58 | 0.28 | 6.9 | *** |

[#] To adjust for multiple testing, the significance level was divided by the number of comparisons (20) using the Bonferroni adjustment

* p<.0025, ** p<.0005, *** p<.00005

[§] Severity of SARS and flu from a new virus was asked in general. The mean score is given in the table for both situations (outbreak in or outside country)

*Knowledge and efficacy beliefs*

Of the respondents in the Asian countries more than 80% could name symptoms of SARS; this percentage was just over 40% in European countries. The proportion who knew SARS was a communicable disease varied between 62% in Spain to 88% in Denmark. The mean knowledge score was 1.2 (range 0 - 2) in Europe and 1.7 in Asia ($p<0.001$; $r=.69$).
Self-efficacy was lower than response efficacy for both SARS and a common cold in all countries, but the difference was larger for SARS. Both response and self-efficacy for SARS were higher in the Asian countries compared to the European countries ($p<0.001$; $r=.28$ and $p<0.001$; $r=.40$, respectively). (see figure 2)

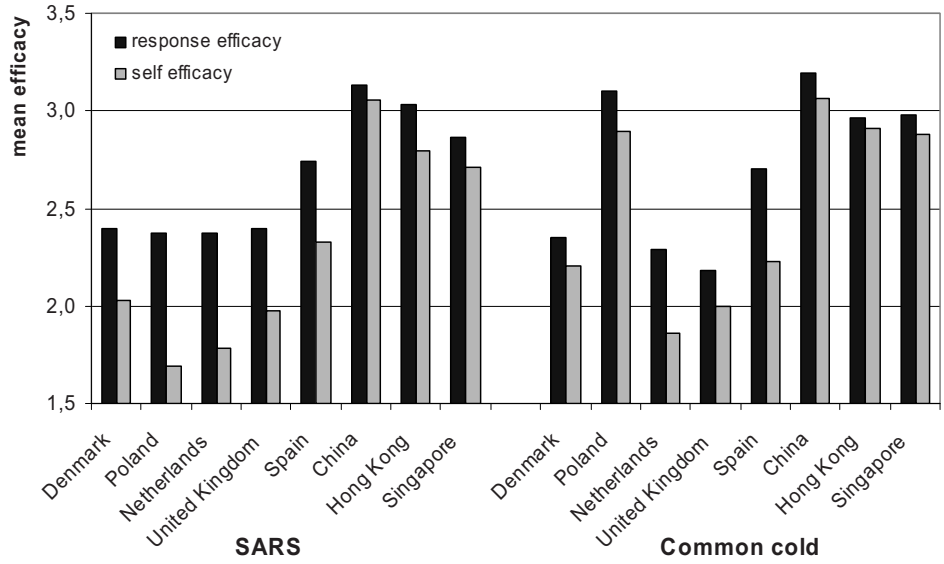
*Linear regression model*

The regression models for perceived severity, vulnerability, threat and comparative vulnerability for all countries combined are presented in Table 4a. Country was significantly associated with perceived threat, vulnerability, severity and comparative vulnerability. Besides country, a higher perceived severity of SARS was significantly associated with female gender, lower level of education, and a higher SARS knowledge score. A higher perceived vulnerability for SARS was significantly associated with lower level of education.

All the variables that were significantly associated with severity and vulnerability were also significantly associated with perceived threat. Comparative vulnerability was significantly associated with gender, and amount of information. Comparative vulnerability in women was lower than in men, and lower in respondents that received more information about SARS. The models for each outcome variable explained less than 10% of the variance (Table 4b). The

proportion of the variance explained by country was higher than that for the other potential correlates in the models.

**Figure 2: Mean response and self efficacy for SARS in case of an outbreak and a common cold by country**




Analysis per country (Table 5) showed that perceived threat of SARS was higher in respondents with lower levels of education in Poland, Great Britain and Spain, while it was higher among the higher educated in Singapore. Singapore was the only country where age was independently associated with perceived threat. Level of urbanization was a significant correlate in Poland only, with living in less urban areas associated with a lower threat. In the Netherlands and Denmark, perceived threat was higher in respondents who received higher amounts of information about SARS and in Great Britain it was higher in respondents with a higher knowledge score. The model for the total population explained 7.5% of variance of which 5.9% was accounted for in a model with only the country variable (Table 4.b). In the separate models by country, the explained variance was less than 5% in all countries.

## Discussion

The present study shows that perceived threat of SARS in case of an outbreak in the country was higher than that of other diseases and conditions included in this study. Perceived vulnerability of SARS was at an intermediate level compared to other diseases while perceived severity was high. Perceived threat for SARS varied between countries in Europe and Asia, with perceived severity higher in Europe and perceived vulnerability higher in Asia. Perceptions of vulnerability compared to other people for SARS was relatively small and comparable to other diseases. Response efficacy and self-efficacy for SARS were higher in Asia as compared to Europe.

**Table 4a: Correlates of perceived SARS severity, vulnerability, perceived threat and comparative vulnerability; un-standardized regression coefficients (B) and p-values derived from linear regression analyses (n=3064)**

| | Severity | | Vulnerability | | Threat | | Vulnerability compared to other people | |
|---|---|---|---|---|---|---|---|---|
| | B[§] | p | B | p | B | p | B | p |
| Country* | | <0.001 | | <0.001 | | <0.001 | | <0.001 |
| Denmark | 8.40 | | 2.32 | | 2.95 | | -0.76 | |
| Poland | 8.16 | | 3.23 | | 3.50 | | -0.25 | |
| The Netherlands | 8.23 | | 2.96 | | 3.37 | | -0.30 | |
| Great Britain | 8.05 | | 2.68 | | 3.11 | | -0.55 | |
| Spain | 7.94 | | 2.83 | | 3.23 | | -0.29 | |
| China | 8.09 | | 2.70 | | 3.14 | | -0.78 | |
| Hong Kong | 8.01 | | 3.01 | | 3.34 | | -0.47 | |
| Singapore | 6.83 | | 2.57 | | 2.73 | | -0.97 | |
| Sex (male is reference) | 0.57 | 0.000 | 0.07 | 0.090 | 0.17 | 0.000 | 0.08 | 0.014 |
| Age | 0.00 | 0.237 | 0.00 | 0.875 | 0.00 | 0.303 | 0.00 | 0.300 |
| Highest education | -0.14 | 0.001 | -0.08 | 0.001 | -0.07 | 0.000 | -0.01 | 0.669 |
| Urbanization | -0.07 | 0.118 | -0.02 | 0.365 | -0.04 | 0.059 | -0.02 | 0.261 |
| Amount of info during SARS outbreak | 0.05 | 0.155 | 0.03 | 0.188 | 0.03 | 0.090 | 0.04 | 0.019 |
| SARS knowledge score | 0.16 | 0.010 | 0.05 | 0.170 | 0.07 | 0.016 | 0.04 | 0.134 |

* the p-value for country stands for the overall significance of the differences between countries.

[§] As no country was chosen as a reference group, the models were run by leaving out the intercept. In doing so, the regression coefficients for the countries do not represent the difference in mean compared to the reference group but the actual (corrected) mean value of the respective dependent variable.

**Table 4b: $R^2$ of the different steps in the linear regression models and significance in F-change**

| | Severity | | Vulnerability | | Threat | | comp vuln | |
|---|---|---|---|---|---|---|---|---|
| | $R^2$ | p | $R^2$ | p | $R^2$ | p | $R^2$ | p |
| $R^2$ step 1 | 0.041 | 0.000 | 0.053 | 0.000 | 0.059 | 0.000 | 0.062 | 0.000 |
| $R^2$ step 2 | 0.064 | 0.000 | 0.057 | 0.008 | 0.072 | 0.000 | 0.064 | 0.051 |
| $R^2$ step 3 (full model) | 0.067 | 0.004 | 0.058 | 0.095 | 0.075 | 0.004 | 0.067 | 0.007 |
| Adjusted $R^2$ full model | 0.063 | | 0.054 | | 0.072 | | 0.063 | |

**Table 5: Correlates of perceived threat for SARS; regression coefficients (B) and corresponding 95% confidence intervals (95% CI) derived from linear regression analyses**

| | NLD | DNK | POL | GBR | ESP | CHN | HKG | SGP |
|---|---|---|---|---|---|---|---|---|
| | B | B | B | B | B | B | B | B |
| **FACTOR** | [95% CI] | [95% CI] | [95% CI] | [95% CI] | [95% CI] | [95% CI] | [95% CI] | [95% CI] |
| Sex (male is reference) | 0.19 | 0.15 | 0.13 | 0.11 | 0.12 | -0.04 | 0.16 | **-0.22**§ |
| | [-0.05, 0.42] | [-0.07, 0.38] | [-0.12, 0.39] | [-0.14, 0.35] | [-0.10, 0.34] | [-0.27, 0.20] | [-0.05, 0.38] | [-0.47, 0.03] |
| Age | 0.00 | 0.00 | -0.01 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | [-0.01, 0.01] | [0.00, 0.01] | [-0.01, 0.00] | [-0.01, 0.01] | [-0.01, 0.01] | [-0.01, 0.01] | [-0.01, 0.01] | [-0.01, 0.01 |
| Highest education | -0.02 | -0.06 | **-0.14**§ | **-0.17*** | **-0.17*** | -0.10 | -0.09 | **0.16*** |
| | [-0.15, 0.12] | [-0.18, 0.07] | [-0.29, 0.01] | [-0.32, -0.03] | [-0.27, -0.06] | [-0.24, 0.04] | [-0.21, 0.03] | [0.01, 0.32] |
| Urbanisation | 0.03 | 0.00 | **-0.11**§ | 0.04 | -0.04 | -0.05 | -0.14 | 0.08 |
| | [-0.12, 0.18] | [-0.13, 0.12] | [-0.24, -0.03] | [-0.09, 0.17] | [-0.19, 0.12] | [-0.26, 0.17] | [-0.33, 0.05] | [-0.15, 0.30] |
| Amount of info during SARS outbreak | **0.13*** | **0.10*** | -0.02 | 0.00 | -0.06 | 0.00 | 0.04 | 0.03 |
| | [0.01, 0.25] | [0.00, 0.20] | [-0.14, 0.01] | [-0.09, 0.10] | [-0.15, 0.04] | [-0.13, 0.13] | [-0.08, 0.17] | [-0.09, 0.16] |
| SARS knowledge score | 0.09 | 0.06 | 0.02 | **0.17**§ | 0.10 | 0.06 | 0.09 | -0.17 |
| | [-0.11, 0.28] | [-0.13, 0.26] | -0.18, 0.21] | [0.00, 0.34] | [-0.06, 0.26] | [-0.15, 0.27] | [-0.13, 0.30] | [-0.40, 0.06] |
| **$R^2$ model 1** | .010 | .001 | .016 | .014 | .041 | .005 | .015 | .022 |
| **$R^2$ model 2** | .026 | .002 | .017 | .024 | .046 | .006 | .018 | .027 |

§ $p<0.10$

* $p<0.05$

(DNK = Denmark, POL = Poland, NLD = the Netherlands, ESP = Spain, CHN = China, HKG = Hong Kong, SGP = Singapore)

In step 1 sex, age, education and urbanization were included, in step 2 amount of information and knowledge were added.

Our study has several limitations, especially related to the means of data collection. Firstly, the response rate varied substantially between countries from 21.3% to 81.1%, with low response rates in the participating Asian countries in particular. This may have led to non-representative samples, and the differences in response rates may partly explain the reported differences in risk perceptions and other variables. These differences in response rates and the low rates in some of the participating countries limit the generalizability of our data, and the results should therefore be interpreted with caution.

Secondly, in lack of an existing validated questionnaire for perceived threat and risk perception of infectious diseases suitable for telephone administration in large samples, the questionnaire was specifically developed for the project reported here based upon an earlier questionnaire used during the SARS outbreak (16). Our study design, aiming to include a large number of respondents from a range of different countries and regions, using telephone surveying as the means of data collection, combined with the financial and time pressure restraints, enabled inclusion of only a limited number of items per construct. This may have reduced the reliability of our measures, especially towards possible underlying cultural differences in constructs. Furthermore, extensive pre-testing of the survey questionnaire with cognitive interviewing was restricted to two European countries. We therefore do not know whether all concepts used were understood in the same way in all participating countries. On the other hand, we did contextualize our risk perception questions by including a setting (in case of an outbreak), time frame (next 12 months) and focusing on the risk of the individual (instead of population) – all issues known to be important for measuring risk perceptions, although not always included in studies on risk perceptions (27).

Data collection took place in autumn 2005, two years after the end of the SARS epidemic. This may have influenced recollection of knowledge and use of information sources during the SARS epidemic. However, the study consortium responsible for the present study also conducted qualitative explorations of risk perceptions, efficacy beliefs and precautionary actions among Chinese populations in the UK and the Netherlands, showing similar results (28).

The present study also has its strengths. It is among the first large scale comparative studies into perceived threat and risk perception of emerging infectious diseases, and in fact unique in the number of countries represented. Perceived threat for SARS, as well as avian influenza, were among the highest and at the same level as for, for example, a heart attack. This indicates that these potential problems were taken very seriously by the general public.

Because few comparative studies into perceived threat of SARS and other newly emerging infectious diseases have been conducted, it is difficult to interpret the differences between countries and continents. Comparing our results with data from several earlier studies on risk perception of SARS in the USA, Canada, the Netherlands, Singapore and Hong Kong has its limitations, as these studies were done in 2003 during the SARS epidemic, whereas in our study we asked respondents to envisage a new outbreak (13-16). For example, in 2003 risk perception of SARS in some of the Asian countries was relatively low compared to risk perception in the USA. Ji et al. in their study on optimism across cultures have pointed out that unrealistic optimism concerning SARS was higher among Chinese than among Canadians (18). They interpreted this being in line with the Chinese and East Asians in general holding a cyclical perception of events, so that a negative event may be seen as antecedent to a positive outcome.

The higher level of severity of some diseases in Europe (SARS, flu from a new virus, HIV, tuberculosis) may indicate that more unfamiliar diseases are perceived more severe. The higher perceived vulnerability for some diseases (SARS, tuberculosis, HIV) in Asia may be based upon the fact that these are indeed more prevalent in these regions.

The observation that, compared to Europe, efficacy beliefs for SARS were more positive in Asia and that people felt more able to control SARS, may be explained in the same way. Alternatively, it may also be that the more direct and closer experience with the disease in Asia, and the experience of outliving and overcoming the outbreak, has increased self-efficacy and response-efficacy beliefs in Asia. Preventive measures in Asia were also more visible and might have been more reassuring to the public (2). Also efficacy beliefs related to a common cold and flu from a new virus were higher in Asian countries, where the latter may be explained by the fact that, despite the first cases of avian influenza among humans in Asia were already reported in 2003, this has not resulted in a larger outbreak (22).
The lower level of risk perception in Denmark may reflect part of a Scandinavian tendency to perceive risks lower than in other countries (29). This result is also in line with a lower risk perception of SARS among Finns compared to Dutch (25, 30). One of the explanations for this tendency is that the media in Scandinavia appear to report more about risks abroad with less attention to risk inside the country (29, 31). However, we need to interpret the differences between countries with care because cognitive constructs such as risk perceptions are not necessarily interpreted in the same way in different cultures (31). Indeed the data of our study on comparison of risk perceptions for various diseases show that the relative risk perceptions for these diseases, i.e. the order of levels of risk perceptions, are rather consistent across countries. This may indicate that differences between countries in absolute risk perception levels for specific diseases or conditions may reflect cultural differences in the way survey questions are answered rather than real differences in risk perceptions. Voeten et al (submitted) in their study on risk perception and efficacy beliefs among Chinese communities in the UK and the Netherlands have shown that efficacy beliefs of Chinese living in the UK and the Netherlands were comparable to those of native UK and Dutch respondents (32). This may indicate that country of residence, perhaps because of country-specific public health systems and media coverage, may be more important than ethnicity or country and culture of origin. Because country appears to a relevant correlate of SARS-related risk perceptions in the multivariate analyses, further research is needed to explain these country differences.

The results on comparative vulnerability indicate that envisioning an outbreak might make a difference; when respondents were asked to compare their personal risk to that of comparable others, the optimistic bias was lower in case of an outbreak. Such a situation is characterized by less control, which is associated with less optimism (33, 34). The notion that for an outbreak risks were perceived to be more evenly distributed, and thus they seemed to be less prone to an optimistic bias, may offer starting points for public interventions. Such interventions should certainly also focus on increasing self-efficacy, especially in the European countries, because low self-efficacy may lead to lack of protection motivation.

Perceived threat of SARS and flu from a new flu virus in case of an outbreak was similar in most countries. However, the level of severity for SARS was higher than for flu from a new virus, while vulnerability for flu from a new virus was higher than for SARS in all countries. One explanation might be that SARS is a more unfamiliar disease for most people compared to flu. It indicates that people do perceive various aspects of risk perceptions differently for different emerging infectious diseases and that risk communication should thus be disease and perception specific.

Perceived threat for emerging infectious diseases such as SARS and avian influenza were amongst the highest rated in the present study, especially in case of an outbreak. From a public health perspective, this offers a good starting point for risk communication and precautionary actions. It also asks for realistic risk communications to put the risks for SARS and other emerging infectious diseases into the perspective of global health risks, to prevent fuelling unnecessary panic (35).

**Acknowledgements**

This work was done as part of SARSControl: Effective and Acceptable Strategies for the Control of SARS and New Emerging Infections in China and Europe, a European Commission project funded within the Sixth Framework Programme, Thematic Priority Scientific Support to Policies, contract no. SP22-CT-2004-003824.M

## References


1. Abraham T. Twenty-First Century Plague. The story of SARS. Baltimore: The John Hopkins University Press; 2004.
2. Smith RD. Responding to global infectious disease outbreaks: lessons from SARS on the role of risk perception, communication and management. Soc Sci Med 2006;63(12):3113-23.
3. Bell DM. Public health interventions and SARS spread, 2003. Emerg Infect Dis 2004;10(11):1900-6.
4. Bell DM. Non-pharmaceutical interventions for pandemic influenza, national and community measures. Emerg Infect Dis 2006;12(1):88-94.
5. Bell DM. Non-pharmaceutical interventions for pandemic influenza, international measures. Emerg Infect Dis 2006;12(1):81-7.
6. Bosman A, Du Ry van Beest Holle M, Conyn - van Spaendonck MAE, Koopmans MPG. Compliance amoung poultry workers to infection control measures during a large epizootic of Avian Influenza in commercial poultry farms in The Netherlands. Bilthoven: RIVM / Instituut voor Psychotrauma; 2004. Report No.: 630940001/2004.
7. 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(2):136-45.
8. Rogers RW. Cognitive and physiological processes in fear appeals and attitude change: A revised theory of protection motivation. New York: Guilford Press; 1983.
9. Sjoberg L. Factors in risk perception. Risk analysis 2000;20(1):1-11.
10. Weinstein ND. The precaution adoption process. Health Psychology 1988;7(4):355-386.
11. Slovic P. Perception of risk. Science 1987;236:280-285.
12. Weinstein ND. Why it won't happen to me: perceptions of risk factors and susceptibility. Health Psychol 1984;3(5):431-57.
13. 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(7):925-31.
14. Lau JT, Yang X, Tsui H, Kim JH. Monitoring community responses to the SARS epidemic in Hong Kong: from day 10 to day 62. J Epidemiol Community Health 2003;57(11):864-70.
15. Leung GM, Lam TH, Ho LM, Ho SY, Chan BH, Wong IO, et al. The impact of community psychological responses on outbreak control for severe acute respiratory syndrome in Hong Kong. J Epidemiol Community Health 2003;57(11):857-63.
16. Brug J, Aro AR, Oenema A, de Zwart O, Richardus JH, Bishop GD. SARS risk perception, knowledge, precautions, and information sources, the Netherlands. Emerg Infect Dis 2004;10(8):1486-9.
17. Cheng C, Ng A-K. Psychosocial factors predicting SARS-preventive behaviours in four major SARS-affected regions. Journal of Applied Social Psychology 2006;36(1):222-247.
18. Ji L, Ziang Z, Usborne E, Guan Y. Optimism across cultures: in response to the Severe Acute Respiratory Syndrome Outbreak. Asian Journal Social Psychology 2004;7:25-34.
19. Gupta RK, Toby M, Bandopadhyay G, Cooke M, Gelb D, Nguyen-Van-Tam JS. Public understanding of pandemic influenza, United Kingdom. Emerg Infect Dis 2006;12(10):1620-1.
20. Abbate R, Di Giuseppe G, Marinelli P, Angelillo IF. Knowledge, attitudes, and practices of avian influenza, poultry workers, Italy. Emerg Infect Dis 2006;12(11):1762-5.
21. Fielding R, Lam WW, Ho EY, Lam TH, Hedley AJ, Leung GM. Avian influenza risk perception, Hong Kong. Emerg Infect Dis 2005;11(5):677-82.
22. de Zwart O, Veldhuijzen IK, Elam G, Aro AR, Abraham T, Bishop GD, et al. Avian influenza risk perception, Europe and Asia. Emerg Infect Dis 2007;13(2):290-3.
23. Chang EC, Asakawa K. Cultural variations on optimistic and pessimistic bias for self versus a sibling: is there evidence for self-enhancement in the west and for self-criticism in the east when the referent group is specified? J Pers Soc Psychol 2003;84(3):569-81.
24. Renn O. Perception of risks. Toxicol Lett 2004;149(1-3):405-13.
25. Vartii A-M, Oenema A, Brug J, de Zwart O, Schreck M, Uitela A, et al. Differences between the Finns and the Dutch in knowledge, risk perception and behaviors related to SARS. Submitted.
26. Sadique MZ, Edmunds WJ, Smith RD, Meerding WJ, de Zwart O, Brug J, et al. Precautionary behavior in response to perceived threat of pandemic influenza. Emerg Infect Dis 2007;13(9):1307-13.
27. Brewer NT, Weinstein ND, Cuite CL, Herrington JE. Risk perceptions and their relation to risk behavior. Ann Behav Med 2004;27(2):125-30.
28. Jiang X, Elam G, Yuen C, Voeten H, de Zwart O, Veldhuijzen I, et al. The impact of SARS on Chinese communities in the United Kingdom and the Netherlands: a qualitative study. International Journal of Behavioural Medicine 2009 - in press.

29. Mullet E, Lazreg C, Candela C, Neto F. The Scandinavian way of perceiving societal risks. Journal of Risk Research 2005;8(1):19-30.
30. Aro AR, Aalto A-M, Oenema A, Brug J, de Zwart O, Turtianen P. Risk perception, information needs, and risk communication related to SARS. European Journal of Public Health 2005;15(suppl 1):70-71.
31. Luszczynska A, Scholz U, Schwarzer R. The general self-efficacy scale: multicultural validation studies. J Psychol 2005;139(5):439-57.
32. Voeten H, de Zwart O, Veldhuijzen IK, Yuen KY, Jiang X, Elam G, et al. Sources of information and health beliefs related to SARS and avian influenza among Chinese communities in the United Kingdom and the Netherlands, as compared to the general population in these countries. International Journal of Behavioral Medicine 2009 Accepted.
33. Pidgeon NF, Kasperson RE, Slovic P. The social amplification of risk and risk communication. Cambridge: Cambridge University Press; 2003.
34. Poortinga W, Bickerstaff K, Langford I, Niewohner J, Pidgeon N. The British 2001 Foot and Mouth crisis: A comparative study of public risk perceptions, trust and beliefs about government policy in two communities. Journal of Risk Research 2004;7(1):73-90.
35. Bonneux L, Van Damme W. An iatrogenic pandemic of panic. BMJ 2006;332(7544):786-8.

# 3.

# Avian Flu Risk Perception: Europe and Asia

Onno de Zwart (1, 2), Irene K. Veldhuijzen (1, 2), Gillian Elam (3), Arja R. Aro (4), Thomas Abraham (5), George Bishop (6), Jan Hendrik Richardus (1, 2), Johannes Brug (2)

1. Municipal Public Health Service Rotterdam- Rijnmond
2. Department of Public Health, Erasmus MC, University Medical Center Rotterdam
3. Behavioural Surveillance and Research Unit, Health Protection Agency – Centre for Infections, London
4. University of Southern Denmark, Esbjerg, Denmark
5. Journalism and Media Studies Centre, The University of Hong Kong
6. Department of Psychology, National University of Singapore

Published in: Emerging Infectious Diseases, 2007, vol 13, no 2, pp. 290-293.

**Abstract**

During autumn 2005 we conducted 3.436 interviews in European and Asian countries. We found risk perceptions of avian influenza to be at an intermediate level and efficacy beliefs to be slightly lower. Risk perceptions differ significantly between countries and were higher in Asia while efficacy beliefs were lower in Europe.

Anticipation, preparation and prevention of a possible influenza pandemic is a major public health challenge. Since 2003 outbreaks of avian influenza (AI) have occurred in Asian, European and African countries. The total number of cases as of August 21, 2006 was 240 with 141 fatalities (1). A cross-over of current human influenza virus with the avian H5N1 virus could result in a human-to-human transmissible virus and the start of a new pandemic.

The recent outbreaks have resulted in extensive media attention for avian influenza, but knowledge on risk perception of AI is scarce. The present study explores the conditions for effective non-medical interventions. In case of an influenza pandemic, public health authorities will be dependent on the willingness and ability of the public to adhere to recommendations regarding personal hygiene, vaccination and prophylaxis, quarantine, travel restrictions or closing down of public buildings (2, 3). This however, is not automatically the case. The evaluation of the outbreak of H7N7 AI in the Netherlands in 2003 showed that adherence to anti-viral therapy and behavioral measures, such as using facial masks and goggles, was low (4).

Our ability to promote health protective behavioral change depends on our knowledge of important determinants of such behavior (5). Protection Motivation Theory posits that health protective actions are influenced by risk perceptions (6-8). Risk perceptions are defined by the perceived seriousness of a health threat and the perceived personal vulnerability. However, Protection Motivation Theory explicitly states that higher risk perceptions will only predict protective behavior when people believe that effective protective actions are available (response efficacy) and when they are confident that they have the abilities to engage in such protective actions (self-efficacy).

**The study**

The present study investigated risk perceptions and efficacy beliefs related to AI in random digital dialing (RDD) samples of the population of eight countries. Data were collected using Computer Assisted Telephone Interviewing (CATI). Interviews were conducted from 20 September through 22 November 2005 in five European countries (Denmark, the Netherlands, Great Britain, Spain, and Poland) and three in East Asia (Singapore, China [province of Guangdong] and Hong Kong).

At the time the telephone survey was conducted news broke out on October 14, 2005 of the introduction of AI in Europe. We therefore ensured that in each country at least 90 interviews were conducted after October 18, 2005.

The questionnaire focused on risk perception of AI and other infectious diseases, precautionary behavior and use of information sources. It was based upon our earlier work on risk perception of SARS (9). Respondents first received a brief explanation on AI.

In line with Protection Motivation Theory (8) one measure of risk perception was constructed by multiplication of seriousness (scale 1-10) and vulnerability (scale 1-5). To make the scores comparable the seriousness score was first divided by two. To normalize the skewed distribution of the new variable a square root transformation was performed which resulted in a measure of risk perception on a scale from 1 (low) to 5 (high).

In total 3,436 respondents were interviewed, participation rates varied from 12.9% in the Asian sample to 81.1% in Poland . Data on background variables in the different participating countries are provided in Table 1. A majority of respondents was female. European respondents were significantly older than Asian respondents (mean age 47 and 39 respectively, range 18-75 years, t=16,2; df=3351; p<0.001)

**Table 1: Participation rates and distribution of general characteristics in the study population**

| | DNK % | POL % | NLD % | GBR % | ESP % | CHN % | HKG % | SGP % | Europe % | Asia % | Total % |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **TOTAL** n | 463 | 488 | 400 | 401 | 425 | 404 | 396 | 426 | 2177 | 1226 | 3403 |
| % | 14 | 14 | 12 | 12 | 12 | 12 | 12 | 13 | 64 | 36 | 100 |
| **Participation rate** | 58 | 81 | 44 | 21 | 34 | - | - | - | 40 | 13 | |
| **Gender** | | | | | | | | | | | |
| Male | 40 | 39 | 42 | 41 | 41 | 47 | 44 | 43 | 40 | 45 | 42 |
| Female | 60 | 61 | 58 | 59 | 59 | 53 | 56 | 57 | 60 | 55 | 58 |
| **Age group** | | | | | | | | | | | |
| 18-30 | 13 | 18 | 10 | 13 | 17 | 43 | 27 | 35 | 14 | 35 | 22 |
| 31-45 | 31 | 31 | 31 | 35 | 34 | 34 | 35 | 31 | 32 | 33 | 33 |
| 44-60 | 36 | 32 | 37 | 31 | 32 | 19 | 27 | 20 | 33 | 22 | 29 |
| 61-75 | 20 | 19 | 24 | 21 | 17 | 4 | 12 | 14 | 20 | 10 | 16 |
| **Area** | | | | | | | | | | | |
| City | 26 | 21 | 9 | 20 | 45 | 86 | 90 | 81 | 24 | 86 | 46 |
| Town | 38 | 25 | 37 | 45 | 42 | 9 | 4 | 16 | 37 | 10 | 27 |
| Village/Countryside | 37 | 54 | 55 | 36 | 13 | 4 | 6 | 2 | 39 | 4 | 26 |
| **Education** | | | | | | | | | | | |
| Primary or lower | 17 | 8 | 5 | 2 | 22 | 4 | 13 | 3 | 11 | 7 | 9 |
| Low | 31 | 22 | 28 | 20 | 9 | 19 | 20 | 11 | 22 | 16 | 20 |
| Intermediate | 38 | 43 | 35 | 35 | 31 | 35 | 32 | 38 | 37 | 35 | 36 |
| High | 13 | 28 | 32 | 43 | 38 | 42 | 35 | 48 | 30 | 42 | 34 |

(DNK = Denmark, POL = Poland, NLD = the Netherlands, ESP = Spain, CHN = China, HKG = Hong Kong, SGP = Singapore)

Overall 45% of respondents thought they were likely or very likely to get AI themselves in case of an outbreak in their country. This varied from 32% in Denmark and Singapore to 61% in Poland and Spain. Risk perception scores varied significantly across countries, with the highest mean score in Poland and the lowest in Denmark (Table 2); higher scores were observed in Europe as compared to Asia (t=5.2; df=3250; p<0.001) and various significant differences were present between individual countries within Europe. In the multivariate analysis country, gender and age group remained independent significant factors and a significant interaction between country and gender and between country and age group was present.

**Table 2: Mean score and 95% CI of seriousness, vulnerability, risk perception, response efficacy and self-efficacy of flu from a new flu virus in case of an outbreak in 8 different countries.**

| Country | Seriousness (scale 1-10) | Vulnerability (scale 1-5) | Risk perception* (scale 1-5) | Response efficacy (scale 1-5) | Self-efficacy (scale 1-5) |
|---|---|---|---|---|---|
| DNK | 6.08 [5.83-6.33] | 2.82 [2.71-2.92] | 2.73 [2.65-2.81] | 2.32 [2.23-2.41] | 2.15 [2.06-2.24] |
| POL | 7.49 [7.29-7.70] | 3.43 [3.31-3.54] | 3.48 [3.39-3.57] | 2.55 [2.46-2.64] | 2.06 [1.96-2.16] |
| NLD | 7.67 [7.48-7.87] | 3.17 [3.07-3.27] | 3.40 [3.32-3.48] | 2.25 [2.14-2.35] | 1.74 [1.66-1.83] |
| UK | 7.38 [7.16-7.61] | 2.93 [2.81-3.05] | 3.17 [3.07-3.26] | 2.41 [2.32-2.51] | 2.03 [1.93-2.12] |
| ESP | 6.76 [6.53-6.99] | 3.43 [3.32-3.53] | 3.29 [3.20-3.37] | 2.75 [2.65-2.85] | 2.26 [2.15-2.36] |
| CHN | 6.58 [6.33-6.82] | 2.88 [2.76-2.99] | 2.94 [2.85-3.04] | 2.99 [2.92-3.06] | 2.90 [2.82-2.99] |
| HKG | 7.02 [6.81-7.23] | 3.33 [3.23-3.42] | 3.33 [3.25-3.40] | 2.95 [2.87-3.03] | 2.64 [2.55-2.73] |
| SGP | 6.63 [6.35-6.91] | 2.70 [2.57-2.83] | 2.82 [2.71-2.93] | 2.81 [2.71-2.91] | 2.70 [2.61-2.80] |
| Europe§ | 7.06 [6.96-7.16] | 3.16 [3.11-3.21] | 3.21 [3.17-3.25] | 2.46 [2.41-2.50] | 2.05 [2.01-2.10] |
| Asia | 6.74 [6.60-6.88] | 2.97 [2.90-3.03] | 3.03 [2.97-3.08] | 2.92 [2.87-2.96] | 2.75 [2.69-2.80] |
| Total | 6.95 [6.86-7.03] | 3.09 [3.05-3.13] | 3.14 [3.11-3.17] | 2.63 [2.59-2.66] | 2.31 [2.27-2.34] |

* Risk perception is the square root of the multiplication of seriousness/2 and vulnerability
§ Differences in mean scores between Europe and Asia are significant for all measures ($p<0.001$)

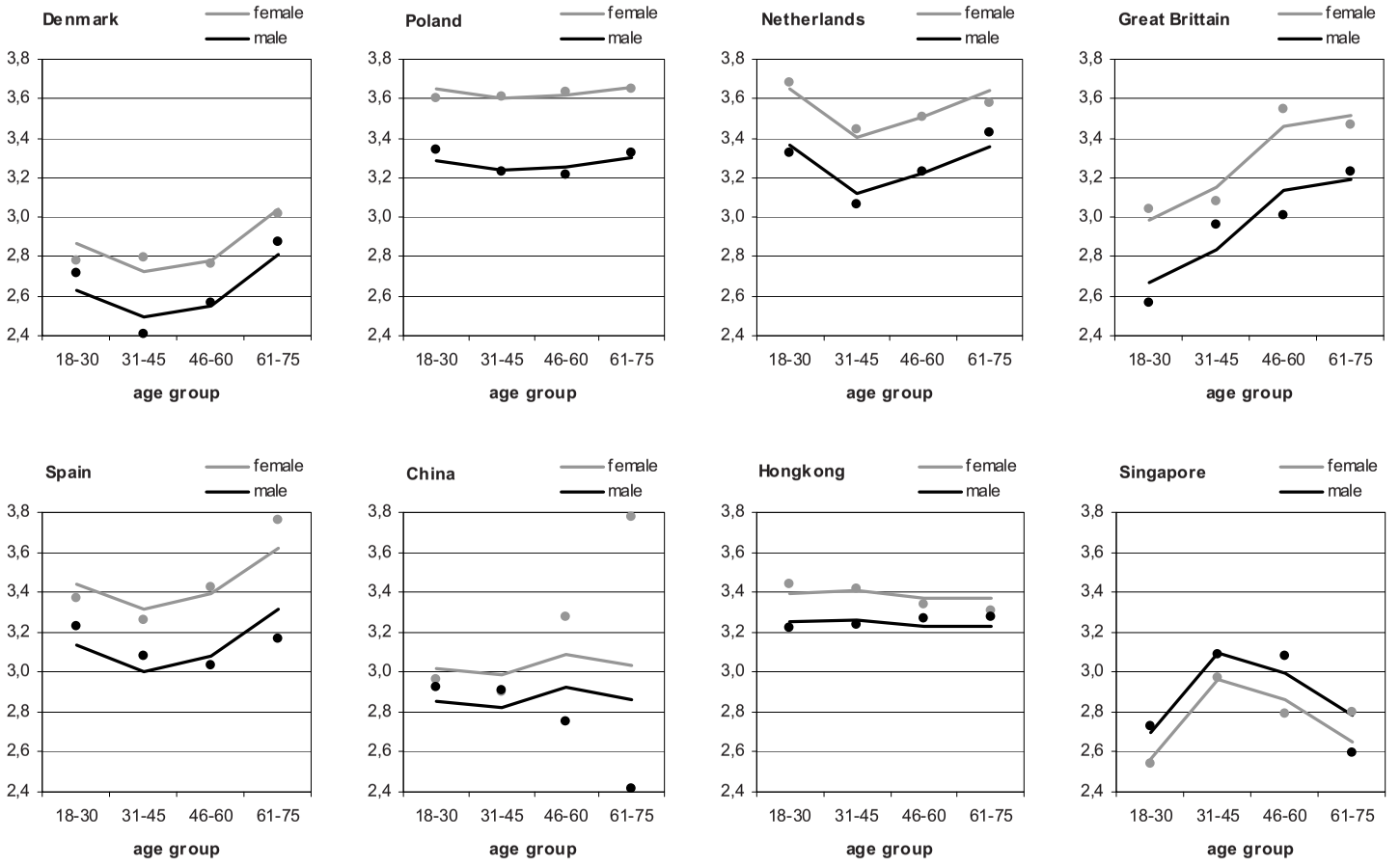
Figure 1 shows risk perception per country by gender for four age groups. In all countries, except Singapore, risk perception among women was higher than among men but this gender difference was smaller in the Asian countries compared to Europe. The effects of age also varied by country, with higher mean risk perception levels in older age groups in Europe, but not in Asia.

Response efficacy and self-efficacy also varied across countries with the highest levels in China and the lowest levels in the Netherlands (Table 2). Mean response efficacy and self-efficacy were significantly higher in Asia than in Europe (response efficacy $t=-14$; $df=2868$; $p<0.001$; self-efficacy $t=-20$; $df=2701$; $p<0.001$). Response and self-efficacy were inversely associated with risk perception ($p=0.013$ and $p<0.001$ respectively).

In the multivariate analysis country was, but gender or age were not significantly associated with response efficacy. Country, gender and age group were all significantly associated with self-efficacy. Lower self-efficacy levels were observed in women and in the youngest age group compared to men and older respondents.

Comparisons of risk perception and efficacy levels before and after the introduction of avian influenza in Europe showed no significant differences.

**Figure 1: Mean risk perception by country, gender and age group (lines: predicted means, dots: observed means**



**Conclusions**

In our study risk perceptions for AI appear to be at an intermediate level, and efficacy beliefs are slightly lower. Both differ between countries and regions. No evidence was found that the introduction of AI in Europe in October 2005 influenced risk or efficacy perceptions.

Fielding has reported on risk perception of AI in Hong Kong, with a focus on live chicken sales (10). Although difficult to compare, the results from our study appear to indicate a higher feeling of vulnerability, with 41.8% of Hong Kong respondents who thought it likely or very likely that they would get flu in case of an outbreak. Takeuchi conducted interviews on Thai consumers food safety practices and reported high levels of knowledge of AI but lower levels of risk perception and behavior change (11). If we compare our results with data from several studies on risk perception of. SARS, it becomes clear that risk perception of SARS in some of the Asian countries was relatively low compared to risk perception in the USA (12). In the Netherlands however, risk perception for SARS was low, whereas the present study indicates that it is high for flu.

The lower level of risk perception for AI in Asia may be related to the proximity to the current outbreak and the experience with the SARS epidemic. This may have resulted in the notion that new epidemics of infectious diseases can be controlled. Also despite the fact that the first cases of H5N1 influenza among humans in Asia were reported in 2003, this has not resulted in a larger outbreak. This is in line with research into risk perception which has shown that the public may be more optimistic when familiar risks are perceived to be largely under volitional control (13, 14).

Our study has several implications for public health policy and research. While in all countries an influenza pandemic is perceived as a real risk, the level of self-efficacy appears to be rather low. When developing preparedness plans for an influenza pandemic, specific attention should therefore be paid to risk communication and how perceived self-efficacy can be increased, otherwise there is a risk that adherence to preventive measures will be low.

**Acknowledgements**

This work was done as part of "SARSControl: Effective and acceptable strategies for the control of SARS and new emerging infections in China and Europe", a European Commission project funded within the Sixth Framework Programme, Thematic Priority Scientific Support to Policies, Contract number: SP22-CT-2004-003824".
The study does not necessarily reflect the Commission's views and in no way anticipates the Commission's future policy in this area.
This study was conducted within the framework of CEPHIR, the Center for Effective Public Health in the larger Rotterdam area.

## References


1. World Health Organization. Cumulative number of confirmed human cases of avian influenza A (H5N1) reported to the WHO. Epidemic and Pandemic Alert and Response (EPR). 2006. Available at: http://www.who.int/csr/disease/avian_influenza/country/cases_table_2006_08_21/en/index.html.
2. Bell DM. Non-pharmaceutical interventions for pandemic influenza, national and community measures. Emerg Infect Dis 2006;12(1):88-94.
3. Bell DM. Non-pharmaceutical interventions for pandemic influenza, international measures. Emerg Infect Dis 2006;12(1):81-7.
4. Bosman A, Du Ry van Beest Holle M, Conyn - van Spaendonck MAE, Koopmans MPG. Compliance amoung poultry workers to infection control measures during a large epizootic of Avian Influenza in commercial poultry farms in The Netherlands. Bilthoven: RIVM / Instituut voor Psychotrauma; 2004. Report No.: 630940001/2004.
5. Green LW, Kreuter MW. Health promotion planning, an educational and ecological approach. Third Edition ed. Mountain View, California: Mayfield Publishing Company; 1999.
6. Weinstein ND. The precaution adoption process. Health Psychology 1988;7(4):355-386.
7. Sjoberg L. Factors in risk perception. Risk analysis 2000;20(1):1-11.
8. Rogers RW. Cognitive and physiological processes in fear appeals and attitude change: A revised theory of protection motivation. New York: Guilford Press; 1983.
9. Brug J, Aro AR, Oenema A, de Zwart O, Richardus JH, Bishop GD. SARS risk perception, knowledge, precautions, and information sources, the Netherlands. Emerg Infect Dis 2004;10(8):1486-9.
10. Fielding R, Lam WW, Ho EY, Lam TH, Hedley AJ, Leung GM. Avian influenza risk perception, Hong Kong. Emerg Infect Dis 2005;11(5):677-82.
11. Takeuchi MT. Avian influenza risk communication, Thailand. Emerg Infect Dis 2006;12(7):1172-3.
12. 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(7):925-31.
13. Pidgeon NF, Kasperson RE, Slovic P. The social amplification of risk and risk communication. Cambridge: Cambridge University Press; 2003.
14. Poortinga W, Bickerstaff K, Langford I, Niewohner J, Pidgeon N. The British 2001 Foot and Mouth crisis: A comparative study of public risk perceptions, trust and beliefs about government policy in two communities. Journal of Risk Research 2004;7(1):73-90.

# 4.

# Risk perception of human avian influenza infections in the Netherlands: strong feeling of risk but limited confidence in protective measures

Onno de Zwart (1, 2), Irene Veldhuijzen (1,2), Jan Hendrik Richardus (1, 2), Johannes Brug (2)

1. Division of Infectious Diseases Control, Municipal Public Health Services (GGD) Rijnmond Rotterdam
2. Department of Public Health, Erasmus Medical Center

Originally published as: Risicoperceptie van infecties van mensen door het vogelgriepvirus in Nederland. Sterk gevoel van risico, maar beperkt vertrouwen in beschermingsmaatregelen. In: TSG. Tijdschrift voor gezondheidswetenschappen, 2007, vol 85, no. 2, p. 86-91.

**Abstract**

Aim

To describe risk perception of avian influenza in the Netherlands in March 2006. To gain insight into the level of knowledge, precautionary actions, response and self -efficacy, and use of media related to avian influenza.

Methods

Through an Internet panel 579 respondents filled in an online questionnaire.

Results

Risk perception of avian influenza in the Netherlands is, especially in the event of a future outbreak, was high - 3.51 (scale 1 – 5). A total of 23.7% of respondents believed that protection against avian influenza is possible, while 28.2% felt that they would be able to protect themselves. A higher level of response and self-efficacy is related to a lower level of risk perception. Respondents with a higher risk perception took more precautionary actions. Thirty-eight percent of respondents had taken at least one precautionary action. All respondents had heard of avian influenza, but knowledge was limited, 2.33 (scale 1 – 4). Television was the most important source of information.

**Conclusions**

Risk perception of avian influenza was relatively high in the Netherlands at a time when no infections were reported. The low levels of response and self-efficacy warrant attention so that advice about preventive measures will be adhered to in the event of an outbreak.

## Introduction

After repeated outbreaks of avian influenza among wild birds and poultry in south-east Asia from 2003 onwards, avian influenza reached Europe in October 2005. Avian influenza has traditionally been regarded as a disease of birds and poultry, but now infection with the avian influenza virus (H5N1) has also been determined in cats and in a stone martin (1). However, infection with the avian influenza virus is not limited to animals; humans can also be infected by this virus although the risk of transmission is small. Up to 19 September 2006, the World Health Organization (WHO) reported 247 cases of infection by H5N1 influenza in humans throughout the world, of which 144 died (2). Avian influenza has been determined in twenty European countries, including Germany, France, the United Kingdom, Rumania, Croatia and Russia. In the Netherlands, type H5N1 avian influenza has not yet been found either in animals or in humans.

Many experts fear that mutation of the avian influenza virus will result in a new type of virus which will be easily transmitted from human-to-human and which could result in an influenza pandemic. There will be no natural protection against a new virus of this type.

Currently, making adequate preparations for an influenza pandemic is one of the biggest challenges in the public health sector. Since the first reports in October 2005 of outbreaks of avian influenza in birds, infections in humans and the possibility of an influenza pandemic in Europe, this subject has received a great deal of media attention. Internationally, and also in the Netherlands, control strategies have been developed and calamity exercises have been carried out relating to the introduction of avian influenza, incidental introduction in humans and an influenza pandemic (3). The first two control strategies were specifically aimed at the prevention of humans becoming infected by the avian influenza virus; precautions included limiting contact with potentially infected people and taking hygiene measures. Preparations for a possible influenza pandemic concentrate on three strategies in particular: vaccination, antiviral treatment and non-medical interventions.

With this study we wanted to contribute towards the optimalization of non-medical interventions. The behaviour of the general population and specific groups within it, plays an important role in the spread and control of infectious diseases. In the control of both the transmission of the avian influenza virus to humans and an influenza pandemic, the government is dependent on the willingness of the population to co-operate with measures relating to personal hygiene, reduction in number of contacts, vaccination, antiviral treatment and measures such as limiting travel, cancelling gatherings and closing schools (4, 5). However, during the most recent outbreak of avian influenza among poultry (H7N7) in 2003 in the Netherlands, it was shown that the measures to avoid the transmission of the avian influenza virus to humans were not automatically adhered to. Large groups did not adhere to either the instructions on personal protective measures such as wearing face masks and protective spectacles, or with instructions on prophylaxis (6). Therefore, in order to successfully achieve changes in behaviour during outbreaks of infectious disease, it is of great importance to pay attention to those factors which can promote changes in behaviour.

In order to introduce effective preventive behaviour into practice it is necessary to recognize the determinants of that behaviour (7). The Protection Motivation Theory proposes that three factors are of importance: risk perception, response efficacy and self-efficacy (8-10). Risk perception has been regarded as the product of the perceived severity of a health risk multiplied by the perceived vulnerability. Both elements need to be present for a high degree

of risk perception. In concrete terms, this means that people will have a high risk perception of avian influenza if they think that this disease will have severe consequences on their health and, at the same time, they believe that they are at high risk of becoming infected with the avian influenza virus. According to the Protection Motivation Theory, the relationship between risk perception and preventive behaviour is influenced by two other factors: response efficacy (the extent of belief in the efficacy of the preventive behaviour in question), and self-efficacy (the extent to which the person themselves believes they are able to carry out the preventive behaviour). The theory predicts that a high risk perception will only lead to preventive behaviour if both response efficacy and self-efficacy are also high.

With the spread of avian influenza throughout Europe, it is important to know how the risk of infection among humans is perceived in order to gain more information in order to realise effective protection and control measures. Research into risk perception relating to infectious diseases has been scanty, certainly research that has been carried out during an outbreak of an infectious disease. Over recent years, a number studies on the risk perception of SARS have appeared, but almost no research at all has been published on the risk perception relating to avian influenza in birds, human infection by the avian influenza virus, or to an influenza pandemic (11-15). For this reason our study was aimed at risk perception, knowledge, response efficacy and self-efficacy, and the use of the media in relation to avian influenza in humans. In this article we will discuss the current situation in the Netherlands.

## Methods

*Recruitment and questionnaires*

Between Friday 10 March and Thursday 16 March 2006, 579 respondents from a representative internet panel (the Flycatcher Panel), completed an on-line questionnaire. The minimum age for participation was 18. The questionnaire was based on previous questionnaires concerning the risk perception of SARS and other infectious diseases (11). As well as questions on demographic characteristics, questions on the severity of a number of diseases, including avian influenza, and on vulnerability were asked. Respondents were also asked to estimate how high the risk was of certain professional groups getting avian influenza. Response efficacy was measured using specific measures as well as in a more general sense. Self-efficacy was measured using the question ‘How sure are you that you will be able to prevent yourself getting avian influenza if avian influenza reaches the Netherlands?' As this is the first time that response efficacy and self-efficacy in infectious disease has been measured in the Netherlands, there are as yet no validated scales available for this purpose.

Knowledge about avian influenza was examined by means of asking respondents if the following statements were true or false. First of all ‘The avian influenza virus can be transmitted from human to human’ (false). Secondly ‘There is a vaccine that protects humans against infection with the avian influenza virus’ (false). Thirdly ‘In the Netherlands in 2006 people have died as a result of an infection with the avian influenza virus’ (false) and finally ‘By eating chicken or poultry someone can become infected with the avian influenza virus‘ (false). A knowledge score on avian flu was arrived at by counting the number of correct answers (score 0-4).

Respondents were asked if they had already taken any measures to prevent themselves becoming infected by the avian flu virus or not, and if they had, what these measures were.

Finally they were asked how much information they had got from various sources, and also about the estimated degree of reliability of these sources.

*Analysis*

Based on the Protection Motivation Theory, a measure of risk perception was constructed by multiplying the degree of severity (scale 1 – 5) by the perceived risk (scale 1 – 5). In order to correct the skewed distribution a square-root transformation was performed. Using univariate analyses, the influences of gender, age and educational level on risk perception were measured. Associations between risk perception and response efficacy and self-efficacy were tested using Pearson's correlation test. The association between knowledge and risk perception, and risk perception and preventive actions taken, was also measured.

**Results**

Of the 952 panel members invited to participate, 579 respondents completed the questionnaire fully. This gave a response rate of 61%. A small majority of the respondents (52.7%) were female, and the average age was 41.2 years. Almost 3% of respondents kept poultry themselves and 17.6% had been vaccinated against influenza the previous year (Dutch population 17.5% in 2004) (16).

All respondents had heard of avian influenza but only a small proportion (10.7%) thought about avian influenza often or all the time. The degree of knowledge about avian influenza varied. Almost everyone (91.5%) knew that in the Netherlands in 2006, no-one had died of avian influenza. The level of knowledge about the risks of eating poultry, a vaccine that protects people and transmission from human-to-human was lower (57%, 42.7%, and 42.1% respectively of the respondents gave the correct answer). The average knowledge score was 2.33 (scale 1 – 4); 43.2% of respondents gave at least three correct answers.

Table 1 shows that on comparison with other health problems, infection of humans by the avian influenza virus is seen as a serious health problem but that people estimate their own risk of getting avian influenza as low. The risk perception of human infection by the avian influenza virus was 2.8, and for infection by the avian influenza virus during an outbreak was 3.1. This makes it one of the health risks that is seen as being major, comparable with the risk perception of having a heart attack. The risk run by various professional and other groups of getting the avian influenza virus was estimated as being the highest for professional poultry keepers (score 3.46; scale 1-5), followed by veterinarians (score 3.23). The risk for amateur poultry keepers was scored at 3.11, while the score for the general public was estimated at 2.23.

**Table 1: Severity, risk and risk perception of infections from the avian influenza virus in humans and other health risks (scale 1-5)**

| Health risk | Severity Average (SD) | Risk Average (SD) | Risk perception Average (SD) |
|---|---|---|---|
| Diabetes | 4.2 (0.8) | 2.0 (0.9) | 2.8 (0.7) |
| Common cold | 1.7 (0.7) | 3.8 (0.9) | 2.5 (0.5) |
| HIV/AIDS | 4.9 (0.3) | 1.2 (0.5) | 2.4 (0.4) |
| High blood pressure | 3.5 (0.8) | 2.4 (0.9) | 2.8 (0.6) |
| Infection by avian influenza virus | 4.6 (0.7) | 1.8 (0.9) | 2.8 (0.7) |
| Infection by the avian influenza virus if there is an outbreak of avian influenza in the Netherlands [§] | * | 2.2 (0.9) | 3.1 (0.8) |
| TB | 4.5 (0.7) | 1.6 (0.7) | 2.6 (0.6) |
| Heart attack | 4.8 (0.4) | 2.1 (0.8) | 3.1 (0.7) |
| Food poisoning | 3.5 (0.9) | 2.3 (0.8) | 2.8 (0.6) |

[§] In the questionnaire the question about risk perception in the event of an outbreak was formulated in general terms: " In your opinion what is the risk that in the coming year you will get avian influenza if avian influenza breaks out in the Netherlands?".
* Severity of outbreak was not asked about separately: when calculating risk perception, the severity of infection by the avian influenza virus was used.

**Table 2: Average effectiveness of measures against the spread of the avian influenza virus among poultry**

| Measure | Average | SD |
|---|---|---|
| Keeping chicken and birds under cover | 3.4 | 0.8 |
| Poultry vaccination | 4.1 | 0.8 |
| Preventive culling | 3.1 | 1.1 |
| Poultry import ban | 3.7 | 0.9 |
| Vehicle disinfection | 3.8 | 0.9 |
| Keeping cats indoors | 3.0 | 1.0 |

Table 2 shows that of the various measures to prevent the spread of the avian influenza virus, the effectiveness of vaccinating poultry against the spread was seen to be highest (score 4.06).

In general, 23.7% of respondents thought that people could be sure to reasonably sure of protection against the avian influenza virus. The average general response efficacy was 2.8 (scale 1 – 5). Of all respondents, 22.8% were reasonably or very sure that they themselves would be able to avoid becoming infected with the avian influenza virus. The average self-efficacy was 2.4 (scale 1-5). A minority of respondents (38%), indicated that they had taken one or more measures to avoid becoming infected by the avian influenza virus (Table 3).

**Table 3: Percentage of respondents (N=579) who took measures to prevent themselves becoming infected by the avian influenza virus (possible to choose more than one measure)**

| Preventive measures | Percentage |
|---|---|
| No measures taken | 62% |
| Avoiding contact with (wild) birds or poultry | 31% |
| Avoided areas where avian influenza is prevalent Not going to areas with avian influenza | 18% |
| Eating less or no chicken or poultry | 9% |
| Paying more attention to hygiene | 9% |
| Cancelled or didn't book a holiday to an area with avian influenza | 7% |
| Keeping the cats indoors | 5% |
| Getting oneself vaccinated against influenza | 2% |
| Avoiding gatherings of people | 2% |
| Avoiding shaking hands | 1% |
| Buying antiviral drugs | 0.9% |
| Acquiring face masks | 0.7% |
| Other | 2% |

A total 31% of respondents indicated that they had avoided contact with tame or wild birds or hens; 18% indicated that they had avoided areas where avian influenza was prevalent; and only a small group (0.7%) had purchased antiviral agents.

Most people (58.4%) had heard and/or seen a reasonable amount of information about avian influenza; 27.8% had heard or seen little or nothing. The biggest source of information was television; internet sites, particularly government internet sites, were regarded as being the most reliable. (Table 4)

**Table 4: Sources of information, amount of information acquired about avian influenza and reliability of sources**

| Source | Average amount of information [1-5](SD) | Average reliability [1 – 5] (SD) |
|---|---|---|
| Newspapers | 2.8 (1.0) | 3.6 (1.3) |
| Magazines | 1.7 (0.8) | 4.2 (1.7) |
| Television | 3.3 (0.9) | 3.4 (1.0) |
| Radio | 2.4 (1.0) | 3.9 (1.4) |
| Internet sites of official institutions | 1.9 (1.0) | 4.7 (1.4) |
| Other internet sites | 1.8 (0.9) | 4.5 (1.7) |
| General practitioner | 1.2 (0.5) | 5.3 (1.2) |
| Small or large animal veterinarian | 1.2 (0.6) | 5.3 (1.2) |
| Government bodies | 1.4 (0.7) | 5.1 (1.4) |
| Family/friends or neighbours | 1.8 (0.9) | 4.0 (1.9) |

Risk perception at time of an outbreak of avian influenza was higher in women than in men (3.23 versus 3.02, $p<0.01$) and higher in participants over the age of 60 than in younger participants (3.39 versus 3.11 $p<0.05$). A higher knowledge score appeared to result in a lower risk perception; respondents with a knowledge score of 4 had an average risk perception score of 2.9, while in respondents with a knowledge score of 0 or 1 this was 3.3 ($p<0.05$). Response efficacy and self-efficacy were positively associated (Pearson's correlation coefficient $r=0.56$; $p<0.01$). Higher response efficacy and higher self-efficacy were associated with a lower risk perception of avian influenza whereby the association of self-efficacy with risk perception was the most significant ($r=-0.09$; $p<0.05$ and $r=-0.32$ $p<0.01$). Risk perception was 3.4 in respondents who were not sure that they could prevent themselves becoming infected, while this was 2.4 in those who were sure that they could. A high risk perception resulted in the taking of preventive (or further preventive) measures, risk perception was 3.3 in respondents who had taken at least one preventive measure, and in those who had taken no measures this was 3.1 ($r=0.013$; $p <0.01$). However, there was no relationship between amount of information and risk perception ($r=0.06$; $p=0.14$).

**Discussion**

In the Netherlands, the risk perception of being infected by the avian influenza virus - particularly if there were to be an outbreak - is very high. Infections by the avian influenza virus are regarded as a serious health problem, but the risk of personally becoming infected is estimated as low. Almost a quarter of respondents thought that at least a reasonable level of protection was possible and were also reasonably certain that they would be able to protect themselves. More confidence in measures and in their own abilities also meant a lower risk perception of infection by the avian influenza virus, while respondents with a high risk perception also took more preventative measures. The results of the study in the Netherlands further show that all respondents had heard about avian influenza, but that the level of factual knowledge about this disease was low. The main source of information was television, and internet sites were regarded as being the most reliable.

This study carried out only one single measurement so the stability of the extent of risk perception is not known. Risk perception can be operationalized in a number of ways. Using the Protection Motivation Theory as a starting point, we defined risk perception as a combination of severity and risk. Perceived severity and perceived vulnerability could also have been analyzed separately. Although clear associations have been shown between risk perception, response efficacy and self-efficacy and the taking of preventive measures, no causal connection could be demonstrated. Further, the questionnaire was administered among an Internet panel, meaning that compared with the general Dutch population, people over the age of 60 were under-represented (10% versus 24%), and people with a higher level of education were over-represented (36% versus 29%). Another limitation is that this questionnaire was not pre-tested. However, the questionnaire upon which our questionnaire was based had been pre-tested and expert validity was established.

Currently, there are no data from other European countries on the risk perception of infection by the avian influenza virus in humans. Comparison with a previous study that we carried out into the risk perception of SARS in the Netherlands at the end of the SARS outbreak in 2003 does offer some insight; however, the questions were not formulated in exactly the same way (11). One limitation of this comparison is that during the SARS-outbreak there was actual human-to-human transmission which is not the case in avian influenza. There is only a small

difference in the percentage of people who think they are running a big, or very big, risk of becoming infected; 2.6% in SARS and 2.0% in avian influenza. At that time the level of self-efficacy related to SARS was higher: 40.5% of the respondents thought they would be able to protect themselves well, or very well, against SARS, as opposed to 22.8% of people who in our study, were sure or reasonably sure, that they will be able to avoid catching the avian influenza virus. The number of protective measures taken at the time of the SARS outbreaks was higher, all respondents said they had taken precautionary measures, while in this study 38% of respondents had taken one or more measures. The latter two differences may be explained by the fact that human-to-human transmission is possible in SARS and people were able to take specific preventive measures in response to this. Furthermore, the spread of SARS was seen to decrease but there is much more uncertainty about the spread of avian influenza among humans. The higher risk perception of infection by the avian influenza virus among women and older people corresponds with another study which shows that the level of risk perception in these groups is higher (17).

The difference between the higher scores in response efficacy for specific measures and the lower scores in general response efficacy and personal efficacy needs to be examined further. The higher scores for specific measures possibly indicate more confidence in measures concerning poultry that were taken by the government, than in confidence in their own personal ability. Further research should show what the response efficacy would be if people were able to take specific measures themselves, such as hygiene measures or limiting contact with other people.

Our research has a number of implications for research and for public health. The low response efficacy and self-efficacy for measures aimed at preventing infection in humans will be cause for concern should changes in behaviour become necessary. Specific information on protective measures aimed at preventing personal infection, and on how these measures should be applied is desirable; the existing confidence in government information is a good starting point. In addition there should be open and frequent communication concerning measures that both citizens and experts regard as being effective.
Particular attention should be paid to the question of which form of communication is most desirable at a time the risk of an infectious disease is changing, and also to the phase during which it is should take place. Further research is necessary in order to establish if the low levels of response efficacy and self-efficacy are related to the fact that an outbreak of avian influenza has not yet occurred in the Netherlands.

In order to gain more insight into risk perception and preventive behaviour at the time of a developing infectious disease, and also to which type of communication is desirable and effective, repeated measurements are necessary. Information from such a study would contribute important information about the development of more effective communication about risks and protection against infections by the avian influenza virus, and therefore to the improvement of the effectiveness of non-medical intervention strategies.

## References


1. European Centre for Disease Control. Influenza update. 2006. Available at: http://www.ecdc.eu.int.
2. World Health Organization. Cumulative number of confirmed human cases of avian influenza A (H5N1) reported to the WHO. Epidemic and Pandemic Alert and Response (EPR). 2006. Available at: http://www.who.int/csr/disease/avian_influenza/country/cases_table_2006_08_21/en/index.html.
3. Ministerie voor Volksgezondheid W, Sport,, Landelijke Coördinatiestructuur Infectieziektebestrijding. Beleidsdraaiboek Influenza Pandemie. 2004. Available at: http://www.infectieziekten.info/index.php3.
4. Bell DM. Public health interventions and SARS spread, 2003. Emerg Infect Dis 2004;10(11):1900-6.
5. Bell DM. Non-pharmaceutical interventions for pandemic influenza, international measures. Emerg Infect Dis 2006;12(1):81-7.
6. Bosman A, Du Ry van Beest Holle M, Conyn - van Spaendonck MAE, Koopmans MPG. Compliance amoung poultry workers to infection control measures during a large epizootic of Avian Influenza in commercial poultry farms in The Netherlands. Bilthoven: RIVM / Instituut voor Psychotrauma; 2004. Report No.: 630940001/2004.
7. Green LW, Kreuter MW. Health promotion planning, an educational and ecological approach. Third Edition ed. Mountain View, California: Mayfield Publishing Company; 1999.
8. Weinstein ND. The precaution adoption process. Health Psychology 1988;7(4):355-386.
9. Sjoberg L. Factors in risk perception. Risk analysis 2000;20(1):1-11.
10. Rogers RW. Cognitive and physiological processes in fear appeals and attitude change: A revised theory of protection motivation. New York: Guilford Press; 1983.
11. Brug J, Aro AR, Oenema A, de Zwart O, Richardus JH, Bishop GD. SARS risk perception, knowledge, precautions, and information sources, the Netherlands. Emerg Infect Dis 2004;10(8):1486-9.
12. 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(7):925-31.
13. Lau JT, Yang X, Tsui H, Kim JH. Monitoring community responses to the SARS epidemic in Hong Kong: from day 10 to day 62. J Epidemiol Community Health 2003;57(11):864-70.
14. Leung GM, Lam TH, Ho LM, Ho SY, Chan BH, Wong IO, Hedley AJ. The impact of community psychological responses on outbreak control for severe acute respiratory syndrome in Hong Kong. J Epidemiol Community Health 2003;57(11):857-63.
15. Fielding R, Lam WW, Ho EY, Lam TH, Hedley AJ, Leung GM. Avian influenza risk perception, Hong Kong. Emerg Infect Dis 2005;11(5):677-82.
16. Tacken M, Verheij R, Mulder J, Van den Hoogen H, Braspenning J. Monitoring griepvaccinatiecampagne 2004. Utrecht: Nivel; 2005.
17. Gustafson PE. Gender differences in risk perception: theoretical and methodological perspectives. Risk Anal 1998;18(6):805-11.

# 5.

# Monitoring of risk perceptions and preventive behaviour related to human avian influenza during 2006 – 2007 in the Netherlands: results of seven consecutive surveys

Onno de Zwart (1, 2) , Irene K. Veldhuijzen (1, 2), Jan Hendrik Richardus (1, 2), Johannes Brug (2, 3)

1. Division of Infectious Diseases Control, Municipal Public Health Service Rotterdam-Rijnmond,
2. Department of Public Health, Erasmus MC, University Medical Center Rotterdam, the Netherlands
3. EMGO Institute, VU University Medical Center, Amsterdam, the Netherlands

Submitted for publication

**Abstract**

Background

Risk perceptions related to emerging infectious disease may be important for protection motivation and behaviour. There is little information about changes or stability in risk perception of emerging infectious diseases such as avian influenza and preventive behaviours over time and associations with possible relevant events such as changes in the spread of avian influenza (AI) or media coverage.

Methods

Seven consecutive surveys were conducted among 3,840 respondents from an Internet panel in the Netherlands, overall response rate was 64%, from March 2006 to March 2007, a period in which no H5N1 infections were reported in either animals or humans in the Netherlands. The surveys assessed perceptions of severity, vulnerability, and engagement in potential preventive behaviours with self-administered electronic questionnaires.

Results

Perceived severity of infection of humans with AI was high, 4.58 (scale 1 – 5) and stable, between 90% and 94% perceived AI as (very) severe. Perceived vulnerability was lower, 1.69, and decreased slightly over the period of administration, from 23% of respondents who felt (very) vulnerable to 17%. The amount of information received about the disease decreased during the same period from 14% to 5% who had received (very) much information (mean 2.88 to 2.47) and the proportion of respondents who provided correct answers to 3 or more knowledge questions decreased from 43 to 22%. Substantial proportions of respondents, varying between 38% and 50%, reported taking one or more preventive measures with staying away from wild birds and poultry remaining high throughout the period.

Conclusions

AI was perceived as a severe health problem and this remained rather stable over time. However, knowledge about the disease decreased over time indicating the need to keep the public continually well informed.

## Background

The possibility of an influenza pandemic originating from a cross over of avian influenza remains a major public health threat. Since December 2003 there is an ongoing epidemic of H5N1 avian influenza which now has affected 63 countries. The epidemic originated in Hong Kong and it reached Russia in July 2005; in October 2005 the first infections were reported in Turkey and mainland Europe (1). Although advances have been made in the development of vaccines and anti-viral treatment, people's risk perceptions, confidence, and engagement in precautionary actions and information exchange, will remain important for outbreak control (2). Protection Motivation Theory (3) states that if people perceive a certain risk to be severe and if they think they are personally vulnerable for this risk they will be more likely to be motivated to act to protect themselves. A recent meta-analysis underlined the importance of risk perception for infectious disease prevention in relation to influenza vaccination (4).

Attention for risk perception as a factor in the control of (emerging) infectious diseases has received more attention in the wake of the SARS-epidemic. A number of - mostly cross-sectional - studies have explored risk perception of H5N1 avian influenza or an influenza pandemic and precautionary behaviour in different countries and regions, including the UK, Italy, Hong Kong and Norway (5-12). Since these studies were mostly single cross sectional surveys it is to date unknown how risk perceptions evolve over time and are affected by such issues as news coverage in the popular media or other events drawing attention to a possible outbreak. Only few studies have studied risk perception related to emerging infectious diseases over a longer period of time. Lau and colleagues studied risk perception of SARS in Hong Kong during the outbreak with ten rounds of surveys and showed changes in both risk perception and precautionary behaviour (13). They showed that perceived susceptibility declined in the second phase of the epidemic, after April 8, 2003 as the number of new infections also declined. During the initial phase of the epidemic with rising figures of new cases there was a sharp rise in preventive measures. Engagement in preventive measures remained on a high level, also after the epidemic started declining and perceived susceptibility also declined. Leung and colleagues also studied SARS in Hong Kong with six surveys and showed a decrease in anxiety over time after the peak of the SARS epidemic (14). They also showed an increase in the number of preventive measures at the start of the epidemic, which remained stable during the epidemic, and this decreased sharply half a year after the epidemic.

The Netherlands is a country with an intensive poultry industry, a history of avian influenza outbreaks, and measures to control such outbreaks. In 2003 there was a severe outbreak of H7N7 avian influenza in the Netherlands, resulting in one human fatality (15). For poultry workers, poultry farmers and their families, specific measures were advised such as the use of facial masks and goggles to prevent infection, and taking anti-viral therapy. Adherence to these measures was low, even among people who were directly at risk for infection (16).

The present study describes trends in risk perceptions and self-reported precautionary behaviours related to H5N1 avian influenza in the Netherlands over a period with changing risks and publicity related to possible outbreaks.

## Methods

We investigated risk perception and perceived severity of infection with avian influenza (AI) among humans, amount of information on AI received, knowledge about AI and self-reported

preventive measures from March 2006 to March 2007 in the Netherlands. Seven web-based surveys among random samples from an Internet panel were conducted. The panel consists of 15.000 members of whom the distribution of demographic variables (gender, age, region, level of education) is comparable to the general Dutch population. For each survey the aim was to include 500 respondents in each of the surveys; for this purpose an independent random sample was drawn for each survey of 700 to 952 panel members from 18 years and older. Respondents who had completed a survey were not invited to participate in future surveys. These panel members received an invitation to participate by email. The surveys were online for a period ranging from 8 to 13 days. Panel members received 1.50 Euro in credits for completion of a survey, members can change their credits for a gift cheque if they have a specific number of credits.

Five of the surveys were periodical with three month intervals. The two remaining surveys were conducted immediately after two relevant events: The first event, in August 2006, was a suspected infection of two owls with AI in the Rotterdam zoo. The survey in August 2006 took place before the Department of Agriculture published a press release informing that no H5N1 infection had been diagnosed in the owls. The second event was news coverage of an outbreak of AI at a turkey farm in the UK, which led to new requirements to keep birds under cover in the Netherlands in February 2007. During the full 13 month period of serial surveys no human cases, or infections among birds or poultry were observed in the Netherlands.

In line with Protection Motivation Theory we assessed perceived vulnerability and perceived severity related to getting infected with avian influenza. Perceived severity ("How serious would it be for you to get avian influenza in the next year") and perceived vulnerability ("How large is the chance that you will get avian influenza in the next year") were both assessed with single items on 5-point scales, in line with the recommendations made by Brewer and colleagues in their recent meta-analysis of the relation between risk perception and influenza vaccination (4).

We also asked how much information people had received about AI (ranging from nothing to very much, 5-point scale), and assessed knowledge of AI based upon four true/false/don't know questions. First of all 'The avian influenza virus can be transmitted from human to human'. Secondly 'There is a vaccine that protects humans against infection with the avian influenza virus'. Thirdly 'In the Netherlands in 2006 people have died as a result of an infection with the avian influenza virus' and finally 'By eating chicken or poultry someone can become infected with the avian influenza virus'. Based upon the official Dutch public information on AI during that period, the answer 'false' was coded as the correct answer to the four knowledge questions. A knowledge score which ranged from 0 to 4 was created based on the number of correct answers

Respondents were also asked whether they had taken measures to prevent getting infected with AI; possible measures that respondents were questioned about were 'not getting in touch with (wild) birds or poultry', 'not going to areas where AI was diagnosed', 'paying more attention to hygiene', 'eating less or no chicken or poultry', 'cancelling or not booking a planned holiday to an area with AI', 'getting oneself vaccinated against influenza', 'avoiding shaking hands', 'keeping the cat indoors', 'avoid gatherings of people', 'buying antiviral drugs', 'buying a mouth mask', 'something else' or 'done nothing'. We categorized these measures as measures recommended by health authorities (not getting in touch with wild birds or poultry), non-effective measures (eating less or no chicken or poultry, getting oneself vaccinated against influenza) and measures which were not recommended although they may

have some preventive effect (all the other measures).The Dutch questionnaire is available on http://www.ggd.rotterdam.nl/smartsite229.dws?Menu=2123645&goto=2123639&style=6400.

Differences in background characteristics (gender and level of education) between the surveys were explored with Chi-square tests. Level of education was divided in three categories: lower education (primary school, lower vocational school or less), intermediate level education (high school or medium level vocational school), or higher education (university or college degree). Differences in age and mean scores between surveys were tested pair wise, taking multiple testing into account, with the Bonferroni post-hoc test in Univariate Analysis of Variance (ANOVA). Time trends were analyzed with linear regression analyses with perceived severity, perceived vulnerability, amount of information, knowledge and the different preventive measures as dependent variables and time (the survey) as the main independent variable and gender, age and level of education as covariates.

**Results**

In total 3,840 respondents participated in the seven surveys, overall response was 64%. The majority of respondents were female (54%). The proportion of women in the first 4 surveys was lower compared to the last 3 surveys (51% vs. 58%, $\chi^2$ (df)= 16.5 (1); p<0.001) (Table 1). Mean age was 45 years (range 18-86, SD 14.8), with respondents in survey 1 being significantly younger (41.3) than respondents in the other surveys (46.0), (F(df)=51.0(1); p<0.001). Over all surveys, 26%, 39% and 35% of respondents had received lower, intermediate and higher education respectively.

**Table 1: Participation rates and distribution of general characteristics in the study population by measurement**

| | Mar '06 | June '06 | Aug '06* | Sep '06 | Dec '06 | Feb '07* | Mar '07 | Total |
|---|---|---|---|---|---|---|---|---|
| Invited | 952 | 700 | 970 | 744 | 877 | 844 | 908 | 5995 |
| Participated | 584 | 542 | 650 | 538 | 555 | 467 | 505 | 3841 |
| Response | 61% | 77% | 67% | 72% | 63% | 55% | 56% | 64% |
| Gender | | | | | | | | |
| Male | 48% | 50% | 48% | 52% | 42% | 43% | 41% | 46% |
| Female | 52% | 50% | 52% | 48% | 58% | 57% | 59% | 54% |
| Age (mean) | 41.3 | 47.5 | 47.0 | 44.7 | 45.9 | 45.5 | 44.9 | 45.3 |
| Education | | | | | | | | |
| Low | 27% | 30% | 24% | 24% | 29% | 25% | 26% | 26% |
| Intermediate | 37% | 39% | 42% | 44% | 41% | 31% | 34% | 39% |
| High | 36% | 31% | 34% | 32% | 30% | 44% | 40% | 35% |

* Additional surveys

Infection with AI was perceived as a (very) severe health problem by 92% of the study population with a mean score of 4.58 (95% CI 4.55 – 4.60; scale 1 – 5); 0.7% reported (very) high perceived vulnerability (mean = 1.69 (95% CI 1.66 – 1.71, scale 1 – 5). The amount of information received was perceived as (very) high by 7% over the entire study period (mean score 2.63 (95% CI 2.61 – 2.65, scale 1 – 5). Of all respondents 10% gave correct answers to all 4 knowledge questions; 17% had all answers wrong. On average respondents, answered fewer than 2 out of 4 knowledge questions correctly (mean score 1.87; 95% CI 1.83 – 1.91,

scale 0-4); 46% respondents reported taking one of more preventive measures, with 36% reporting to have stayed away from (wild) birds or poultry.
In the regression analyses, time was not significantly associated with perceived severity (β=-0.002, p=0.772) and for perceived vulnerability the regression coefficient of time was just short of being statistically significant (β=-0.011, p=0.08). Time was significantly associated with amount of information received (β=-0.065, p<0.001), knowledge (β=-0.127, p<0.001) and taking preventive measures (Table 2). In the pair wise comparisons, a few more significant differences in variables of interest were found between different surveys.

**Table 2: Proportion of respondents that took preventive measures, overall and by measurement**

| | Mar '06 | June '06 | Aug '06* | Sept 06 | Dec 06 | Feb 07* | March 07 | Overall | β-value[+] | Beta[§] | p-value[#] |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Took preventive measures | 38% | 50% | 49% | 43% | 45% | 48% | 49% | 46% | -0.008 | -0.032 | 0.042 |
| Avoiding contact with (wild) birds or poultry | 31% | 39% | 39% | 33% | 34% | 38% | 38% | 36% | 0.005 | 0.022 | 0.175 |
| Not going to areas with AI | 18% | 25% | 28% | 23% | 27% | 33% | 31% | 26% | 0.018 | 0.081 | 0.000 |
| Paying more attention to hygiene | 9% | 16% | 17% | 16% | 14% | 16% | 18% | 15% | 0.008 | 0.042 | 0.003 |
| Eating less or no chicken or poultry | 9% | 12% | 11% | 9% | 14% | 12% | 12% | 11% | 0.004 | 0.022 | 0.175 |
| Cancelled or didn't book a holiday to an area with AI | 7% | 9% | 9% | 6% | 9% | 11% | 11% | 9% | 0.006 | 0.039 | 0.016 |
| Getting oneself vaccinated against influenza | 2% | 6% | 5% | 6% | 8% | 4% | 6% | 5% | 0.004 | 0.032 | 0.044 |
| Keeping the cat indoors | 5% | 5% | 4% | 3% | 4% | 6% | 6% | 5% | 0.001 | 0.013 | 0.428 |
| Avoid gatherings of people | 2% | 2% | 3% | 3% | 3% | 3% | 4% | 3% | 0.003 | 0.036 | 0.024 |
| Buying antiviral drugs | 1% | 2% | 2% | 2% | 2% | 1% | 4% | 2% | 0.002 | 0.034 | 0.036 |
| Buying a mouth mask | 1% | 1% | 2% | 2% | 2% | 2% | 3% | 2% | 0.003 | 0.045 | 0.005 |
| Something else | 2% | 2% | 2% | 1% | 3% | 2% | 2% | 2% | 0.000 | 0.001 | 0.975 |
| Avoiding shaking hands | 1% | 1% | 1% | 1% | 1% | 1% | 2% | 1% | 0.000 | 0.000 | 0.980 |

[*] additional surveys
[+] β-value: regression coefficient of time variable as a correlate of the independent variables, adjusted for gender, age and level of education
[§] Beta: standardised regression coefficient
[#] p-value of the standardised regression coefficient from the linear regression analyses

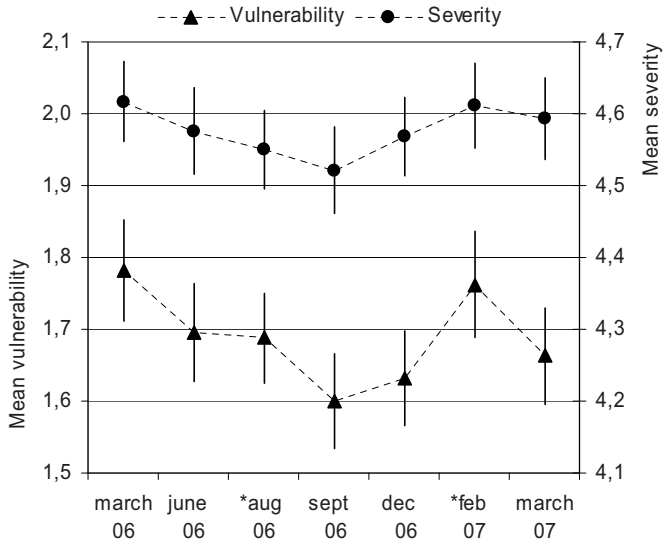
Perceived severity was stable over the seven surveys, ranging between 90 (August 2006) and 94% (March 2007). Perceived vulnerability decreased slightly between March 2006, when 2% perceived a (very) large chance of getting infected the coming year and September and December 2006, with 0.4 and 0.4% respectively (ANOVA September and December 2006 vs. March 2006 p=0.005 and p=0.040 respectively). Perceived vulnerability was increased in February 2007 compared to September 2006 (ANOVA p=0.04) (Figure 1).

There was a significant decrease in the amount of information received about AI from 2.88 in March 2006 to 2.47 in March 2007, in March 2006 14% had received (very) much information, in March 2007 this had decreased to 5% (Figure 2) Knowledge about AI also showed a significant decrease from 2.33 in March 2006 to 1.51 in March 2007, with in March 2006 43% of respondents answering three or four questions correct while in March 2007 this was 22%. The level of knowledge was positively associated with the amount of information received (Pearson $r=0.24$, $p<0.001$).

There was a significant increase in the percentage of respondents who had taken preventive measures between March and June 2006 from 38% to 50% ($\chi^2$ (df)=18.4 (1), $p<0.001$), while there was no difference among the second until the last survey, ranging from 50% in the second survey to 43% in the fourth survey ($\chi^2$ (df)=8.2 (5), $p=0.147$). Avoiding contact with (wild) birds or poultry was reported most often, by 36% of respondents (ranging between 33% in September 2006 and 39% in August 2006). For the specific preventive actions, an increase over time was observed for not going to areas with AI (March 2006 18%, February 2007 33%), paying more attention to hygiene (9% March 2006, 18% in March 2007), cancelled or did not book a holiday to an area with AI (6% in September 2006, 11% in March 2007), getting oneself vaccinated against influenza (2% March 2006, 8% December 2006), avoiding gatherings of people (2% March 2006, 4% March 2007), buying antiviral drugs (1% March 2006, 4% March 2007), and buying a mouth mask (1% March 2006, 3% March 2007) (Table 2).

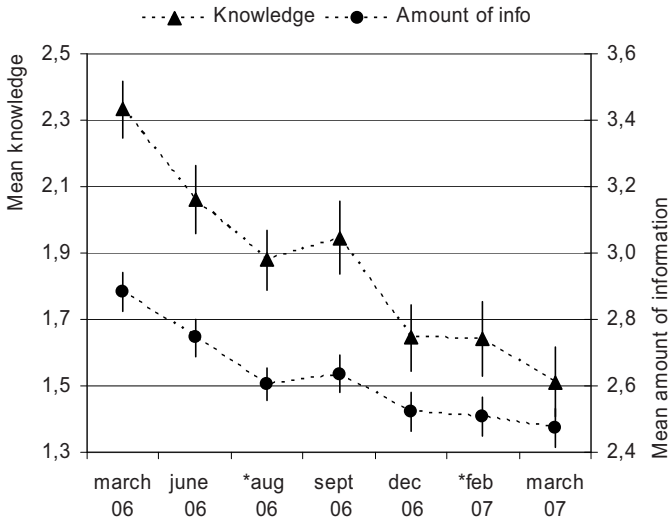
No differences in risk perceptions, precautionary actions or information received were observed related to the specific events (August 2006 and February 2007) when compared to the previous and consecutive surveys.

**Figure 1: Mean severity and vulnerability for AI with 95% confidence intervals**




* additional surveys

**Figure 2: Mean knowledge score and mean amount of information with 95% confidence levels**




* additional surveys

**Discussion and conclusions**

Our study indicates that perceived severity of infection of humans with AI was high and stable, while perceived vulnerability was lower and decreased slightly during a period of more than a year covering part of 2006 and 2007 with a few risk-related events. The amount of information received and the level of knowledge during the same period also decreased. Substantial groups reported taking one or more preventive measures with staying away from wild birds and poultry remaining high throughout the period. Eleven percent of respondents reported to have eaten less or no chicken or poultry as a precautionary behaviour.

The overall levels of risk perception and preventive actions were high, which is in line with earlier studies in Hong Kong, the UK and Norway which showed that AI is seen as a real risk and that many people planned to take several precautionary actions (5-7, 9). While perceived severity remained stable and perceived vulnerability decreases slightly, there was a stronger decrease in the amount of information received and related decrease in knowledge. The level of knowledge was positively associated with the amount of information received (Pearson $r=0.24$, $p<0.001$). This relation may be associated with the decrease in media attention to avian influenza during this period. An inventory of attention for AI and an influenza pandemic in two of the main national newspapers, Algemeen Dagblad and NRC Handelsblad showed this decrease. While in 2006 from March until December these newspapers published 150 and 107 articles respectively, this number decreased in 2007 to 74 and 55 respectively and to 8 and 6 in the first three months of 2008.

There was, however, no significant effect on either perceived severity, perceived vulnerability nor amount of information or knowledge of the two episodes: the suspicion of AI among owls in the Rotterdam zoo or the outbreak among poultry in the UK leading to a new requirements to keep birds under cover. During the SARS outbreak in Hong Kong changes in risk perception where shown to be related to the course of the outbreak (13, 14), whereas even the introduction of AI in Europe did not appear to lead to a change in risk perception (17). This might indicate that only a true outbreak of an emerging infectious disease and changes in its course will lead to changes in risk perception.

The stable high level of preventive measures is in line with the earlier studies on SARS in Hong Kong where these measures remained high during the epidemic and as Leung showed only decreased after the epidemic (13, 14). More research, however, is needed to establish in more detail how changes in the course of outbreaks in and outside the country and media coverage are related to risk perceptions and preventive behaviour.

The study has a number of limitations. First the study was conducted using an Internet based panel thus possibly over representing those who are computer literate. The panel, however, is representative of the Dutch population in terms of age, gender and level of education. A second limitation is that because no infections of birds or humans with avian influenza took place during the study period in the Netherlands we could not study the effect of such an episode. Finally our questionnaire has not been validated in other studies, although it is based upon questionnaires used in earlier studies on this or closely related topics (11, 17).

Our study has several implications for public health research and policy. AI is perceived as a severe health problem and the stability of the level of risk perception indicates that it is not seen as a temporary problem. Knowledge however, decreased over time indicating the need to keep the public continually well informed, especially about which measures will be effective,

since a substantial numbers of respondents took non-effective measures. The stability of the levels of risk perception gives credibility to cross sectional one time surveys of risk perception.

**Acknowledgements**

This study was conducted within the framework of CEPHIR, the Center for Effective Public Health in the larger Rotterdam area. This study was funded by the Municipal Public Health Service Rotterdam-Rijnmond and the Centre for Infectious Diseases Control Netherlands.

## References


1. World Health Organization. H5N1 avian influenza: Time line of major events. 2008. Available at: http://www.who.int/csr/disease/avian_influenza/Timeline_080418.pdf.
2. Aledort JE, Lurie N, Wasserman J, Bozzette SA. Non-pharmaceutical public health interventions for pandemic influenza: an evaluation of the evidence base. BMC Public Health 2007;7(147):208.
3. Rogers RW. Cognitive and physiological processes in fear appeals and attitude change: A revised theory of protection motivation. New York: Guilford Press; 1983.
4. 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(2):136-45.
5. Fielding R, Lam WW, Ho EY, Lam TH, Hedley AJ, Leung GM. Avian influenza risk perception, Hong Kong. Emerg Infect Dis 2005;11(5):677-82.
6. Gupta RK, Toby M, Bandopadhyay G, Cooke M, Gelb D, Nguyen-Van-Tam JS. Public understanding of pandemic influenza, United Kingdom. Emerg Infect Dis 2006;12(10):1620-1.
7. Kristiansen IS, Halvorsen PA, Gyrd-Hansen D. Influenza pandemic: perception of risk and individual precautions in a general population. Cross sectional study. BMC Public Health 2007;7(147):48.
8. Lau JT, Tsui H, Kim JH, Griffiths S. Perceptions about status and modes of H5N1 transmission and associations with immediate behavioral responses in the Hong Kong general population. Prev Med 2006;43(5):406-10.
9. Lau JT, Kim JH, Tsui HY, Griffiths S. Anticipated and current preventive behaviors in response to an anticipated human-to-human H5N1 epidemic in the Hong Kong Chinese general population. BMC Infect Dis 2007;7:18.
10. Lau JT, Kim JH, Tsui H, Griffiths S. Perceptions related to human avian influenza and their associations with anticipated psychological and behavioral responses at the onset of outbreak in the Hong Kong Chinese general population. Am J Infect Control 2007;35(1):38-49.
11. de Zwart O, Veldhuijzen IK, Elam G, Aro AR, Abraham T, Bishop GD, Richardus JH, Brug J. Avian influenza risk perception, Europe and Asia. Emerg Infect Dis 2007;13(2):290-3.
12. Di Giuseppe G, Abbate R, Albano L, Marinelli P, Angelillo IF. A survey of knowledge, attitudes and practices towards avian influenza in an adult population of Italy. BMC Infect Dis 2008;8:36.
13. Lau JT, Yang X, Tsui H, Kim JH. Monitoring community responses to the SARS epidemic in Hong Kong: from day 10 to day 62. J Epidemiol Community Health 2003;57(11):864-70.
14. Leung GM, Lam TH, Ho LM, Ho SY, Chan BH, Wong IO, Hedley AJ. The impact of community psychological responses on outbreak control for severe acute respiratory syndrome in Hong Kong. J Epidemiol Community Health 2003;57(11):857-63.
15. Fouchier RA, Schneeberger PM, Rozendaal FW, Broekman JM, Kemink SA, Munster V, Kuiken T, Rimmelzwaan GF, Schutten M, Van Doornum GJ, Koch G, Bosman A, Koopmans M, Osterhaus AD. Avian influenza A virus (H7N7) associated with human conjunctivitis and a fatal case of acute respiratory distress syndrome. Proc Natl Acad Sci U S A 2004;101(5):1356-61.
16. Bosman A, Du Ry van Beest Holle M, Conyn - van Spaendonck MAE, Koopmans MPG. Compliance amoung poultry workers to infection control measures during a large epizootic of Avian Influenza in commercial poultry farms in The Netherlands. Bilthoven: RIVM / Instituut voor Psychotrauma; 2004. Report No.: 630940001/2004.
17. Brug J, Aro AR, Oenema A, de Zwart O, Richardus JH, Bishop GD. SARS risk perception, knowledge, precautions, and information sources, the Netherlands. Emerg Infect Dis 2004;10(8):1486-9.

# 6.

# Correlates of precautionary behaviours related to avian influenza in 2006 – 2007 in the Netherlands

Onno de Zwart (1, 2), Irene K. Veldhuijzen (1, 2), Jan Hendrik Richardus (1, 2), Johannes Brug (2, 3)

1. Municipal Public Health Service Rotterdam-Rijnmond
2. Department of Public Health, Erasmus MC, University Medical Center Rotterdam
3. EMGO-Institute, VU University Medical Center, Amsterdam

Submitted for publication

**Abstract**

Avian influenza (AI) is a public health challenge because of ongoing spread and pandemic potential. Non-pharmaceutical measures are important to prevent the spread of AI and to contain a pandemic. The effectiveness of such measures is largely dependent on the behaviour of the population. Risk perception is a central element in changing behaviour. This study aimed to investigate perceived vulnerability, severity and precautionary behaviour related to AI in the Netherlands during seven consecutive surveys in 2006 – 2007.

Seven web-based surveys were conducted including 3,840 respondents. While infection with AI was considered a very severe health problem with mean score of 4.57 (scale 1 – 5); perceived vulnerability was much lower, with a mean score of 1.69. Almost half of the respondents (46%) reported taking one or more preventive measures, with 36% reporting to have stayed away from (wild) birds or poultry. In multivariate logistic regression analysis the following factors were significantly associated with taking preventive measures: time of the survey, higher age, lower level of education, non-Dutch ethnicity, vaccinated against influenza, higher perceived severity, higher perceived vulnerability, higher self efficacy, lower level of knowledge, more information about AI, and thinking more about AI. Self efficacy was a stronger predictor of precautionary behaviour for those who never or seldom think about AI (OR 2.3, 95% CI 1.9 – 2.7), compared to those who think about AI more often (OR 1.5, 95% CI 1.2 – 1.9).

The fact that perceived severity of AI appears to be high offers a good point of departure for more specific risk communications to promote precautionary actions. Such communications should aim at improving knowledge about the disease and preventive actions, and focus on perceived personal vulnerability and self efficacy in taking preventive measures.

## Introduction

Infectious diseases are once again among the major public health challenges. The SARS epidemic of 2003 showed not only that there are new unknown viruses which can have severe health consequences, but also made clear how fast a disease can spread globally, what the societal and economic impact can be, as well as how the media may contribute to awareness and public concerns (1, 2). While SARS came as a surprise, the world is preparing itself for newly emerging infectious diseases, including an influenza pandemic.

Up to June 19, 2008 the World Health Organization (WHO) has confirmed 385 human cases of avian influenza (AI) in 15 countries, mostly in South-East Asia, with 243 fatalities. (3). Outbreaks of AI among (wild) birds or poultry have been reported in 61 countries (4). So far, human AI infections were limited to people who had been in close contact with (wild) birds or poultry. Nonetheless, the possibility of an adaptation of the current H5N1 AI virus might lead to a new influenza virus which would be easily transmitted from human-to-human and may thus lead to a new influenza pandemic. After the three influenza pandemics in the 20$^{th}$ century, the 'Spanish influenza' in 1918, the 'Asian influenza' in 1957 and the 'Hong Kong influenza' in 1968 the world is now in the so-called pandemic alert phase of the WHO (phase 3, no or very limited human-to-human transmission) (5).

In preparing for an influenza pandemic the development of vaccines as well as the stockpiling of antiviral drugs has received most attention. While developments have been made and some countries have now a (limited) amount of antiviral drugs, some argue that the countries fail the precautionary principle because they have not ensured enough effective drugs (6). Furthermore, focusing on vaccines and antiviral drugs only will probably not be enough to limit the consequences of an influenza pandemic, as these will likely neither be available in time nor in the right quantities, and non-medical interventions will be of great importance in the control of the epidemic (7). The WHO has proposed a number of measures: recommendations on personal hygiene, quarantine, travel restrictions, closures of schools and other public gatherings (8, 9). A historical analysis by Markel and colleagues of the reaction to the 'Spanish influenza' in several cities in the United States showed that cities which took earlier nonpharmaceutical interventions, such as school closures, public gatherings bans and isolation and quarantine, and sustained these measures, had greater delays in reaching peak mortality, lower peak mortality rates and lower total mortality (10). During the SARS outbreak the importance of nonpharmaceutical interventions was also shown; quarantine and hygiene measures helped the control of the SARS outbreak (11).

The effectiveness of both pharmaceutical and nonpharmaceutical interventions is largely dependent on the behaviour of the population, i.e. compliance with the recommended preventive measures. For promotion of adequate precautionary behaviour among the populations, public health authorities need to know how people perceive risks, how they perceive the effectiveness and acceptance of nonpharmaceutical interventions and whether they will trust and be willing and able to use the information from public health and other authorities. Based upon earlier outbreaks of infectious diseases, there is only very limited information on these issues. In 2003 there was a severe outbreak of H7N7 AI in the Netherlands, resulting in one fatality (12). For poultry workers, poultry farmers and their families, specific measures were advised such as the use of facial masks and goggles to prevent infection, and taking anti-viral therapy. Adherence to these measures was low even if people were directly at risk for infection (13).

Risk perception is a central element of various behaviour theories (14). Risk perception has been studied intensively in relation to environmental and technical-industrial risk. Smith distinguishes two approaches in the field of risk perception studies. The first is the so-called 'realistic' approach focusing on measuring the objective risk of a specific threat or danger, which can be measured independently from the social context (1, 15). Much of the early work of Slovic which included comparisons of perceptions of risk can be placed in this tradition (16). The second approach is the 'social constructionist' approach, where the perception of risk is the result of social and cultural processes and is shaped by these processes (see e.g. the works of Joffe (17) and Beck (18)). In the present study into risk perception of AI we combine a realistic approach – since there is a real risk for human AI and the possibility of influenza pandemic and specific knowledge about these – with a social constructionist approach focusing on how people perceive risks and what actions they take.

Based upon Protection Motivation Theory we distinguish between the perceived severity of a disease, described by Brewer et al. as the extent of harm a hazard would cause, and the perceived vulnerability (often also described as perceived likelihood or risk perception as such), described as the probability that one will be harmed by the hazard (14, 19). Additionally, comparative vulnerability can be defined as the probability that one will be harmed by the hazard compared to others of the same age and gender. Risk perceptions are often biased. A low comparative vulnerability, which may indicate unrealistic optimism, is regularly observed towards familiar risks that are perceived to be largely under volitional control. People perceive their comparative vulnerability compared to others of the same sex and age as lower. The opposite, when people perceive their comparative vulnerability to be higher than others of the same sex and age may indicate a pessimistic bias, which is more likely for new risks that are perceived as uncontrollable. The latter might be the case with new emerging infectious diseases, like AI or an influenza pandemic (20-23).

Protection Motivation Theory suggests that, apart from risk perception, response efficacy and self efficacy are two key determinants of precautionary behaviour. Response efficacy relates to the belief of people in the effectiveness of the available protective actions, for example hygienic measures. Self efficacy relates to a person's perception of their ability to engage in such protective actions, e.g. that they are able to carry out the proposed hygienic measures. Several reviews and meta-analyses focusing on the effects of fear, risk perception and fear appeals on health behaviours have suggested that higher risk perception will only predict precautionary behaviour when people believe that effective protective actions are available (in case of sufficient response efficacy) and when they have confidence that they have the opportunities and abilities to engage in such protective actions (sufficient self-efficacy) (24, 25).

While risk perception is an important factor in many health psychology models, there is ongoing discussion about the (size of the) effect of risk perception on precautionary behaviours (14). While effects are found, they are often small. In their recent meta analysis Brewer and colleagues showed that perceived likelihood, susceptibility and severity all had a significant effect on whether people got vaccinated against influenza with the largest effect for likelihood (pooled r =0.26). Since most studies into risk perception of infectious diseases do not take place during outbreaks of infectious diseases, it is difficult to include measures of precautionary behaviour in such research. Most of such studies therefore focus on future behaviour or intended behaviour in case of an outbreak (26, 27). In the present study we were able to include self-reported precautionary behaviour related to AI at the time of the data collection.

Since the SARS outbreak research into risk perception of infectious diseases has gained interest. Several studies that were conducted during the SARS outbreak and its aftermath, indicated a relatively high level of risk perceptions in the United States, and relatively lower levels in Hong Kong and the Netherlands (28-31).

A number of studies have looked into risk perception of AI or an influenza pandemic and future preventive behaviours. A Norwegian study showed that most people thought an influenza pandemic to be a serious health problem, although almost half of them underestimated the expected mortality compared to the official estimations (32). 80% of respondents reported that they would be careful about personal hygiene, while 11% reported to stay home and avoid contact with others. Gupta and colleagues in a street-based survey in London concluded that 71% of their respondents thought an influenza pandemic (very) likely in the coming ten years, and almost all respondents would wash their hands more than five times per day if requested (33). Fielding studied risk perception of AI in relation to live chicken sales and reported that 36% considered touching chicken while buying them as risky (34).

Lau and colleagues carried out three studies in Hong Kong on different aspects of human AI (27, 35, 36). In a first study substantial unconfirmed beliefs and misconceptions were reported related to AI which were correlated to immediate behavioural responses, such as avoiding visits to hospitals and eating less poultry (35). A second study indicated that if human-to-human transmission would occur in Hong Kong, large proportions of respondents would wear face masks in public venues (74%), increase the frequency of hand washing (87%) or avoid eating poultry (64%) (27). The results of the third study showed that between 71 and 81% of respondents reported to avoid visiting hospitals, crowds, going out or going abroad when there was either bird-to-human transmission or human-to-human transmission (36).

The present study explored risk perception, efficacy beliefs and precautionary behaviour related to human AI in seven consecutive surveys in the Netherlands. As far as we know our study is the first with such a large sample and consecutive surveys looking into actual self-reported precautionary behaviour instead of reports on would-be behaviours in case of an outbreak or other event. To explore if risk perceptions were specific for human AI, risk perception related to other (infectious) diseases were also investigated. The study had the following specific objectives:

- To study levels of perceived severity, perceived vulnerability and comparative vulnerability of infection with human avian influenza and compare these with other diseases and conditions such as common cold, diabetes, HIV, high blood pressure, tuberculosis, food poisoning and a heart attack
- To explore knowledge of avian influenza, the amount of information people had received about avian influenza and how often they thought about it.
- To analyse correlates of risk perception of avian influenza, and gender, age, having children below the age of twelve, ethnicity, education, thinking about AI, knowledge about AI, the amount of information received and being vaccinated against influenza.
- To study precautionary behaviour related to avian influenza and its potential determinants

We have reported on the effects of time in relation to possible changes in risk perception and precautionary behaviour elsewhere (29, 37). Perceived severity of AI remained stable over time, while perceived vulnerability decreased slightly. No clear time trend was observed for precautionary behaviour.

**Methods**

Seven web-based surveys among random samples from an Internet panel were conducted. At the time of data collection, the panel consisted of approximately 15.000 members of whom the distribution of demographic variables (gender, age, region, level of education) was comparable to the Dutch adult population at large. For each survey an independent random sample was drawn of between 700 and 952 panel members from 18 years and older. These panel members received an invitation to participate by email. Each survey was online between 8 and 13 days. Panel members received 1.50 Euro in credits for completion of a survey, if panel members have a certain amount of credits for participating in survey they can exchange their credits for a gift cheque covering the exact amount of credit. Five of the surveys were periodical with three months intervals. The two remaining surveys were conducted within a week after two AI-related events that received quite some media attention in the Netherlands and thus with a potential impact on risk perception: a suspected infection of two owls with AI in the Rotterdam zoo in August 2006 and an outbreak of AI at a turkey farm in the UK which led to a new requirements to keep birds under cover in the Netherlands in February 2007.

In line with Protection Motivation Theory we developed a survey which focused on risk perception, precautionary behaviour, and self and response efficacy. The survey was based on two earlier surveys used in studies into risk perception and pandemic influenza (29, 37). As we used an existing internet panel with known data on gender, age, country of birth and level of education, questions on these demographics were not included in the questionnaire. The questionnaire started with additional demographic questions concerning the country of birth of both parents, size of the household and whether there were children younger than 12 years in the household. Next, a number of questions were asked about perceived severity and susceptibility on five point answering scales. First it was asked how serious it would be for the respondent to get one of the following diseases and conditions in the next year: diabetes, a regular cold, hiv/aids, high blood pressure, AI, tuberculosis, a heart attack and food poisoning. Answer possibilities ranged from very serious to not serious at all. The next question included the same diseases and condition and asked how likely it would be that the respondents themselves would get the disease in the coming years (very small chance - very large chance). These formulations are in line with the conditioned risk questions as discussed by Brewer and colleagues in their recent meta-analysis of the relation between risk perception and influenza vaccination (14). To assess comparative vulnerability respondents were asked whether compared to someone of the same age and gender in the Netherlands they would have a smaller or larger chance to get one of the diseases and conditions in the coming years (a much smaller chance - a much larger chance).

The next question asked how often people thought about AI (never – always). Self efficacy was assessed by asking ‘How sure are you that you yourself can prevent getting AI when AI reaches the Netherlands’ (not sure, - very sure. Respondents were also asked whether they had taken measures to prevent themselves getting infected with AI. Possible measures included not getting in touch with (wild) birds or poultry, not going to areas with AI, paying more attention to hygiene, eating less or no chicken or poultry, cancelled or didn’t book a holiday to an area with AI, getting oneself vaccinated against influenza, avoiding shaking hands, keeping the cat indoors, avoid gatherings of people, buying antiviral drugs, buying a mouth mask, something else or done nothing.

We also asked how much information people had received about AI (ranging from nothing to very much), and assessed knowledge of AI based upon four questions. First of all ‘The avian

influenza virus can be transmitted from human to human' (false). Secondly 'There is a vaccine that protects humans against infection with the avian influenza virus' (false). Thirdly 'In the Netherlands in 2006 people have died as a result of an infection with the avian influenza virus' (false) and finally 'By eating chicken or poultry someone can become infected with the avian influenza virus' (false). The questionnaire included a question on whether the respondent was vaccinated against influenza in the last year and whether he or she kept chicken or poultry.

Mean scores and 95% confidence intervals were calculated for the perceived severity, vulnerability and comparative vulnerability of several diseases and conditions. Univariate associations of several determinants with perceived vulnerability were tested with ANOVA or T-test. To study correlates of precautionary behaviour, a new dichotomous variable 'precautionary measures' was defined and coded 1 (yes), if respondents had taken any of the specific measures, and coded 0 (no) if respondents had done nothing. Univariate logistic regression analyses were performed, with self reported characteristics as independent variables and taking precautionary measures as the dependent variable. For the odds ratios, 95% confidence intervals (CI) were calculated. Variables showing an association of $p < 0.1$ were included in the multivariate analysis. Variables were included blockwise, with the time of the survey and general characteristics in the first step, severity and vulnerability were added in the second step, self efficacy in the third step, and knowledge, amount of information received and thinking about AI in the fourth step. All first order interactions between the variables added after the first step were assessed. The final model was run after excluding variables with an association of $p>0.1$.

**Results**

In total 3,840 respondents participated in the seven surveys; per survey the number of participants varied between 467 and 650. Overall response was 64% and varied between 55% and 77% (see table 1). In all but one, (i.e. the August 2006 survey) the majority of respondents were women, in total 54%. Mean age was 45.3 years, of the respondents 26% had lower education (i.e. primary education, lower general or lower vocational education or less), 39% intermediate education (secondary general or vocational education) and 35% higher education (higher professional education or university), with some differences between surveys. 11% of the participants were of non-Dutch origin. 23% had been vaccinated against influenza. In 22% of the households there were children under 12 living. Only 4% kept chicken or poultry at home.

**Table 1: Participation rates and distribution of general characteristics in the study population**

| | N | % |
|---|---|---|
| Invited | 5995 | |
| Participants, response | 3841 | 64% |
| Gender | | |
| Male | 1765 | 46% |
| Female | 2046 | 54% |
| Age (mean) | 45.3 | |
| Education | | |
| Low | 1000 | 26% |
| Intermediate | 1479 | 39% |
| High | 1332 | 35% |
| Children <12 in household | | |
| Yes | 845 | 22% |
| No | 2966 | 78% |
| Ethnicity | | |
| Dutch | 3398 | 89% |
| Non-Dutch | 413 | 11% |
| Vaccinated against influenza | | |
| Yes | 887 | 23% |
| No | 2909 | 76% |
| Keeping chicken or poultry | | |
| Yes | 137 | 4% |
| No | 3674 | 96% |

Infection with AI was perceived as a (very) severe health problem by 91.8% of the study population with a mean score of 4.57 (95% CI 4.55 – 4.60; scale 1 – 5); 0.7% reported (very) high perceived vulnerability, mean = 1.69 (95% CI 1.66 – 1.71, scale 1 – 5) (see table 2).

**Table 2: Perceived severity, vulnerability and comparative vulnerability (mean and 95% CI)**

| | Severity | Vulnerability | Comparative vulnerability |
|---|---|---|---|
| | Mean (95% CI) | Mean (95% CI) | Mean (95% CI) |
| HIV | 4.92 (4.91 - 4.93) | 1.23 (1.21 - 1.24) | 1.88 (1.85 - 1.91) |
| Heart attack | 4.82 (4.80 - 4.83) | 2.26 (2.23 - 2.29) | 2.82 (2.80 - 2.85) |
| Avian influenza | 4,57 (4.50 - 4.60) | 1.69 (1.66 - 1.71) | 2.59 (2.56 - 2.61) |
| Tuberculosis | 4.49 (4.47 - 4.51) | 1.68 (1.65 - 1.70) | 2.50 (2.47 - 2.52) |
| Diabetes | 4.18 (4.16 - 4.21) | 2.11 (2.08 - 2.14) | 2.85 (2.82 - 2.87) |
| High blood pressure | 3.60 (3.57 - 3.62) | 2.44 (2.41 - 2.47) | 2.84 (2.82 - 2.87) |
| Food poisoning | 3.59 (3.57 - 3.62) | 2.38 (2.36 - 2.41) | 2.73 (2.71 - 2.75) |
| Common cold | 1.87 (1.85 - 1.89) | 3.64 (3.61 - 3.67) | 3.07 (3.05 - 3.09) |

Comparative vulnerability for AI was 2.59 (95% CI 2.56 – 2.61, scale 1 – 5, whereby 3 stands for an equal chance to others of the same age and gender). Compared with other diseases, getting infected with AI was perceived as very serious with a score of 4.57 on a scale from 0-5 (see table 2). Only HIV, 4.92 (95% CI 4.91 – 4.93), and heart disease, 4.82 (95% CI 4.80 –

4.83), had a significantly higher perceived severity. Perceived severity of other diseases and conditions varied from 4.18 (95% CI 4.16 – 4.21) to 1.87 (95% CI 1.85 – 1.89) for a common cold. In contrast perceived vulnerability for common cold was the highest with 3.64 (95% CI 3.61 – 3.67), while for HIV it was the lowest at 1.23 (95% CI 1.21 – 1.24). Comparative vulnerability of HIV was also low at 1.88 (95% CI 1.85 – 1.91), while for a common cold it was 3.07 (95% CI 3.05 – 3.09).

All four knowledge questions were answered correctly by 10.2% of the respondents; 16.5% had all answers wrong. The mean score for knowledge was 1.87 (95% CI 1.83 – 1.91, scale 0-4). Of all respondents 49% reported to have received a reasonable amount of information about AI and 7% (very) much, with a mean score for information received of 2.63 (95% CI 2.61 – 2.65, scale 1 – 5); 3% of respondents thought often or always about AI and 30% sometimes, resulting in a mean score of 2.19 (95% CI 2.17 – 2.22). 33% of respondents were not sure that they could do anything to prevent themselves from getting infected with AI, while 20% felt reasonably sure or very sure. The mean score for self efficacy was 2.23 (95% CI 2.20 – 2.27)

Almost half of the respondents, 46%, reported taking one or more preventive measures, with 36% reporting to have stayed away from (wild) birds or poultry, 26% not going to areas where AI was present and 2% buying antiviral drugs (see table 3).

**Table 3: Proportion of respondents that reported to have taken preventive measures**

| Took any preventive measure | 46% |
|---|---|
| Avoiding contact with (wild) birds or poultry | 36% |
| Not going to areas with AI | 26% |
| Paying more attention to hygiene | 15% |
| Eating less or no chicken or poultry | 11% |
| Cancelled or didn't book a holiday to an area with AI | 9% |
| Getting oneself vaccinated against influenza | 5% |
| Keeping the cat indoors | 5% |
| Avoid gatherings of people | 3% |
| Buying antiviral drugs | 2% |
| Buying a mouth mask | 2% |
| Something else | 2% |
| Avoiding shaking hands | 1% |

Most demographic factors and knowledge and information determinants were significantly associated with perceived vulnerability (table 4). Perceived vulnerability was higher for women, for elder respondents, for respondents without children below 12, for those with a lower education, for those who thought more about AI, for those with a lower level of knowledge and for those vaccinated against influenza. Ethnicity and amount of information were not significantly associated with perceived vulnerability.

**Table 4: Determinants of vulnerability for avian influenza**

| | mean | p-value |
|---|---|---|
| Gender | | 0,019 |
| male | 1,66 | |
| female | 1,72 | |
| Agegroup | | 0,002 |
| 18-29 | 1,66 | |
| 30-44 | 1,63 | |
| 45-59 | 1,73 | |
| 60+ | 1,75 | |
| Children <12 in household | | 0,024 |
| Yes | 1,64 | |
| No | 1,71 | |
| Ethnicity | | 0,256 |
| Dutch | 1,68 | |
| Non-Dutch | 1,73 | |
| Education | | <0.001 |
| Low | 1,84 | |
| Intermediate | 1,65 | |
| High | 1,62 | |
| Think flu | | <0.001 |
| Never | 1,46 | |
| Rarely | 1,62 | |
| Sometimes | 1,88 | |
| Often/All the time | 2,19 | |
| Knowledge score | | <0.001 |
| 0 | 1,80 | |
| 1 | 1,73 | |
| 2 | 1,72 | |
| 3 | 1,60 | |
| 4 | 1,53 | |
| Amount of info | | 0,886 |
| Nothing/Little | 1,69 | |
| Some | 1,68 | |
| (very) much | 1,67 | |
| Vaccinated against influenza | | 0,001 |
| Yes | 1,77 | |
| No | 1,67 | |

In univariate logistic analysis of precautionary behaviour as the dependent (outcome) variable the demographic variables, the specific surveys and variables from the Protection Motivation Theory were included as independent variables (Table 5). Of the demographic variables all, apart from gender and keeping chicken or poultry, were significantly associated with precautionary behaviour. Respondents with a higher age, a lower education, without children below 12, of non-Dutch ethnicity, and those who had been vaccinated against influenza were more likely to take preventive measures. Furthermore preventive measures were taken more often by those respondents who considered AI very severe, who had a higher perceived vulnerability, who had a higher self efficacy, who had less knowledge, who had received more information about AI and thought more about AI. Compared to the first survey, respondents in the subsequent surveys reported to have taken precautionary measures more often.

**Table 5: Proportions of respondents that reported to have taken any preventive measures and results from logistics regressions analyses (Odds ratio (OR and 95% confidence intervals (95%CI)) exploring correlates of preventive measures.**

| | | | | univariate | | | | multivariate | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | n | N | % | OR | 95% | CI | p-value | OR | 95% | CI | p-value |
| Overall | 1750 | 3811 | 45,9% | | | | | | | | |
| Survey | | | | | | | <0,001 | | | | <0,001 |
| 1 | 218 | 579 | 37,7% | 1,0 | | | | 1,0 | | | |
| 2 | 272 | 540 | 50,4% | 1,7 | 1,3 | 2,1 | | 1,8 | 1,4 | 2,4 | |
| 3 | 314 | 644 | 48,8% | 1,6 | 1,3 | 2,0 | | 1,6 | 1,3 | 2,1 | |
| 4 | 230 | 535 | 43,0% | 1,2 | 1,0 | 1,6 | | 1,4 | 1,1 | 1,9 | |
| 5 | 248 | 549 | 45,2% | 1,4 | 1,1 | 1,7 | | 1,5 | 1,2 | 2,0 | |
| 6 | 224 | 463 | 48,4% | 1,6 | 1,2 | 2,0 | | 1,7 | 1,3 | 2,3 | |
| 7 | 244 | 501 | 48,7% | 1,6 | 1,2 | 2,0 | | 1,9 | 1,5 | 2,5 | |
| Gender | | | | | | | 0,493 | | | | |
| male | 821 | 1765 | 46,5% | 1,0 | | | | | | | |
| female | 929 | 2046 | 45,4% | 1,0 | 0,8 | 1,1 | | | | | |
| Age group | | | | | | | <0,001 | | | | <0,001 |
| 18-29 | 222 | 690 | 32,2% | 1,0 | | | | 1,0 | | | |
| 30-44 | 478 | 1178 | 40,6% | 1,4 | 1,2 | 1,8 | | 1,4 | 1,1 | 1,7 | |
| 45-59 | 581 | 1187 | 48,9% | 2,0 | 1,7 | 2,5 | | 1,8 | 1,5 | 2,2 | |
| 60+ | 469 | 756 | 62,0% | 3,4 | 2,8 | 4,3 | | 2,9 | 2,2 | 3,7 | |
| Education | | | | | | | <0,001 | | | | 0,002 |
| low | 538 | 1000 | 53,8% | 1,0 | | | | 1,0 | | | |
| intermediate | 659 | 1479 | 44,6% | 0,7 | 0,6 | 0,8 | | 0,9 | 0,7 | 1,1 | |
| high | 553 | 1332 | 41,5% | 0,6 | 0,5 | 0,7 | | 0,7 | 0,6 | 0,9 | |
| Children <12 in household | | | | | | | 0,071 | | | | |
| no | 1385 | 2966 | 46,7% | 1,0 | | | | | | | |
| yes | 365 | 845 | 43,2% | 0,9 | 0,7 | 1,0 | | | | | |
| Ethnicity | | | | | | | 0,070 | | | | 0,078 |
| Dutch | 1543 | 3398 | 45,4% | 1,0 | | | | 1,0 | | | |
| Non-Dutch | 207 | 413 | 50,1% | 1,2 | 1,0 | 1,5 | | 1,2 | 1,0 | 1,5 | |
| Vaccinated against influenza | | | | | | | <0,001 | | | | 0,010 |
| yes | 506 | 887 | 57,0% | 1,0 | | | | 1,0 | | | |
| no | 1240 | 2909 | 42,6% | 0,6 | 0,5 | 0,7 | | 0,8 | 0,7 | 0,9 | |

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Keeping chicken or poultry | | | | | | | 0,715 | | | | |
| no | 1685 | 3674 | 45,9% | 1,0 | | | | | | | |
| yes | 65 | 137 | 47,4% | 1,1 | 0,8 | 1,5 | | | | | |
| Severity | | | | | | | <0,001 | | | | <0,001 |
| (not) serious (1-4) | 485 | 1256 | 38,6% | 1,0 | | | | 1,0 | | | |
| very serious (5) | 1265 | 2555 | 49,5% | 1,6 | 1,4 | 1,8 | | 1,5 | 1,3 | 1,7 | |
| Vulnerability | | | | | | | <0,001 | | | | <0,001 |
| very small (1) | 839 | 1984 | 42,3% | 1,0 | | | | 1,0 | | | |
| > very small (2-5) | 911 | 1827 | 49,9% | 1,4 | 1,2 | 1,5 | | 1,3 | 1,1 | 1,5 | |
| Self efficacy | | | | | | | <0,001 | | | | |
| not confident (1) | 482 | 1273 | 37,9% | 1,0 | | | | | | | |
| > not confident (2-5) | 1268 | 2538 | 50,0% | 1,6 | 1,4 | 1,9 | | | | | |
| Self efficacy when never/rarely thinking of flu | | | | | | | <0,001 | | | | <0,001 |
| not confident (1) | 251 | 815 | 30,8% | 1,0 | | | | 1,0 | | | |
| > not confident (2-5) | 796 | 1738 | 45,8% | 1,9 | 1,6 | 2,3 | | 2,3 | 1,9 | 2,7 | |
| Self efficacy when sometimes- all the time thinking of flu | | | | | | | <0,001 | | | | 0,001 |
| not confident (1) | 231 | 458 | 50,4% | 1,0 | | | | 1,0 | | | |
| > not confident (2-5) | 472 | 800 | 59,0% | 1,4 | 1,1 | 1,8 | | 1,5 | 1,2 | 1,9 | |
| Knowlegde score | | | | | | | <0,001 | | | | 0,001 |
| 0-1 | 732 | 1496 | 48,9% | 1,0 | | | | 1,0 | | | |
| 2 | 514 | 1094 | 47,0% | 0,9 | 0,8 | 1,1 | | 0,9 | 0,8 | 1,1 | |
| 3-4 | 504 | 1221 | 41,3% | 0,7 | 0,6 | 0,9 | | 0,7 | 0,6 | 0,9 | |
| Amount of info | | | | | | | <0,001 | | | | <0,001 |
| nothing/little (1-2) | 695 | 1691 | 41,1% | 1,0 | | | | 1,0 | | | |
| some - very much (3-5) | 1055 | 2120 | 49,8% | 1,4 | 1,2 | 1,6 | | 1,3 | 1,1 | 1,5 | |
| Thinking of flu | | | | | | | <0,001 | | | | <0,001 |
| never/rarely (1-2) | 1047 | 2553 | 41,0% | 1,0 | | | | 1,0 | | | |
| sometimes-all the time (3-5) | 703 | 1258 | 55,9% | 1,8 | 1,6 | 2,1 | | 2,2 | 1,7 | 2,9 | |

The results of the multivariate logistic regression analysis are also shown in table 5. As the odds ratio's of variables already in the model did not change substantially after inclusion of variables in subsequent steps we present the full model. The only statistically significant interaction term in the model was between self efficacy and thinking about AI. In the final model the time of the survey, a higher age, a lower level of education, a non-Dutch ethnicity, being vaccinated against influenza, a higher perceived severity, a higher perceived vulnerability, a higher self efficacy, a lower level of knowledge, more information about AI, thinking more about AI were all associated with taking preventive measures. Self efficacy was a stronger predictor of precautionary behaviour for those who never or seldom think about AI (OR 2.3; 95% CI 1.9 – 2.7), compared to those who think about AI more often (OR 1.5; 95% CI 1.2 – 1.9).

## Discussion

The results of our study indicate that perceived severity of human infection with AI was high and perceived vulnerability was low, as compared to diseases such as high blood pressure and a common cold. Comparative vulnerability was also relatively low indicating that people perceived it less likely that they would get infected with AI compared to others, which may be an indication of an optimistic bias. Our results further indicate that older people, women, people with younger children, those with a lower education, who thought more about AI, with a lower level of knowledge about AI, and who were vaccinated against influenza perceived their vulnerability for AI as higher. Furthermore, respondents who were older, lower educated, or of non-Dutch ethnicity, who were vaccinated against influenza, who had higher risk perceptions or self efficacy, less knowledge, who had received more information about AI, and thought more often about AI, were more likely to report engagement in precautionary actions.

The high level of perceive severity of AI is in line with earlier studies that were conducted in Norway, the UK and Hong Kong (27, 32, 33). In our own earlier international comparative study perceived severity for AI in the Netherlands was also high (38). As in other studies women, the elderly and those with a lower education have a higher perceived vulnerability (39, 40). Many of the determinants we identified in this study are in line with the studies of Lau and colleagues conducted in Hong Kong (27, 36). Of the common demographic variables (gender and age), in these studies older respondents also reported higher intentions to take preventive measures. In their studies anticipated preventive behaviour was also related to a higher perceived susceptibility to H5N1 infection for oneself or one's family, which is in line with our findings on perceived vulnerability. As we found in an earlier study (37), time, i.e. repeated measurements over a one year period, had only a limited effect on likelihood of taking precautionary measures; in contrast to popular thinking the growing attention and media coverage on AI over the year of measurements did not lead to more self-reported precautionary behaviour.

Our study makes clear that AI is seen as a serious but rare disease, similar to such infectious diseases as tuberculosis and HIV These diseases are rare and rather unfamiliar in the population at large, leading to high perceived severity but lower perceived vulnerability. HIV and tuberculosis are often referred to as diseases with high prevalence in specific population groups, leading to low comparative vulnerability in the general population: for the population at large such diseases, especially HIV, are perceived as a threat to 'others'. A similar low comparative vulnerability as for tuberculosis was observed for AI.

An important result of our study is the difference between thinking about AI and knowledge about AI in relation to perceived vulnerability. While more 'actual' knowledge about the disease is associated with lower perceived vulnerability, thinking more often about AI correlates with a higher perceived vulnerability. 'Thinking about' AI may be a proxy for worry about the disease. Worry can both be related to risk perception as to preventive behaviours (41, 42). Lau and colleagues also found that worry about oneself or family members contracting the virus was associated with anticipated preventive behaviour (27). The interaction effect between thinking about AI and self efficacy also underlines that thinking about AI, or worry, warrants separate attention.

The present study is unique in that we included self-reported preventive behaviours related to AI rather than only intentions or plans. Our findings confirm that next to demographic variables perceived severity, perceived vulnerability, knowledge, amount of information, thinking about AI and self efficacy are significantly associated with precautionary behaviour. If additional research suggests that these relations are causal, it may inform public health interventions as these determinants can be influenced by communication strategies, which is of great importance for non-pharmaceutical intervention strategies during outbreaks or a pandemic.

Our study has several limitations. Firstly we used an Internet based panel, which may have led to an overrepresentation of those who are computer literate. The panel, however, is representative for the Dutch population in terms of age, gender and level of education. The percentage of people being vaccinated against influenza in our study, 23%, is a somewhat higher than what has been reported for the general Dutch population (18,1%) (43). A second limitation is that in our question about precautionary behaviour we did not specify when the respondents engaged in such behaviour. This may have resulted in over-reporting of preventive measures especially in the latter surveys. Finally, we used a questionnaire which has not been validated in other studies, although it has been based on earlier studies related to risk perception of SARS, AI and other (infectious) diseases (29, 38).

Our study has several implications for public health policy and research. The results of this study support the validity of the Protection Motivation Theory for investigations of potential determinants of precautionary behaviours for emerging infectious diseases. The fact that perceived severity of AI appears to be high offers a good point of departure for more specific risk communications to promote precautionary actions if needed. Such communications should aim at improving knowledge about the disease and preventive actions, focus on perceived personal vulnerability as well as self efficacy in taking preventive measures.

**Acknowledgements**

This study was conducted within the framework of CEPHIR, the Center for Effective Public Health in the larger Rotterdam area. This study was funded by the Municipal Public Health Service Rotterdam-Rijnmond and the Centre for Infectious Diseases Control Netherlands.

## References


1. Smith RD. Responding to global infectious disease outbreaks: lessons from SARS on the role of risk perception, communication and management. Soc Sci Med 2006;63(12):3113-23.
2. Wallis P, Nerlich B. Disease metaphors in new epidemics: the UK media framing of the 2003 SARS epidemic. Soc Sci Med 2005;60(11):2629-39.
3. World Health Organization. Cumulative number of confirmed human cases of avian influenza A (H5N1) reported to the WHO. Epidemic and Pandemic Alert and Response (EPR). 2006. Available at: http://www.who.int/csr/disease/avian_influenza/country/cases_table_2006_08_21/en/index.html.
4. World Organisation for Animal Health. 61 Countries Report H5N1 Avian Influenza in Domestic Poultry/Wildlife 2003-2008. 2008. Available at: http://www.oie.int/eng/info_ev/en_AI_factoids_2.htm.
5. World Health Organization. Current WHO phase of pandemic alert. 2008. Available at: http://www.who.int/csr/disease/avian_influenza/phase/en/index.html.
6. Basili M, Franzini M. Understanding the risk of an avian flu pandemic: rational waiting or precautionary failure? Risk Anal 2006;26(3):617-30.
7. Aledort JE, Lurie N, Wasserman J, Bozzette SA. Non-pharmaceutical public health interventions for pandemic influenza: an evaluation of the evidence base. BMC Public Health 2007;7(147):208.
8. Bell DM. Non-pharmaceutical interventions for pandemic influenza, national and community measures. Emerg Infect Dis 2006;12(1):88-94.
9. Bell DM. Non-pharmaceutical interventions for pandemic influenza, international measures. Emerg Infect Dis 2006;12(1):81-7.
10. Markel H, Lipman HB, Navarro JA, Sloan A, Michalsen JR, Stern AM, Cetron MS. Nonpharmaceutical interventions implemented by US cities during the 1918-1919 influenza pandemic. Jama 2007;298(6):644-54.
11. Bell DM. Public health interventions and SARS spread, 2003. Emerg Infect Dis 2004;10(11):1900-6.
12. Fouchier RA, Schneeberger PM, Rozendaal FW, Broekman JM, Kemink SA, Munster V, Kuiken T, Rimmelzwaan GF, Schutten M, Van Doornum GJ, Koch G, Bosman A, Koopmans M, Osterhaus AD. Avian influenza A virus (H7N7) associated with human conjunctivitis and a fatal case of acute respiratory distress syndrome. Proc Natl Acad Sci U S A 2004;101(5):1356-61.
13. Bosman A, Du Ry van Beest Holle M, Conyn - van Spaendonck MAE, Koopmans MPG. Compliance amoung poultry workers to infection control measures during a large epizootic of Avian Influenza in commercial poultry farms in The Netherlands. Bilthoven: RIVM / Instituut voor Psychotrauma; 2004. Report No.: 630940001/2004.
14. 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(2):136-45.
15. Kahneman D, Slovic P, Tversky A. Judgement under uncertainty. Heuristics and biases. Cambridge: Cambridge University Press; 1982.
16. Slovic P. The Perception of Risk. London: Earthscan; 2000.
17. Joffe H. Risk: from perception to social representation. Br J Soc Psychol 2003;42(Pt 1):55-73.
18. Beck U. Risk society. Towards a new modernity. London: Sage; 1992.
19. Rogers RW. Cognitive and physiological processes in fear appeals and attitude change: A revised theory of protection motivation. New York: Guilford Press; 1983.
20. Sjoberg L. Factors in risk perception. Risk analysis 2000;20(1):1-11.
21. Slovic P. Perception of risk. Science 1987;236:280-285.
22. Weinstein ND. Why it won't happen to me: perceptions of risk factors and susceptibility. Health Psychol 1984;3(5):431-57.
23. Weinstein ND. The precaution adoption process. Health Psychology 1988;7(4):355-386.
24. Rippetoe PA, Rogers RW. Effects of components of protection-motivation theory on adaptive and maladaptive coping with a health threat. Journal of Personality and Social Psychology 1987;53(3):596-604.
25. Ruiter RAC, Abraham C, Kok G. Scary warnings and rational precautions: a review of the psychology of fear appeals. Psychology and Health 2001;16:613-630.
26. Sadique MZ, Edmunds WJ, Smith RD, Meerding WJ, de Zwart O, Brug J, Beutels P. Precautionary behavior in response to perceived threat of pandemic influenza. Emerg Infect Dis 2007;13(9):1307-13.
27. Lau JT, Kim JH, Tsui HY, Griffiths S. Anticipated and current preventive behaviors in response to an anticipated human-to-human H5N1 epidemic in the Hong Kong Chinese general population. BMC Infect Dis 2007;7:18.
28. 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(7):925-31.

29. Brug J, Aro AR, Oenema A, de Zwart O, Richardus JH, Bishop GD. SARS risk perception, knowledge, precautions, and information sources, the Netherlands. Emerg Infect Dis 2004;10(8):1486-9.
30. Lau JT, Yang X, Tsui H, Kim JH. Monitoring community responses to the SARS epidemic in Hong Kong: from day 10 to day 62. J Epidemiol Community Health 2003;57(11):864-70.
31. Leung GM, Lam TH, Ho LM, Ho SY, Chan BH, Wong IO, Hedley AJ. The impact of community psychological responses on outbreak control for severe acute respiratory syndrome in Hong Kong. J Epidemiol Community Health 2003;57(11):857-63.
32. Kristiansen IS, Halvorsen PA, Gyrd-Hansen D. Influenza pandemic: perception of risk and individual precautions in a general population. Cross sectional study. BMC Public Health 2007;7(147):48.
33. Gupta RK, Toby M, Bandopadhyay G, Cooke M, Gelb D, Nguyen-Van-Tam JS. Public understanding of pandemic influenza, United Kingdom. Emerg Infect Dis 2006;12(10):1620-1.
34. Fielding R, Lam WW, Ho EY, Lam TH, Hedley AJ, Leung GM. Avian influenza risk perception, Hong Kong. Emerg Infect Dis 2005;11(5):677-82.
35. Lau JT, Tsui H, Kim JH, Griffiths S. Perceptions about status and modes of H5N1 transmission and associations with immediate behavioral responses in the Hong Kong general population. Prev Med 2006;43(5):406-10.
36. Lau JT, Kim JH, Tsui H, Griffiths S. Perceptions related to human avian influenza and their associations with anticipated psychological and behavioral responses at the onset of outbreak in the Hong Kong Chinese general population. Am J Infect Control 2007;35(1):38-49.
37. de Zwart O, Veldhuijzen IK, Richardus JH, Brug J. Monitoring of risk perceptions and preventive behaviour related to human avian influenza during 2006 - 2007 in the Netherlands: results of seven consecutive surveys. In; submitted.
38. de Zwart O, Veldhuijzen IK, Elam G, Aro AR, Abraham T, Bishop GD, Richardus JH, Brug J. Avian influenza risk perception, Europe and Asia. Emerg Infect Dis 2007;13(2):290-3.
39. Gustafson PE. Gender differences in risk perception: theoretical and methodological perspectives. Risk Anal 1998;18(6):805-11.
40. Slovic P. Trust, emotion, sex, politics, and science: Surveying the risk-assessment battlefield. Risk Analysis 1999;19(4):689-701.
41. Sjoberg L. Worry and risk perception. Risk Anal 1998;18(1):85-93.
42. Chapman GB, Coups EJ. Emotions and preventive health behavior: worry, regret, and influenza vaccination. Health Psychol 2006;25(1):82-90.
43. Tacken M, Mulder J, van der Hoogen H, Donkers J, Tiersma W, Verheij R, Braspenning J. Monitoring griepvaccinatiecampagne 2006. Utrecht: Nivel; 2007.

# 7.

# SARS-related risk perceptions and precautionary actions in a Chinese community in the Netherlands: cross sectional survey

Onno de Zwart (1, 2), Irene Veldhuijzen (1, 2), Anke Oenema (2),
Jan Hendrik Richardus (1, 2), Johannes Brug (2, 3)

1. Municipal Public Health Service Rotterdam-Rijnmond
2. Department of Public Health, Erasmus MC, University Medical Center Rotterdam
3. EMGO-Institue, VU University Medical Center, Amsterdam

Submitted for publication

**Abstract**

Background

In case of an outbreak of infectious diseases, like SARS, non-medical interventions focusing on behavioral change and precautionary actions are essential for slowing or preventing an epidemic. Precautionary actions are influenced by risk perception. SARS outbreaks outside China were the result of imported infections relating to travel behaviour of members of Chinese communities. We explored SARS related perceptions of risk, precautionary actions, travel behaviour and sources of information in a Chinese community sample in a non-affected area.

Methods

A cross-sectional survey by means of self-administered written questionnaires was conducted in 2003 in the Chinese community in Rotterdam, the Netherlands. 222 men and women from the Chinese community were recruited through Chinese schools, church, women's groups and cultural organisations. The results of this study were compared with the results of a Dutch Internet sample of 373 respondents from June 2003.

Results

In the year of the SARS outbreak, 2003, 44% of the respondents had travelled to or met people from Southeast Asia. SARS-related knowledge was lower in the Chinese community compared to the Dutch population sample. Respondents from the Chinese community were quite likely to express worries about the risk of SARS-infection (53%) and significantly more likely to have high risk perceptions than the Dutch sample (15% versus 3%). Almost every Chinese respondent reported taking some precautionary measures, with postponing travel as the most often mentioned measure. Over half of the respondents took diagnostic measures, such as paying attention to coughing. Chinese media were used most often for SARS-related information and thought to be the trustworthiest. Risk perception, and precautionary and diagnostic measures where higher in the Chinese community than in the Dutch population sample.

Conclusion

There was a considerable risk of introduction of SARS into the Netherlands due to extensive travel to, and contact with people from Southeast Asia. In future outbreaks of SARS and comparable diseases, risk communication should target travel behaviour of ethnic communities, take into account advice from media in countries of origin, and focus on options for precautionary behaviour.

## Background

In 2003 the world was first confronted with Severe Acute Respiratory Syndrome (SARS). From November 2002 to August 2003 8.096 people were infected with SARS of whom 774 died (1). SARS is a recent example of a newly emerging infectious disease and has shown how rapid a disease can spread. All SARS-cases in Toronto, Canada, for example, were the result of two imported SARS infections (2). The non-health consequences of SARS were profound: a world-wide reduction in air travel, a lower economic growth in Southeast Asia and concern throughout the world (3).

To control new infectious diseases, the identification of the organisms, vaccines, therapies, contact tracing, isolation, and screening all are important. Inducing realistic risk perceptions and precautionary actions in the general public however, are of additional importance, especially in the early phase of an outbreak. Precautionary behaviour in the general public is often essential for slowing or avoiding an epidemic, and risk perceptions are an important determinant of precautionary actions (4).

Yet risk perceptions are often biased (5, 6). Unrealistic optimism about risks is often observed in relation to familiar risks that are perceived to be largely under volitional control. A pessimistic bias, i.e. perceptions of risk that are (much) higher than actual risk, is more likely for new risks that are perceived as uncontrollable (5-8).

The Netherlands was unaffected by SARS but has a large Chinese community of whom 7,000 live in Rotterdam (9). To determine the risks of import of SARS in the Netherlands as well as the possibilities of risk communication in a non-affected area we studied travel behaviour, risk perception and precautionary behaviour among the Chinese community in Rotterdam, one of the largest Chinese communities in the Netherlands.

To establish whether the Chinese community felt more at risk and to explore the consequences of these risk perceptions, we compared the Chinese sample with data obtained in a general Dutch population sample (4).

## Methods

*Participants and procedure*

Participants were recruited in the Chinese community in Rotterdam, the main harbour city in the Netherlands. Since no sampling framework existed for this community, a convenience sample was recruited assisted by key figures in the Chinese community, such as church leaders, school principals and community workers. They randomly distributed 363 questionnaires in Chinese schools, a Chinese church, women's groups, and Chinese social service and cultural organisations in September and October 2003; 222 questionnaires were completed and returned (62%). In June 2003, data for an earlier study on SARS-related risk perceptions, knowledge, actions and use of information sources in the Dutch general adult population were collected through an electronic survey (N=373; response 75%). In this study 373 respondents from an Internet panel participated; characteristics of this population and the study results have been described elsewhere (4).

*Questionnaire*

We used the SARS Psychosocial Research Consortium questionnaire, which was translated into Chinese and subsequently checked by native Chinese health officials. Questions were added about travel to and from China and Southeast Asia. The questionnaire included questions on knowledge about SARS, SARS-related risk perceptions and worries, what respondents had done to avoid getting SARS and to detect if they had SARS. The total number of correct answers to the questions on SARS-related knowledge, and the number of precautionary actions and diagnostic actions were summed to make overall SARS-knowledge, precautionary action and diagnostic action scores as proposed by Brug et al (4). For the Chinese sample, Cronbach's coefficient alpha for the precautionary behaviour score (.88) and the SARS diagnostic behaviour score (.71) were satisfactory and comparable to the Dutch sample (.72 and .77 respectively). Additionally, respondents were asked to indicate how much information about SARS they obtained from different Chinese and Dutch media, official health agencies, doctors, friends or relatives, and the Internet, and how much confidence they had in the information on SARS from these sources on 5-points scales (none/very little (1) to very much (5)). Finally, we asked the respondents about travel to Southeast Asia in 2003 and the last five years and whether they had hosted guests from that region during those same periods.

*Statistical analysis*

Statistical analyses were conducted with SPSS 10.0 (SPSS, Inc., Chicago, Illinois). Descriptive statistics were used to describe demographics and travel history of the sample. Differences between the Chinese and the Dutch sample were explored with Chi-square tests, Fisher's exact test, Student t-test, or analysis of variance, depending on the level of the outcome variable. Further multiple regression analyses were conducted to study differences in knowledge, risk perceptions, worries, perceived capabilities to avoid SARS and precautionary actions between the Chinese and the Dutch population samples (coded 1 and 0 respectively), while adjusting for possible differences in sex, age group and level of education. We tested for two-way interactions between ethnic group, sex, age group and level of education. A p-value $<0.05$ was considered statistically significant.

## Results

In comparison to the Dutch sample, the Chinese sample had a higher percentage of females and respondents in the lower education category. Two thirds of the respondents in the Chinese community sample, and more than 90% of their parents were born in China, Hong Kong or Taiwan; 90% of respondents had obtained Dutch citizenship. The vast majority of respondents had travelled to Southeast Asia in the five years preceding the outbreak; one third had travelled there in 2003, the year of the outbreak. The proportion that had received visitors from this region staying overnight was also substantial (Table 1).

**Table 1: Key statistics of the Chinese and Dutch study sample and p-values from the tests to study differences between both samples.**

| | Chinese sample (n=218) | | Dutch sample (n=373) | | |
|---|---|---|---|---|---|
| | n | % | n | % | p-value |
| Female | 136 | 62 | 192 | 52 | 0.014 |
| Under 40 | 97 | 44 | 163 | 44 | n.s |
| 40 and older | 123 | 56 | 208 | 56 | |
| Low education | 138 | 63 | 145 | 39 | <0.001 |
| Intermediate and high | 80 | 37 | 228 | 61 | |
| Travel to Southeast Asia (SEA) | | | | | |
| In 2003 | 74 | 34 | | | |
| Past 5 years | 186 | 84 | | | |
| Guests from SEA | | | | | |
| In 2003 | 41 | 19 | | | |
| Past 5 years | 95 | 43 | | | |
| Travel and guests from SEA | | | | | |
| In 2003 | 98 | 44 | | | |
| Past 5 years | 197 | 89 | | | |

A large majority of the respondents had heard of SARS and knew some basic facts about the disease, but very few respondents knew the correct mortality rate (Table 2). The mean overall knowledge score was 2.47 (SD 0.8) on a scale of 0 to 4; 60% had at least three out of four correct answers. Multiple linear regression analyses showed a significant association between ethnic group and SARS-related knowledge (Standardised regression coefficient (Beta)=-.38; p=.002), indicating that SARS-related knowledge was lower in the Chinese population. Because of significant interactions of ethnic group with age and level of education, analyses were stratified by ethnic group. Only in the Chinese community sample SARS-related knowledge was positively associated with the level of education (Beta)=.30; p<.001).

Substantial proportions of respondents reported worrying about SARS during and also after the outbreak, much more so than the Dutch population sample (Table 2). Worries about family members in Southeast Asia contracting SARS were strong. Multiple linear regression analyses showed that respondents in the Chinese community sample and lower educated were significantly more worried to get SARS than respondents from the Dutch sample (Beta=.38; p<.001) and higher educated respondents (Beta=-.11; p=.007), respectively.

**Table 2: Knowledge, worry and risk perception of SARS and differences in these factors between the Chinese community sample and the Dutch sample**

| | Chinese sample | Dutch sample | p-value |
|---|---|---|---|
| **Knowledge** | | | |
| Serious type of pneumonia | 83% | 91% | 0.002 |
| Caused by a virus | 69% | 89% | <0.001 |
| Correct mortality rate (15%) | 6% | 9% | 0.148 |
| **Worry** | | | |
| (Very) worried about SARS as a health problem during the epidemic | 53% | 39% | <0.001 |
| (Very) worried about SARS as a health problem after the epidemic | 44% | * | |
| (Very) worried about getting SARS themselves | 35% | 5% | <0.001 |
| (Very) worried about a family member in the Netherlands getting SARS | 38% | 8% | <0.001 |
| (Very) worried about a family member in Asia getting SARS | 73% | * | |
| **Risk perception** | | | |
| A (very) high risk of getting infected with SARS during the epidemic | 15% | 3% | <0.001 |
| A lower risk than other Chinese in the Netherlands | 53% | * | |
| A lower risk than Dutchmen | 48% | * | |
| A lower risk than Chinese in Asia | 78% | * | |

* Questions were not included in the Dutch questionnaire

Perceived risk to get SARS was not high (3.5% perceived the risk as (very) likely) but the mean score was statistically significantly higher than in the Dutch sample (1.0% perceived the risk as (very) likely); this while risk perceptions for other important health risks were lower in the Chinese as compared with the Dutch (Table 3). Risk perception for getting SARS was higher than for HIV/AIDS. In multiple linear regression analyses perceived risk to get SARS was shown to be higher in Chinese community respondents and in women as compared with Dutch respondents (Beta=.21; p<.001) and men (Beta=.09; p=.039), respectively.

**Table 3: Perceived risk of being affected by SARS and other diseases or accidents (1=very unlikely and 5=very likely) in the Chinese community and the Dutch sample, p-values from the tests to study differences in means between both samples.**

| | Chinese sample | | | Dutch sample | | | |
|---|---|---|---|---|---|---|---|
| | mean | SD | %** | mean | SD | %** | p-value |
| SARS | 1.9 | 0.9 | 3.5 | 1.5 | 0.8 | 1.0 | <0.001 |
| Flu or a common cold | 3.2 | 1.2 | 38.0 | 4.0 | 1.0 | 72.9 | <0.001 |
| Die of a traffic accident | 2.3 | 1.1 | 10.6 | 2.8 | 0.9 | 16.1 | <0.001 |
| Accident at home | 2.2 | 1.0 | 6.1 | 3.5 | 1.0 | 52.0 | <0.001 |
| Cancer | 2.1 | 1.1 | 7.6 | 3.0 | 1.0 | 18.5 | <0.001 |
| Heart attack | 2.1 | 1.1 | 8.6 | 2.9 | 0.9 | 21.7 | <0.001 |
| Food poisoning | 2.0 | 1.1 | 8.8 | 2.8 | 1.0 | 21.4 | <0.001 |
| HIV/AIDS | 1.4 | 0.7 | 1.9 | 1.5 | 1.9 | 1.9 | 0.276 |

** percentage (very) likely

Almost every Chinese respondent reported to have taken precautionary measures; the mean number of precautions reported was 6 out of 8. Not travelling to SARS infected areas was reported most often (Table 4).

**Table 4: Proportion of Chinese Dutch and Dutch respondents (N=222, N=373) who reported specific actions to prevent Severe Acute Respiratory Syndrome (SARS) #**

| | Chinese | Dutch |
|---|---|---|
| Avoided travel to SARS-infected areas | 83.8 | 39.9 |
| Washed hands more often | 59.5 | 2.1 |
| Avoided large gatherings of people | 50.5 | 2.1 |
| Avoided eating in restaurants | 46.8 | 0.3 |
| Were more attentive to cleanliness | 44.6 | 1.9 |
| Avoided travel by aeroplane | 44.1 | 1.1 |
| Exercised regularly | 35.6 | 0.3 |
| Ate a balanced diet | 32.4 | 1.6 |
| Avoided shaking hands | 31.5 | 1.1 |
| Avoided eating at food stalls or food centres | 31.1 | 2.9 |
| Voluntary isolation after travelling to Asia or Toronto | 27.5 | * |
| Wore a mask | 25.7 | 3.8 |
| Made sure to get sufficient sleep | 25.2 | 8.3 |
| Used disinfectants | 20.7 | 2.1 |
| Avoided particular types of people | 20.3 | 1.6 |
| Avoided travel by subways or buses | 16.2 | 0.3 |
| Avoided travel by taxis | 14.4 | 0.5 |
| Took an herbal supplement | 7.2 | 2.4 |
| Did not go to school or work | 6.3 | 1.1 |

* Not included in the questionnaire for the Dutch sample
# P-value<0.001 for all items

Multiple linear regression analyses showed that Chinese community respondents reported more precautionary measures than Dutch respondents did (Beta=.46; p<.001). Since interaction between ethnic group and age group was present, stratified analyses were performed. In the Chinese sample the mean number of precautionary actions differed significantly by age group (Beta=.44; p<.001). The under 40 year olds took less precautionary

actions (mean 4,1) than participants aged 40 years and older (mean 8,1). For Dutch respondents no significant correlates of precautionary actions were found.

More than half of the respondents took one or more diagnostic measures, such as paying close attention to coughing, but very few respondents called a SARS information 'hotline'. Chinese community respondents took more diagnostic actions than Dutch respondents (Beta=.48; p<.001). Because of a significant interaction of ethnic group with sex and age, analyses were again stratified. Chinese respondents aged 40 years and older took more diagnostic actions (Beta=.26; p<.001) than younger respondents and men more than women (Beta=-.15; p=.026).

Chinese media, both TV and newspapers, were used most often as a source of information. Chinese television was used significantly more than most other sources, including Dutch television. In the Chinese community friends were a more important source of information compared to the Dutch sample. Trustworthiness of all sources was high.

**Table 5: Sources of information about SARS and confidence in those sources: mean (95% confidence interval) on scales ranging from very little (1) to very much (5), p-values from the tests to study differences between both samples.**

| | Chinese sample (N=222) | | Dutch sample (N=373) | | | |
|---|---|---|---|---|---|---|
| Information source | Amount of information Mean (95% CI) | Confidence in the information Mean (95% CI) | Amount of information Mean (95% CI) | Confidence in the information Mean (95% CI) | p-value amount | p-value confidence |
| Chinese television | 3,9 (3,7-4,1) | 4,0 (3,8-4,2) | * | * | | |
| Chinese newspapers | 3,6 (3,4-3,8) | 3,9 (3,7-4,0) | * | * | | |
| Dutch television | 3,4 (3,2-3,6) | 3,8 (3,7-4,0) | 3.9 (3.8-4.0) | 3.6 (3.5-3.7) | <0.001 | 0.03 |
| Friends | 3,2 (3,0-3,4) | 3,3 (3,1-3,4) | 1.6 (1.5-1.7) | 2.5 (2.3-3.6) | <0.001 | <0.001 |
| Dutch newspapers | 2,9 (2,7-3,1) | 3,6 (3,4-3,8) | 3.5 (3.3-3.6) | 3.4 (3.3-3.5) | <0.001 | 0.09 |
| SARS leaflet in Chinese of health service | 2,7 (2,5-2,9) | 3,7 (3,5-3,9) | * | * | | |
| Chinese sites on the internet | 2,7 (2,2-2,7) | 3,3 (3,0-3,5) | * | * | | |
| Health officials | 2,3 (2,1-2,5) | 3,7 (3,5-3,9) | 1.7 (1.6-1.8) | 3.3 (3.2-3.5) | <0.001 | 0.01 |
| Dutch magazines | 2,0 (1,8-2,1) | 2,9 (2,7-3,1) | 2.1 (2.0-2.3) | 2.7 (2.6-2.8) | 0.09 | 0.04 |
| Dutch sites internet | 1,8 (1,6-2,0) | 3,0 (2,8-3,3) | 2.3 (2.2-2.5) | 3.0 (2.9-3.1) | <0.001 | 0.93 |
| Doctors | 1,7 (1,5-1,8) | 3,4 (3,1-3,6) | 1.3 (1.2-1.4) | 3.2 (3.1-3.4) | <0.001 | 0.34 |

* Not included in the questionnaire for the Dutch respondents

**Discussion**

We demonstrated intensive travel and other contacts between the Chinese community in Rotterdam and infected areas in Southeast Asia during 2003, the year of the SARS outbreak. This represented a serious risk of import of SARS into the Netherlands. Furthermore, the Chinese community in Rotterdam showed substantial worries about the risk of SARS-infection and reported significantly higher risk perceptions and more precautionary and diagnostic behaviours than in a Dutch population sample. Our results show that the Chinese community in a non-affected area took their own perceived precautionary measures and used Chinese media as their most important source of information.

This study has several limitations. Since no comparison data are available, we do not know if our questionnaire distribution scheme resulted in a representative sample. An effort was made to include a wide variety of Chinese organisations in questionnaire distribution to ensure diversity. The different sampling methods applied limit the comparison between the Dutch and Chinese samples. Also, because the questionnaire was distributed after the SARS outbreak, answers may be liable to recall bias. The time difference between the two questionnaires, June for the Dutch respondents and September – November for the Chinese respondents may also account for some of the differences. The difference in behavioural chances between the Chinese and Dutch samples may also be a reflection of opportunities. It is logical that more Chinese respondents report avoidance of travel to and from South-East Asia as that is more common in this group.

SARS has resulted in very different levels of concern. In North America the level of concern about contracting SARS was significantly higher in affected than in unaffected area's (Ontario 69%, Canada, excluding Ontario 57%, US 32%) (10). In Hong Kong from March 21$^{st}$ to May 12$^{th}$ (2003) between 3.9% and 14,3% of people perceived the chance of infection for oneself as (very) large, and between 19,8% and 41,7% (overall 33,6%) was (much) worried about oneself and family members being infected (11). A resurgence of SARS in was considered to be likely by a majority of respondents in Hong Kong, although most thought it would not become a major outbreak (12). In Singapore the perceived likelihood of contracting SARS was (very) high for only 14% of the population (13, 14). The level of concern of contracting SARS among the general Dutch population was significantly lower at 4,9% (while 38,9% were concerned about SARS as a general health problem) (4). Among the present Dutch Chinese community, however, personal concerns were higher. These findings indicate that there can be large differences in concern about a health problem, which may not be related to whether a country is affected or not.

Little is known about risk perception of Chinese communities, especially with regard to (infectious) diseases, which makes it difficult to evaluate the results that respondents had a lower risk perception than respondents from the Dutch sample. Research conducted in mainland China showed that diseases took the eighteenth place in an overview of potential risks, with risks that threaten national stability and economic development being more important (15). A study in the US showed that Chinese Americans perceive their risks for all diseases lower, compared to Hispanic- and African Americans (16). These results warrant further research into risk perception among different ethnic communities, specific precautionary practices like hand washing and their relation to actual health differences.

Our finding that media from the countries of origin, like China and Hong Kong, were important sources of information is in line with data from the US that showed that Asian

communities were getting more information, and also sooner, from sources in Southeast Asia than from US news media or health officials (17). Reports from Hong Kong confirm the importance of both television and radio as information sources during and after the SARS outbreak (11). Furthermore, the popularity of different precautionary actions in Hong Kong has similarities with what we found in the Chinese community in Rotterdam, with better hand hygiene and the avoidance of crowded places as the most performed measures, possibly because both communities used similar information sources.

During the outbreak of SARS the risk of introduction of SARS in the Netherlands through the Chinese community was significant considering its close contacts with people from, and extensive travel to and from Southeast Asia. For future outbreaks the risk posed by travel between ethnic communities and their countries of origin is of great importance. In analysing potential risks and in risk communication it is therefore important to consider risks related to travel to countries of origin. Targeted risk communication should pay attention to travel of members of ethnic communities, take into account the advice given by media in countries of origin, and focus on possibilities for precautionary behaviour.

## References


1. World Health Organization. Summary of probable SARS cases with onset of illness from 1 November 2002 to 31 July 2003. 2004. Available at: http://www.who.int/csr/sars/country/table2004_04_21/en/index.html.
2. Svoboda T, Henry B, Shulman L, Kennedy E, Rea E, Ng W, Wallington T, Yaffe B, Gournis E, Vicencio E, Basrur S, Glazier RH. Public health measures to control the spread of the severe acute respiratory syndrome during the outbreak in Toronto. N Engl J Med 2004;350(23):2352-61.
3. Abdullah AS, Thomas GN, McGhee SM, Morisky DE. Impact of severe acute respiratory syndrome (SARS) on travel and population mobility: implications for travel medicine practitioners. J Travel Med 2004;11(2):107-11.
4. Brug J, Aro AR, Oenema A, de Zwart O, Richardus JH, Bishop GD. SARS risk perception, knowledge, precautions, and information sources, the Netherlands. Emerg Infect Dis 2004;10(8):1486-9.
5. Weinstein ND. The precaution adoption process. Health Psychology 1988;7(4):355-386.
6. Sjoberg L. Factors in risk perception. Risk analysis 2000;20(1):1-11.
7. Weinstein ND. Why it won't happen to me: perceptions of risk factors and susceptibility. Health Psychol 1984;3(5):431-57.
8. Slovic P. Perception of risk. Science 1987;236:280-285.
9. COS. Information on number of Chinese in Rotterdam. In; 2005.
10. 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(7):925-31.
11. Lau JT, Yang X, Tsui H, Kim JH. Monitoring community responses to the SARS epidemic in Hong Kong: from day 10 to day 62. J Epidemiol Community Health 2003;57(11):864-70.
12. Lau JT, Yang X, Pang E, Tsui HY, Wong E, Wing YK. SARS-related perceptions in Hong Kong. Emerg Infect Dis 2005;11(3):417-24.
13. Leung GM, Quah S, Ho LM, Ho SY, Hedley AJ, Lee HP, Lam TH. A tale of two cities: community psychobehavioral surveillance and related impact on outbreak control in Hong Kong and Singapore during the severe acute respiratory syndrome epidemic. Infect Control Hosp Epidemiol 2004;25(12):1033-41.
14. Quah SR, Hin-Peng L. Crisis prevention and management during SARS outbreak, Singapore. Emerg Infect Dis 2004;10(2):364-8.
15. Lai JC, Tao J. Perception of environmental hazards in Hong Kong Chinese. Risk Anal 2003;23(4):669-84.
16. Haomiao J, Santana A, Lubetkin EI. Measuring risk perception among low-income minority primary care patients. J Ambul Care Manage 2004;27(4):314-27.
17. Person B, Sy F, Holton K, Govert B, Liang A. Fear and stigma: the epidemic within the SARS outbreak. Emerg Infect Dis 2004;10(2):358-63.

# 8.

# Sources of information and health beliefs related to SARS and avian influenza among Chinese communities in the United Kingdom and the Netherlands, as compared to the general population in these countries

Helene ACM Voeten (1), Onno de Zwart (1, 2), Irene K Veldhuijzen (1, 2), Cicely Yuen (2), Xinyi Jiang (3), Gillian Elam (3), Thomas Abraham (4), Johannes Brug (1, 5)

1. Department of Public Health, Erasmus MC, University Medical Center Rotterdam, the Netherlands
2. Division of Infectious Disease Control, Municipal Public Health Service Rotterdam-Rijnmond, Rotterdam, the Netherlands
3. Centre for Infections, Health Protection Agency, London, United Kingdom
4. Journalism and Media Study Centre, The University of Hong Kong, Hong Kong
5. EMGO-Institute, VU University Medical Center, Amsterdam, the Netherlands

International Journal of Behavioral Medicine: in press

**Abstract**

Background

Ethnic minorities in Europe such as the Chinese may need a special strategy with regard to risk communication about emerging infectious diseases. To engage them in precautionary actions it is important to know their information sources, knowledge and health beliefs.

Purpose

To study use of information sources, knowledge, and health beliefs related to SARS and avian flu of Chinese people in the United Kingdom (UK) and Netherlands; to make comparisons with the general population in these countries.

Method

Results of a self-administered questionnaire among 300 British/Dutch Chinese were compared to data obtained from a computer-assisted phone survey among the general population (n=800).

Results

British/Dutch Chinese got most information about emerging diseases from family and friends, followed by Chinese media and British/Dutch TV. They had less confidence than general groups in their doctor, government agencies and consumer/patient interest groups. Their knowledge of SARS was high. They had a lower perceived threat than general populations with regard to SARS and avian flu, due to a lower perceived severity. They had higher self-efficacy beliefs regarding SARS and avian flu.

Conclusion

In case of new outbreaks of SARS/avian flu in China, local authorities in the UK and Netherlands can best reach Chinese people through informal networks and British/Dutch TV, while trying to improve confidence in information from the government. In communications the severity of the disease rather than the susceptibility appears to need most attention.

## Introduction

Early 2003, the world was startled by a new infectious lung disease, which was later called Severe Acute Respiratory Syndrome (SARS). In a few months over 8000 people got infected and 774 people died of SARS (1). The majority of deaths occurred in Asia, but in Canada 43 deaths occurred, which could all be traced back to two cases who imported SARS from Asia (1, 2) . Asia has also been more heavily affected during recent years by avian influenza. By July 2007, this infectious disease caused over 250 infections and 176 deaths within Asia, compared to 40 infections and 16 deaths in other regions (3). Scientists fear that a mutation within the virus that enables human-to-human transmission might occur, and such a pandemic could result in millions of deaths worldwide (4). Future outbreaks of avian influenza and SARS - which is caused by a virus of suspect animal origin - are likely to start in densely populated regions where humans live in close contacts with livestock and poultry, such as in large parts of China/Asia (5). Through international air travel, further spread to the rest of the world including Europe is very likely. In case of such outbreaks, public health authorities will need to convince the general public to adopt precautionary behaviour such as taking prophylaxis, wearing facemasks, and adhering to quarantine and travel restrictions (6).

Ethnic minority groups may need a special strategy with regard to risk communication that differs from approaches to reach the general population. For example during the SARS outbreak in 2003, Chinese people in Europe and the US did not always consider information for general populations to be appropriate. They therefore turned to media from China and Hong Kong and sometimes adopted precautionary behaviour that was targeted at people living in China (7, 8). In case future outbreaks originate in Asia, Asian minorities living in Europe may be at higher risk of infection than general populations in Europe, due to their own travel behaviour or their contact with people from affected Asian countries. A Dutch study on travel behaviour of Chinese living in the Netherlands showed that in 2003, the year of the SARS outbreak, one third of Chinese respondents had travelled to Southeast Asia and one fifth had received guests from this region (unpublished manuscript by De Zwart et al, see chapter 8.). Timely informing these ethnic minority groups is of utmost importance to prevent spread of the disease, inappropriate behaviour and discrimination.

In order to develop effective information and other intervention strategies for such vulnerable groups it is important to have insight in their use of information sources, but also in their health beliefs such as perceived threat and efficacy beliefs. These concepts are derived from the Protection Motivation Theory, which posits that people's motivation to engage in precautionary actions is influenced by the perceived threat, that is, the severity of the disease and the perceived vulnerability (9-11). High perceived threat will only lead to adoption of precautionary behaviour if a person believes that effective protective actions are generally available (the perceived response efficacy), and that oneself has the ability to engage in such protective actions (the perceived self-efficacy). The choice of information sources may determine people's knowledge related to health risks and precautionary actions. This knowledge in turn may determine health beliefs. On the other hand, high perceptions of vulnerability may promote use of more sources of information.

We performed an explorative study amongst a convenience sample of Chinese living in the UK and the Netherlands. The aim of the study was twofold: 1) to assess use of information sources, knowledge, and health beliefs related to SARS and avian flu among Chinese living in the UK and the Netherlands; and 2) to compare the findings from the Chinese populations in the UK and Netherlands with findings from the general population living in these countries.

Our study was an add-on to a qualitative study using focus group discussions (7). The UK and Netherlands were chosen because these countries have large Chinese communities, of 297.000 and 145.000 people respectively (12). Also, comparison data from the general population were available for these countries. The findings of the study amongst the general populations are reported separately elsewhere (13); in the present paper they only serve as a comparison group for the Chinese in the UK and Netherlands.

## Methods

*Procedure and respondents*

Chinese respondents living in the UK and Netherlands were recruited through snowball technique in cities with a considerable Chinese community: London, Manchester, Glasgow, Belfast, and Cardiff in the UK; and Rotterdam, Amsterdam, Utrecht, and Arnhem in the Netherlands. In these cities, Chinese community representatives facilitated and assisted in the recruitment of respondents. In the Netherlands, community members were addressed during meetings of Chinese community groups such as women's groups, church/temple groups, a youth group, and a school. In the UK, respondents were also recruited through snowballing contacts of selected participants, and by newsletters. A purposive sample design ensured diversity in background by setting recruitment targets for sex, age, country of origin, length of residence in Europe, and occupation. In the UK, respondents who met the criteria were invited to take part in a Focus Group Discussion (FGD) at least two weeks in advance by letters; recruiters contacted them by phone days before to remind them. In the Netherlands, respondents were asked during the recruitment to participate in a FGD, which was planned a few days later. FGDs in both countries took place between October 2005 and April 2006. Results of the FGDs are presented elsewhere (7).

The procedure for the self-administration of the questionnaire slightly differed between the UK and Netherlands. In the UK, participants were mailed the questionnaire prior to the FGD meeting along with the invitation letter, and they were asked to bring the finished questionnaire to the FGD. Extra questionnaires were sent for family members or friends. To those who forgot to bring the questionnaires, pre-stamped envelopes were given. In the Netherlands, participants were given a pen-and-paper questionnaire at the beginning of the FGD, to be completed on the spot before the FGD started. Participants who experienced difficulties in filling-in the questionnaire were assisted by the FGD moderator, who clarified some questionnaire items by rephrasing them. Filling-in mostly took about half an hour. Respondents were then asked to take home one or more additional questionnaires, to be filled-in by their spouses, other family members, or friends. Envelopes that were free of postal charges were also provided.

*Questionnaire*

The content of the questionnaire was the same as the survey that was used during the Computer Assisted Telephone Interviewing (CATI, see below) for studying the general populations (13, 14). It was originally based on an Internet survey instrument used for research during the SARS outbreak (15). It was adapted for paper-and-pen self-administration, and British, Dutch and Chinese versions were prepared so that respondents could choose a version in the language they preferred. The questionnaire contained questions about information sources and health and efficacy beliefs regarding SARS and flu from a new

virus, which was described as "a new type of flu virus that can arise from avian flu; it causes serious illness and spreads easily in the population". Questions covered the following aspects: socio-demographic background; the amount of information about emerging infectious diseases the respondent got in the past year from a range of different sources of information ("How much information about emerging diseases did you get from the following sources in the past year: none, little, some, much, very much"); the confidence he/she had in this information ("How much confidence did you have in information about emerging diseases you got from these sources in the past year: none, little, some, much, very much"); SARS knowledge ("Can you name the most important symptom of SARS"; "SARS is a communicable disease: true, false, don't know"); perceived severity ("On a scale from 1 to 10, how serious would it be for you to get the following diseases in the next year"); perceived vulnerability ("How likely do you think it is for you to get the following diseases in the next year: very unlikely, unlikely, not unlikely/not likely, likely, very likely"); response efficacy ("In general, do you think that people in Great Britain / the Netherlands can take actions to prevent getting the following diseases: not at all, a little bit, quite a bit, definitely"); and self-efficacy ("How confident are you that you yourself can prevent getting the following diseases: not confident, somewhat confident, quite confident, very confident").

*Study of general populations by Computer Assisted Telephone Interviewing (CATI)*

Between 20 September and 22 November 2005, phone-interviews were held with random samples of general populations in 5 European countries (UK, the Netherlands, Denmark, Spain, and Poland), and 3 regions in East-Asia (Singapore, China, and Hong Kong). The interviews were conducted using Computer Assisted Telephone Interviewing (CATI) with random digit dialling, and took on average 16 minutes. About 400 people were interviewed in each country, by native-speaking interviewers, a sample of 3436 in total.

*Statistical analysis*

Findings from the self-administered questionnaires were double entered into Epi-Info and converted into an SPSS file. This file was merged with the SPSS file that resulted from the CATI. In line with Protection Motivation Theory one measure was defined as 'perceived threat', it was constructed by multiplication of the measures of perceived severity (scale 1-10) and vulnerability (scale 1-5). To make the scores comparable the severity score was first divided by two. To normalize the skewed distribution of the new variable a square root transformation was performed which resulted in a measure of perceived threat on a scale from 1 (low) to 5 (high). Data from Chinese respondents in the UK and Netherlands were compared with those collected during the CATI amongst general populations in these countries, using the Chi-squared test and student's t-test. Linear and logistic regression analyses were performed to adjust for socio-demographic differences between Chinese and general population groups (gender, age, place of residence and education).

## Results

Because our study population consisted of a convenience sample, response rates could not be calculated. Almost all focus group discussion participants filled in the questionnaire; a few were missed in the UK. About 140 questionnaires were filled-in by spouses, other family members or friends of FGD participants, of which the majority came from the Netherlands. This resulted in a total of 299 self-administered questionnaires in both countries.

Table 1 gives the socio-demographic characteristics of the respondents. Chinese respondents in both the UK and Netherlands were younger and more often lived in cities than general population respondents in these countries. Chinese people in the UK were better educated than the general British population whereas Chinese people in the Netherlands were poorer educated than the Dutch.

**Table 1: Socio-demographic characteristics of Chinese respondents in the United Kingdom and the Netherlands, as compared to general population respondents in these countries**

| Socio-demographic characteristic | Chinese in UK, % (n=104) | UK, % (n=401) | P-value[1] | Chinese in NL, % (n=195) | NL, % (n=403) | P-value[1] |
|---|---|---|---|---|---|---|
| Gender | | | 0.5 | | | 1.0 |
| Male | 44 | 41 | | 42 | 42 | |
| Female | 56 | 59 | | 58 | 58 | |
| Age Group | | | <0.001 | | | <0.001 |
| 16-30 | 31 | 13 | | 22 | 10 | |
| 31-45 | 36 | 35 | | 26 | 31 | |
| 46-60 | 24 | 31 | | 48 | 37 | |
| 61+ | 9 | 21 | | 4 | 24 | |
| Place of residence | | | <0.001 | | | <0.001 |
| City | 68 | 20 | | 48 | 9 | |
| Town | 27 | 45 | | 30 | 37 | |
| Village/countryside | 5 | 36 | | 23 | 55 | |
| Highest education | | | <0.001 | | | <0.01 |
| Primary or lower | 4 | 2 | | 14 | 5 | |
| Low | 15 | 20 | | 26 | 28 | |
| Intermediate | 17 | 35 | | 33 | 35 | |
| High | 64 | 43 | | 28 | 32 | |

[1] Chi-squared test
UK = United Kingdom, NL = Netherlands

Respondents were asked how much information about emerging diseases they got in the past year from a list of sources of information (Table 2). Chinese people in both the UK and Netherlands got less information from British/Dutch TV, and much more from family or friends than the general populations. British and Dutch respondents from the general population mentioned newspapers and TV as the sources from which they got most information. In contrast, Chinese people from the UK and the Netherlands mentioned family and friends as the source from which they got most information, followed by Chinese media (such as Chinese newspapers, Chinese cable TV, and Chinese websites) and British/Dutch TV. Chinese respondents from the UK and the Netherlands had significantly less confidence than the general groups in information from their doctor, government agencies, consumer/patient interest groups, and the radio. They had most confidence in information from family or friends, Chinese newspapers and cable TV, and British/Dutch TV.

**Table 2: Mean scores of the amount of information regarding emerging infectious diseases received from different information sources and confidence in the information (both scale 1-5) among Chinese respondents in the United Kingdom and the Netherlands, as compared to general population respondents in these countries**

| | Chinese in UK[1] (n=104) | UK[2] (n=401) | P-value Unadj.[3] | P-value Adj.[4] | Chinese in NL[1] (n=195) | NL[2] (n=403) | P-value Unadj.[3] | P-value Adj.[4] |
|---|---|---|---|---|---|---|---|---|
| Mean amount of information | | | | | | | | |
| British/Dutch newspapers | 2.8 | 2.8 | 1.0 | 0.9 | 2.8 | 3.2 | <0.001 | <0.001 |
| British/Dutch television | 3.0 | 3.3 | <0.01 | <0.01 | 3.2 | 3.4 | 0.02 | <0.01 |
| British/Dutch internet websites | 2.9 | 1.8 | <0.001 | <0.001 | 2.0 | 2.0 | 1.0 | 0.2 |
| Radio | 2.4 | 2.4 | 0.8 | 1.0 | 2.2 | 2.2 | 0.6 | 0.2 |
| Your doctor | 1.8 | 1.8 | 1.0 | 0.5 | 1.6 | 1.5 | 0.2 | 0.7 |
| Government agencies | 2.2 | 1.7 | <0.01 | <0.01 | 1.9 | 2.0 | 0.5 | 0.05 |
| Consumer/patient interest groups | 1.8 | 1.5 | <0.01 | <0.01 | 1.8 | 1.6 | 0.08 | 0.1 |
| Family or friends | 3.4 | 2.1 | <0.001 | <0.001 | 3.3 | 2.1 | <0.001 | <0.001 |
| Chinese newspapers | 3.2 | - | | | 3.1 | - | | |
| Chinese cable television | 2.9 | - | | | 3.1 | - | | |
| Chinese community centers | 2.5 | - | | | 2.4 | - | | |
| British/Dutch websites for the Chinese community | 2.2 | - | | | 1.7 | - | | |
| Chinese websites | 3.1 | - | | | 2.1 | - | | |
| Mean confidence in information | | | | | | | | |
| British/Dutch newspapers | 2.7 | 2.9 | 0.3 | 0.1 | 2.7 | 3.0 | <0.01 | <0.001 |
| British/Dutch television | 3.0 | 3.1 | 0.3 | 0.1 | 3.0 | 3.1 | 0.2 | 0.4 |
| British/Dutch internet websites | 2.7 | 2.9 | 0.2 | 0.09 | 2.1 | 3.0 | <0.001 | <0.001 |
| Radio | 2.4 | 2.8 | <0.01 | <0.01 | 2.4 | 2.9 | <0.001 | <0.001 |
| Your doctor | 2.2 | 3.4 | <0.001 | <0.001 | 2.3 | 3.6 | <0.001 | <0.001 |
| Government agencies | 2.4 | 2.9 | <0.01 | <0.001 | 2.4 | 3.2 | <0.001 | <0.001 |
| Consumer/patient interest groups | 2.0 | 2.6 | <0.001 | <0.01 | 2.3 | 3.3 | <0.001 | <0.001 |
| Family or friends | 3.2 | 2.9 | <0.01 | 0.2 | 3.3 | 2.7 | <0.001 | <0.001 |
| Chinese newspapers | 3.2 | - | | | 3.3 | - | | |
| Chinese cable television | 3.0 | - | | | 3.3 | - | | |
| Chinese community centers | 2.6 | - | | | 2.6 | - | | |
| British/Dutch websites for the Chinese community | 2.3 | - | | | 2.2 | - | | |
| Chinese websites | 3.0 | - | | | 2.4 | - | | |

[1] Data derived by a self administered survey among a convenience sample
[2] Data derived by a phone-survey among a random sample
[3] Student's t-test
[4] Adjusted for sex, age group, place of residence and highest education
UK = United Kingdom, NL = Netherlands, Unadj. = Unadjusted, Adj. = Adjusted

Knowledge of SARS was very high among Chinese populations in the UK and Netherlands (Table 3). Over three quarters could mention a main symptom of SARS, which was a significantly higher proportion than among the general populations of both countries. Over 95% of the Chinese in the UK and Netherlands knew that SARS is a communicable disease; in the UK this was significantly higher than the score of the general population.

**Table 3: SARS-related knowledge among Chinese respondents in the United Kingdom and the Netherlands, as compared to general population respondents in these countries**

| SARS knowledge | Chinese in UK[1], % (n=104) | UK[2], % (n=401) | P-value | | Chinese in NL[1], % (n=195) | NL[2], % (n=403) | P-value | |
|---|---|---|---|---|---|---|---|---|
| | | | Unadj.[3] | Adj.[4] | | | Unadj.[3] | Adj.[4] |
| Can mention a symptom of SARS (open question) | 77 | 44 | <0.001 | <0.001 | 79 | 57 | <0.001 | <0.001 |
| Knows that SARS is a communicable disease (closed question) | 96 | 70 | <0.001 | <0.001 | 95 | 91 | 0.08 | 0.2 |

[1] Data derived by a self administered survey among a convenience sample
[2] Data derived by a phone-survey among a random sample
[3] Chi-squared test
[4] Adjusted for sex, age group, place of residence and highest education
UK = United Kingdom, NL = Netherlands, Unadj. = Unadjusted, Adj. = Adjusted

Mean perceived severity, vulnerability and threat scores related to SARS and flu from a new virus are given in Table 4. Perceived severity was lower for SARS among Chinese people in the UK and for flu from a new virus among both Chinese groups as compared to the general populations, also after adjusting for socio-demographic differences between Chinese and general populations. Among all respondent groups, SARS was considered the most severe, then flu from a new virus. The perceived vulnerability for SARS and flu from a new virus in case of an outbreak within the country of residence was perceived equally by Chinese and general populations. However, Chinese people perceived themselves to be more vulnerable in case of a SARS outbreak outside their country of residence; this was not the case for a flu outbreak outside their country of residence. All respondent groups perceived themselves most vulnerable to flu from a new virus, and then to SARS. Chinese people in both countries had a lower perceived threat than general populations with regard to SARS in case of an outbreak within the country and flu from a new virus in case of an outbreak within and outside the country. Chinese in the Netherlands had a higher perceived threat regarding SARS in case of an outbreak outside the country than Dutch people in general. Among all respondent groups perceived threat was about equally high for SARS and flu from a new virus.

**Table 4: Mean scores of perceived severity (scale 1-10), perceived vulnerability (scale 1-5), and perceived threat (scale 1-5) related to SARS and flu from a new virus among Chinese respondents in the United Kingdom and the Netherlands as compared to general population respondents in these countries**

| | Chinese in UK[1] (n=104) | UK[2] (n=401) | P-value Unadj.[3] | P-value Adj.[4] | Chinese in NL[1] (n=195) | NL[2] (n=403) | P-value Unadj.[3] | P-value Adj.[4] |
|---|---|---|---|---|---|---|---|---|
| Mean perceived severity | | | | | | | | |
| SARS | 7.2 | 8.3 | <0.01 | <0.01 | 8.3 | 8.5 | 0.3 | 0.2 |
| Flu from a new virus | 5.3 | 7.4 | <0.001 | <0.001 | 6.3 | 7.7 | <0.001 | <0.001 |
| Mean perceived vulnerability | | | | | | | | |
| SARS, outbreak in country | 2.4 | 2.5 | 0.3 | 0.2 | 2.7 | 2.9 | 0.1 | 0.1 |
| SARS, outbreak outside country | 2.1 | 1.8 | <0.01 | <0.01 | 2.4 | 1.8 | <0.001 | <0.001 |
| Flu from a new virus, OB in country | 3.1 | 2.9 | 0.4 | 0.5 | 3.2 | 3.2 | 0.7 | 0.9 |
| Flu from a new virus, OB outside country | 2.8 | 2.6 | 0.08 | 0.2 | 2.8 | 2.7 | 0.06 | 0.07 |
| Mean perceived threat[5] | | | | | | | | |
| SARS, outbreak in country | 2.8 | 3.1 | 0.02 | 0.02 | 3.2 | 3.4 | 0.05 | 0.02 |
| SARS, outbreak outside country | 2.6 | 2.6 | 0.9 | 0.5 | 3.0 | 2.7 | <0.01 | <0.01 |
| Flu from a new virus, OB in country | 2.7 | 3.2 | 0.001 | 0.03 | 3.1 | 3.4 | <0.01 | <0.01 |
| Flu from a new virus, OB outside country | 2.6 | 3.0 | <0.01 | 0.07 | 2.9 | 3.1 | <0.01 | <0.01 |

[1] Data derived by a self administered survey among a convenience sample
[2] Data derived by a phone-survey among a random sample
[3] Student's t-test
[4] Adjusted for sex, age group, place of residence and highest education
[5] Perceived threat is the square root of the multiplication of severity/2 and vulnerability
UK = United Kingdom, NL = Netherlands, Unadj. = Unadjusted, Adj. = Adjusted, OB = outbreak

Response efficacy, i.e. the extent to which respondents think that people generally can take effective actions to prevent a disease, was scored higher among both Chinese groups as compared to general populations for flu from a new virus, also after adjusting for sociodemographic differences (Table 5). Self-efficacy, i.e. the extent to which respondents think they themselves can prevent a disease, was scored higher among Chinese respondents in both countries as compared to general populations, for both diseases.

**Table 5: Mean scores of response and self-efficacy (both scale 1-4) regarding SARS and flu from a new virus among Chinese respondents in the United Kingdom and the Netherlands, as compared to general population respondents in these countries**

| | Chinese in UK[1], % (n=104) | UK[2], % (n=401) | P-value | | Chinese in NL[1], % (n=195) | NL[2], % (n=403) | P-value | |
|---|---|---|---|---|---|---|---|---|
| | | | Unadj.[3] | Adj.[4] | | | Unadj.[3] | Adj.[4] |
| Response efficacy | | | | | | | | |
| SARS | 2.5 | 2.4 | 0.2 | 0.3 | 2.5 | 2.4 | 0.2 | 0.2 |
| Flu from a new virus | 2.6 | 2.4 | 0.06 | 0.06 | 2.5 | 2.2 | <0.01 | <0.01 |
| Self-efficacy | | | | | | | | |
| SARS | 2.3 | 2.0 | <0.01 | 0.02 | 2.1 | 1.8 | <0.001 | <0.001 |
| Flu from a new virus | 2.3 | 2.0 | <0.01 | <0.01 | 2.2 | 1.7 | <0.001 | <0.001 |

[1] Data derived by a self administered survey among a convenience sample
[2] Data derived by a phone-survey among a random sample
[3] Student's t-test
[4] Adjusted for sex, age group, place of residence and highest education
UK = United Kingdom, NL = Netherlands, Unadj. = Unadjusted, Adj. = Adjusted

## Discussion

In this explorative study we found that Chinese people from the UK and the Netherlands got most information about emerging infectious diseases from family and friends, followed by Chinese media and British/Dutch TV. They had significantly less confidence than the general population in their doctor, government agencies, and consumer/patient interest groups. They had most confidence in information from family/friends, Chinese newspapers and Chinese cable TV, followed by TV from their country of residence. Knowledge of SARS was high among Chinese populations. Chinese people in both countries appeared to have a lower perceived threat than general populations with regard to SARS in case of an outbreak within the country, and avian flu in case of an outbreak within and outside the country; this was mainly due to a lower perceived severity of SARS and avian flu and not due to lower vulnerability perceptions. Self-efficacy was scored higher for SARS and avian flu among Chinese respondents in both countries as compared to general populations.

Because studies into risk behaviour of SARS and other emerging infectious diseases are scarce, our research intended to be a first exploration of risk perception/health beliefs among high-risk minority groups in the Netherlands and UK. It was a descriptive, epidemiological study without strong a-priori hypotheses. There are several limitations to our study. Firstly, we used the snow-ball technique to sample Chinese in the UK/Netherlands, whereas we used random sampling for the general population; the comparison of the two groups may therefore

be biased. Nevertheless, probably because we recruited Chinese people in the UK and Netherlands in very diverse settings and used purposive sampling with recruitment targets, our respondents seem to reflect the Chinese communities in the two countries quite well. Also, the random samples of the general populations may not truly have been representative; participation rates in the Netherlands and the UK were 44% and 21% respectively. We tried to reduce biases in sampling by adjusting all outcome measures for differences in socio-economic background variables. Secondly, we used slightly different methods to collect the questionnaire data from the British/Dutch Chinese compared to the general groups. However, previous studies have found little differences in responses to Computer Assisted Telephone Interviewing as compared to pen-and-paper questionnaires (16, 17). Thirdly, because our study is one of the first studies to make investigations of information sources, risk perceptions, and (other) beliefs related to recently emerging infectious diseases in various populations, the questionnaire that we used was not validated, it had only a limited number of items per construct, and it was pre-tested with cognitive interviewing only among general populations in the UK and Netherlands. Nevertheless, the questionnaire seemed to be well understood by the Chinese respondents, considering that the proportion of missing values was low (both on average 4% missing values per question). Because this proportion did not differ between British and Dutch Chinese, the rephrasing of some questions by the focus group moderator in the Netherlands seemed not to have influenced the item response-rate. Fourthly, about half of our respondents were participants of focus groups discussions, and they may have been motivated to participate in such a discussion because they were more worried / felt more vulnerable about SARS and avian flu than non-participants. Our explorative study can therefore be seen as a first step towards more comprehensive and representative studies on differences in risk perceptions and health beliefs. Lastly, data collection took place two years after the end of the SARS epidemic, which may have resulted in recall bias. We tried to minimise this by not referring to the outbreak in 2003 but instead always refer to ”in case of an outbreak”.

In response to emerging infectious diseases such as SARS, accurate, timely and transparent provision of information is critical in containing the outbreak. Mass media are very important channels in the delivery of information relevant to perceived threat. Our study showed that Chinese people mainly used sources of information that are not under control of British/Dutch authorities, such as family or friends, or Chinese newspapers and Chinese cable TV. These Chinese language media were regarded as more trustworthy than local European media, because the content was in-depth and updated regularly (7). Use of information targeted towards Chinese groups that was available from British and Dutch public health organisations was low, even though some of this information was provided in the Chinese languages, such as British/Dutch websites for the Chinese communities (7). Our findings are in line with a study from the US that shows that Asian communities were getting more and more timely information from sources in Southeast Asia, than from US news media or health officials (8). The only British/Dutch source of information that was well-used and well-trusted was the British/Dutch TV. Overall, Chinese people seemed to have made more use of sources of information than general populations from the UK and Netherlands, which may have resulted in their better knowledge regarding SARS.

Chinese people had a lower perceived severity of SARS (UK only) and avian flu (both countries) than general populations. Possible explanations might be that SARS and avian flu are more familiar diseases to Chinese people than to the average British and Dutch people, and that the Chinese groups had better knowledge regarding these diseases.

British and Dutch Chinese had a higher perceived vulnerability of SARS in case of an outbreak outside the country of residence than general populations. Although we are not sure whether they considered "outside the country" to be their home country, this would provide a logic explanation for their higher perceived vulnerability. Assuming that future outbreaks of SARS will be more likely to originate in Asia again, this may reflect a real actual higher risk, due to travel to and contact with people from infected areas.

Little is known about perceived threat of SARS and avian flu among Chinese communities who live abroad. This makes it difficult to evaluate our finding that British Chinese had a lower perceived threat than respondents from the general samples for SARS (in case of an outbreak within the country) and flu from a new virus. A study in the US showed that Chinese Americans perceived their risks for various diseases (all kinds of cancer, heart disease, diabetes mellitus, asthma, and tuberculosis) lower as compared to Hispanic and African-Americans (18). However, their lower perceived threat was due to lower perceived vulnerability, whereas in our study it was perceived severity that was lower. More research is needed on risk perception among different ethnic communities, and how different ethnic groups interpret cognitive constructs such as perceived severity and vulnerability. Also, additional research is needed among Chinese groups living in other European and other countries, which could clarify the relevance of the present results to Chinese in other countries.

We found that British and Dutch Chinese had higher self-efficacy beliefs regarding SARS and avian flu than general populations in the UK and Netherlands. Maybe their closer involvement in past outbreaks in China has convinced them that effective precautionary measures for SARS are available, and that they themselves are able to apply these measures in future outbreaks. Alternative explanations are also possible, such as that higher efficacy beliefs among the Chinese are a result of cultural optimism, or illusion of control(19-21). Further research is needed into efficacy beliefs related to SARS and avian flu and their relation to precautionary behaviour, among general populations as well as vulnerable groups in different countries, in order to develop effective public health strategies.

Our study has implications for risk communication and risk management, in case of future outbreaks of SARS and avian flu originate in China. It will be important to well-inform Asian communities in Europe of a potentially higher infection risk - due to frequent travel and contact with people from infected areas - and of appropriate precautionary behaviours. British/Dutch TV was the only British/Dutch source of information that was well-used and well-trusted. It seems therefore wise for British/Dutch health authorities to use special TV broadcasts for Chinese groups to inform the Chinese community in their countries, taking into account news coverage in locally available Chinese media. It should also be explored whether informal networks can be used, such as Chinese community groups and Chinese peer educators. It is also important to increase awareness of and confidence in more formal sources of information, such as from the government, so that their information targeted towards Chinese and other vulnerable groups is well used. Studies have shown that informal sources of information were used mainly because Chinese people in the UK and Netherlands lacked appropriate and timely information from relevant authoritative sources (7). Especially related to vulnerable groups, government agencies should ensure relevant and timely information using well-trusted means of communication.

According to Protection Motivation Theory, precautionary actions against a health threat are most likely when perceived severity and perceived vulnerability are high, as well as response

and efficacy beliefs. Our study suggests that knowledge, perceived vulnerability, and efficacy beliefs are high enough among Chinese communities in the UK and Netherlands to predict successful adoption of precautionary actions in case of future outbreaks of SARS and avian flu in China. Perceived severity of these two diseases however was relatively low - and therefore also perceived threat - at least when comparing it to severity perceptions of SARS/avian flu among the general population. Therefore it seems wise to stress the severity rather than the susceptibility of SARS and avian influenza in risk communication.

In conclusion, British/Dutch Chinese got most information about emerging diseases from family and friends, Chinese media, and British/Dutch TV. They appeared to be well informed about SARS. They seemed to have a lower perceived threat than general populations with regard to SARS and avian flu due to a lower perceived severity, but higher self-efficacy beliefs. In case of future outbreaks of SARS or avian flu in China, local authorities in the UK and Netherlands can best reach Chinese people through informal networks and British/Dutch TV, while trying to improve confidence in information from the government. In risk communication they need to stress the severity rather than the susceptibility of the disease.

**Acknowledgements**
This work was done as part of "SARSControl: Effective and acceptable strategies for the control of SARS and other merging infectious diseases in China and Europe", a European Commission project funded within the Sixth Framework Programme, Thematic Priority Scientific Support to Policies, Contract number: SP22-CT-2004-003824.

## References


1. World Health Organization. Summary of probable SARS cases with onset of illness from 1 November 2002 to 31 July 2003. 2004. Available at http://www.who.int/csr/sars/country/table2004_04_21/en/index.html.
2. Svoboda T, Henry B, Shulman L, Kennedy E, Rea E, Ng W, et al. Public health measures to control the spread of the severe acute respiratory syndrome during the outbreak in Toronto. N Engl J Med 2004;350(23):2352-61.
3. WHO. Cumulative Number of Confirmed Human Cases of Avian Influenza A/(H5N1) Reported to WHO. 2008. Available at http://www.who.int/csr/disease/avian_influenza/country/cases_table_2008_06_19/en/index.html.
4. Colizza V, Barrat A, Barthelemy M, Valleron AJ, Vespignani A. Modeling the worldwide spread of pandemic influenza: baseline case and containment interventions. PLoS Med 2007;4(1):e13.
5. Saif LJ. Animal coronavirus vaccines: lessons for SARS. Dev Biol (Basel) 2004;119:129-40.
6. Smith RD. Responding to global infectious disease outbreaks: lessons from SARS on the role of risk perception, communication and management. Soc Sci Med 2006;63(12):3113-23.
7. Jiang X, Elam G, Yuen C, Voeten H, de Zwart O, Veldhuijzen I, et al. The impact of SARS on Chinese communities in the United Kingdom and the Netherlands: a qualitative study. International Journal of Behavioral Medicine 2009 - in press.
8. Person B, Sy F, Holton K, Govert B, Liang A. Fear and stigma: the epidemic within the SARS outbreak. Emerg Infect Dis 2004;10(2):358-63.
9. Rogers RW. A protection motivation theory of fear appeals and attitude change. Journal of Psychology 1975;91:93-114.
10. Rogers RW. Cognitive and physiological processes in fear appeals and attitude change: A revised theory of protection motivation. New York: Guilford Press; 1983.
11. Weinstein ND. The precaution adoption process. Health Psychology 1988;7(4):355-386.
12. Overseas Compatriotic Affairs Commission R.O.C. Taiwan. The ranking of ethnic Chinese population 2005. 2008. Available at http://www.ocac.gov.tw/english/public/public.asp?selno=1163&no=1163&level=B.
13. de Zwart O, Veldhuijzen I, Elam G, Aro AR, Abraham T, Bishop GD, et al. Perceived threat. risk perception and efficacy beleifs related to SARS and other (emerging) infectious diseases. Results of an international survey. International Journal of Behavioral Medicine 2009 - in press.
14. de Zwart O, Veldhuijzen IK, Elam G, Aro AR, Abraham T, Bishop GD, et al. Avian influenza risk perception, Europe and Asia. Emerg Infect Dis 2007;13(2):290-3.
15. Brug J, Aro AR, Oenema A, de Zwart O, Richardus JH, Bishop GD. SARS risk perception, knowledge, precautions, and information sources, the Netherlands. Emerg Infect Dis 2004;10(8):1486-9.
16. Groves R, Mathiowetz N. Computer assisted telephone interviewing: effects on interviewers and respondents. Public Opinion Q 1984;48:356-369.
17. Groves R, Mathiowetz N, Chapter V. A comparison of CATI and non-CATI questionnaires. Vital Health Stat 2 1987;106:33-39.
18. Haomiao J, Santana A, Lubetkin EI. Measuring risk perception among low-income minority primary care patients. J Ambul Care Manage 2004;27(4):314-27.
19. Chang EC, Asakawa K, Sanna LJ. Cultural variations in optimistic and pessimistic bias: do Easterners really expect the worst and Westerners really expect the best when predicting future life events? J Pers Soc Psychol 2001;81(3):476-91.
20. Chang EC, Asakawa K. Cultural variations on optimistic and pessimistic bias for self versus a sibling: is there evidence for self-enhancement in the west and for self-criticism in the east when the referent group is specified? J Pers Soc Psychol 2003;84(3):569-81.
21. Renn O, Rohrmann B. Cross-cultural risk perception: a survey of empirical studies. Dordrecht: Kluwer Academic Publisher; 2000.

# 9.

# General discussion

This thesis deals with risk perception of emerging infectious diseases such as SARS and avian influenza and related precautionary behaviour. Risk perception was studied in an international comparative perspective, over time in the Netherlands, and among Chinese communities. The aim of this final chapter is to summarize and discuss the main research findings and, where appropriate, provide answers to the research questions posed in the introduction to this thesis. Furthermore, the results reported are put into perspective by comparing our findings to other studies. Methodological issues related to external and internal validity will be discussed, and implications for further research as well as for public health practice will be proposed.

This thesis reports on a number of explorative studies on risk perceptions, potential determinants and correlates, and the relevance for precautionary behaviours. In 2003, when the studies started, there was neither a body of literature available on risk perception and newly emerging infectious diseases such as SARS or avian influenza, nor validated questionnaires or other measurement instruments for such research. The studies reported in this thesis are therefore a first description of risk perception and emerging infectious diseases and meant as a point of departure for future, more in-depth research on this topic.

## 9.1. Main findings

For each of the research questions the main findings are discussed and in answering these questions the results of the different studies will be integrated.

*Research issue 1: Exploring risk perceptions for emerging infectious diseases: how are the risks of new emerging infectious diseases like SARS and human avian influenza perceived?*

The studies reported in this thesis consistently suggest that both SARS and avian influenza are perceived as severe diseases. SARS' severity was rated higher than that of avian influenza in the international study, both in Europe and Asia. Interestingly, in regions and communities with more direct experience with SARS and avian influenza, i.e. in Asia and in Chinese populations in the Netherlands and the UK, perceived severity of both diseases was rated somewhat lower, except for perceived severity of SARS among the Chinese community in the Netherlands.

Perceived vulnerability of SARS and avian influenza was lower than perceived severity in all studies. In the international studies perceived vulnerability is at an intermediate level, while perceived vulnerability of avian influenza in the Dutch studies is low. Perceived vulnerability of avian influenza was lower in these Dutch studies in 2006-2007 than amongst the Dutch participants in the international study in 2005. Chinese communities perceived their vulnerability generally in line with the general populations in the Netherlands and the UK; only perceived vulnerability for SARS in case of an outbreak outside the country was higher among the Chinese in the UK and the Netherlands.

The assessments of comparative vulnerability, i.e. how respondents perceived their chance of getting infected with SARS or avian influenza compared to others of the same age and gender, suggest an optimistic bias in risk perceptions for both SARS and avian influenza.

*Research issue 2: Exploring potential determinants of risk perceptions for new emerging infectious diseases: How do risk perceptions of SARS and/or avian influenza*

- compare to risk perceptions of other diseases and conditions?
- differ according to sociodemographic variables such as age, sex, level of education?
- differ between countries and regions?
- change over time, possibly related to occurrence of outbreak-related events?

*Comparison with other diseases*

Compared to other diseases and conditions, such as tuberculosis, diabetes and high blood pressure, SARS in the international study is seen as a severe disease, perceived severity of avian influenza is somewhat lower and at the same level with these diseases. In the Dutch studies perceived severity of avian influenza was comparable to perceived severity of tuberculosis, but higher than that of diabetes or high blood pressure.

Perceived vulnerability for both SARS and avian influenza, the latter especially in the Dutch study, was relatively low compared to diseases as common cold, food poisoning and high blood pressure. However, perceived vulnerability in the international study appears to depend strongly on the situation. If respondents were asked to envision an outbreak in the country of residence, perceived vulnerability became higher than all other diseases apart from a common cold. In the Dutch study of 2006 not only perceived vulnerability of a common cold, but also that of high blood pressure and food poisoning remained higher than perceived vulnerability in case of an outbreak of avian influenza in the country.

Only for a common cold in the international and Dutch studies participants perceive their vulnerability as equal to others. For all other diseases there was evidence for different degrees of optimistic bias. Whereas in the international study the optimistic bias for SARS and avian influenza appeared to be relatively small compared to other diseases, in contrast in the Dutch study the optimistic bias was large compared to other diseases as heart attack or high blood pressure.

*Sociodemograhic variables*

Female gender was associated with higher perceived vulnerability for both SARS and avian influenza. This association was found in both Europe and Asia, as well as in the Netherlands and among the Dutch Chinese community. A lower level of education was also associated with a higher perceived vulnerability for SARS in the international study, among the Chinese community in the Netherlands, and for avian influenza in the Dutch study. The international comparative study indicated that age was associated with higher perceived threat of avian influenza in Europe, but not in Asia. In the Dutch study higher age was also associated with higher perceived vulnerability. No clear associations between sociodemographic variables and perceived severity were found. No analyses in these studies were conducted to explore sociodemographic correlates of other diseases.

*Differences between countries and regions*

SARS and flu from a new virus were perceived as more severe in Europe compared to Asia; most other diseases were also perceived as more severe in Europe. There is no clear pattern in differences in perceived vulnerability between Europe and Asia. Perceived vulnerability in Asia was higher for SARS in case of an outbreak in the country; while for flu from a new virus in case of an outbreak outside the country it was higher in Europe. For other situations, there was no difference in perceived vulnerability between Asia and Europe.

Remarkably, differences between countries are more pronounced in differences of the levels of perception, than in the order of perceived threat of diseases. This order of perceived threat was almost the same in all countries for SARS, flu from a new virus, high blood pressure and diabetes. The highest perceived threat in all countries was for SARS, followed by flu from a new virus, high blood pressure and diabetes. Both response and self efficacy related to measures for SARS and avian influenza were higher in Asian countries compared to European countries.

*Changes over time in risk perception*

The studies in this thesis consistently show only a very limited change in risk perception over time and no effects related to the occurrence of outbreak-related events. Perceived severity for avian influenza remained stable in the Netherlands from March 2006 to March 2007. Perceived vulnerability decreased only slightly during this period. No effect was seen on perceived vulnerability in the Netherlands of the two avian influenza related events after which additional surveys were conducted. Also no effect was seen in the 2005 surveys in Europe after the introduction of avian influenza among birds in Europe.

While perceived severity did not change in the Netherlands and perceived vulnerability decreased only slightly, during the same period both the amount of information received and the level of knowledge about avian influenza decreased significantly. Our studies suggest that both perceived severity and perceived vulnerability are relatively stable concepts.

*Research issue 3: Exploring the importance of risk perceptions for management of new emerging infectious diseases: how do risk perceptions relate to precautionary actions and to other potential determinants of such actions?*

A higher level of perceived severity and a higher level of perceived vulnerability in the Dutch study were associated with self-reported precautionary actions against avian influenza, like not getting in touch with (wild) birds or poultry, not going to areas with avian influenza or paying more attention to hygiene. Self efficacy was also positively associated with taking precautionary actions. Other factors associated with taking precautionary actions included a lower level of knowledge, more information about avian influenza, thinking more about avian influenza, the time of the survey and the sociodemographic factors: a higher age, a lower level of education, non-Dutch ethnicity and being vaccinated against influenza.

In the Rotterdam study Chinese respondents reported to have taken substantially more precautionary actions than Dutch respondents in relation to the SARS outbreak, like avoiding travel to SARS-infected areas and taking up diagnostic measures. In the study among

Chinese communities in the Netherlands and the UK perceived self efficacy was significantly higher among the Chinese communities than in the general populations.

## 9.2. Putting the results into perspective

In this paragraph the results of our studies in relation to other studies on risk perception and emerging infectious diseases will be discussed.

*Risk perception of SARS and avian influenza*

During the SARS outbreak several studies were conducted in both areas with SARS (Asia, Canada) and non-affected areas (USA, Netherlands) (1-6). These studies measured perceived vulnerability in different ways; none reported on perceived severity separately. The studies showed different levels of perceived vulnerability, from a high level in Toronto, Hong Kong and the USA (2, 5) to a lower level in Singapore (3) and a very low level in the Netherlands (6). Higher perceived vulnerability was not necessarily related to proximity of the outbreak, as perceived vulnerability in the USA with only 27 cases was high, whereas in Singapore with 238 cases it was lower (7). The studies in this thesis made clear that while perceived severity of SARS was high, perceived vulnerability was at an intermediate level. Different ways in measuring perceived vulnerability make it difficult to compare results (8), but a plausible explanation for the lower levels of perceived vulnerability found in the present studies compared to some reported earlier, may be the fact that the study in this thesis was conducted in 2005, i.e. two years after the SARS outbreak, while the other studies were conducted during or immediately after the outbreak.

In the last years a number of studies have been published focusing on different aspects of risk perception of avian influenza and an influenza pandemic, some in Europe and some in Asia (9-16). Because different measures and time frames were used in the different studies, comparisons between these studies and the results of this thesis are not straightforward. Only two studies (15, 16) measured perceived severity and in both studies avian influenza was considered a serious health problem. Quite consistent results were found concerning perceived vulnerability and expectations about the likelihood of an outbreak in the near future. The possibility of an outbreak of avian influenza among humans is considered quite likely (9, 11, 14). Perceptions of personal vulnerability for the near future were high during an outbreak of avian influenza among humans and among poultry in Vietnam and when an outbreak was envisioned (11, 16). Perceived personal risk of contracting avian influenza in a non-outbreak situation was lower and similar to the results presented in this thesis (15).

Apart from the two studies among the Chinese communities in this thesis only two, qualitative, studies that focused on the specific situation of Asian communities related to SARS have been published (17, 18). These did not study specific levels of perceived severity or perceived vulnerability among these communities, but focused more on the impact of SARS on Asian communities in general and adverse consequences. Jiang et al., based on focus group interviews with members of Chinese communities in the UK and the Netherlands, reported that these communities considered SARS as a serious health threat (18). A consistent finding in both studies among Chinese communities in this thesis and these two other studies is the importance of Chinese media as the most used and trusted source of information (17, 18). This tendency to use information sources from the country of origin

may have important consequences, as people may base their risk perception and precautionary actions on the situation in the country of origin, possibly resulting in unnecessary precautionary behaviours or refraining from precautions in real risk situations. Health and other authorities in the country of residence may not reach specific communities because they use other sources of information. The situation of ethnic communities in outbreak situations, in this case the Chinese communities, warrants specific attention in how to reach communities and to ensure that tailored advice, taking into account the possibility of close contacts with family or friends in the country of origin, is available.

*Geographical differences and differences between ethnic communities*

Our observation that risks for diseases are perceived differently in different regions, countries and that there are differences between ethnic communities has been seen in other studies as well (19, 20). In relation to SARS, Leung reported on differences between Hong Kong and Singapore, with higher levels of perceived vulnerability and more precautionary actions taken in Hong Kong (3). The explanation for this difference is that Hong Kong had been harder hit by the SARS outbreak. Blendon reported on differences in risk perception between Canada and the USA during the SARS outbreak, with higher levels of risk perception in Canada (5). It is difficult to interpret geographical differences and differences between groups. Are differences in risk perception related to cultural differences or sometimes also to the 'objective' chance for certain risks, like the level of exposure? (19) While perceived severity for SARS and avian influenza appeared to be higher in Europe, there is no clear pattern on perceived vulnerability. Different explanations are possible. The higher perceived vulnerability for SARS in case of an outbreak in Asia might be explained because Asia was hit harder by SARS, and the lower perceived severity in Asia could be a result of having lived through the SARS epidemic. Thus people realized the disease could be overcome; it had become a more familiar risk. Another explanation however, might be that in Asia in general people may perceive risks as less severe, which might be related to a more cyclic way of thinking and the influence of Confucianism whereby positive and negative events follow each other, so that something is not considered as only negative (20-23).

Geographical differences in risk perceptions have a direct practical relevance because emerging infectious diseases can spread rapidly throughout the world. Differences in risk perception between countries may influence individual precautionary actions as well as collective reactions of (health) authorities, media and civil society. Insight in geographical differences in risk perception can be a starting point for concerted international action.

*Sociodemographic variables*

The observation that women in most of the studies in this thesis had a higher perceived vulnerability is in line with other studies reported in the literature (25-27) as well as other studies on risk perception of SARS (1, 6, 28). The higher perceived personal risk among women is a consistent finding in risk perception literature, and different explanations have been suggested (25, 26). Some argue that women in society are often more vulnerable to violence and that because of this they may be sensitized also to other risks; others argue that women are raised for a more nurturing role in the world and are thus more concerned about health, or that women and men attach different meanings to risks (25, 26). It has also been suggested that gender differences are based more on socio-political differences. A relatively

small group of white males perceives risks as very low and has a high level of trust in authorities. They may benefit more from risk taking, and because of their very low risk perception, women in comparison seem to have a higher risk perception (25, 26, 29). It has also been suggested that gendered ideology, the socialization of women and men in gender roles, and differences in daily life based on gender, e.g. the fact that men work more often away from home, leads to gender differences in risk perception (26). These explanations do not directly explain gender differences in risk perception of emerging infectious disease and further research is needed to explain these differences.

The finding that those with a lower level of education had a higher perceived vulnerability and sometimes a higher perceived severity has also been seen in a study on risk perception of SARS in Hong Kong (28) and on avian influenza in Italy (15).The level of education is not, like gender, a consistent factor influencing risk perception, although some studies reported the same association (11, 30, 31). One explanation might be that the level of education can be seen as a proxy for knowledge and theoretically more knowledge about a risk would mean a lower level of risk perception.

The association between higher age and a higher level of perceived vulnerability in the international comparative study and the Dutch study on avian influenza was also seen in a study on risk perception of SARS in Hong Kong, but not in a study on avian influenza in Hong Kong (1, 11). Currently it is not possible to draw specific conclusions on the relationship between age and risk perception (27, 31).

*Changes over time in risk perception and effects of specific events*

A limited number of studies has looked into the change of risk perception over time or effects of specific (outbreak-related) events on risk perception or precautionary behaviour (2, 5, 16, 32). In two studies in Hong Kong a decline in perceived vulnerability for SARS was shown during the second phase of the epidemic in 2003. In this second phase there were fewer SARS cases, which was suggested to be the cause for the lower perceptions of vulnerability (1, 3). A similar decline in perceived vulnerability was found in Canada and the United States (5). Using anxiety level as an indicator, Leung has reported that half a year after the SARS epidemic this had returned to baseline levels (28). In a study on avian influenza conducted in Vietnam it became clear that what was called personal anxiety (concern for oneself and one's relatives with regard to the outbreak) diminished substantially four to five months after the first outbreak of avian influenza among both humans and poultry in 2004 (16). In the study presented in this thesis, perceived severity in the Netherlands remained high throughout 2006 – 2007, but perceived vulnerability declined slightly. The results of these different studies suggest that during an outbreak perceived vulnerability seems related to the magnitude of the outbreak and that after an outbreak perceived vulnerability can decrease rapidly. During a non-outbreak period perceived vulnerability will decline less sharply, which may also be explained by the fact that in the Netherlands perceived vulnerability was already at a low level. Neither the introduction of avian influenza among birds in Europe nor the two events in the Dutch study had a significant effect on perceived vulnerability. This suggests that outbreaks of avian influenza among birds are not enough to change perceived vulnerability.

Precautionary actions related to SARS in Hong Kong increased sharply during the first phase of the outbreak, remained high during the next stages of the outbreak, decreased slightly at

the very end of the outbreak and decreased substantially after the outbreak (1, 3). In the study done in Vietnam most respondents stopped eating poultry during the avian influenza outbreak of early 2004. However, only a small group continued not eating poultry up to six months after the outbreak, although a majority reported eating less poultry as before (16). In our study the proportion of respondents who reported to have taken preventive measures remained high during the whole study period.

These studies combined suggest a contrast between changes over time during an outbreak and a non-outbreak period. During an outbreak both perceived vulnerability and precautionary behaviour seem to be related to the magnitude of the outbreak. A decline in perceived vulnerability seems to precede a decline in precautionary actions. After an outbreak most precautionary actions do not seem to continue. However, if there is no outbreak among humans, hardly any changes are seen in either perceived vulnerability or precautionary actions. There are no studies yet which have described the change from a non-outbreak period to an outbreak or the possible effects of a first human case; such research is needed to really understand changes in risk perception over time.

*Associations between risk perceptions and precautionary actions*

In the Dutch study an association was found between higher levels of risk perception, both perceived severity and perceived vulnerability, and taking precautionary action. These findings are in line with other studies both on SARS and avian influenza among general populations; although not always the same concepts for perceived vulnerability were used. Leung found that in Hong Kong a higher level of anxiety and a higher perceived likelihood of contracting SARS during the outbreak were associated with taking at least five of seven possible preventive measures, like covering the mouth when coughing or sneezing, wearing a face mask, washing hands with soap and washing hands after coughing (2). In another study in Hong Kong an association was found between those who worried more about themselves or a family member being infected with SARS and frequent hand washing, and also with disinfecting one's house (1). A study in Singapore confirmed an association between a higher level of anxiety for SARS and taking more preventive measures, such as covering the mouth with a tissue when coughing, washing hands after coughing or using serving utensils for shared food, but no significant relationship was found between perceived likelihood of getting SARS and engagement in these preventive measures (4). Another study in Singapore did not find an association with either anxiety or perceived vulnerability (3). In Canada and the USA perceived vulnerability for contracting SARS oneself or a family member in the coming year was associated with a number of specific measures like using a disinfectant, avoiding people who were suspected of having recently visited Asia and avoiding Asian restaurants or stores (Canada only) (5). Similar associations were found in a study conducted in the Netherlands in 2004, where perceived risk of acquiring SARS was associated with self reported measures as avoiding travel to SARS-infected areas, ensuring sufficient sleep or wearing a face mask (6).

In recent studies on precautionary actions for avian influenza mostly intentions for future preventive behaviour in case of an outbreak have been assessed. Generally, people reported high intentions to engage in a range of precautionary actions if they envisioned such an outbreak in their country of residence. For example, in Norway a large majority of the general population reported that they would be extra careful about personal hygiene if confronted with an avian influenza outbreak; while in a study in London almost all

respondents would wash their hands five times a day or more if requested (13, 14). An Italian study reported an association between precautionary actions during food handling, like washing hands with soap and using gloves, and a higher risk perception for contracting avian influenza (15).

In a study conducted among a sample of 503 respondents in Hong Kong almost three quarters of respondents indicated that they would wear face masks and even more would increase the frequency of hand washing if confronted with an outbreak of avian influenza among humans (10). Both these preventive behaviours as well as the avoidance of eating poultry and the use of face masks in public venues if one had symptoms related to influenza (so to protect others), were associated with a higher perceived likelihood of contracting avian influenza oneself or a family member. In this study not only an association with perceived vulnerability was found, but also between a higher level of perceived efficacy of measures as the use of face masks and frequent hand washing, and the uptake of these measures. In another study in Hong Kong Lau et al. found that higher expectations about fatality rates for avian influenza and feeling that avian influenza would have a higher impact on oneself or a family member than SARS, were associated with higher intentions of preventive behaviours such as not sending children to school, avoiding crowds or not going out (11). In contrast, Sadique and colleagues, using the same international comparative survey as in this thesis, which included five European (the Netherlands, United Kingdom, Spain, Denmark and Poland) and three Asian countries (Singapore, Hong Kong and China – Guangdong region), did not find an association for the whole sample between either perceived threat, perceived vulnerability or perceived severity of an influenza pandemic and intentions to engage in future precautionary actions, like avoiding public transportation, limit shopping or keeping children from school (33). The study did not include specific analyses per country.

Most studies on SARS and avian influenza found an association between a higher risk perception and engaging in precautionary actions. This, however, does not yet mean that causal relationships have been established as these were all cross-sectional studies. Nonetheless, the associations found, complemented with evidence from other fields regarding the associations between risk perceptions and precautionary actions (34), as well as theoretical insights (35), suggest that in stimulating precautionary actions in the control of outbreaks specific attention should be paid to ensure a high enough level of perceived vulnerability so that people will engage in these actions.

## 9.2. Methodological issues

This part of the discussion addresses several methodological issues which are important when interpreting the results of the studies reported in this thesis. The focus will be on external validity, especially related to the sampling procedures and response rates, and internal validity, especially related to the design of the studies conducted and the measures used to collect the data.

### *9.2.1. Data collection, sampling and external validity*

In the studies collected in this thesis three ways of sampling were used. Telephone-administered questionnaires were used for the international comparative study (chapters 2 and 3). The studies on avian influenza in the Netherlands were conducted through a survey

among an Internet panel (chapters, 4, 5 and 6). The research among the Chinese communities (chapters 7 and 8) was done by using convenience sampling among the community with written questionnaires. Advantages and limitations of these different sampling methods will be discussed as well as the response rates that were realised with each of these methods separately.

*Telephone-administered questionnaires*

Telephone-administered questionnaires have a number of advantages. In a relatively short period of time large numbers of people can be included in studies with acceptable costs. As in most countries almost everyone has a telephone, representative samples among the general population can be realised. Questionnaires can be scripted for people doing the interviews, so that data collection is standardised and data can be entered into the database directly. The studies in this thesis were based on random digit dialling (RDD), whereby the computer automatically selects a telephone number from all possible telephone numbers. If unanswered, but in use, numbers were tried again up to five times and, where possible, call back appointments were made.

Despite the practical advantages of telephonic questionnaires, there are also a number of limitations. Such limitations may be relevant for generalizability (as well as the internal validity, see paragraph 9.2.2.1) of the results of our studies. General limitations include the fact that not everybody has a telephone and thus people without one are excluded from such studies. With the growing number of people who only have a mobile phone, this group would not be represented in the sample. Because the level of coverage for mobile phones differs per country this might have lead to unforeseen differences between countries in the studies. A telephone survey also limits the length of the questionnaire because the attention of respondents will diminish if the survey takes too much time. Furthermore, questions have to be formulated relatively simple, because respondents cannot, for example, take their time to read questions over again.

The registered response rates of the survey in this thesis in the European countries differed greatly, between 21% in the United Kingdom and 81% in Poland. It is known that response rates for telephone surveys have been diminishing over the last years (36-38). Although lower response rates do not necessarily lead to differences in results compared to higher response rates (39), the differences may have reduced the external validity of the results, since composition of the samples varied between countries and regions, with older respondents in Europe and with respondents in Asia living more often in cities and who were higher educated.

A specific limitation of the studies in this thesis was that the execution of the surveys in the Asian countries (Singapore, Hong Kong and the province of Guangdong in China) did not go as planned by the Dutch company which was responsible for carrying out the surveys. Although the company is specialized in international telephone survey research, it became clear during the first weeks of the surveys that they could not include enough respondents from the Asian countries and regions. The Dutch company therefore subcontracted an Asian company to carry out the survey for them. The staff of the Dutch company was carefully instructed by the research team on how to go through the survey questions, but this training could not be provided to the survey administrators from the subcontracted company. The Asian company further failed to register the specific response rate, but recruited respondents

until the required number of 400 respondents per country was reached. It was therefore not possible to compare the response rate in all countries, and made assessment of selection bias in the Asian countries impossible.

*Internet surveys*

To study risk perception of human avian influenza in the Netherlands we conducted seven consecutive web-based survey's using an existing Internet panel. These studies are described in chapters 4, 5 and 6.

Internet surveys have a number of advantages. It is an efficient way for repeated measurements in a relatively short time. Internet surveys are also cost-effective especially when compared to other ways of data-collection (40). Internet surveys also have high response rates in a relatively short time (41). Internet based research, however, has also been criticized as these surveys may over-represent those who are computer literate (42). Internet access in the Netherlands, however, is almost universal, with 83% of the population having Internet access at home (43).

A specific feature of the studies in this thesis was the use of an existing internet panel. The panel was representative for the Dutch population in terms of gender, age and level of education. The percentage of respondents however, who had been vaccinated against influenza in our studies (23%) was higher than the national vaccination coverage reported for 2006 (18%) (44). An existing panel has the advantage that the participants are used to answering questionnaires. During 2006 and 2007 when the studies were conducted, the panel consisted of 15,000 members who were invited regularly to participate in surveys on a variety of topics. A selection of members of this panel received an invitation to participate when a new survey came online; each survey was online between 8 and 13 days. For completion of the survey panel members received 1.50 Euro in credits. After panel members had collected a certain amount of credits, these could be exchanged for a gift cheque. A panel also has limitations because of self-selection of participants (42). Firstly, people who participate in a panel may be more motivated to participate in research and thus not be representative of the general population. Secondly, panel members decide for themselves to which invitations for a survey they will respond to. Although to remain a member of the panel they have to participate in a certain number of surveys each year, this does not exclude self-selection. This may have caused that more members participated in the surveys who were especially interested in avian influenza, and therefore possibly already received more information or took more preventive measures than the general population.

The aim was to include at least 500 participants in each of the seven surveys and, apart from the additional survey in February 2007 with 467 respondents, this aim was reached. With 500 respondents in each survey the size of each survey would be large enough to ensure that trends and changes could be observed. Because of this aim, however, the number of panel members which was approached varied between 700 and 952, and also duration the survey was online varied (8 to 13 days). This way of drawing the samples has made comparison of the response rates of the surveys difficult. Response rates varied between 55% (February 2007) to 77% (June 2006).

*Written questionnaires among convenience samples*

The studies in the Chinese communities in the Netherlands and in the United Kingdom, chapters 7 and 8, were based on convenience samples. Participants received written questionnaires to fill in and could either hand these in at the location or send it back to the researchers.
Written questionnaires are an established method in conducting research. Advantages are that respondents can fill in the questionnaire at a time when it is convenient to them, can reread questions, questionnaires can be relatively long, and interviewer bias is avoided. A disadvantage is that it will exclude those who are illiterate and there is no control over who actually completes the questionnaire. Specific for the studies in this thesis is that the written questionnaire used in the Dutch and UK study was the same as the questionnaire for the telephone survey in the international comparative studies. This was done in order to be able to compare the results of Chinese communities with those of the general populations in the Netherlands and the UK. The questionnaire in the Rotterdam study was based upon the internet questionnaire developed for a study into risk perception of SARS among the general Dutch population (6) and included some additional questions, e.g. on travel behaviour.

The choice for using convenience samples was based on the fact that no other sampling frameworks are easily available or have been used successfully before in research among these communities. In the Netherlands hardly any studies have been conducted within the Chinese community (45); and in the UK the number of studies has also been limited, often also using convenience sampling (46-49). In the Netherlands it would be theoretically possible to draw a sample from the population register and send out a questionnaire. However, response to such questionnaires among ethnic communities in the Netherlands has been relatively low (50). Because the Chinese community in Rotterdam had no experience with participating in such types of survey, we decided to carry out the study by distributing the questionnaire through networks within the Chinese community. This made it possible to give more background information to possible respondents and led to a response rate of 62%.

The use of this convenience sample makes it difficult to generalize any of the results. In Rotterdam questionnaires were distributed with the help of key figures in the Chinese community, and distributed at Chinese schools, a Chinese church and meetings of Chinese women's groups, social service organisations and cultural organisations. This sampling framework has probably excluded those members of the Chinese community who did not participate (or less frequently) in organised community activities. Women were overrepresented in this sample (62%). One can speculate that young people and employed people might have been less represented.

In the combined UK – Dutch study, convenience sampling was carried out in a purposive sampling design. Through snowballing techniques in cities with substantial Chinese communities in the UK and the Netherlands respondents were recruited to participate in focus groups. In the Netherlands recruitment took place mostly through Chinese organisations, whereas in the UK newsletters and personal contacts of participants were used. In both countries additional questionnaires were distributed through the participants to friends and relatives, next to participants in the focus groups. Because of this procedure response rates could not be calculated. The fact that most respondents participated in focus groups may indicate that they were more interested in the topic and thus results cannot be considered completely representative for the Chinese communities.

### *9.2.2. Research designs, measurements and internal validity*

In the following paragraphs the different designs used in the studies will be discussed, as well as the questionnaire and how the different concepts were measured.

*Design*

A first major issue to acknowledge is that all studies reported in this thesis used cross-sectional designs. The results therefore give only information about associations and not about predictions or causation. These limitations apply to all the studies reported, but each of the specific studies has additional design and data collection issues that may limit the internal validity.

*International comparative survey*

In the international comparative study the surveys were carried out between 20 September and 22 November 2005. As this was more than two years after the SARS outbreak the survey did not focus on risk perception during the 2003 outbreak, but respondents were asked to think about possible future outbreaks of SARS or avian influenza. While the design was cross-sectional, during the time of data collection that lasted nine weeks, avian influenza was found among birds in Europe for the first time, and the popular media reported on these outbreaks. As we considered the possibility that this might have an effect on risk perceptions and related issues, we made sure to include enough respondents after the outbreaks were made public, so that a comparison could be made of risk perceptions and related issues before and after the outbreak.

A telephone survey limits the length of the questionnaire because the attention of respondents will diminish if the survey takes too much time. Questions also have to be formulated relatively simple (see 9.2.1.1). This leads to short questionnaires with simple questions, which makes it more difficult to include different aspects of risk, efficacy or precautionary actions in different situations (e.g. different scenarios on avian influenza outbreaks). In answering questions there is the issue of social desirability, which may be more important for telephone surveys because respondents are in direct contact with an interviewer compared to internet surveys or written questionnaires. In a telephone conversation silent pauses are generally felt as uncomfortable both by respondents and interviewers and this may have prompted both to ask questions or give answers too quickly (51).

An advantage of telephone surveys is that questionnaires, administration and data entry can be standardised, using Computer Assisted Telephone Interviewing (CATI), supported by standardized instructions to the interviewers. Such standardization is of great importance to ensure valid comparison of data, even more so in international research, whereby otherwise differences in interpretation may arise. An advantage of CATI in international comparative studies is that it offers the opportunity to carry out the surveys at the same time and conducted by native speakers.

*Dutch Internet surveys*

In the design of the study into risk perception of avian influenza in the Netherlands it was important to have the possibility to act rapidly so to have the opportunity to start up a survey if a specific event related to avian influenza would take place. The agency which carried out the surveys had the questionnaire available, so that they would be able to put the survey online within a few days, thus ensuring that immediate responses to an event could be measured. This set-up worked and was used twice in this manner. To give one example; on Saturday August 12, 2006 the Dutch Ministry of Agriculture released information about two owls who had died in the Rotterdam zoo and were suspected to have been infected with avian influenza. The survey, with additional questions on this event, went online on Wednesday August 16, only four days later. The survey was completed with 650 participants on August 25, before it was clear whether the owls indeed had been infected with avian influenza or not. Only on August 25, 2006, in a new press release, the Ministry of Agriculture announced that the owls had not been infected with avian influenza.

All seven consecutive surveys in the Netherlands were cross-sectional surveys. A limitation of a panel design can be that respondents will be influenced because they have filled in the questionnaire more than once. To prevent this effect, each time only members of the panel were invited to participate who had not been invited for earlier rounds of the survey. This ensured that no learning effect took place. One might argue that a longitudinal design using the same panel members would have resulted in more specific insight into possible individual changes in risk perception. This might also make clear whether certain factors at T1, the first survey, e.g. perceived vulnerability, would predict specific behaviours at T2. This approach could be taken in future studies.

Using web based surveys has several advantages, some of which are related to the actual process of data collection. Respondents enter their answers to the questions directly into a database, which after the survey has been completed, is directly transferred to the database of the researchers. The design of the survey can help to limit errors and enhance the quality of the data by preventing respondents from missing questions and allowing immediate data analyses. Social desirability in answering internet based surveys or computer-based surveys is less frequent than in written questionnaires (52).

*Convenience samples among the Chinese communities*

Because no sampling framework existed, the design for the studies among Chinese communities in the Netherlands and the UK used cross-sectional convenience samples. This set-up allowed the study of risk perception among the Chinese community in Rotterdam quite soon after the SARS outbreak in the autumn of 2003. A specific aspect of the Dutch and UK study was that the questionnaire was distributed to participants in a focus group study on risk perception of SARS (18). The participants in these focus groups were also asked to distribute questionnaires to family and friends. While the advantage is that those participating in the focus groups were motivated to fill in the questionnaire, some of their contacts may have filled in the questionnaire because they felt obliged to do so.

The choice for convenience sampling was partly based upon the unfamiliarity of Chinese communities with survey research. Because questionnaires were distributed through Chinese welfare groups, schools, churches and other organisations, Chinese members of the research

team were present to hand out the questionnaire. They also answered questions of respondents and sometimes clarified questions for respondents. Although assistance was only given when asked, this might have led to more social desirable answers, because participants might have felt the need to answer in line with the views of the research team that was part of official health authorities. As it is not clear how many respondents asked questions, it might have led to differences between people who answered the questionnaire alone at home and those who answered in the presence of a member of the research team. This limits the validity of the results.

The survey in Rotterdam took place in the autumn of 2003 and although this was relatively short after the outbreak, respondents may have had difficulties in recollecting their specific activities. While both surveys were available in Chinese (Mandarin or Cantonese) and had been checked by native speakers who were part of the research team, no pre-testing had taken place within the Chinese communities. It may have been possible that some concepts were not familiar in the Chinese communities or understood differently, thus explaining some of the differences between Chinese communities and Dutch and UK respondents.

*Questionnaire, measures and measurement*

In this paragraph the questionnaire used and what measures were constructed to measure the different concepts used in the studies in this thesis will be discussed.

*Development of the questionnaire*

During the SARS outbreak in 2003 the SARS Psychosocial Research Consortium was formed on line and scientists from various parts of the world collaborated in developing a questionnaire to enable assessment of risk perceptions and precautionary behaviour in different settings (6, 53). The construction of the questionnaire was informed by the Protection Motivation Theory (PMT). This questionnaire formed the basis for the measures used in the studies presented in this thesis.

The English Consortium questionnaire was first translated to Dutch and adapted for web-based administration for a preliminary study in the Netherlands (6). Next, the questionnaire formed the basis for a questionnaire used to study risk perceptions and related issues among the Chinese community in Rotterdam. For this purpose the questionnaire was translated into Cantonese and additional questions on specific risk behaviours were included. For the international comparative study the questionnaire was further adapted for telephone administration in various languages, and included questions on avian influenza next to SARS. Using cognitive interviewing the questionnaire was pre-tested among fifteen participants, nine in the Netherlands and six in the United Kingdom. The cognitive interviewing led to some alterations in the questionnaire, especially in the phrasing of specific questions. The questionnaire was subsequently translated from English to Dutch, Spanish, Polish, Danish, Cantonese and Mandarin and checked by native speakers from the research team. Because this international questionnaire was based on the preliminary experiences in the earlier studies, was submitted to at least some pre-testing, and included avian influenza-related questions, this questionnaire was also used for the further studies among Chinese communities in the UK and the Netherlands, and for the study using

consecutive surveys in the Netherlands. While the framework of this questionnaire remained the same throughout the seven surveys, additional questions were included.

The development of the questionnaire was thus a collaborative effort in various phases. The contribution of many scientists will have improved the expert and face validity of the questionnaire. The experiences with the questionnaire in the preliminary studies were used to further improve it, and later in the process some formal pre-testing was conducted. However, the questionnaires were not formally validated, and therefore no information on the test-retest reliability or predictive validity is available. The fact that quite consistent results were found, for example in the series of studies conducted in the Netherlands may be a very crude indicator of reliability of the questionnaire.

*Terminology*

Since both SARS and avian influenza are relatively new diseases, specific information in the questionnaire was necessary to ensure that respondents would have a common understanding of terms when confronted with these in the questionnaire. This was important, because different terms were being used in the media, like avian influenza, bird flu, bird pest ('vogelpest' in Dutch) and flu pandemic. The international questionnaire included the following brief explanations: 'SARS is a severe acute breathing related illness caused by a previously unknown virus' and for flu 'a new type of flu virus can arise from avian flu, it causes serious illness and spreads easily in the population'. The Dutch questionnaire included the following introduction: 'This questionnaire deals with bird flu, also called avian influenza. We talk about the flu virus (H5N1) which can lead to deaths among birds and which can also cause illness among people'. Although we included definitions of SARS and human avian influenza, in answering respondents might have considered not only the current situation, but also a future influenza pandemic. Trying to be as specific as possible in the questions concerning risk perception, we included two situations, one related to the bird flu situation as it was at the time of questionnaire administration, and a second scenario in case of a bird flu outbreak in the country of residence.

*Assessment of risk perceptions*

In their meta-analysis of studies on risk perception and influenza vaccination Brewer and colleagues formulated criteria for specific and valid questions in studying risk perception (34). They distinguish three separate dimensions of risk perception: perceived likelihood, perceived susceptibility and perceived severity. In all studies, apart from the study among the Chinese community in Rotterdam, two concepts were included: perceived likelihood – which we called perceived vulnerability -, the probability that one will be harmed by a hazard, and perceived severity, the extent of harm a hazard would cause. Perceived susceptibility, which was defined as 'an individual's constitutional vulnerability to a hazard', was not included (34). Measuring this dimension would have given additional information especially related to the other diseases and conditions included in our studies. Probably it would have been difficult for respondents to score their individual constitutional vulnerability to either SARS or avian influenza, as these are new diseases.

In line with PMT in the international study on avian influenza and the first Dutch study a measure defined as 'perceived threat' was constructed. The measure 'perceived threat' tried

to combine in one measure perceived vulnerability and perceived severity, the two main elements of PMT. 'Perceived threat' was constructed by the multiplication of the measures of perceived severity (scale 1 – 10) and perceived vulnerability (scale 1 – 5). To make the scores comparable, the severity score was first divided by two. To normalize the skewed distribution of the new measure a square root transformation was performed, that resulted in the measure 'perceived threat' on a scale from 1 tot 5. As this was a new measure, perceived severity, perceived vulnerability and perceived threat were all included in the analyses. While this measure had the advantage of giving insight through one measure, it also had the risk that it would mask differences between perceived severity and perceived vulnerability. In understanding which determinants are important in precautionary behaviour and which elements should receive specific attention in risk communication, separate measures are more insightful. In the other studies only the separate measures perceived severity and perceived vulnerability were used.
Another aspect discussed by Brewer et al. is the need for personalized questions ('How serious would it be for you to get …') and the inclusion of time frames in questions. ('What is the chance that you will get … in the coming year') (34). In all the questionnaires the questions were personalized and included a time frame. Conditioned risk questioning is another critical factor in risk perception studies, especially when the outcome, the probability of a hazard, is depending on specific precautionary behaviour, like influenza vaccination (8, 34). Brewer et al. state that conditioning risk questions is necessary when the risk might change as a result of the behaviour. Using unconditioned questions might lead to lower levels of perceived vulnerability as some people will answer for their perceived vulnerability in light of the precautionary actions they took, e.g. they will report their perceived vulnerability for influenza taking into account that they have been vaccinated. In the studies in this thesis no conditioned risk questions were used. One can argue that in the international comparative studies and the studies among the Chinese communities this was not necessary, because these were retrospective studies at a time the SARS epidemic was over (8). For the studies based on the seven consecutive surveys from 2006 to 2007 in the Netherlands, including conditioned risk questions might have led to more specific information. This would have given additional information about whether risk perception was related to (different types) of precautionary behaviour, e.g. was risk perception lower for those who had taken precautionary measures.

Risk perception studies have sometimes been criticized because they tend to focus on a rationalistic-individualistic approach and do not pay enough attention to emotional-heuristic processes (8). Leppin has argued that in situations which are characterized by a high level of uncertainty, like outbreaks of emerging infectious diseases, people may rely more on common judgement, memory and emotional processes. Taking this criticism into account it would be important to measure the more emotional aspects of risk separately, like fear or worry. In the studies presented in this thesis these emotional aspects were therefore not measured and it has not been possible to assess the more emotional-heuristic processes related to risk perception.

*Assessment of precautionary actions*

In studies on risk perception it is important to measure precautionary actions as precisely as possible. In the development of the international study, however, it became clear that measuring actual precautionary actions during the SARS epidemic would be very difficult as the survey took place more than two years after the outbreak. That would have probably

resulted in recall bias. In this survey therefore, respondents were asked to envision a future outbreak of SARS or avian influenza and possible future precautionary actions were included.

Precautionary actions were retrospectively assessed in the study among the Chinese community in Rotterdam and in the consecutive surveys in the Netherlands between 2006 and 2007. The study among the Chinese community also included questions on diagnostic measures and about possible precautionary actions in case of a future outbreak, these latter questions however were not included in the analyses. Participants were asked to report whether they had engaged in a specific activity or not. In both studies, however, no time frame was included for these questions regarding precautionary behaviour. In the study among the Chinese community this was no problem as this was limited to measures during the SARS outbreak. In the consecutive surveys, as people were asked to report the precautionary actions they had taken to prevent infection with avian influenza, this might have meant that people used different time frames in answering this question (for some one month, for others a year). In the latter surveys answering this question might have resulted in an over-estimation of precautionary measures, as people may have reported measures they took months ago and not measures taken during the last three months. In new studies not only questions on risk but also those on precautionary behaviour, should include a time frame.

Different types of precautionary actions were included in the Dutch study and these varied from not getting in touch with (wild) birds or poultry and not going to areas with avian influenza to paying more attention to hygiene and buying antiviral drugs or a face mask. As these are very different types of measures, this may have influenced how people have answered these questions. Measures like buying antiviral drugs or a face mask are more specific and concrete measures. In contrast to these specific measures, one might argue that respondents who answered that they took measures like not getting in touch with (wild) birds or poultry or not going to areas with avian influenza actually did report intentions rather than specific behaviours. One can raise the question whether all respondents who answered that they did not get in touch with (wild) birds or poultry actually did not touch poultry when they were confronted with these animals or whether they had the intention of not doing that when they would be confronted with these animals.

Although the Dutch study is one of the few studies that reported on actual precautionary measures related to avian influenza, questions remain about the validity of the results.

*Other measurement issues*

In measuring perceived severity, perceived vulnerability, response and self efficacy single and few item constructs were used and not multiple-item testing. For measurement of psychosocial constructs, it is often argued that use of multiple item assessments is to be preferred over single item measures in order to increase reliability and internal consistency (54, 55). However, several studies suggest little differences between single and multiple item assessments (56-58). However, because no psychometric research has been conducted for most of the measures used in the studies presented in this thesis, it is uncertain if the single item assessments used were valid and reliable.

Response efficacy and self efficacy are important elements in PMT and it has been shown that higher efficacy beliefs are necessary for people to engage in precautionary actions (54). In the studies in this thesis self efficacy and response efficacy were included in all studies, however, measurement of these concepts had its limitations. Because of the limited length of the questionnaire in the international survey, response and self efficacy were asked in general and not for specific measures, e.g. like washing hands or wearing a face mask. In the Dutch study response efficacy was asked for specific measures in preventing spread of avian influenza among birds and poultry, like vaccination of poultry or a ban on import of live poultry. Response efficacy was not measured for possible precautionary actions by individuals to protect themselves. Self efficacy was measured in general terms in one question, and not measured for specific measures like hygienic measures or limiting social contacts. Response efficacy and self efficacy may differ between a general notion of efficacy and efficacy beliefs for specific measures, this however was not measured.

## 9.3. Implications

This thesis has focused on step 3 of the model of planned health education and health promotion and has explored potential determinants of risk behaviour and precautionary actions related to emerging infectious diseases. The studies have concentrated mostly on making an inventory of risk perceptions in different populations and circumstances and focused primarily on SARS and avian influenza as relevant emerging infectious diseases. In theory, this step in intervention planning and development should indeed inform interventions. However, because our studies had an exploratory and preliminary character, the implications for public health are still limited, and more research is much needed. Nevertheless, some (preliminary) implications for public health practice can be derived from the studies described. First some implications for further research will be given.

### *9.3.1. Implications for research*

Research into risk perception of emerging infectious diseases is in its infancy and should be emerging itself. The studies presented in this thesis are examples of research that may form the basis for further studies, and our research certainly has raised questions for such further research. Also some of the methodological issues we have discussed have implications for research in the future.

- The differences in risk perception between countries, regions and population groups, as reported in chapters two and three, warrant more research into geographic and population differences. The results reported in this thesis suggest that such differences are not straightforwardly associated with differences in true risks or exposure. Further research is needed to investigate to what extent such differences are related to different levels of prevalence and incidence of diseases in countries or to, for example, cultural differences in risk perceptions in general.

- Outbreaks of (emerging) infectious diseases cannot be planned. To be able to conduct research to gain more insight in changes in risk perception and precautionary action over time and to measure whether specific interventions in the future may be effective, it is necessary to set up a research infrastructure beforehand with a longitudinal design. That

would enable research over time and measure possible changes related to outbreaks and other relevant incidents.

*Improving design of studies and measurement*

- As studies into risk perception of emerging infectious diseases are still in its infancy, more in-depth studies are needed to explore different concepts in more detail and to test theory. Behavioural laboratory research may be an appropriate option, allowing longer questionnaires that include multi-item assessments of all relevant constructs, and allowing manipulations of, for example, risk scenarios.

- For adequate comparison of results and further development of measures and questionnaires of risk perception research related to new emerging infectious diseases, it is important that questionnaires used are published and that the main measures are described in detail in the scientific papers reporting the research results. Brewer and Leppin have shown the importance of specific measures for measuring perceived severity and perceived vulnerability (8, 34). It is also important that the terminology used in questionnaires is consistent, or that the exact terminology which is used is described. For example, in research on avian influenza, for the infectious disease itself different terms have been used.

- The relevance of risk perception in predicting precautionary behaviours is dependent on response efficacy and self-efficacy of these behaviours. In measuring these efficacy beliefs, it is important to be as specific as possible and such specific measures should be included in future studies. Efficacy regarding, for example, different hygienic behaviours may differ, and a more general efficacy assessment may be of limited use.

*Research to enhance the control of infectious diseases during outbreaks*

- Based on more in-depth studies it would be advisable to develop a standard questionnaire which should be tested, adapted and finalized. Such a questionnaire could then be used during outbreaks of (emerging) infectious diseases. In the development of this questionnaire attention should be paid to:
    - Measuring perceived severity, perceived vulnerability and perceived susceptibility
    - Using a time frame for precautionary behaviour and conditioned questioning
    - Using multi-items to measure constructs like response and self efficacy
    - Measuring response and self efficacy linked to specific measures

In November 2008 a new study will start in which one of the aims is to develop such a questionnaire. The study should result in a questionnaire that is tested and validated and which can be used as a standard questionnaire during outbreaks. The latter means that the questionnaire should be relatively short so that it can be administered rapidly. Results should then be quickly analysed so that these can used as input for deciding on control measures and developing risk communication during the outbreak.

- It would be advisable to set up a representative panel, including enough respondents from ethnic communities, to monitor risk perception and different precautionary and risk behaviours. During a non-outbreak situation risk perception, behaviours, efficacy beliefs, knowledge and use of information could be measured once a year. If such a panel is available and a standard questionnaire would be available, consecutive measurements

could take place during the outbreak to monitor risk perception and possible changes related to the course of the outbreak. It would also be an instrument to inform control policies and risk communication and to measure the effects of these activities on knowledge, intention and behaviour.

*Other research suggestions*

- The role of stigma in control of emerging infectious diseases warrants further research. The studies among the Chinese communities showed that communities used specific sources for information. Jiang et al. showed that Chinese communities chose risk avoidance strategies because they were afraid that they would be stigmatized when wearing a face mask (18). Research on environmental risks has shown that communities can be stigmatized because of certain risks happening in their community (59). Research is needed in how risks may or may not be associated with specific groups. Outbreaks can take place in specific countries and communities abroad, and they then may be stigmatized (8). Also research is needed on the process within communities, not only to see whether they are stigmatized, but also what kind of strategies they engage in to prevent possible stigmatization and what the consequences may be for control of the disease.

- The studies in this thesis have focused on risk perception of general populations and specific communities like the Chinese. In the control of infectious diseases, risk perception of other groups, like health professionals, national and (local) politicians and policy makers are also important. Health professionals can be in the frontline of the control, sometimes during the SARS outbreak those working with SARS patients were exposed to large risks. How professionals perceive risks and possible protective actions is of great importance to ensure that health professionals will carry out their tasks (60-62). Insight in risk perception of politicians and policy makers is also important, as they will have to take decisions during outbreaks, and different aspects (apart from vulnerability and efficacy), such as accountability, will probably play a role in their decision making.

### *9.3.2. Implications for public health practice*

Although the studies reported in this thesis first of all imply further research, the results reported do have preliminary implications for public health practice. The results of our studies can hopefully help to enhance the quality and effectiveness of prevention and control of emerging infectious diseases.

- The studies in this thesis show that while perceived severity of avian influenza is high, perceived vulnerability and efficacy beliefs are relatively low. In information campaigns about avian influenza these aspects should receive specific attention.

- In international perspective efficacy beliefs in the Netherlands are relatively low. This has consequences for both the development of control measures and the information on such measures. In developing control plans for emerging infectious diseases it is important not to only consider what measures have the largest effect theoretically, but also to discuss (perceived) response and self efficacy. The effectiveness of mouth masks has recently been proved to reduce aerosol exposure (63). It is, however, not

known how people perceive the response efficacy of such masks or whether they feel able to wear them. A Hong Kong study comparing different non-pharmaceutical interventions showed limited adherence to wearing face masks in households (64). Ideally, such information should be available when deciding what preventive measures to focus on in the control of an outbreak. If possible, one wants to prevent that theoretically effective measures will not be effective in practice because people doubt their efficacy or feel unable to adhere to such measures. Priority should thus be given to enhance efficacy beliefs and improve user friendliness of (technical) measures so that self efficacy will be enhanced. In deciding about measures, those measures which are known to be effective and have a high response and self efficacy should be prioritized.

- It would be useful to already start developing information materials on avian influenza and an influenza pandemic and pre-test these. A first study has been published reporting on the effect of fear-arousal information about avian influenza on risk perception of school children in South Korea (65). While the information had effect on risk perception it did not have an effect on behaviour. Therefore, to ensure that effective risk communication and information strategies are in place before an outbreak happens, information materials should be developed, pre-tested and if necessary adapted. Testing such materials could take place as part of behavioural laboratory research on risk perception and risk communication.

- Specific attention should be given to prevention and control of (emerging) infectious diseases related to ethnic communities. Travel to and from countries of origin may pose risks for introduction of diseases in the Netherlands (and elsewhere), so monitoring outbreaks abroad in relation to ethnic communities is important. Timely and specific information – to be made available in different languages – for ethnic communities is also needed. Relevant information sources from countries of origin should be monitored, so that information from these sources can be taken into account when developing information in the Netherlands. Such a monitoring system might be something to coordinate on a European level (for example by the European Centre for Diseases Prevention and Control, ECDC), as ethnic communities may live in many countries. As trustworthiness of authorities may be perceived lower by ethnic communities, it is important to invest in rapid and relevant communication with these communities, including key figures from the communities as informal networks play an important role in communication.

- Trust is an important element in how risks are perceived and how people judge risk communication. If experts contradict each other this might enhance risk perception. In the control of emerging infectious diseases often situations are not clear. In the current thinking about avian influenza and the possibilities of an influenza pandemic there are uncertainties about issues such as the likelihood that H5N1 will cause a pandemic or when a new pandemic can be expected to take place. While it is clear that open communication leads to trust, it means that open communication should take place during uncertain times (66, 67). Public health authorities should engage in open communication and openly discuss the dilemmas they are facing. There is the dilemma that on the one hand authorities should prepare themselves for a pandemic, whereas on the other hand people should be informed that currently there is no acute risk. The question is how to engage best in such open communication at a time when some already speak of ‘flu planning fatigue’ (67). Public health authorities should

engage in open dialogue with both politicians and the general public, explain the uncertainties and involve them actively in thinking and developing communication.

- The studies reported in this thesis were informed by Protection Motivation Theory. This theory appears to be the most appropriate psychology theory available to further develop applied risk perception research for emerging infectious diseases, and to help to guide the development of preventive activities.

- Knowledge on risk perception is not only useful for the control of emerging infectious diseases, but can also be useful for the day-to-day practice of infectious diseases control. In the control of local outbreaks attention should also be given to factors as perceived severity and perceived vulnerability among those involved, as well as the perception of response and self efficacy of the measures proposed. Taking these factors into account in deciding about control measures and paying attention to them in risk communication may already enhance the effectiveness of day-to-day work.

### 9.4. General conclusion

Infectious diseases remain an important public health problem and new emerging infectious diseases may have world-wide and enormous public health as well as non-health (e.g. economic and social) consequences. Non-pharmaceutical prevention, based on precautionary and preventive behaviours of the population, will be essential in controlling outbreaks and preventing full-blown epidemics.

The model for planned health education and planned health promotion offers a framework for the development and evaluation of such non-pharmaceutical measures. To develop such measures, insight is necessary in correlates and determinants of protective and preventive behaviour, and risk perceptions are one relevant category of such potential behavioural determinants. Protection Motivation Theory offers a useful framework for identification of the importance of risk perceptions and other possible determinants for such behaviours. The studies in this thesis have made clear that perceived severity of emerging infectious diseases like SARS and avian influenza is high among the Dutch population as well as populations in a range of other countries and regions. Perceived vulnerability and efficacy beliefs, however, are much lower. Perceived vulnerability and efficacy beliefs are regarded as stronger drivers of preventive actions than perceptions of severity.

The studies in this thesis further indicate that certain population groups, in the case of SARS and avian influenza for example Chinese communities in Europe, deserve special attention in non-pharmaceutical management of emerging infectious diseases. Such population groups may run higher risks because of travel habits; they may use other information sources to make informed choices about precautions; and also be the target of stigmatization due to their specific situation.

The prevention and control of emerging infectious diseases and how to prepare for such situations is an important challenge for international, national and local health authorities. This thesis has provided further evidence for the importance of realistic risk perception for disease management. As public health workers, we need to use this knowledge to enhance

the quality and effectiveness of our work, both in the case of outbreaks of emerging infectious diseases, and also in the day-to-day practice of infectious diseases control.

## References


1. Lau JT, Yang X, Tsui H, Kim JH. Monitoring community responses to the SARS epidemic in Hong Kong: from day 10 to day 62. J Epidemiol Community Health 2003;57(11):864-70.
2. Leung GM, Lam TH, Ho LM, Ho SY, Chan BH, Wong IO, Hedley AJ. The impact of community psychological responses on outbreak control for severe acute respiratory syndrome in Hong Kong. J Epidemiol Community Health 2003;57(11):857-63.
3. Leung GM, Quah S, Ho LM, Ho SY, Hedley AJ, Lee HP, Lam TH. A tale of two cities: community psychobehavioral surveillance and related impact on outbreak control in Hong Kong and Singapore during the severe acute respiratory syndrome epidemic. Infect Control Hosp Epidemiol 2004;25(12):1033-41.
4. Quah SR, Hin-Peng L. Crisis prevention and management during SARS outbreak, Singapore. Emerg Infect Dis 2004;10(2):364-8.
5. 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(7):925-31.
6. Brug J, Aro AR, Oenema A, de Zwart O, Richardus JH, Bishop GD. SARS risk perception, knowledge, precautions, and information sources, the Netherlands. Emerg Infect Dis 2004;10(8):1486-9.
7. WHO. Summary of probable SARS cases with onset of illness from 1 November 2002 to 31 July 2003. 2004. Available at: http://www.who.int/csr/sars/country/table2004_04_21/en/index.html.
8. Leppin A, Aro AR. Risk perception related to SARS and avian flu: Theoretical foundations of current empirical research. International Journal of Behavioural Medicine 2009 - in press.
9. Lau JT, Tsui H, Kim JH, Griffiths S. Perceptions about status and modes of H5N1 transmission and associations with immediate behavioral responses in the Hong Kong general population. Prev Med 2006;43(5):406-10.
10. Lau JT, Kim JH, Tsui HY, Griffiths S. Anticipated and current preventive behaviors in response to an anticipated human-to-human H5N1 epidemic in the Hong Kong Chinese general population. BMC Infect Dis 2007;7:18.
11. Lau JT, Kim JH, Tsui H, Griffiths S. Perceptions related to human avian influenza and their associations with anticipated psychological and behavioral responses at the onset of outbreak in the Hong Kong Chinese general population. Am J Infect Control 2007;35(1):38-49.
12. Fielding R, Lam WW, Ho EY, Lam TH, Hedley AJ, Leung GM. Avian influenza risk perception, Hong Kong. Emerg Infect Dis 2005;11(5):677-82.
13. Kristiansen IS, Halvorsen PA, Gyrd-Hansen D. Influenza pandemic: perception of risk and individual precautions in a general population. Cross sectional study. BMC Public Health 2007;7(147):48.
14. Gupta RK, Toby M, Bandopadhyay G, Cooke M, Gelb D, Nguyen-Van-Tam JS. Public understanding of pandemic influenza, United Kingdom. Emerg Infect Dis 2006;12(10):1620-1.
15. Di Giuseppe G, Abbate R, Albano L, Marinelli P, Angelillo IF. A survey of knowledge, attitudes and practices towards avian influenza in an adult population of Italy. BMC Infect Dis 2008;8:36.
16. Figuie M, Fournier T. Avian influenza in Vietnam: chicken-hearted consumers? Risk Anal 2008;28(2):441-51.
17. Person B, Sy F, Holton K, Govert B, Liang A. Fear and stigma: the epidemic within the SARS outbreak. Emerg Infect Dis 2004;10(2):358-63.
18. Jiang X, Elam G, Yuen C, Voeten H, de Zwart O, Veldhuijzen I, Brug J. The impact of SARS on Chinese communities in the United Kingdom and the Netherlands: a qualitative study. International Journal of Behavioural Medicine 2009 - in press.
19. Boholm A. Comparative studies of risk perception: a review of twenty years of research. Journal of Risk Research 1998;1(2):135-163.
20. Renn O, Rohrmann B. Cross-cultural risk perception: a survey of empirical studies. Dordrecht: Kluwer Academic Publisher; 2000.
21. Lai JC, Tao J. Perception of environmental hazards in Hong Kong Chinese. Risk Anal 2003;23(4):669-84.
22. Ji L, Ziang Z, Usborne E, Guan Y. Optimism across cultures: in response to the Severe Acute Respiratory Syndrome Outbreak. Asian Journal Social Psychology 2004;7:25-34.
23. Weber EU, Hsee CK. Models and mosaics: investigating cross-cultural differences in risk perception and risk preference. Psychon Bull Rev 1999;6(4):611-7.
24. Schaller M, Murray DR. Pathogens, personality and culture: disease prevalence predicts world wide variability in sociosexuality, extraversion and openness tot experience. Journal of Personality and Social Psychology 2008;95(1):212-221.

25. Slovic P. Trust, emotion, sex, politics, and science: Surveying the risk-assessment battlefield. Risk Analysis 1999;19(4):689-701.
26. Gustafson PE. Gender differences in risk perception: theoretical and methodological perspectives. Risk Anal 1998;18(6):805-11.
27. Dosman DM, Adamowicz WL, Hrudey SE. Socioeconomic determinants of health- and food safety-related risk perceptions. Risk Anal 2001;21(2):307-17.
28. Leung GM, Ho LM, Chan SK, Ho SY, Bacon-Shone J, Choy RY, Hedley AJ, Lam TH, Fielding R. Longitudinal assessment of community psychobehavioral responses during and after the 2003 outbreak of severe acute respiratory syndrome in Hong Kong. Clin Infect Dis 2005;40(12):1713-20.
29. Flynn J, Slovic P, Mertz CK. Gender, race and perception of environmental health risks. Risk Analysis 1994;16(6):1101-1108.
30. Rosen AB, Tsai JS, Downs SM. Variations in risk attitude across race, gender, and education. Med Decis Making 2003;23(6):511-7.
31. Chauvin B, Hermand D, Mullet E. Risk perception and personality facets. Risk Anal 2007;27(1):171-85.
32. Lau JT, Yang X, Pang E, Tsui HY, Wong E, Wing YK. SARS-related perceptions in Hong Kong. Emerg Infect Dis 2005;11(3):417-24.
33. Sadique MZ, Edmunds WJ, Smith RD, Meerding WJ, de Zwart O, Brug J, Beutels P. Precautionary behavior in response to perceived threat of pandemic influenza. Emerg Infect Dis 2007;13(9):1307-13.
34. 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(2):136-45.
35. Norman P, Boer H, E.R. S. Protection Motivation Theory. In: Conner M, Norman P, editors. Predicting health behaviour. Maidenhead: Open University Press; 2005. p. 81-126.
36. Kempf AM, Remington PL. New challenges for telephone survey research in the twenty-first century. Annual Review of Public Health 2007;28:113-126.
37. Boland M, Sweeney MR, Scallan E, Harrington M, Staines A. Emerging advantages and drawbacks of telephone surveying in public health research in Ireland and the U.K. BMC Public Health 2006;6:208.
38. Dillman DA. Why choice of survey mode makes a difference. Public Health Rep 2006;121(1):11-3.
39. Keeter S, Miller C, Kohut A, Groves R, Presser S. Consequences of reducing nonresponse in a national survey. Public Opinion Q 2000;62(2):125-148.
40. Kraut R, Olson J, Banaji M, Bruckman A, Cohen J, Couper M. Psychological research online: report of Board of Scientific Affairs' Advisory Group on the Conduct of Research on the Internet. Am Psychol 2004;59(2):105-17.
41. Rhodes SD, Bowie DA, Hergenrather KC. Collecting behavioural data using the world wide web: considerations for researchers. J Epidemiol Community Health 2003;57(1):68-73.
42. Eysenbach G, Wyatt J. Using the Internet for surveys and health research. J Med Internet Res 2002;4(2):E13.
43. CBS. De digitale economie 2007. Den Haag: Centraal Bureau voor de Statistiek; 2008.
44. Tacken M, Mulder J, van der Hoogen H, Donkers J, Tiersma W, Verheij R, Braspenning J. Monitoring griepvaccinatiecampagne 2006. Utrecht: Nivel; 2007.
45. Geense P, Pels TVM. Opvoeding in Chinese gezinnen in Nederland. Assen: Van Gorcum; 1998.
46. Huang SL, Spurgeon A. The mental health of Chinese immigrants in Birmingham, UK. Ethn Health 2006;11(4):365-87.
47. Robb KA, Solarin I, Power E, Atkin W, Wardle J. Attitudes to colorectal cancer screening among ethnic minority groups in the UK. BMC Public Health 2008;8:34.
48. Papadopoulos I, Guo F, Lees S, Ridge M. An exploration of the meanings and experiences of cancer of Chinese people living and working in London. Eur J Cancer Care (Engl) 2007;16(5):424-32.
49. Bradby H, Varyani M, Oglethorpe R, Raine W, White I, Helen M. British Asian families and the use of child and adolescent mental health services: a qualitative study of a hard to reach group. Soc Sci Med 2007;65(12):2413-24.
50. van Buren LP, Joosten - van Zwanenburg E. Gezondheidsenquete onder Turken en Marokkanen van 16-84 jaar in Rotterdam 2003/2004. Onderzoek naar het effect van onderzoeksmethode op respons en representativiteit en op informatie over gezondheid, welzijn, leefstijl en zorggebruik. Rotterdam: GGD Rotterdam e.o.; 2006.
51. Weeks MF, Kulka RA, Lessler JT, Whitmore RW. Personal versus telephone surveys for collecting household health data at the local level. Am J Public Health 1983;73(12):1389-94.
52. Booth-Kewly S, Larson GE, Miyoshi DK. Social desirability effects on computerized and paper-and-pencil questionnaires. Computers in Human Behavior 2007;23(1):463-477.

53. Aro AR, Aalto A-M, Oenema A, Brug J, de Zwart O, Turtianen P. Risk perception, information needs, and risk communication related to SARS. European Journal of Public Health 2005;15(suppl 1):70-71.
54. Conner M, Norman P. Predicting Health Behaviour. Maidenhead: Open University Press; 2005.
55. Barofsky I, Erickson P, Eberhardt M. Comparison of a single global item and an index of a multi-item health status measure among persons with and without diabetes in the US. Qual Life Res 2004;13(10):1671-81.
56. Copfer AE, Ampel NM, Hughes TE, Gregor KJ, Dols CL, Coons SJ, Colgan K, Wu AW. The use of two measures of health-related quality of life in HIV-infected individuals: a cross-sectional comparison. Qual Life Res 1996;5(2):281-6.
57. Abdel KAM. Single- versus multi-item scales in measuring death anxiety. Death Studies 1998;22(8):763-772.
58. Cunningham PJ, Hadley J. Differences between symptom-specific and general survey questions of unmet need in measuring insurance and racial/ethnic disparities in access to care. Med Care 2007;45(9):842-50.
59. Gregory RS, Satterfield TA. Beyond perception: the experience of risk and stigma in community contexts. Risk Anal 2002;22(2):347-58.
60. DiGiovanni CJ, Reynolds B, Harwell R, Stonecipher EB, Burkle FMJ. Community reaction to bioterrorism: prospective study of simulated outbreak. Emerging Infectious Diseases 2003;9(6):708-712.
61. Imai T, Takahashi K, Hasegawa N, Lim MK, Koh D. SARS risk perceptions in healthcare workers, Japan. Emerg Infect Dis 2005;11(3):404-10.
62. Koh D, Lim MK, Chia SE, Ko SM, Qian F, Ng V, Tan BH, Wong KS, Chew WM, Tang HK, Ng W, Muttakin Z, Emmanuel S, Fong NP, Koh G, Kwa CT, Tan KB, Fones C. Risk perception and impact of Severe Acute Respiratory Syndrome (SARS) on work and personal lives of healthcare workers in Singapore: what can we learn? Med Care 2005;43(7):676-82.
63. van der Sande M, Teunis P, Sabel R. Professional and home-made face masks reduce exposure to respiratory infections among the general population. PLoS ONE 2008;3(7):e2618.
64. Cowling BJ, Fung RO, Cheng CK, Fang VJ, Chan KH, Seto WH, Yung R, Chiu B, Lee P, Uyeki TM, Houck PM, Peiris JS, Leung GM. Preliminary findings of a randomized trial of non-pharmaceutical interventions to prevent influenza transmission in households. PLoS ONE 2008;3(5):e2101.
65. Kim P, Sorcar P, Um S, Chung H, Lee YS. Effects of episodic variations in web-based avian influenza education: influence of fear and humor on perception, comprehension, retention and behavior. Health Educ Res 2008.
66. Pitrelli N, Sturloni G. Infectious diseases and governance of global risks through public communication and participation. Ann Ist Super Sanita 2007;43(4):336-43.
67. Menon KU. Risk communications: in search of a pandemic. Ann Acad Med Singapore 2008;37(6):525-10.

**Summary**

The outbreak of SARS in 2003 and the possible risk of an influenza pandemic have led to a revived attention to prevention and control of infectious diseases. Research efforts have intensified to develop effective prevention and around the world health authorities are preparing themselves for outbreaks of emerging diseases. Risk perceptions among the general public and populations at risk may influence people's willingness to comply with health protection measures. This thesis addresses risk perceptions of emerging infectious diseases as SARS and avian influenza and explores potential determinants of preventive actions.

**Chapter one** is the introduction to this thesis and describes the risk of outbreaks of new emerging diseases taking place in what can be called a risk society, i.e. a society which wants to exclude risks as much as possible and considers authorities responsible for the prevention of, or protection against, risks. The effectiveness of the control of outbreaks of new emerging infectious diseases will be largely dependent on the behaviour of the population and their willingness to adhere to recommended preventive measures. For promotion of adequate precautionary behaviour among the population, public health authorities need to know how people perceive risks, how they perceive the effectiveness and acceptance of interventions and whether they will trust and be willing and able to use the information from public health authorities. Based on earlier outbreaks of infectious diseases, there is only limited information about these issues.

To develop successful public health interventions a planned approach is crucial. The model for planned health education and health promotion is used as the framework for this thesis. This model describes a five-step theory and evidence-based process from an analysis of important health problems via identification of risk factors and determinants of exposure to such risk factors, to intervention development and evaluation. Step 1 of this model analyzes health and quality of life. In 2003 the world was confronted with Severe Acute Respiratory Syndrome (SARS), which led to 8.098 cases and 774 fatalities. SARS was controlled through traditional public health measures like isolation and quarantine. Since 2003 there have been outbreaks of avian influenza among birds and poultry in 63 countries and 382 humans have been infected, of whom 241 died in 14 countries. There is the possible risk that avian influenza may develop into a virus that can spread easily from human-to-human and could start an influenza pandemic. It has been estimated that an influenza pandemic in the Netherlands could lead to 5 million people being infected with 5.000 fatalities, according to the so-called 'mild' scenario.

Step 2 of the model analyzes the risk factors, including risk behaviours and potentially protective actions. SARS and avian influenza are both viruses that are transmitted through the respiratory tract by means of droplet infection. This means that day-to-day behaviour that involves human contact poses a risk. For the control of SARS and avian influenza pharmaceutical and non-pharmaceutical measures have been identified; the latter include hand hygiene, respiratory etiquette, the use of masks and social distancing measures. For these measures to be effective people will have to change their behaviour.

The main focus of this thesis is on step 3 of the model; the analysis of determinants of behaviour. Protection Motivation Theory (PMT) forms the theoretical basis of the studies. Central to the PMT are the concepts of perceived severity of a risk and the perceived vulnerability of an individual for a risk, which influence threat appraisal and is supposed to lead to protection motivation. Two other key elements in the theory are response efficacy and

self efficacy – i.e. if people perceive protective behaviours to be effective and if they have confidence in their abilities to engage in such behaviours - which form important conditions before people will engage in protective behaviour.

While studies into risk perception of emerging infectious diseases are relatively new, there is a tradition of research related to technological and environmental risks. The few available recent studies into risk perception of SARS and avian influenza in Europe and Asia indicate that they are considered important health problems.

In this thesis the aim is to answer the following research issues and questions. 1. How are the risks of new emerging infectious diseases like SARS and human avian influenza perceived? 2. How do risk perceptions of SARS and/or avian influenza (a) compare to risk perceptions of other diseases; (b) differ according to sociodemographic variables; (c) differ between countries; and (d) change over time? 3. How do risk perceptions relate to precautionary actions and to other potential determinants of such actions?

In **chapter two** the results are described of an international study in 5 countries in Europe and 3 countries in Asia into risk perception of SARS. In autumn 2005 perceived threat, perceived severity, perceived vulnerability, response and self efficacy for SARS and eight other diseases (i.e. tuberculosis, diabetes, common cold) were studied using a computer-assisted telephone survey among 3,436 respondents. A combined measure of perceived threat was constructed based on perceived severity and perceived vulnerability. Perceived threat of SARS in case of an outbreak in the country was higher than that of other diseases. Perceived severity of SARS in particular was high compared to other diseases, while perceived vulnerability was at an intermediate level. Perceived threat for SARS varied between countries in Europe and Asia, with a higher perceived severity of SARS in Europe and a higher perceived vulnerability in Asia. Response and self-efficacy for SARS were higher in Asia as compared to Europe. In multiple linear regression analyses, country was strongly associated with perceived threat. The relatively high perceived threat for SARS indicates that it is seen as a public health risk and offers a basis for communication in case of an outbreak.

Based on the same survey, in **chapter three** the focus is on risk perception of avian influenza in Europe and Asia. Overall 45% of respondents thought they were likely or very likely to become infected with avian influenza if an outbreak occurred in their country. Both perceived severity and perceived vulnerability were higher in Europe as compared to Asia. Efficacy beliefs, however, were higher in Asia than in Europe. Risk perception and efficacy beliefs before and after the introduction of avian influenza among birds in Europe in the autumn 2005 did not differ significantly. In multivariate analyses country, age and gender were associated with perceived threat and self efficacy, while response efficacy was associated with country. The low level of self efficacy suggests that it is important to pay specific attention to how self efficacy can be increased in prevention activities to ensure adherence to preventive measures.

In **chapter four** risk perception of avian influenza is studied based on data collected in the Netherlands in March 2006. Using an internet panel with 579 respondents the study showed that perceived threat of avian influenza was high, with a score of 3.5 on a scale from 1-5; 24% of the respondents thought that a reasonable amount of protection against avian influenza was possible and 28% felt reasonable sure that they could protect themselves. A higher response and self efficacy were associated with a lower perceived threat. Respondents who perceived a higher threat had taken more preventive measures. At least one preventive measure had been

taken by 38% of the respondents. All respondents had heard of avian influenza. Television was the most important source of information on the topic. Although perceived threat was relatively high, the low level of self efficacy again points out that that this issue requires attention.

**Chapter five** describes the result of seven consecutive surveys that were conducted between March 2006 to March 2007 in the Netherlands, a period in which no H5N1 infections were reported in either animals or humans in this country. The study explored changes in risk perceptions over time, and assessed the impact of relevant events on these perceptions. In total 3,840 respondents participated in the study and the response rate was 64%. Perceived severity of infection of humans with avian influenza was high with a score of 4.6 on a scale of 1 – 5, and remained stable. Between 90% and 94% perceived avian influenza as a severe or very severe disease. Perceived vulnerability was much lower and decreased slightly during the observation period, from 23% of respondents who felt (very) vulnerable to 17%. The amount of information received about the disease decreased during the same period from 14% to 5% of respondents who had received much or very much information and the proportion of respondents who provided correct answers to three or more knowledge questions decreased from 43% to 22%. Substantial proportions of respondents, varying between 38% and 50%, reported taking one or more preventive measures with staying away from wild birds and poultry remaining high throughout the period. The decrease of knowledge over time indicates the need to keep the public well informed continually.

In **chapter six** the focus is on the relationship between risk perception and precautionary behaviour. Based on the seven web-based surveys we reported that almost half of the respondents (46%) reported taking one or more preventive measures, with 36% reporting to have stayed away from (wild) birds or poultry. In multivariate logistic regression analysis the following factors were positively associated with self-reported engagement in preventive measures: time of the survey, higher age, lower level of education, non-Dutch ethnicity, vaccinated against influenza, higher perceived severity, higher perceived vulnerability, higher self efficacy, lower level of knowledge, more information about avian influenza, and thinking more about avian influenza.

**Chapter seven** describes the results of the first of two studies among Chinese communities. A cross-sectional survey by means of self-administered written questionnaires was conducted in 2003 in the Chinese community in Rotterdam; 222 respondents were recruited through Chinese schools, a church, women's groups and cultural organisations. The results of this study were compared with the results of a Dutch Internet sample of 373 respondents from June 2003. In 2003, the year of the SARS outbreak, 44% of the Chinese respondents had travelled to or met people from South-East Asia. SARS-related knowledge was lower in the Chinese community compared to the Dutch population sample. Respondents from the Chinese community were likely to express worries about the risk of SARS-infection (53%) and significantly more likely to have a high risk perception than the Dutch sample (15% versus 3%). Almost every Chinese respondent reported taking precautionary measures, most often postponing travel. Over half of the respondents took diagnostic measures, such as paying attention to coughing. Chinese media were used most often for SARS-related information and thought to be the most trustworthy. Precautionary measures and diagnostic measures were higher in the Chinese community than in the Dutch population sample. As there was considerable risk of introduction of SARS into the Netherlands due to the extensive travel to, and contact with, people from South-East Asia, and because ethnic communities may be more

prone to use media from their country of origin than Dutch media, specific attention for ethnic communities, such as the Chinese community, is warranted.

In **chapter eight** the results of a self-administered questionnaire among 300 British/Dutch Chinese, part of whom participated in focus group discussions, are discussed. These results were compared to data obtained from a computer-assisted telephone survey among the general population in the UK and the Netherlands (n=800; part of the international survey reported in chapter 2). British/Dutch Chinese got most information about emerging diseases from family and friends, followed by Chinese media. They had less confidence than the comparison population in their doctor, government agencies and consumer/patient interest groups. Their knowledge of SARS was high. They had a lower perceived threat than general populations with regard to SARS and avian flu, due to a lower perceived severity. They had higher self-efficacy beliefs regarding SARS and avian flu prevention.

In **chapter nine**, the General Discussion, the research questions are revisited and we discuss the extent to which these were answered based on the studies presented in this thesis. The results are put into perspective, limitations of the studies are discussed and suggestions are made for further research and public health practice. The main conclusions are that SARS and avian influenza are perceived as severe diseases, but perceived vulnerability for these diseases is at an intermediate to low level. For both SARS and avian influenza most people perceive their personal risk to be lower than that of others of the same age and gender, indicating that there is an optimistic bias regarding these infectious diseases. Self-efficacy for prevention was rather low in the Netherlands, and was lower in countries in Europe as compared to Asian countries. Being female, a lower level of education and in some cases a higher age are associated with higher perceived vulnerability for SARS and avian influenza. There is only a very limited change over time in the perceived vulnerability of avian influenza in the Netherlands, perceived severity remained stable; and no effect of outbreak-related events on risk perception was found.

A higher perceived severity and perceived vulnerability, and a higher self-efficacy were associated with a higher likelihood of reporting to take precautionary actions against avian influenza.

It is recommended to conduct more research into geographical differences in risk perception, to carry out more in-depth studies to explore different concepts in more detail and to test theory and to develop a standard-questionnaire and an ongoing research infrastructure to be able to study risk perception and precautionary behaviour before and during outbreaks. For public health activities it is recommended to start developing and pre-testing information campaigns and thereby pay specific attention to efficacy beliefs. Specific attention should be paid to prevention and control of (emerging) infectious diseases related ethnic communities, the possible risk of introduction of diseases, the use of information sources from countries of origin and the need for timely and specific information.

**Samenvatting**

De uitbraak van SARS in 2003 en het risico van een grieppandemie hebben de afgelopen jaren geleid tot hernieuwde aandacht voor de preventie en bestrijding van infectieziekten. Er wordt meer onderzoek gedaan en overal ter wereld werken gezondheidsautoriteiten aan de voorbereiding van de bestrijding van uitbraken van opkomende infectieziekten. De risicoperceptie van zowel het algemene publiek, als van risicogroepen kan de bereidheid van mensen om aanbevolen preventieve maatregelen op te volgen beïnvloeden. In dit proefschrift wordt ingegaan op de risicoperceptie betreffende opkomende infectieziekten als SARS en vogelgriep en mogelijke determinanten van preventief gedrag.

In **hoofdstuk 1** – de inleiding van het proefschrift – worden de risico's van uitbraken van opkomende infectieziekten in een zogenoemde risicomaatschappij beschreven. Een maatschappij waarin het doel is het risico zoveel mogelijk uit te sluiten en waarin de overheid verantwoordelijk wordt gehouden voor de preventie en bescherming tegen risico's. Of uitbraken van nieuwe opkomende infectieziekten effectief bestreden kunnen worden hangt voor een belangrijk deel af van het gedrag van de bevolking en in hoeverre deze preventieve adviezen zal opvolgen. Om adequaat voorzorgsgedrag te stimuleren moeten gezondheidsautoriteiten inzicht hebben in hoe mensen risico's ervaren, hoe ze de effectiviteit en aanvaardbaarheid van interventies beoordelen, of ze de informatie van gezondheidsautoriteiten willen vertrouwen en bruikbaar vinden. Tot nu toe is er, op basis van verschillende uitbraken van infectieziekten, maar beperkte informatie over deze onderwerpen.

Om succesvolle interventies ter verbetering van de volksgezondheid te ontwikkelen is een planmatige aanpak cruciaal. In dit proefschrift wordt het model voor planmatige gezondheidsvoorlichting en gezondheidsbevordering als basis gebruikt. Dit model beschrijft hoe in vijf stappen op basis van theorieën en bewijzen via een analyse van belangrijke gezondheidsproblemen, en via het in kaart brengen van risicofactoren en determinanten van blootstelling aan deze factoren, tot de de ontwikkeling en evaluatie van interventies kan worden gekomen.

In stap 1 van dit model wordt de gezondheid en kwaliteit van leven geanalyseerd.
In 2003 werd de wereld geconfronteerd met *Severe Acute Respiratory Syndrome* (SARS); er waren 8.098 gevallen van SARS, waarvan er 774 overleden. SARS werd onder controle gebracht met gebruikmaking van traditionele bestrijdingsmaatregelen zoals isolatie en quarantaine. Sinds 2003 zijn er uitbraken van aviaire influenza, vogelgriep, geweest onder vogels en pluimvee in 63 landen. 382 mensen zijn geïnfecteerd geraakt met vogelgriep, van wie er 241 zijn overleden, in 14 landen. Het risico bestaat dat het huidige virus dat vogelgriep veroorzaakt zich ontwikkelt tot een virus dat makkelijk van mens-op-mens wordt overgedragen en het begin zou kunnen vormen van een influenzapandemie. De schatting is dat een influenzapandemie, volgens het 'milde' scenario, in Nederland zou kunnen leiden tot vijf miljoen geïnfecteerde mensen en vijfduizend sterfgevallen.

In stap 2 van het model worden de risicofactoren geanalyseerd inclusief het gedrag dat risico met zich mee kan brengen en mogelijk beschermend gedrag. SARS en vogelgriep zijn beiden virussen die worden overgedragen via de keel en neus door zeer kleine druppeltjes. Dit betekent dat alledaags gedrag tussen mensen een risico op infectie met zich meebrengt . Bij de bestrijding van SARS en vogelgriep kan onderscheid worden gemaakt tussen farmaceutische en non-farmaceutische bestrijdingsmaatregelen. Tot de laatste categorie behoren maatregelen als het in acht nemen van persoonlijke hygiëne door bijvoorbeeld handen te wassen en bij het

hoesten en niezen tissues te gebruiken, het gebruik van mondmaskers en maatregelen die het aantal nauwe contacten tussen mensen beperken.

Willen dit soort maatregelen effectief zijn, dan is het nodig dat mensen hun gedrag aanpassen. De kern van dit proefschrift vormt stap 3 van het model; de analyse van determinanten van het gedrag. De Protectie Motivatie Theorie (PMT) vormt de theoretische basis van dit proefschrift. Centraal onderdeel in de PMT zijn de concepten 'gepercipieerde ernst' en 'gepercipieerde kwetsbaarheid' van een persoon betreffende een risico. De perceptie van ernst en kwetsbaarheid leidt tot een inschatting van de bedreiging, en als die groot genoeg is tot de intentie om zichzelf te beschermen. Twee andere belangrijke elementen van de theorie zijn de 'responseffectiviteit' en de 'eigen effectiviteit'. 'Responseffectiviteit' gaat over de vraag of maatregelen succesvol kunnen zijn, en 'eigen effectiviteit' met het vertrouwen in het eigen handelen om die maatregelen uit te voeren. Mensen zullen het gevoel moeten hebben dat er effectieve maatregelen zijn die voor henzelf uitvoerbaar zijn, alvorens ze deze beschermende maatregelen zullen nemen.

Hoewel het onderzoek op het terrein van risicoperceptie en infectieziekten relatief nieuw is, is er al wel een onderzoekstraditie op het terrein van technische en milieugerelateerde risico's en de perceptie van die risico's. Het beperkte aantal studies naar de risicoperceptie van SARS en vogelgriep dat de afgelopen jaren in Azië en Europa is uitgevoerd, wijst er op dat mensen SARS en vogelgriep als belangrijke gezondheidsproblemen zien.

Doel van dit proefschrift is om de volgende onderzoeksvragen te beantwoorden: 1. Hoe worden de risico's van opkomende infectieziekten als SARS en vogelgriep gepercipieerd? 2a. Hoe verhoudt de risicoperceptie van SARS en vogelgriep zich tot de risicoperceptie van andere ziekten, (b) wat is de invloed van demografische factoren op risicoperceptie, (c) zijn er eventuele verschillen in risicoperceptie tussen landen en (d) verandert risicoperceptie in de loop der tijd? 3. Wat is de betekenis van risicoperceptie voor voorzorgsgedrag en welke andere determinanten spelen hierbij een rol?

In **hoofdstuk 2** worden de resultaten beschreven van een internationaal vergelijkend onderzoek naar de risicoperceptie van SARS in vijf Europese en drie Aziatische landen.
In het najaar van 2005 werd met behulp van een telefonisch steekproef gepercipieerde dreiging, gepercipieerde ernst, gepercipieerde kwetsbaarheid voor SARS en acht andere ziekten (bijvoorbeeld tuberculose, diabetes en verkoudheid) en 'responseffectiviteit' en 'eigen effectiviteit' onderzocht bij 3.436 respondenten. Een gecombineerde maat van gepercipieerde dreiging werd geconstrueerd door gepercipieerde ernst en gepercipieerde kwetsbaarheid te combineren.

De gepercipieerde dreiging van SARS in het geval van een uitbraak in het eigen land was hoger dan voor andere ziekten. Met name de gepercipieerde ernst van SARS was hoog in vergelijking tot andere ziekten; de gepercipieerde kwetsbaarheid was op een gemiddeld niveau. De gepercipieerde dreiging van SARS verschilde tussen landen in Europa en Azië. In Europa was gepercipieerde ernst hoger , terwijl in Azië de kwetsbaarheid hoger gepercipieerd werd. Responseffectiviteit en eigen effectiviteit in relatie tot SARS waren hoger in Azië dan in Europa. Multi-lineaire regresssieanalyse maakte duidelijk dat de factor land sterk verbonden was met gepercipieerde dreiging. De relatief hoog gepercipieerde dreiging van SARS wijst erop, dat SARS wordt gezien als een belangrijk volksgezondheidsprobleem. Dat is een goede basis voor risicocommunicatie, mocht zich een uitbraak voordoen.

Op basis van dezelfde telefonische steekproef, zoals beschreven in hoofdstuk 2, wordt in **hoofdstuk 3** de risicoperceptie van aviaire influenza in Europa en Azië beschreven. In totaal dacht vijfenveertig procent van de respondenten dat het (erg) waarschijnlijk was dat zij met vogelgriep zouden worden geïnfecteerd als er sprake was van een uitbraak in hun eigen land. Zowel de gepercipieerde ernst, als de gepercipieerde kwetsbaarheid was hoger in Europa vergeleken met Azië. Respons- en eigen effectiviteit waren echter hoger in Azië. Er was geen verschil in zowel de risicoperceptie als de opvattingen over effectiviteit voor en na de ontdekking van vogelgriep bij vogels in Europa in het najaar van 2005. In de multivariate analyse bleken de factoren land, leeftijd en geslacht verbonden met gepercipieerde dreiging en eigen effectiviteit, terwijl responseffectiviteit enkel verband hield met de factor land. Het lage niveau van eigen effectiviteit suggereert dat het belangrijk is om in voorlichting specifiek aandacht te besteden aan hoe de eigen effectiviteit versterkt kan worden om te zorgen dat preventieve maatregelen ook daadwerkelijk worden uitgevoerd.

In **hoofdstuk 4** wordt de risicoperceptie van vogelgriep beschreven op basis van gegevens die in Nederland in maart 2006 zijn verzameld. Voor de studie werd gebruik gemaakt van een internetpanel met 579 respondenten. De gepercipieerde dreiging van vogelgriep in Nederland was, met name indien zich een uitbraak onder mensen zou voordoen, hoog: 3,5 (schaal 1 – 5). 24% van de respondenten dacht dat er tenminste een redelijke mate van bescherming tegen vogelgriep mogelijk was en 28% was er ook redelijk zeker dat zij zichzelf zouden kunnen beschermen. Meer vertrouwen in maatregelen en het eigen kunnen was significant verbonden met een lagere risicoperceptie van infecties door vogelgriep. Respondenten met een hogere gepercipieerde dreiging hadden meer preventieve maatregelen genomen. 38% van de respondenten had tenminste één maatregel genomen om infectie door het vogelgriepvirus te voorkomen. Alle respondenten hadden over vogelgriep gehoord. Televisie was de belangrijkste bron van informatie. Hoewel de gepercipieerde dreiging relatief hoog scoorde, wijst het lagere niveau van eigen effectiviteit erop dat dit onderdeel specifieke aandacht verdient in voorlichting.

In **hoofdstuk 5** wordt ingegaan op de resultaten van zeven opeenvolgende surveys die in Nederland werden uitgevoerd, van maart 2006 tot en met maart 2007. Een periode dat er geen infecties met H5N1 (vogelgriep) werden gerapporteerd in Nederland; noch bij vogels, noch bij mensen. In de studie werden veranderingen in risicoperceptie in de loop der tijd onderzocht en de eventuele invloed van specifieke gebeurtenissen op risicoperceptie. Er werd door in totaal 3.840 respondenten aan de onderzoeken deelgenomen, het responspercentage bedroeg 64%. De gepercipieerde ernst van infecties van mensen met vogelgriep was hoog met een score van 4.6 op een schaal van 1 tot 5 en bleef gedurende de periode stabiel. Tussen de 90 en 94% van de respondenten percipieerde vogelgriep als een ernstige of zeer ernstige ziekte. Gepercipieerde kwetsbaarheid was veel lager en nam gedurende de studieperiode af, van 23% van de respondenten die zich zeer kwetsbaar voelden tot 17%. De hoeveelheid informatie die respondenten over vogelgriep hadden ontvangen gedurende deze periode nam af van 14% naar 5% van de respondenten die (heel) veel informatie hadden ontvangen. Het aandeel van respondenten die op drie of meer van de vier kennisvragen het juiste antwoord hadden daalde eveneens van 43% tot 22%. Een aanzienlijk deel van de respondenten, tussen de 38% en 50%, gaf aan één of meer preventieve maatregelen te hebben genomen om infectie met vogelgriep te voorkomen; gedurende de hele periode gaven veel mensen aan uit de buurt van wilde vogels en pluimvee te blijven. De afname van het kennisniveau gaandeweg de periode wijst erop, dat het belangrijk is het publiek goed geïnformeerd te houden.

De focus van **hoofdstuk 6** richt zich op de relatie tussen risicoperceptie en voorzorgsgedrag. Uit de zeven opeenvolgende surveys blijkt dat bijna de helft van de respondenten (46%) één of meer voorzorgsmaatregelen heeft genomen, waarbij 36% aangaf weggebleven te zijn bij (wilde) vogels en pluimvee. In de multivariate logistische regressieanalyse waren de volgende factoren verbonden met het nemen van voorzorgsmaatregelen: het moment van de survey, een hogere leeftijd, een lager opleidingsniveau, een niet-Nederlandse etniciteit, tegen normale griep gevaccineerd zijn, een hogere gepercipieerde ernst, een hogere gepercipieerde kwetsbaarheid, een hogere eigen effectiviteit, een lager kennisniveau, meer informatie over vogelgriep en vaker over vogelgriep denken.

In **hoofdstuk 7** worden de resultaten beschreven van de eerste van twee onderzoeken onder Chinese gemeenschappen. In 2003 werd een cross-sectioneel onderzoek uitgevoerd bij de Chinese gemeenschap in Rotterdam aan de hand van schriftelijke vragenlijsten. Er werden 222 deelnemers geworven via Chinese scholen, een kerk, vrouwengroepen en culturele organisaties. De resultaten van deze steekproef werden vergeleken met de resultaten van een onderzoek via internet onder 373 Nederlanders in juni 2003. In 2003, het jaar van de SARS-uitbraak, had 44% van de Chinese respondenten of zelf naar Zuidoost-Azië gereisd of mensen uit die regio ontmoet. De SARS-gerelateerde kennis was lager in de Chinese gemeenschap dan onder de Nederlandse respondenten. Respondenten uit de Chinese gemeenschap (53%) waren bezorgd over het risico van een infectie met SARS en hadden significant vaker een hogere risicoperceptie dan binnen de Nederlandse steekproef (15% vergeleken met 3%). Bijna alle Chinese respondenten gaven aan voorzorgsmaatregelen genomen te hebben. Het meest gerapporteerd werd het uitstellen van een reis. Meer dan de helft van deze groep had ook diagnostische maatregelen genomen, zoals letten op hoesten. De Chinese media werden het meest gebruikt om informatie over SARS te verkrijgen en werden ook het meest betrouwbaar gevonden. Respondenten uit de Chinese gemeenschap gaven vaker aan voorzorgs- en diagnostische maatregelen te hebben genomen, vergeleken met Nederlandse respondenten. Het feit dat er een reëel en aanzienlijk risico was op introductie van SARS in Nederland door zowel het reisverkeer met, als de contacten met mensen uit Zuidoost Azië, en het feit dat etnische gemeenschappen, zoals de Chinese gemeenschap, vooral gebruik maken van media afkomstig uit het land van herkomst, betekent dat het belangrijk is dat er specifieke aandacht komt in de infectieziektebestrijding voor etnische gemeenschappen zoals de Chinese.

De resultaten van een schriftelijke vragenlijst bij driehonderd Chinese Nederlanders en Chinese Engelsen worden beschreven in **hoofdstuk 8**. Een deel van deze groep nam ook deel aan focusgroepgesprekken. De resultaten van de schriftelijke vragenlijsten werden vergeleken met die van een telefonisch onderzoek onder de algemene bevolking in Nederland en het Verenigd Koninkrijk (N=800; dit betrof een deel van het internationale onderzoek zoals beschreven in hoofdstuk 2). Nederlandse en Engelse Chinezen ontvingen de meeste informatie over opkomende infectieziekten van familie en vrienden en daarna van de Chinese media. In vergelijking met de algemene bevolking hadden zij minder vertrouwen in hun arts, de nationale autoriteiten en patiënten- en consumentenorganisaties. De kennis van SARS was hoog bij de Engelse/Nederlandse Chinese gemeenschappen; de ervaren dreiging met betrekking tot SARS en vogelgriep was lager, met name voortkomend uit een lager gepercipieerde ernst. De Engelse/Nederlandse Chinese gemeenschappen gaven aan een hogere eigen effectiviteit te hebben voor de preventie van SARS en vogelgriep.

In **hoofdstuk 9**, de algemene discussie, worden de onderzoeksvragen opnieuw bekeken en wordt besproken in hoeverre deze vragen zijn beantwoord op basis van de studies beschreven in het proefschrift. De resultaten van de studies worden in perspectief gezet door ze te

vergelijken met de literatuur, de beperkingen van de studies worden besproken en er worden suggesties gedaan voor verder onderzoek en voor de praktijk van de publieke gezondheidszorg. De belangrijkste conclusies zijn dat SARS en vogelgriep worden gepercipieerd als ernstige ziekten, maar dat de gepercipieerde kwetsbaarheid voor deze ziekte op een laag of gemiddeld niveau is. Voor SARS en vogelgriep percipiëren de meeste mensen hun eigen risico als lager dan dat van andere mensen van hun eigen leeftijd of geslacht; dit wijst op een zogenaamde optimistische *bias* met betrekking tot deze infectieziekten. De ervaren eigen effectiviteit inzake maatregelen om SARS en vogelgriep te voorkomen is in Nederland relatief laag en was in Europa lager vergeleken met de Aziatische landen in de studie. Vrouw zijn, een lager opleidingsniveau en soms een hogere leeftijd hangen samen met een hogere ervaren kwetsbaarheid voor SARS en vogelgriep. De ervaren kwetsbaarheid van SARS verandert maar zeer beperkt gedurende de tijd, terwijl de gepercipieerde ernst stabiel blijft en er geen effect is van kleinschalige uitbraken op de risicoperceptie van vogelgriep.
Een hogere gepercipieerde ernst en een hogere gepercipieerde kwetsbaarheid, evenals een hogere eigen effectiviteit, zijn geassocieerd met een grotere kans op het nemen van voorzorgsmaatregelen tegen vogelgriep.

Eén van de aanbevelingen is om meer onderzoek te doen naar onder andere de geografische verschillen in risicoperceptie, maar ook om meer diepgaande studies uit te voeren om de verschillende concepten meer in detail te onderzoeken, om theorieën te testen, om een standaardvragenlijst te ontwikkelen en om een onderzoeksstructuur op te zetten om zowel voor, als tijdens uitbraken onderzoek te kunnen doen naar risicoperceptie en voorzorgsgedrag. Voor de praktijk van de publieke gezondheidszorg is één van de aanbevelingen om te beginnen met het ontwikkelen en pre-testen van informatiecampagnes en daarbij specifiek aandacht te besteden aan de respons- en eigen effectiviteit. Specifieke aandacht moet worden besteed aan de preventie en bestrijding van (opkomende) infectieziekten in relatie tot etnische gemeenschappen, zowel wat betreft het mogelijke risico op introductie van infectieziekten via deze groepen, en het gebruik van informatiebronnen uit het land van herkomst, als vooral ook het belang van tijdige en relevante informatie voor deze groepen.

**Dankwoord**

Het willen schrijven van een proefschrift kwam bij mij voort uit een mengeling van wetenschappelijke interesse, de wil te bewijzen goed en deugdelijk onderzoek te kunnen verrichten, ambitie, plichtsbesef ('een doctorandus is iemand die nog moet promoveren') en – toen ik eenmaal was begonnen – de combinatie van gegrepen zijn door het onderwerp en de noodzaak datgene af te maken waar je aan begonnen bent kortom: gewoon doorgaan. Ik had het promotieonderzoek echter niet kunnen voltooien zonder de steun van velen; dank daarvoor. Een aantal mensen wil ik in het bijzonder bedanken.

Allereerst natuurlijk Hans Brug als mijn promotor. Onze eerste ontmoeting was in café Rotterdam. Toen bekend werd dat jij als hoogleraar was benoemd aan het Erasmus MC suggereerde mijn collega Katy van den Hoek een ontmoeting; hier was immers een gedreven nieuwe hoogleraar die aan de Universiteit Maastricht al veel onderzoek had gedaan op het terrein van gedragsverandering. Zulke kennis ontbrak grotendeels bij het Erasmus MC en dus wilden wij de kans grijpen om je te verleiden tot samenwerking op het terrein van onderzoek naar gedrag in relatie tot infectieziekten en de effecten van interventies. Dat is het begin geweest van voor mij een bijzondere en inspirerende samenwerking. Dit onderzoek is mede het resultaat van ideeën die zondags per mail heen en weer gingen om snel in te spelen op de actualiteit van SARS en vogelgriep. Tijdens het onderzoek en het schrijven van de artikelen was je scherpzinnig in je commentaar, gaf je richting waar nodig en hielp je me herinneren dat onderzoek leuk is en prioriteit moet blijven houden naast management. Veel dank en ik hoop dat ook in de toekomst zich kansen voor zulke samenwerking zullen voordoen.

Jan Hendrik Richardus, niet alleen co-promotor maar ook projectleider van het grote Europese SARSControl project waar drie van de artikelen uit dit proefschrift uit voortkomen. Jan Hendrik, niet alleen kon zo het onderzoek plaatsvinden, maar je commentaren waren to the point en zorgden ook voor zorgvuldiger formuleringen. Mijn dank betreft niet alleen je rol als co-promotor; dankzij jouw inbreng is het onderzoek binnen het cluster Infectieziektebestrijding van de GGD Rotterdam-Rijnmond sterk gegroeid, is het Huisman Onderzoekscentrum tot stand gekomen en is er werkelijk sprake van een nauwe interactie tussen wetenschap en praktijk.

De leden van de promotiecommissie dank ik voor hun bereidheid deel te nemen aan de commissie en de oppositie te voeren: dank Henk van der Molen, Marion Koopmans, Marianne Donker, Daniëlle Timmermans. Speciaal wil ik Jim van Steenbergen bedanken; mijn aandacht voor risicoperceptie van infectieziekten is verdiept tijdens jouw supervisie van mijn MPH-thesis in 2003. Gerjo Kok en Harm Hospers wil ik niet alleen bedanken voor de deelname aan de commissie; maar ook voor de jarenlange inspirerende samenwerking bij de diverse projecten op het terrein van hiv-preventie.

Irene Veldhuijzen heeft een cruciale rol gespeeld bij de onderzoeken uit dit proefschrift; zonder jou was deze promotie er niet geweest. Niet alleen heb jij de statische analyses verricht, jij organiseerde ook de studies en schreef mee aan alle artikelen. Irene, heel veel dank, voor je enthousiasme, je bereidheid steeds opnieuw tijd te steken in weer een nieuwe vraag, je methodologische kennis en je steun. Working on the SARSControl project meant working with inspiring colleagues from around the globe. Without you we would not have been able to conduct an international survey as well as a study among Chinese communities. Thanks very much for your ideas, suggestions and critical feedback: Gillian Elam, Arja Aro, Thomas Abraham, George Bischop and Xinyi Jiang. Speciale dank aan Hélène Voeten voor

niet alleen de samenwerking aan de artikelen, maar ook de coördinatie van SARSControl; ik ben blij dat je sinds 2008 als senior-onderzoeker bij de GGD bent komen werken. Bijzondere dank ook aan Cicely Yuen: dankzij jouw steun konden we niet alleen snel inspelen op de onrust rondom SARS in de Chinese gemeenschap in Rotterdam 2003, maar was het bovendien mogelijk de onderzoeken binnen de Chinese gemeenschap uit te voeren.

Een historicus die promoveert op een proefschrift over risicoperceptie van infectieziekten; op het eerste gezicht lijkt dat misschien een vreemde combinatie. In mijn beleving is er echter sprake van een rode draad in mijn onderzoek en andere werk sinds de start van mijn studie maatschappijgeschiedenis. Dit proefschrift begint met een citaat uit 'The child in America' van W.I. Thomas en D.S. Thomas dat in het eerste jaar van mijn studie bij het vak sociale psychologie aan de orde kwam. Deze stelling kan worden beschouwd als die rode draad. Het sloot nauw aan bij het sociaal-constructivisme waar ik tijdens mijn studie in was geïnteresseerd; hoe ontstond de homoseksuele identiteit in de loop van de negentiende eeuw en hoe beïnvloedde dit het zelfbeeld en het biografische verhaal van mensen met (seksuele) gevoelens voor het eigen geslacht. Een aanvraag om rond dit thema een promotieproject te starten werd na mijn afstuderen niet gehonoreerd. Maar de belangstelling voor hoe mensen de werkelijkheid interpreteren, daar betekenis aan geven en wat dit betekent voor hun handelen is gebleven. In onderzoek op het terrein van hiv-preventie en in het ontwikkelen van interventies waarbij de perceptie van het eigen risico en de betekenis die de ander heeft keer op keer cruciaal blijken.

De stelling 'If men define situations as real, they are real in their consequences' is voor mij ook behulpzaam gebleken in mijn werk als manager. Immers als het lukt om te zien en te erkennen dat de werkelijkheid voor mensen kan verschillen en hun handelen vanuit die werkelijkheid een logica kan hebben, biedt dat naar mijn idee de mogelijkheid om verbinding tussen werkelijkheden te leggen. Bovendien heeft het mij zelf geholpen mijn eigen werkelijkheid – hopelijk – niet als al te maatgevend te beschouwen.

Ter afronding van mijn master of public health verrichtte ik een kleinschalig onderzoek naar de legionellaproblematiek en hoe daar vanuit een risico- of voorzorgsperspectief tegen aan gekeken kan worden. Dat betekende een sterke stimulans van mijn interesse in risicoperceptie en de betekenis daarvan voor de infectieziektebestrijding. Niet alleen gericht op hoe concreet met het probleem van legionella om te gaan, maar juist ook voor het maatschappelijk debat over hoe om te gaan met risico's. Waar infectieziektebestrijding lang is gezien als alleen een medische aanpak, geloof ik dat juist in de bestrijding van opkomende infectieziekten aandacht voor gedrag, de perceptie van risico's en de mogelijkheid van gedragsbeïnvloeding aanvullend op de medische aanpak van groot belang zijn.

De SARS-uitbraak in het voorjaar van 2003 confronteerde de wereld niet alleen met een nieuwe infectieziekte; het leidde bovendien tot veel maatschappelijke onrust. De uitbraak bood echter ook de mogelijkheid te starten met onderzoek naar de perceptie van SARS en de relatie van risicoperceptie met voorzorgsgedrag. Zo kreeg mijn belangstelling voor percepties van mensen een nieuwe invulling; en zo creëren historici hun eigen verhaal van continuïteit.

Sinds 1994 werk ik met veel plezier bij de GGD Rotterdam-Rijnmond. De GGD heeft mij ongekende mogelijkheden gegeven om mijzelf te ontwikkelen zowel als manager, in de ontwikkeling van nieuwe interventies en als onderzoeker. Belangrijk hierin is het klimaat waarin er de ruimte is om – gedreven door het doel om de gezondheidssituatie van Rotterdammers en bewoners uit de regiogemeenten te verbeteren en infectieziekten te

voorkomen en te bestrijden – buiten de gebaande paden te treden en te investeren in onderzoek en innovatie. Naar mijn idee is dit onderzoek slechts één van de vele voorbeelden van dat klimaat. De collega's van de GGD wil ik daarom bedanken voor hun gedrevenheid en enthousiasme waardoor het een zeer inspirerende werkomgeving is die mij blijft uitdagen.

Er zijn verschillende mensen die ik in het bijzonder wil noemen. Astrid, Diane, Inci, Wilma en Linda als eerste, niet alleen omdat ik altijd een beroep heb kunnen doen op jullie ondersteuning vanuit het secretariaat, maar ook en vooral voor jullie warmte. Astrid, bovendien hartelijk dank voor al het werk aan de productie van het proefschrift. Winfred, Evert en Bea, als sectieleiders is het een plezier met jullie samen te werken en gezamenlijk voor het cluster te staan. Winfred, we zijn bijna gelijk bij de GGD begonnen en in al die jaren werken we nauw samen, kunnen zo ongeveer elkaars zinnen af maken en jouw steun en inzet betekenen veel voor me. Gerard, het is stimulerend om te zien hoe jij steeds werkt aan een verbetering van de tbc-bestrijding, kritische vragen blijft stellen en het was prettig om af en toe samen de last van het promoveren te bespreken. Hannelore, in alle jaren dat we samenwerken heb ik nooit tevergeefs een beroep op je gedaan, hoe druk je het ook had. Je kennis van de infectieziektebestrijding is groot, je doorzettingsvermogen zo mogelijk nog groter. Katy, samen hebben we niet alleen veel projecten ondernomen en vernieuwde aandacht voor seksuele gezondheid gerealiseerd, er was ook altijd die extra band. Het is voor mij daarom bijzonder dat je mijn paranimf wilt zijn.

De collega's van het cluster Infecteziektebestrijding zijn inspirerend om mee te samenwerken, betrokken en geven energie. Jeanelle en Reinoud voor de samenwerking rondom infectieziekten en druggebruikers; Anja al jarenlang een combinatie van betrokkenheid en onderlinge vertrouwdheid; Mireille, Monique en Marja voor de inspiratie om te gaan voor de gezondheid van ROC-studenten; Ytje, Sander en Ellen voor de onderzoekssamenwerking en speciaal Paul en Pjer, samenwerken met jullie is steeds weer een cadeau, omdat het me even ontheft van van mijn rol als manager en het me een vrijplaats geeft om als collega's samen inhoudelijk aan vernieuwende hiv-preventie te werken.

Naast de collega's uit het cluster ook dank aan de directie; Marianne en Vincent voor het vertrouwen in mij en de ruimte die jullie me steeds hebben gegeven om dit onderzoek te doen. De (oud-) collega's uit het MT voor de samenwerking Aat, Arie, Cees, Dorine, Raymond, Reind, Rina, Rinus en Toine. Speciale dank ook voor de medewerkers van de bibliotheek Charles, David, Engelien en Jan voor het steeds weer vinden van de artikelen en andere gegevens.

Onderzoek is niet iets wat je alleen doet, toen ik ging studeren had ik de verwachting in een intellectueel stimulerende omgeving te komen waar mensen elkaar voortdurend inspireerden. Die verwachting bleek deels waar en was natuurlijk ook deels een illusie. Maar ik prijs me gelukkig dat ik afgelopen jaren met veel mensen naast de collega's van de GGD heb mogen samenwerken aan diverse onderzoeks- en innovatieprojecten, zowel met onderzoekers van het Erasmus MC als van de Universiteit Maastricht en met collega's van organisaties als Soa Aids Nederland, Schorer, Rutgers Nisso Groep, GGD Nederland, GGD Amsterdam en GGD Zuid-Limburg. Dank aan Johan Mackenbach, Anke Oenema, Pepijn van Empelen, Harry Jansen, Rob de Man, Rob de Knegt, Gerard van Doornum, Henri Verbrugh, Herman Schaalma, Arjan Bos, Ton Coenen, Jan van Bergen, Jos Poelman, Suzanne Meijer, Wim Zuilhof, Ineke van der Vlugt, Udi Davidovich, Han Fennema, Jelle Doosje en Christian Hoebe.

De GGD collega's in Zuid-Holland en in Nederland wil ik bedanken voor de samenwerking in de infectieziektebestrijding om zo de kwaliteit en effectiviteit te versterken. Jan Groot wil ik speciaal bedanken voor de foto voor de omslag die genomen werd tijdens een oefening van het Rampenbestrijdingsplan Infectieziekten.

Giel, op de belangrijke momenten in mijn leven ben je er altijd: zowel als getuige bij mijn partnerregistratie en nu als paranimf. Voor mij is het een vriendschap als geen ander, één waarin jij me inspireert, je luistert, je me steunt en we veel moois kunnen delen. Erik, voor het delen van voorstellingen, vele films en literatuur en in het bijzonder voor de gezamenlijke liefde voor Paul Auster. Lou, een vriend en sparringpartner, niet om de hoek, maar toch dichtbij en bijzonder. Michael, voor de ontspanning en je redactionele commentaren op het proefschrift. Dank aan jullie allen.

Mijn ouders, Rob en Joke, wil ik bedanken voor het vertrouwen en de vrijheid die ze mij mijn hele leven al hebben gegeven. Bovendien voor de belangrijke raad om dat te doen waar mijn hart in ligt. Voor de traditie van tolerantie, de bescheidenheid en van 'gewoon doorgaan'. Marijke voor de start toen we samen in Rotterdam gingen studeren en nu samen met Marcel nog steeds vertrouwd. Jetske ooit het 'lieve kleine zusje', maar al lang veel meer dan dat en samen met Michel dank voor de gezamenlijke weekends weg en de oudejaarsavonden. Nienke en Sieb, het plezier om bij jullie te kunnen zijn, met jullie te spelen, voor te lezen en jullie liefde is elke keer bijzonder. Ditte, een speciale band verbindt ons als tante en neef en die is met Marian en André samen nog sterker geworden.

Mijn schoonfamilie Theo, Nellie, Lodewijk, Friso, Patricia, Celeste en Rafaela dank voor jullie interesse in de ontwikkeling van het proefschrift. Maar meer nog voor alle warmte en liefde door de jaren samen in Rotterdam, Delft en Heiloo.

Stephen, in 2005 kwam je voor het eerst thuis bij André en mij en ik ben heel blij dat je zo vaak bij ons wilt komen en deel van ons leven bent geworden. Heel fijn dat wij er voor jou kunnen zijn en dat jij ons jong en alert houdt; ik zou je niet willen missen.

André, van al degenen in dit dankwoord ben jij voor mij de belangrijkste. Al meer dan 22 jaar mijn man en de rust en de zekerheid van je steun, je vertrouwen, je warmte, je liefde en je geloof dat die promotie er ooit zou komen en het proefschrift afgerond zou worden, verlaten me nooit. Mijn dank is groot en daarom opnieuw 'O mia vita, o mio tesoro, io son tuo, tuo son io'.

**Curriculum vitae**

Onno de Zwart (1967) werd geboren in Amstelveen en groeide op in Doetinchem. Na zijn eindexamen VWO aan de Gemeentelijke Scholengemeenschap Doetinchem (nu Rietveld Lyceum) startte hij in 1985 met de studie maatschappij-geschiedenis aan de Erasmus Universiteit Rotterdam. Een deel van zijn studie volgde hij aan de University of Essex. Na het afronden van zijn studie werkte hij twee jaar als onderzoeker op het terrein van hiv-preventie en homomannen bij de Universiteit Utrecht.

Vanaf 1994 werkt hij bij de GGD Rotterdam-Rijnmond. Hij begon als beleidsmedewerker aids-bestrijding en coördinator van een Europees stedennetwerk gericht op aidsbestrijding. Na beleidscoördinator aids-bestrijding te zijn geweest, werd hij in 1998 (waarnemend) afdelingshoofd Algemene Infectieziekten. Sinds 2005 is hij clustermanager Infectieziektebestrijding. Naast zijn managementtaken binnen de GGD was hij onder andere verantwoordelijk voor de uitvoering van de meningokokken C vaccinatiecampagne en de ontwikkeling van een draaiboek SARS. Hij was initiatiefnemer en verantwoordelijk voor de ontwikkeling en evaluatie van verschillende vernieuwende preventieprojecten op het terrein van hiv, soa en andere infectieziekten, bijvoorbeeld Sense, centrum voor seksuele gezondheid, Gaycruise en het Gezonde ROC.

In 2003 voltooide hij zijn Master of Public Health aan de NSPOH en begon hij aan de onderzoeken beschreven in dit proefschrift. Vanuit de GGD is hij mede-verantwoordelijk voor de vorming van het Huisman Onderzoekscentrum voor Infectieziekten en Publieke Gezondheidszorg, als onderdeel van CEPHIR, de academische werkplaats met het Erasmus Medisch Centrum. In 2007 – 2008 nam hij deel aan het Kandidatentraject Topkader van de afdeling Management Development van de gemeente Rotterdam.

Hij was lid van de commissie chlamydiabestrijding van de Gezondheidsraad en de Raad van Toezicht van het Aids Fonds – Soa Aids Nederland. Momenteel is hij bestuurslid van de Federatie Preventieve Gezondheidszorg Zuidwest Nederland en voorzitter van het Platform soa en seksuele gezondheid.

Per 1 januari 2009 is Onno de Zwart benoemd als projectdirecteur bij de GGD Rotterdam-Rijnmond met als één van de aandachtsgebieden de versterking van het gebiedsgericht werken voor de regiogemeenten.

**Publicaties**

**Dit proefschrift:**

**De Zwart O**, Veldhuijzen IK, Elam G, Aro AR, Abraham T, Bishop GD, Richardus JH, Brug J. Avian influenza risk perception, Europe and Asia. Emerg Infect Dis 2007;13(2):290-3.

**De Zwart O**, Veldhuijzen IK, Richardus JH. R, Brug J. Risicoperceptie van infecties van mensen door het vogelgriep in Nederland: sterk gevoel van risico, maar beperkt vertrouwen in beschermingsmaatregelen. TSG 2007;85(2):86-91.

**De Zwart O**, Veldhuijzen IK, Elam G, Aro AR, Abraham T, Bishop GD, Voeten HA, Richardus JH, Brug J. Risk perception and efficacy beliefs related to SARS and other (emerging) infectious diseases. Results of an international survey. Int J Behav Med in press

Voeten HACM, **De Zwart O**, Veldhuijzen IK, Yuen C, Jiang X, Elam G, Abraham Th, Brug J. Sources of information and health beliefs related to SARS and avian influenza among Chinese communities in the United Kingdom and the Netherlands, as compared to the general population in these countries. Int J Behav Med in press

**De Zwart O,** Veldhuijzen IK, Richardus JH. Brug J. Monitoring of risk perceptions and preventive behaviour related to human avian influenza during 2006 – 2007 in the Netherlands: results of seven consecutive surveys. Submitted

**De Zwart O,** Veldhuijzen IK, Richardus JH. Brug J. Correlates of precautionary behaviour related tot avian influenza in 2006 and 2007 in the Netherlands. Submitted.

**De Zwart O**, Veldhuijzen IK, Oenema A, Richardus JH, Brug J. SARS-related risk perceptions and precautionary actions in a Chinese community in the Netherlands: cross sectional survey. 2007. submitted.

**Risicoperceptie overig**

Brug J, Aro A, Oenema A, **de Zwart O**, Richardus JH. SARS risk perception, knowledge, precautions, and information sources, the Netherlands. Emerging Infectious Diseases 2004;10:1486-1489.

Sadique MZ, Edmunds WJ, Smith RD, Meerding WJ, **de Zwart O**, Brug J, Beutels P. Precautionary behaviour in response to the perceived threat of pandemic influenza. Emerging Infectious Diseases 2007; 13(9)1307-13: Available from http://www.cdc.gov/EID/content/13/9/1307.htm.

Jiang X, Elam G, Yuen C, Voeten H, **De Zwart O**, Veldhuijzen I, Brug J (2008) The perceived threat of SARS and its impact on precautionary actions and adverse consequences from the perspective of vulnerable communities living in unaffected regions: a qualitative study among Chinese communities in the United Kingdom and the Netherlands. Int J Behav Med in press

**Overige publicaties**

Veldhuijzen IK, van Driel HF, Vos D, **de Zwart O**, van Doornum GJ, de Man RA, Richardus J. Viral hepatitis in a multi ethnic neighbourhood: results of a community based study in a low prevalence country. Int J Inf Dis 2008 Aug 2 (Epub ahead of print).

Götz HM, Schutten M, Borsboom GJ, Hendriks B, van Doornum G, **de Zwart O.** A cluster of hepatitis B infections associated with incorrect use of a capillary blood sampling device in a nursing home in the Netherlands, 2007. Euro Surveill. 2008 Jul 3;13(27). pii 18918.

Kok G, Hospers HJ, Harterink P, **de Zwart O**. Social-cognitive determinants of HIV risk-taking intentions among men who date men through the Internet. AIDS Care 2007;19(3):410-7.

Kok G, **de Zwart O**, Schaalma H. AIDS 2006 - time to deliver. Patient Educ Couns 2007;65(1):1-2.

Pars LL, Wolfers ME, **de Zwart O**, Brug J, de Man RA, Richardus JH. Towards an evidence-based guideline for counselling of chronic hepatitis B virus infected patients. Liver Int 2007;27(5):731-2.

Wolfers MEG, Van den Hoek C, Brug J, **de Zwart O**. Using Intervention Mapping to develop a programme to prevent sexually transmittable infections, including HIV, among heterosexual migrant men, BMC Public Health 2007, 7:141.

Gotz HM, Veldhuijzen IK, Ossewaarde JM, **de Zwart O**, Richardus JH. Chlamydia trachomatis infections in multi-ethnic urban youth: a pilot combining STI health education and outreach testing in Rotterdam, Netherlands. Sex Transm Infect 2006;82(2):148-52; discussion 152-3.

Kok G, Harterink P, Vriens P, **de Zwart O**, Hospers HJ. The Gay Cruise: Developing a Theory- and Evidence-Based Internet HIV-Prevention Intervention. Sexuality Research & Social Policy: Journal of NSRC 2006;3(2):52-67.

Gotz HM, van Doornum G, Niesters HG, den Hollander JG, Thio HB, **de Zwart O**. A cluster of acute hepatitis C virus infection among men who have sex with men--results from contact tracing and public health implications. Aids 2005;19(9):969-74.

Gotz HM, Veldhuijzen IK, van Bergen JE, Hoebe CJ, **de Zwart O**, Richardus JH, et al. Acceptability and consequences of screening for chlamydia trachomatis by home-based urine testing. Sex Transm Dis 2005;32(9):557-62.

Hospers HJ, Kok G, Harterink P, **de Zwart O**. A new meeting place: chatting on the Internet, e-dating and sexual risk behaviour among Dutch men who have sex with men. Aids 2005;19(10):1097-101.

Tjon GM, Gotz H, Koek AG, **de Zwart O**, Mertens PL, Coutinho RA, et al. An outbreak of hepatitis A among homeless drug users in Rotterdam, The Netherlands. J Med Virol 2005;77(3):360-6.

Reintjes R, Bosman A, **de Zwart O**, van der Knaap L, Stevens M, Van den Hoek K. Outbreak of hepatitis A in Rotterdam associated with visits to 'darkrooms' in gay bars. Communicable Diseases and Public Health 1999;2(1):43-46.

**De Zwart O**, Kerkhof M, Sandfort T. Anal sex and gay men: the challenge of HIV and beyond. Journal of Psychology and Human Sexuality 1998;10(3/4):89-102.

**De Zwart O**, Sandfort T, Kerkhof M. No anal sex please: we are Dutch. A dilemma in HIV prevention directed at gay men. In: Sandfort T, editor. Pragmatism and consensus: the Dutch response to AIDS. London: Taylor & Francis; 1998. p. 133-151.

Wright M, Rosser B, **de Zwart O**. New international directions in HIV prevention for gay and bisexual men. Binghamton: The Hayworth Press Inc.; 1998.

**Overige publicaties Nederlandstalig**

Kidgell-Koppelaar D, Louman PMA, Breemer JN, **de Zwart O.** Aanbod gratis hiv-testen en hepatitis-B-vaccinaties bij nieuwkomers in Rotterdam. Infectieziektenbulletin 2007; 18(1):19-23.

Van Veen MG, Gotz HM, **de Zwart O**, van de Laar MJW. Hiv-prevalentie en risicogedrag bij prostituees in Rotterdam. TSG 2006;84(7):403-28.

Wolfers M, van den Hoek K, de Brito O, al Taqatqa W, **de Zwart O.** HIV/soa interventies voor heteroseksuele migrantenmannen planmatig ontwikkeld bij een GGD. TSG. 2006; (7):425-428

Kocken P, Voorham A, **de Zwart O**. Amor i salú; resultaten van een communityproject ter bevordering van de seksuele gezondheid van Antillianen en Arubanen in Rotterdam. TSG 2005;83:190-199.

Van den Hoek K, Kok G, Van Kesteren N, Hospers HJ, **de Zwart O**. De Waaghals en de prins. TSG Tijdschrift voor Gezondheidswetenschappen 2005;83(2):159-165.

Veldhuijzen IK, Gotz H, Nuradini B, Van den Hoek K, **de Zwart O**. HIV-sneltest: een pilot met integratie in de reguliere praktijk van GGD Rotterdam. Infectieziektenbulletin 2005;16(5):123-129.

De Boer I, Op de Coul E, Beuker R, **de Zwart O**, Al Taqatqa W, van de Laar M. Trends in HIV-prevalentie en risicogedrag bij injecterende druggebruikers in Rotterdam 1994 - 2002. Ned Tijdschr Geneeskd. 2004;148(47):2325-2330.

Götz HM, Ossewaarde JM, Nieuwenhuis RF, van der Meijden WI, Dees J, Thio B, **de Zwart O,** van der Laar MJ. Cluster van lymphogranuloma venereum onder homoseksuele mannen in Rotterdam, met grensoverschrijdende gevolgen. Ned Tijdschr Geneeskd. 2004; 148; 441-2

De Vries J, Gotz HM, **de Zwart O**. Hepatitis A uitbraak onder dak- en thuislozen. Infectieziektenbulletin 2004;15(6):212-214.

Van den Hoek K, **de Zwart O**. Van pionieren tot planmatig werken. Intervention mapping in de HIV/soa praktijk. TSG Tijdschrift voor Gezondheidswetenschappen 2003;81(6):360-363.

Bosman A, **de Zwart O**, Schop W, van der Meijden W, Chien-A-Lien R. Toename van vroege syfilis in Rotterdam. Ned Tijdschr Geneeskd. 1999;143(46):2324-2328.

Reintjes R, Bosman A, **de Zwart O**. Antistoffen tegen hepatitis A onder Rotterdamse reizigers; is het huidige screeningsbeleid kosteneffectief? Ned Tijdschr Geneeskd. 1999;143(35):1777-1780.

Bosman A, **de Zwart O**, Schoots B. Syfilis in Rotterdam. Infectieziektenbulletin 1997;4:76-80.

**De Zwart O**, Van den Hoek K, Koopmans M, Wagemans M. Sexpress en Meidenseks: nieuwe vormen van aids-voorlichting voor jongeren. Tijdschrift voor Jeugd en Jongerenwerk 1996;8(2):8-13.

Kerkhof M, **de Zwart O**, Sandfort T. Van achteren bezien: anale sex in het aids-tijdperk. Amsterdam: Schorer; 1995.

Erasmus MC
Universitair Medisch Centrum Rotterdam

## PhD Portfolio Summary

## Summary of PhD training and teaching activities

| | | |
|---|---|---|
| Name PhD student: Onno de Zwart<br>Erasmus MC Department: MGZ<br>Research School: | PhD period: 2003 - 2008<br>Promotor(s): prof.dr.ir. J. Brug<br>Supervisor: dr. J.H. Richardus | |
| **1. PhD training** | | |
| | **Year** | **Workload (Hours/ECTS)** |
| **General academic skills** | | |
| **Research skills** | | |
| **In-depth courses (e.g. Research school, Medical Training)** | | |
| **Presentations**<br>- Risicoperceptie van SARS en vogelgriep. Presentatie tijdens symposium 'Wat denkt het publiek van infectieziekten' georganiseerd door het Centrum Infectieziektebestrijding | 2007 | 20 hours |
| **International conferences** | | |
| **Seminars and workshops**<br>- SARS control workpackage 5: risk perceptions quantitative survey. Presentation at the 1st SARSControl integration Workshop, Paris, France.<br>- Studying risk perception of avian influenza and preventive behaviours. Presentation at the workshop of 'Flumodcont. Modelling the spread of pandemic influenza and strategies for its containment and mitigation', Rome, Italy. | 2006<br><br>2008 | 30 hours<br><br>20 hours |
| **Didactic skills** | | |
| **Other** | | |
| **2. Teaching activities** | | |
| | **Year** | **Workload (Hours/ECTS)** |
| **Lecturing** | | |
| **Supervising practicals and excursions** | | |
| **Supervising Master's theses** | | |
| **Other** | | |