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1 The SARSControl Project

1.1 Introduction and Background

In the beginning of 2003, in the midst of a tense political situation due to the war in Iraq, the world was alarmed by the emergence of a new and apparently fatal infectious disease. The disease was labelled Severe Acute Respiratory Syndrome (SARS). Thanks to enormous efforts made by national and international organisations, the epidemic was brought under control by the summer of that year.

SARS is a new infectious disease caused by infection with a novel coronavirus which was provisionally termed SARS-associated coronavirus (SARS-CoV). The earliest cases of SARS are known to have occurred in mid-November 2002 in Guangdong Province, China. SARS was first recognised in late February 2003, when cases of an atypical pneumonia of unknown cause began appearing among staff at hospitals in Guangdong, China, and Hanoi, Vietnam. Within two weeks, similar outbreaks occurred in various hospitals in Hong Kong, Singapore and Toronto. The number of world-wide cases exceeded 4000 on 23 April and then rapidly soared to 5000 on 28 April, 6000 on 2 May, and 7000 on 8 May, when cases were reported from 30 countries. During the peak of the global outbreak, near the start of May, more than 200 new cases were being reported each day. By the beginning of July 2003, SARS had been diagnosed in more than 8,000 patients, of whom more than 900 have died. China was hit hardest, with over 5,000 patients and approximately 350 deaths. After July, SARS appeared to be under control.

SARS did not have the disastrous health impact that many at first feared, yet the panic caused by SARS temporarily affected economies in many countries. The global travel, tourism and related industries in particular faced a significant downturn in income. The global macroeconomic impact has been estimated at 30 to 100 billion US dollars. Although the European Union was not afflicted heavily by the SARS epidemic in terms of patient numbers, there is no guarantee at all that this will not be the case if SARS reappears or when comparable diseases, such as avian influenza, emerge.

Following the SARS epidemic, a European Union sponsored research programme was started with collaborators from Europe and China with the title “Effective and Acceptable Strategies for the Control of SARS and new emerging infections in China and Europe” (acronym: SARSControl). The study aimed at improving:

1 Knowledge about the spread of SARS in various affected countries, with special reference to mainland China (the epicentre of the epidemic), and assessment of the impact of various determinants on this spread;

2 Control of possible future outbreaks of SARS and other emerging diseases by developing appropriate intervention strategies based on epidemiological and economic modelling; and

3 Surveillance and risk communication strategies for effective control of SARS.

1.2 Rationale of the SARSControl Project

SARSControl is an integrated multidisciplinary project funded by the European Commission within the sixth framework programme. The project was carried out in line with the European Commissions objective of “Strengthening of the surveillance and control of communicable diseases through research and development: To develop models for risk assessment, intervention strategies and implementation/evaluation scenarios, including the health
economics and social aspects (including cost-benefit analyses of different public health measures such as screening of travellers, rapid contact tracing, information to specific categories for major new or emerging communicable diseases such as SARS); to carry out research on risk communication in order to favour proper understanding of the risks connected with communicable diseases such as SARS and to minimise discrimination and overreactions in the population.”

When SARS emerged in 2003, the prompt reaction of many affected and non affected countries combined with a high level of international cooperation allowed the rapid containment of the outbreak. Nevertheless, many countries recognized that they were insufficiently prepared, if a larger epidemic would have occurred. Comprehensive and intersectoral plans have subsequently been developed and revised to prevent and control outbreaks of highly communicable diseases such as pandemic influenza. In parallel, various research works have been carried out, among which the EU-funded SARSControl project "Effective and acceptable strategies to prevent and control SARS or SARS-like diseases". In that context, we analyze and discuss the findings and recommendations from the various SARSControl works in terms of policies, with a specific focus on inter-country and supranational collaboration mechanisms.

The research results and recommendations arising from this project aim to aid European policy on public health management of new emerging infections by improving the public health response to emerging infections with pandemic potential such as SARS and influenza.

The recommendations aim to address policy makers at the supranational level i.e. European Commission, in particular DG SANCO and DG RESEARCH and other relevant directorates. In addition the results will inform decision makers at the national level, based in Ministries of Health and national institutes of public health both within and outside Europe.

These overall objectives were achieved in a series of both quantitative and qualitative studies, conducted by separate work packages with specific objectives and deliverables.

1.3 The Workpackages

The SARSControl project involves a consortium of 17 European, Asian and international partners coordinated by the Erasmus University Medical Centre in Rotterdam, the Netherlands. The project has been divided into 9 Workpackages including 7 research Workpackages (WPs) which are presented in figure 1.

Workpackages 1 & 9 deal with Co-ordination and management of the project and are co-ordinated by J.H. Richardus, Erasmus MC, University Medical Center Rotterdam Netherlands

WP2: Risk assessment models
Co-ordinated by J.C. Desenclos, Institut de Veille Sanitaire, France

The task of WP2 was to develop risk assessment models based on international travel and to assess the risk of introduction of new infectious diseases like SARS and Influenza. To achieve this, data sources of international travel were identified and analysed. Different risk assessment scenarios were developed to estimate the risk of importation of infections by air travel under different scenarios.
**WP3: Chinese data analysis**  
Co-ordinated by W. Cao (Beijing Institute of Microbiology & Epidemiology, China) and S.J. de Vlas (Erasmus MC, University Medical Center Rotterdam, Netherlands)

The task of WP3 was to make available an optimally complete data base with (nearly all) epidemiological data on the 2002/03 SARS outbreak in mainland China. To estimate key parameters in the spread and control of SARS as well as to assess the (economic) impact of interventions used in the control of SARS in China and to additionally develop protocols for standardized recording of epidemiological data.

![Figure 1: Schematic representation of the SARSControl workpackages](image)

**WP4: Mathematical modeling**  
Co-ordinated by N. Gay (Health Protection Agency, United Kingdom)

The task of WP4 was to develop a range of transmission dynamic models of SARS and pandemic influenza capable of simulating both local and global spread and to model the impact of various interventions identified in WP8 and estimate their effectiveness. This was to be achieved with the help of a series of stochastic models for assessing the community transmission of influenza within countries and by assessing the effectiveness of local control measures and travel restrictions to impede global spread. The results are to provide policy recommendations.

**WP5: Risk perception**  
Co-ordinated by J. Brug (Erasmus MC, University Medical Center Rotterdam, Netherlands)

The task of WP5 was to analyse risk perceptions related to SARS, influenza and other infectious diseases in Europe and Asia. This was achieved with a survey questionnaire developed to measure risk perceptions, precautionary actions, sources of information used etc,
related to SARS and other diseases. In addition focus group interviews of Chinese communities in two European countries were conducted to explore the reactions to risk communications and impact of SARS on vulnerable communities living in unaffected regions. Finally the aim was to develop strategies for effective risk communication directed at realistic risk perceptions and precautionary actions in the populations.

WP6: Risk communication
Co-ordinated by T. Abraham, Journalism and Media Studies Centre, University of Hong Kong (China) and M. Salter Health Protection Agency, United Kingdom

The task of WP6 was to evaluate risk communication strategies employed by affected Asian countries and other professional bodies like WHO and EU during the SARS outbreak and to analyse the media response. The work package analysed the institutional structures within which government communication occurred, as well as the content and timeliness of communication from governments and public health authorities to the public. In addition to identify critical ethical issues in the communication of risks for example due to cross-cultural differences and to determine whether discrimination or stigmatisation of groups identified as a special risk source played a role in both the Asian and European context. The aim is to contribute to policy development at the European and national level on risk communication strategies for new and emergent infections.

WP7: Economic analysis
Co-ordinated by P. Beutels, University of Antwerpen, Belgium

The task of WP7 was to estimate the macro- and micro-economic impact of the SARS outbreak of 2003 and of potential scenarios of pandemic influenza and future SARS outbreaks on European countries. In addition an economic analysis of strategies to control and prevent new and emerging communicable diseases such as SARS and pandemic influenza was undertaken.

WP8: Policy evaluation
Co-ordinated by R. Reintjes, Hamburg University of Applied Sciences, Germany

The task of WP8 is Policy Evaluation. The research objectives were achieved by the preparation of an inventory of the main SARS control strategies implemented by the European and Non-EU countries including China and Canada during the 2002/03 SARS epidemic and the identification of critical ethical issues associated with the implementation of such measures. In addition it included the application of the HACCP Model to identify critical control points in pandemic management and a qualitative Delphi analysis with questionnaire rounds and face to face meetings to assess the current preparedness situation and feasibility of intervention strategies. Multidisciplinary workshops and seminars provided additional insight for generating and appraising scientific advice. Finally the results from the WP8 analysis along with the outcomes generated from research WPs 2 – 7, the experiences gained from the 2002/03 SARS outbreak and information gained at SARSControl meetings and workshop have been compiled in this policy evaluation report.
2 The SARSControl Policy Evaluation Report

The information sources used for this report include works from the various SARSControl workpackages. Additional information was obtained from scientific literature, national pandemic preparedness recommendations and experiences gained during the SARS epidemic. These sources provide both, quantitative information on the state of preparedness of European countries against SARS or pandemic influenza as well as qualitative information, bringing more in-depth views on specific problems shared by European countries. The needs or issues identified through our review are discussed and recommendations given, where possible. The report concludes with a summarized list of recommendations for improving pandemic preparedness in Europe and highlights areas where further research is needed. For a more detailed understanding of the recommendations and the research work an Appendix with summaries and abstracts of various project deliverables is attached. Each Appendix has reference links to the complete deliverable on the SARSControl website.

Criteria to select specific issues of relevance for this report include (i) the topic is part of the SARSControl research activities; (ii) the topic clearly appears to pose a specific problem: not tackled in the national plans, or not detailed enough, or because doubts have been expressed by some sources or (iii) the subject implies inter-country collaboration mechanisms, to be discussed at the European level.

Table 1. Sources of information

<table>
<thead>
<tr>
<th></th>
<th>Nb of countries</th>
<th>Reference</th>
<th>Year</th>
</tr>
</thead>
<tbody>
<tr>
<td>Quantitative information</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1. SARS</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Inventory of measures by European countries (1)</td>
<td>23</td>
<td>EU [1]</td>
<td>2003</td>
</tr>
<tr>
<td>Inventory of European measures (update)</td>
<td>29</td>
<td>WP8 [2]</td>
<td>2006</td>
</tr>
<tr>
<td>Inventory of measures by non-European countries</td>
<td>10</td>
<td>WP8 [3]</td>
<td>2006</td>
</tr>
<tr>
<td>2. Pandemic influenza</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ECDC evaluation (country visits, meetings, etc.)</td>
<td>27</td>
<td>ECDC [5]</td>
<td>2006</td>
</tr>
<tr>
<td>Qualitative information</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Research Workpackages 2, 3, 4, 5, 6 &amp; 7</td>
<td></td>
<td>SARSControl Project, Appendix</td>
<td>2005 – 2007</td>
</tr>
</tbody>
</table>

2.1 Preparedness and planning

The first inventories of measures taken by European countries against SARS revealed heterogeneous implementation mechanisms [1,2]. Progress has been made and for pandemic influenza, plans are now in place in all European countries (Table 2-a). These plans are consistent with international guidance.
The pandemic influenza plans are usually specific for pandemic influenza but in 1/3 of the countries they are part of a broader plan against any infectious disease with a pandemic potential. This generic approach is considered more cost-effective by the concerned countries.

Coordination of pandemic influenza plans is mainly under the health sector. The intersectoral approach is hardly developed and when mentioned, it is limited to links with veterinary services while links with other sectors are poor.

The command and control mechanisms seem satisfactory at the central level but the decentralized level clearly appears as neglected. Implementation steps, procedures, detailed descriptions of the roles and responsibilities are rarely developed for the regional/local level.

The maintenance of essential services during a pandemic situation is considered as a priority by all countries, but implementation mechanisms are only developed for the health sector. For instance, a list of additional health care workers (retired personnel, students, volunteers) to assist the existing workforce was prepared by 52% of the countries in 2005. The capacity of non-health services is rarely planned and procedures are not developed. The capacity building and training of first-line workers outside of the health sector is rarely considered.

The Delphi panel experts have provided a list of vital sectors (communication, transports, food, energy, police, fire-safety, waste disposal, emergency decision makers, health care sector, civil protection, law enforcement institutions), but there is no prioritization within this list.

Finally, regular exercises have been carried out only in a limited number of countries.

<table>
<thead>
<tr>
<th>Table 2-a. Preparedness and Planning</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Number of Countries</strong></td>
</tr>
<tr>
<td>Date</td>
</tr>
<tr>
<td>Source/reference</td>
</tr>
<tr>
<td>National plans in place</td>
</tr>
<tr>
<td>Plans available on national websites</td>
</tr>
<tr>
<td>Consistent with international guidelines</td>
</tr>
<tr>
<td>Command &amp; Control in place</td>
</tr>
<tr>
<td>Coordination by Ministry of Health</td>
</tr>
<tr>
<td>Cross sectoral with veterinary services</td>
</tr>
<tr>
<td>Cross sectoral with other services</td>
</tr>
<tr>
<td>Command &amp; Control detailed</td>
</tr>
<tr>
<td>Decentralization planned</td>
</tr>
<tr>
<td>Decentralization needed</td>
</tr>
<tr>
<td>Maintenance of essential services planned</td>
</tr>
<tr>
<td>Plans systematically &amp; regularly tested (exercises)</td>
</tr>
</tbody>
</table>

**Recommendations:**

1. The intersectoral collaboration in pandemic preparedness should be strengthened. Social scientists, anthropologists, philosophers, ethicists, etc. should be more involved at both, policy and operational levels.

2. Decentralization must be reinforced. This is especially important in countries with a federal organisation where disparities between states may generate ethical conflicts.
Decentralization should include a clear distribution of roles and responsibilities at all levels.

3 The national level should monitor the development and completion of the regional/local plans, to ensure a standardized approach between geographical levels.

4 A national emergency assessment and response team should be set up, to provide expertise when infectious diseases outbreaks are reported or suspected.

5 Pandemic plans should be regularly updated and tested through exercises. Guidance on the objectives, expected outcomes, process and contents of exercises should be provided.

6 Plans and exercises should include inter-country issues, to facilitate relations with neighbouring countries during crisis situations.

2.2 Ethical aspects

There are many ethical issues as regards to SARS or pandemic influenza. At the public health level, there is a constant dilemma between the common good vs. individual liberties, risk communication vs. creating fear and panic in the community, etc.

Specific ethical concerns can be raised as regards to health care workers (HCWs) who face the dilemma of their duty to care for patients versus the duty to protect themselves and their contacts. Physicians often face a difficult choice between the individual patient’s benefit versus public health considerations, when resources are scarce or overwhelmed. Their institutions have the duty to ensure their safety during an epidemic.

At the global level, travel and trade restrictions to control SARS must be balanced against the economic losses.

Most sources indicate serious ethical concerns as regards to equity and triage, but yet no agreed framework exists for public health ethics.

For SARS, triage procedures have been developed after the outbreak [1;2]. For pandemic influenza efforts are still needed and 89% of the Delphi panel experts [6] stress a need for triage policies. In 2005, guidance on priority groups who would benefit from antiviral drugs for prophylactic use against a pandemic influenza strain was available in 76% of the countries. But usually, only health care workers, representing the first priority group, are considered and there is no hierarchy for triage among other groups.

Recommendations:

1 Triage policies and procedures must be developed to avoid ethical dilemmas and inefficiencies at the operational (decentralized) level: local stakeholders must not be left alone to deal with difficult triage issues.

2 The balance between public good vs. individual rights to privacy and freedom has to be carefully weighed. Solutions respecting ethics and the least restrictive alternative should be prioritized, for instance trying to keep solutions in a voluntary perspective unless totally inevitable.

3 Constraining measures or the determination of priority groups who would benefit from an intervention are more likely to be accepted if the stakeholders and the community participate in their elaboration and if measures are accompanied by early communication.
4. Vulnerable groups should be identified and specific solutions should be provisioned in advance.

5. Guidance and training should be provided to health care workers (HCWs) to deal with the difficult issue of triage. In addition HCWs should be provided psychological support during pandemic situations.

2.3 Early detection and surveillance

For the pre-pandemic stage, the capacity of national surveillance systems to detect and analyze the occurrence of a new strain (i.e. a strain adapted to an inter-human transmission) is variable. Links between animal and human surveillance are mentioned in most pandemic plans but precise procedures enabling the early detection and monitoring of the new strain are not detailed. Even if this scenario is more likely to happen outside of the EU zone, Mounier-Jack et al. [4] suggest that many countries are not equipped for a timely recognition of an emerging infection within their own boundaries.

For adequate planning, decision makers need to estimate the impact of the infection: expected numbers of cases (and false cases), deaths, burden on the health care system, etc. These estimations are difficult because of the uncertainties around the epidemiological characteristics of the emerging strain. For instance, during the SARS outbreak, the European countries constantly adapted their strategies according to epidemiological information from international sources. For pandemic influenza, the expected numbers which are used for planning vary between countries: attack rates range from 15 to 50%, death rates from 14 to 1685 per $10^5$ persons and hospital admission rates range from 40 to 2707 per $10^5$ persons [4]. In addition the capacities of European countries to adapt their surveillance systems from routine influenza to a specific system adapted to the pandemic situation are questioned [5].

<table>
<thead>
<tr>
<th>Table 2-b. Surveillance</th>
<th>SARS</th>
<th>Pandemic Influenza</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of Countries</td>
<td>29</td>
<td>21</td>
</tr>
<tr>
<td>Date</td>
<td>2006</td>
<td>2005</td>
</tr>
<tr>
<td>Source/reference</td>
<td>EU/WR8</td>
<td>Mournier/WR8</td>
</tr>
<tr>
<td>Ability to detect a new strain</td>
<td>na</td>
<td>88%</td>
</tr>
<tr>
<td>Links animal/human surveillance planned</td>
<td>81%</td>
<td></td>
</tr>
<tr>
<td>Links described and detailed</td>
<td>&lt;50%</td>
<td></td>
</tr>
<tr>
<td>Country prepared if outbreak start in own territory</td>
<td>33%</td>
<td>87%</td>
</tr>
<tr>
<td>Joint operational procedures are needed</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Surveillance schemes for seasonal influenza</td>
<td>100%</td>
<td>96%</td>
</tr>
<tr>
<td>Guidance for adaptation to pandemic surveillance</td>
<td>83%</td>
<td>33%</td>
</tr>
</tbody>
</table>

For the pandemic phase, most countries intend to reinforce their existing seasonal influenza surveillance systems and to adapt their existing indicators. The SARS experience in non-EU countries revealed this need to adapt systems, but also to develop a specific surveillance for high risk groups like health care workers, elderly, immuno-compromised patients, with a particular attention to atypical clinical presentations among these groups [3]. But lessons learnt and detailed guidance are rarely available. The ECDC survey [5] indicates that the flexibility of the surveillance and monitoring plans is not yet optimal.
Experience from SARS in non-European countries showed that when a new pathogen emerges, early communication and open sharing of epidemiological and clinical data within and between countries are key factors to allow the adaptation of strategies. Standard definitions, protocols and procedures for international reports and exchanges, including pathways of report, must be developed in that objective.

In parallel, real-time prediction models including the daily number of new infections and deaths must be developed, in order to predict the spread of the infection at the national level and to allow decision makers to adapt their strategies.

Because the adaptation capacities of the existing seasonal influenza surveillance systems in European countries are not optimal, timely reporting by the operational actors (clinicians, hospital managers) at the peripheral level should be strengthened through sensitization, guidelines and exercises. Develop case scenarios to test the channels of information and outbreak management procedures at the peripheral level.

The channels of data transmission should also be strengthened. This can include computer systems for real-time surveillance, specific telephone hotline or internet channels for the health system.

**Recommendations:**

1. Set up surveillance data systems with the capacity to manage huge datasets in a timely manner
2. Set up communication systems to disseminate surveillance data in time to the relevant public health professionals.

### 2.4 Clinical management and infection control

Clinical guidelines are either included in the pandemic influenza plans or available as links and references to other documents. All countries recommend the use of antiviral drugs for treatment. They also integrate infection control procedures and outline the essential requirements for the isolation of infected patients. However, there is no plan which specifies how treatment/equipments will be provided.

The adequacy and applicability of the guidelines at the decentralized level can be questioned, as well as the training level of HCWs in the peripheral level. For instance inadequate training of health workers was a major problem identified during SARS in non-European countries [3].

The provision of personal protective equipment (PPE) for health care workers is mentioned by 62% of the countries but PPE is mainly understood as masks, without further specification. The Delphi panel members consider that encouraging health care workers to wear PPE is an efficient (96%) and applicable (89%) intervention, despite being uncomfortable and only bearable for a short period of time. ECDC indicates that evidence base supporting PPE use by health care workers is weak [9].

**Recommendations:**

1. The training levels and the adequacy of guidelines and supply channels at the decentralized level must be assessed.
2. A core team of experts in infectious disease assessment and control should be identified at the hospital level, as well as national/regional experts who can be called upon when required.

3. Similarly, the supply channels should be strengthened and detailed, including the provision of material (PPE, etc.)

4. Available resources should be listed and if needed, alternate strategies (e.g. co-operation with neighbouring countries) should be discussed in case the health systems are overwhelmed.

### Table 2-3. Clinical management and infection control

<table>
<thead>
<tr>
<th></th>
<th>SARS</th>
<th>Pandemic Influenza</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Number of Countries</strong></td>
<td>29</td>
<td>21</td>
</tr>
<tr>
<td><strong>Date</strong></td>
<td>2006</td>
<td>2005</td>
</tr>
<tr>
<td><strong>Source/reference</strong></td>
<td>EU/WP8</td>
<td>Mounier/WP8</td>
</tr>
<tr>
<td><strong>Clinical guidelines available/accessible</strong></td>
<td>57%</td>
<td></td>
</tr>
<tr>
<td><strong>Strategy for antiviral treatment</strong></td>
<td>95%</td>
<td>85%</td>
</tr>
<tr>
<td><strong>Priority of curative care over prophylaxis</strong></td>
<td>24%</td>
<td></td>
</tr>
<tr>
<td><strong>Protocols available for curative treatment</strong></td>
<td>62%</td>
<td></td>
</tr>
<tr>
<td><strong>Isolation and infection control procedures</strong></td>
<td>76%</td>
<td></td>
</tr>
<tr>
<td><strong>Guidelines and procedures available</strong></td>
<td>100%</td>
<td>57%</td>
</tr>
<tr>
<td><strong>Provision of protective equipment planned</strong></td>
<td>62%</td>
<td></td>
</tr>
<tr>
<td><strong>Supplies and distribution mechanisms detailed</strong></td>
<td>33%</td>
<td></td>
</tr>
<tr>
<td><strong>Quantities of antiviral drugs estimated</strong></td>
<td>52%</td>
<td>5-50% *</td>
</tr>
</tbody>
</table>

* Variation partially explained by different antiviral strategies between countries: curative only, or curative+prophylactic

### 2.5 Laboratory

The laboratory capacity to investigate the initial cases exists in all EU countries but shortages are expected in the longer term (table). Some countries envisage the use of rapid diagnostic tests when the pandemic will generate a high burden on health services, despite unsatisfactory sensitivity and specificity of currently available tests.

**Recommendations:**

1. In order to optimize the detection and characterization of a new/emerging strain, inter-country collaboration and referral to supranational reference laboratories should be promoted.

2. National laboratories must ensure they have clear protocols on specimen collection, handling and transportation according to international biosafety regulations.
### Table 2-4. Laboratory facilities

<table>
<thead>
<tr>
<th>Number of Countries</th>
<th>SARS</th>
<th>Pandemic Influenza</th>
</tr>
</thead>
<tbody>
<tr>
<td>Date</td>
<td>2006</td>
<td>2005 2006 2006</td>
</tr>
<tr>
<td>Source/reference</td>
<td>EU/WP8</td>
<td>Mounier Delphi/WP8 EdDC</td>
</tr>
<tr>
<td>GUIDELINES ON SPECIMEN COLLECTION / TRANSPORTATION</td>
<td>86%</td>
<td></td>
</tr>
<tr>
<td>NATIONAL REFERENCE LABORATORY IN PLACE</td>
<td>83%</td>
<td>90%</td>
</tr>
<tr>
<td>NATIONAL PROTOCOLS IN PLACE</td>
<td>76%</td>
<td></td>
</tr>
<tr>
<td>BIOSAFETY GUIDELINES AVAILABLE</td>
<td>24%</td>
<td></td>
</tr>
<tr>
<td>CAPACITY TO INVESTIGATE INITIAL CASES</td>
<td>low</td>
<td>88%</td>
</tr>
<tr>
<td>CAPACITY TO PRIORITIZE SAMPLING (PANDEMIC PHASE)</td>
<td>33%</td>
<td>low</td>
</tr>
<tr>
<td>FEAR THAT LABORATORIES WILL BE OVERWHELMED</td>
<td>95%</td>
<td></td>
</tr>
<tr>
<td>USE OF RAPID DG TESTS AS ALTERNATIVE</td>
<td>47%</td>
<td></td>
</tr>
</tbody>
</table>

### 2.6 Prevention and control: individual and community based interventions

Prevention relies on a combination of strategies which include individual prevention, social distancing measures, and/or vaccination or prophylactic treatment when available. Information on individual prevention can be made readily available when needed, as was the case for SARS. This experience has been used by countries to develop new, sometimes innovative approaches against pandemic influenza, but the application of the planned strategies into effective interventions is doubtful according to various sources [4;5;9]. At the community level, social distancing measures and advice for quarantine were also rapidly put in place in EU countries during the SARS outbreak. Protocols were rapidly developed in that objective and were later adapted for pandemic influenza. At least one social distancing measure such as closing schools, restrictions of public gatherings or encouraging voluntary quarantine is included in the pandemic influenza plans but the feasibility and acceptability of these measures need further exploration.

The Delphi panel considers that individual precautionary behaviours such as using face masks in public are an efficient intervention (96%) which is also applicable (89%) and cost-effective (75%). As for other measures, the Delphi panel members consider them not efficient nor applicable, including quarantine (because infectiousness starts after the onset of symptoms, when SARS patients are isolated), closing education or business establishments, ban on mass gatherings.

In one research project carried out by WP5, the levels of risk perceptions and efficacy beliefs in selected European and South East Asian countries were assessed and compared. Perceived places at risk were ranked as follows [11]: public transportation, entertainment places, shops, workplace or schools, hospitals. Some reported precautionary behaviours were similar across regions, such as avoiding public transportation (75%) and staying indoors (20% -30%), but Europeans were more likely to avoid public places of entertainment and Asians were more likely to avoid seeing a physician.

Other research from WP5 shows the need to adapt information and education messages according to each situation, and to pay specific attention to vulnerable groups.

European citizens had high risk perceptions but low efficacy beliefs whilst in Asian countries, risk perceptions were lower and efficacy beliefs were higher [12]. The differences were partly attributed to the fact that control of SARS proved feasible. Considering that protective behaviours are more likely to be applied if risk perceptions and efficacy beliefs are high, WP5 researchers conclude that the current levels of self-efficacy are low in EU countries.
Another WP5 research focused on vulnerable communities, defined as those living in European countries who have ethnic, familial or business links with regions where SARS occurred [13]. The risk perceptions and protective behaviours of the Chinese communities in the United Kingdom and The Netherlands were explored. Since these communities had access to media from both geographical areas, a gap was perceived between protective measures recommended by the European countries versus those recommended in the origin country, yielding a feeling of particular vulnerability. Tensions between residents and visitors/returnees were also reported. Relatives or friends returning from affected areas were avoided. Self-imposed or advised quarantine was regarded as a necessary precaution.

<table>
<thead>
<tr>
<th>Table 2-5. Public education and individual prevention</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Number of Countries</strong></td>
</tr>
<tr>
<td><strong>Date</strong></td>
</tr>
<tr>
<td><strong>Source/reference</strong></td>
</tr>
<tr>
<td><strong>Information available through various media</strong></td>
</tr>
<tr>
<td><strong>Risk perceptions and beliefs taken into account</strong></td>
</tr>
</tbody>
</table>
| **Adaptation of messages for vulnerable groups** | 100% * | 66% *

* 100% for pandemic influenza

<table>
<thead>
<tr>
<th>Table 2-6. Prevention and control at the community level</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Number of Countries</strong></td>
</tr>
<tr>
<td><strong>Date</strong></td>
</tr>
<tr>
<td><strong>Source/reference</strong></td>
</tr>
<tr>
<td><strong>Contact tracing (SARS)</strong></td>
</tr>
<tr>
<td><strong>Specific measures for mass gathering</strong></td>
</tr>
<tr>
<td><strong>School closure</strong></td>
</tr>
<tr>
<td><strong>Mandatory quarantine</strong></td>
</tr>
<tr>
<td><strong>Voluntary quarantine</strong></td>
</tr>
<tr>
<td><strong>Face masks</strong></td>
</tr>
</tbody>
</table>

A SARSControl study investigated the effect of different intervention measures by a mathematical modelling approach, with comparisons being based on the effective reproduction number ($R_e$). The analysis showed that early case detection followed by strict isolation can control a SARS outbreak. Tracing close contacts of cases and contacts of exposed health care workers can additionally reduce the $R_e$. Yet, tracing of casual contacts and measures aiming to decrease social interaction were less effective in reducing the number of SARS cases.

**Recommendations:**

1. Governments and health agencies should ensure that a global communication strategy is planned; this should integrate new communication technologies (mobile phones, blogs, forums, etc.).
2 Risk communication should focus on improving specific precautionary behaviour and on the efficacy beliefs necessary for this (e.g. what people can do to appropriately and effectively reduce their risks). It must be timely and must detail the effective and the non effective protective behaviours.

3 To ensure better adherence to preventive measures, dialogue with communities of various backgrounds and cultures is essential in order to develop specific communication messages. Vulnerable communities include those who have ethnic, familial or business links with regions where an outbreak is ongoing.

4 Determine which priority groups would first benefit from interventions, especially pharmaceutical measures such as vaccines or prophylactic treatment.

5 A well functioning surveillance infrastructure is needed to facilitate early case detection and contact tracing as soon as possible.

6 Isolation facilities and staff trained in infection control practice are needed in hospitals to reduce the number of secondary cases. Measures to decrease social interaction, like banning mass gatherings, have only a minor effect in controlling SARS spread.

<table>
<thead>
<tr>
<th>Table 2-7. Other community containment measures</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
</tr>
<tr>
<td><strong>Number of Countries</strong></td>
</tr>
<tr>
<td><strong>Date</strong></td>
</tr>
<tr>
<td><strong>Source/reference</strong></td>
</tr>
<tr>
<td><strong>Prophylactic treatment planned</strong></td>
</tr>
<tr>
<td><strong>Priority of treatment over prophylactic use</strong></td>
</tr>
<tr>
<td><strong>Priority groups identified</strong></td>
</tr>
<tr>
<td><strong>Immunisation strategy developed</strong></td>
</tr>
<tr>
<td><strong>Priority groups identified</strong></td>
</tr>
<tr>
<td><strong>Generic mass vaccination plans will be used</strong></td>
</tr>
<tr>
<td><strong>Detailed measures developed</strong></td>
</tr>
</tbody>
</table>

2.7 Communication

The importance of communication in outbreak situations is widely acknowledged. Open communication about diseases is often difficult for governments, which fear the economic and political costs that might flow from such disclosure. But as SARS demonstrated, diseases spread through lack of knowledge, and there is a high cost both to nations and to the international community in lack of early disclosure.

Communication at the early stages of a pandemic threat is a challenge because information must be disseminated to the public as early as possible, but at the same time there is a necessary delay to verify, assess and confirm a situation. Preparedness and tools to organize early communication are thus considered as a priority strategy in order to ensure precise communications and to avoid rumours.

Communication strategies for pandemic influenza are usually under the responsibility of the Ministry of Health. Communication strategies were not detailed in 1/3 of the European countries in 2005. The EU has produced guidelines on communication strategies [5], organized meetings and exchanges between communication experts from the health ministries and invested in standard materials (leaflets, TV spots) that can be adapted according to needs.
Risk communication policies followed by governments in South East Asian countries affected by SARS, European Union and WHO were studied by WP6 (ref). This shows that training is crucial. SARS exposed the challenges for both health communicators and journalists of explaining an unknown disease to an anxious public. There is a great deal of experience now available in the countries that faced SARS on the success and failures of their strategies and it is important to tap this expertise. Journalists too found the requirements of reporting on SARS challenging. Many of them who had never reported on health issues before, found themselves reporting on a major infectious disease epidemic. They were unfamiliar with medical and technical terms that experts used and when experts opinions differed, they were unable to synthesis information in a readable way for the public.

The identification of specific target groups, considered as a key priority by 75% of the Delphi panel members, needs further precisions. Experts from a WP8 meeting [8] rank health care workers, public servants, general public, travellers and media personnel as the five priority groups.

<table>
<thead>
<tr>
<th>Table 2-8. Communication</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of Countries</td>
</tr>
<tr>
<td>Date</td>
</tr>
<tr>
<td>Source/reference</td>
</tr>
<tr>
<td>Information disseminated through various media</td>
</tr>
<tr>
<td>Actions taken against discrimination</td>
</tr>
<tr>
<td>Communication plans detailed and developed</td>
</tr>
<tr>
<td>Responsible agency identified</td>
</tr>
<tr>
<td>Specific groups are targeted</td>
</tr>
<tr>
<td>Real-time communication considered as a priority</td>
</tr>
</tbody>
</table>

Recommendations:

1. Build commitment at the highest political levels for early and open communication, especially in countries which do not have a tradition of open communication between government and public.

2. Ensure that communication plans are in place as soon as possible, given the unpredictability of infectious disease epidemics.

3. Plans should include infrastructures and resources, such as channels of communication to be used, templates for messages, designated spokespersons to brief the press. Adaptation mechanisms using diverse channels and adapted messages according to the evolution of the outbreak should be ensured.

4. Ensure intercountry and international coordination between health communicators, so that messages are coherent and accepted by the public. In parallel, target specific population groups especially considering the impact of the outbreak on communities having links with affected regions.

5. Develop training programmes for health communicators and for the media, using the lessons learnt from SARS.

6. Since mass media is the most effective way to get messages to large audiences, spokespeople should work with, and use the media to deliver messages;

7. Research should be strengthened:
• to test the efficacy of messages through feedback mechanisms. If messages are not getting through to the public in an effective way or are misinterpreted, mechanisms should be in place to fine tune the messages.

• to look at cultural differences in the perceptions of risk and efficacy beliefs and how these differences may influence precautionary actions.

• ECDC /EU should have a system in place to monitor risk perceptions, efficacy beliefs and precautionary actions, to be able to react on time and with a tailored response according to risk perceptions in the general population and in special interest groups.

2.8 Delaying the risk of introduction through travel-related measures

Travel related measures cover a wide variety of sectors and activities, at the domestic and/or international levels. Passive or active measures can be put in place in the country of departure (exit screening) and the country of arrival (entry screening). Measures which have been detailed in an international analysis of SARS-related interventions [15] can include information to travellers (signs, posters, videos, etc.); travel advisory (advice to postpone non essential travels to, or from, affected countries); distribution of health alert notices to all passengers; asking passengers to fill a health declaration form upon arrival (self health-reporting); screening (entry/exit screening) of febrile passengers through a visual inspection of passengers, or through thermal scanning; eventually, a ban on domestic and/or international travels can be decided by countries; finally a travel advisory can be decided by international institutions such as WHO.

Border control measures have been planned by most European countries in their pandemic influenza plans [16]. Restrictions on international travels are planned by many countries for pandemic influenza but the application mechanisms are rarely detailed. In their update analysis, the authors indicate that many countries diverge from WHO guidance. Also, many countries recognize that the benefits of such measures would be limited and that there is no scientific evidence on the efficiency of entry/exit screening. Finally the feasibility of bans on domestic and international travels is limited. Though, the EU considers the possibility of temporary internal or external border restrictions for public security reasons, for instance to maintain public order when people would seek care in a neighbouring country.

Findings from WP2 research on the risk of introduction of SARS in the EU area show that the predicted number of cases arriving from an infected region increase exponentially over time, in the same way as the epidemic grows in the country of origin. Importation depends on the time when the outbreak started in the source area, the transmission dynamic in that area (including control measures in place) and the intensity of travel traffic between regions. Inversely, the predicted number of imported cases is unaffected by border screening in the country of arrival, whatever the importance and size of such border control measures, because entry screening would miss the non-symptomatic SARS cases who are in the incubation period.

For pandemic influenza, WP4 research [17;18] show that interventions to reduce the local transmission of influenza are more likely to be effective than air travel restrictions. This work also shows that the delay gained by travel restrictions is small, compared to the time needed for the response.
Travel restrictions and border closure may reduce the risk of introduction of influenza in a given area and thus may allow for some delay to organize the response. However, information is very limited on the delay gained, the cost-effectiveness and impact of such measures, especially when resources are limited.

**Recommendations:**
1. Cooperation between public health organizations of both origin and destination countries should be strengthened in order to improve early detection and early response.
2. Travellers should be reassured that they can seek care anywhere.
3. Among travel related measures, travel advisory is considered as the only efficient and feasible measure.

### 2.9 Cooperation within EU countries: “inter-operability”

In theory, inter-country cooperation may represent an alternative solution to some resource-poor countries, and may be effective in a pre-pandemic phase. In the pandemic phase, it is more likely that priorities will be re-directed towards the national response.

Inter-operability between EU countries was tested through the 2005 Common Ground Exercise [19]. This showed a need to coordinate communication to the public because of inconsistent messages between countries. It also highlighted some expected difficulties as regards to inconsistent vaccine and treatment policies, creating disparities.

In 2006, the potential impact of national measures for neighbouring countries remains neglected [9], and is taken into consideration in only half of the countries. It was noted that some countries may not want to accept assistance from a neighbouring country and would prefer asking for the assistance of an institution such as EU or WHO, especially for countries at the edges of the EU zone.

Finally, in their update analysis of European preparedness against pandemic influenza, Mounier-Jack et al. [16] indicate that only one-half of the countries explicitly plan to coordinate their border control strategy with the neighbouring ones.

**Recommendations:**
1. Countries should exchange information on their coping strategies and must develop joint agreements on specific topics such as cross-border contact tracing, sharing human resources, etc.
2 Considering the risk that inter-country relations may not be easily solved during a crisis situation, it is envisaged that the supra-national level (i.e. the EU) should then take the lead.

3 EU to promote inter-country exercises and to take part in their evaluation (e.g. drills with focus on specific interventions). These questions may include surveillance; access to care; rapid channels of information; exchange of virological strains when there is no reference laboratory general approach in outbreak co-operation.

### 2.10 Economic analysis

Economists in the SARSControl project conducted a historical analysis on the global macro-economic cost of the 20th Century Influenza pandemics and the SARS outbreak. The main effects of the influenza pandemics were on broad macro-economic indicators concerning GDP and production, whilst the effect of SARS was more sectoral, with losses concentrated on tourism and transport. In all cases impacts occurred at the time of the outbreak but tended to be short lived. In most cases the economy rapidly bounced back to pre-pandemic levels. They conclude that the economic impact of a pandemic is unlikely to realise some of the model estimates and media hype and suggest that a global macro-economic and epidemiological model that focuses on global infectious disease outbreak and is also able to take into account other factors is needed. [20]

Economists in the SARSControl project argue that traditional health economic analysis is ill-equipped to estimate the cost effectiveness and cost benefit of interventions that aim at controlling and/or preventing public health emergencies of international concern (such as pandemic influenza or severe acute respiratory syndrome). They propose that accounting for behavioural changes and capacity problems that are expected to occur when such an outbreak strikes would be more accurate.

A decision analytic model which investigated the cost-effectiveness of stockpiling and treating with antiviral drugs, for a potential influenza pandemic in the United Kingdom in relation to the option of applying a near-patient test to conserve AV drug stocks showed that treating all symptomatic patients was considered as cost effective. The test and treat only patients with positive results, option would incur relatively large additional costs. Hence stockpiling sufficient AV drugs (but not near-patient tests) to treat all patients with clinical symptoms would be cost-effective, provided AV drugs are effective at preventing deaths from pandemic influenza.

Yet this raises the question that Oseltamivir the antiviral drug generally used for treating influenza patients may not be effective on account of resistances as has been documented in a number of cases across Europe.

### Recommendations:

1 Stockpiling antiviral drugs (e.g. oseltamivir) is recommended, provided that oseltamivir is effective in reducing the risk of death and is delivered soon after onset.

2 The available near-patient influenza tests are not likely to be cost effective in a pandemic influenza stage and are thus not recommended at this stage.
3 Summary

This review combines various sources of information and despite variable methods and indicators used by these sources and considering that the number of assessed countries varied, situations are comparable between EU countries, with only small differences. Since plans evolve and are regularly updated, the more recent inventories provide a slightly different picture from older ones, but the global picture remains consistent over time. The following list summarizes the core recommendations which evolved from this research project.

3.1 Core policy recommendations

The key issues identified through this review are summarized in the list of recommendations below.

<table>
<thead>
<tr>
<th>Recommendation</th>
<th>Rationale</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Planning</strong></td>
<td></td>
</tr>
<tr>
<td>Plans should be comprehensive (especially for the health care sector) and should be regularly updated and tested through exercises, to ensure that all levels are prepared</td>
<td>Implementation steps and procedures, description of roles and responsibilities at the local level are rarely planned and developed</td>
</tr>
<tr>
<td>Exercises should include inter-country issues</td>
<td>If plans remain theoretical there will not be an effective response</td>
</tr>
<tr>
<td></td>
<td>This will facilitate co-operation with neighbouring countries during a crisis</td>
</tr>
<tr>
<td><strong>Inter-sectoral collaboration</strong></td>
<td></td>
</tr>
<tr>
<td>Inter-sectoral collaboration should be strengthened beyond the human-animal health links, at both policy and operational levels. Social scientists, anthropologists, philosophers, ethicists, etc. should be involved, as well as the workforce from private sectors</td>
<td>Inter-sectoral collaboration is essential for understanding and accepting, the proposed control plan and achieving compliance as well as for an early and efficient response</td>
</tr>
<tr>
<td><strong>Ethics</strong></td>
<td></td>
</tr>
<tr>
<td>Triage policies and procedures must be:</td>
<td></td>
</tr>
<tr>
<td>- developed at the national level</td>
<td>The operational level (health care workers) must not be left alone to deal with difficult triage issues.</td>
</tr>
<tr>
<td>- communicated to the field as early as possible</td>
<td>Risk of inequity (between population groups or between regions) would lead to poor acceptance by the public and discrimination.</td>
</tr>
<tr>
<td>Stakeholders and the community should participate in the elaboration of triage criteria and in the hierarchisation of constraining measures</td>
<td>These constraining measures are more likely to be accepted if the concerned groups are involved in decision making</td>
</tr>
<tr>
<td><strong>Rapid sharing of knowledge, data and biomaterials</strong></td>
<td></td>
</tr>
<tr>
<td>Develop standard protocols (incl. standard case definitions) and procedures for reporting and information exchange within and between countries</td>
<td>SARS experience showed that when a new pathogen emerges, early communication and open sharing of epidemiological/clinical data within and between countries are key factors to allow the adaptation of strategies.</td>
</tr>
</tbody>
</table>
To ensure the detection and characterization of a emerging/novel pathogen, inter-country collaboration and referral to supranational reference laboratories should be promoted

Many countries are not equipped for a timely recognition of a novel pathogen.

Clear protocols on specimen collection, handling and transportation according to international biosafety regulations should be developed

Simple and robust surveillance systems must be developed in advance and tested before the pandemic influenza outbreak occurs

To be accepted and used in a sustainable way by GPs and local public health actors during a pandemic phase, functioning surveillance systems must exist.

It must be simple, easy to use and should not be overwhelming.

Timely and sufficient information on the situation is essential for detecting potential threats and to adapt strategies.

This should include a minimum dataset (e.g. numbers of cases and deaths per date of onset, age group and geographical areas)

Automatic systems should be promoted

Building upon existing seasonal influenza systems should be promoted

Timely and sufficient information on the situation is essential for detecting potential threats and to adapt strategies.

This should include a minimum dataset (e.g. numbers of cases and deaths per date of onset, age group and geographical areas)

Automatic systems should be promoted

Building upon existing seasonal influenza systems should be promoted

Develop a national or supranational capacity to monitor resistances to antiviral drugs

The effectiveness of antiviral drugs on a novel pathogen must be assessed to adapt strategies and recommendations

Use evidence from previous pandemic strains: e.g. virological mutations & adaptations

### Pharmaceutical interventions

Stockpiling antiviral drugs (oseltamivir) can be recommended, provided that oseltamivir is effective in reducing the risk of death and is delivered soon after onset.

Modelling works show that large scale use of antiviral treatment (oseltamivir) in a pandemic situation is likely to be cost-effective, if the antiviral is effective on the new strain and if the antivirals are made available at an early stage at peripheral level

Clinical trials should be carried out during the pandemic phase in order to adapt treatment protocols. The design and organisation of such trials should be developed in advance,

Given the uncertainties around a novel pathogen, clinical management protocols must be adapted according to recent knowledge and based on the follow-up of clinical data.

Rules to ensure rapid and transparent dissemination of findings within the scientific community should be established

Planning ahead will facilitate processes like activation of ethical committees in an emergency situation and rapid sharing of results (i.e. not waiting for publication)

The available near-patient influenza tests are unlikely to be useful during a pandemic influenza situation and are thus not recommended at this stage

Testing symptomatic patients in a pandemic situation to decide on treatment options is generally not cost-effective as compared to treating all symptomatic patients

### Non pharmaceutical interventions

Isolation facilities and staff trained in infection control practice are needed in hospitals to reduce the number of secondary cases.

Early case detection followed by strict isolation, most effectively reduces the effective reproduction number yet isolation transfers cases to hospitals, requiring them to be well equipped to avoid nosocomial spread as was the case for SARS in many countries

Measures to decrease social interaction, like banning mass gatherings, have only a minor effect
in controlling SARS spread

**Communication.**

<table>
<thead>
<tr>
<th>Commitment at the highest political level should be built, for early and open announcement of an outbreak such as pandemic influenza. Plans should include infrastructures and resources, such as channels of communication to be used, templates for messages, designated spokespersons to brief the press. Adaptation mechanisms using diverse channels and adapted messages according to the evolution of the outbreak should be ensured.</th>
<th>Experience and WP6 work show this is a key factor for trust, building confidence and ensuring better response. This is especially important in countries which do not have a tradition of open communication between government and public.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Test the efficacy of messages through feedback mechanisms (ongoing monitoring).</td>
<td>If messages are not getting through to the public in an effective way or are misinterpreted, mechanisms should be in place to fine tune the messages.</td>
</tr>
<tr>
<td>Target specific population groups, especially considering the impact of the outbreak on communities having links with affected regions.</td>
<td>This is necessary to avoid discrimination and adverse economical, social and psychological impacts of emerging infections on communities linked with affected countries.</td>
</tr>
</tbody>
</table>

**Travel related measures**

| Travel related measures including border control are not recommended | Massive travel restrictions and border closure has not proven to be an effective strategy for significantly delaying the spread of pandemic influenza. In addition, they divert important resources needed in other sectors. The number of imported cases is not affected by border screening in the country of arrival. |

**3.2 Areas for further research**

The following list of research recommendations was developed at the workpackage leader meeting in Delft / The Netherlands held on 29th & 30th November 2007.

**General:**

- Research into improving policy decision-making & implementation.
- Research on decision-making procedures and ethical issues related to prioritisation of groups or individuals receiving treatment and interventions in infectious disease control.
- Further research into broad-spectrum (pre-pandemic) influenza vaccines.
- Possible effectiveness and acceptability of social distancing measures and behavioural response to emerging epidemic risks.
- Understanding the conditions for evolution of an AI strain for successful transmission and pathogenicity to humans.
WP 2:
- Improving and applying existing tools to quantify the risk of importation of certain, emerging (vector-borne) diseases from the source country into Europe and the risk of onward transmission.
- Assessing travel movements and the socio-demographic characteristics of the traveller.
- Tools to detect the start of a pandemic.

WP 4:
- Further development of real time modelling tools for predicting pandemic flu.
- Research how to communicate results from real time models to HCWs, policy makers and the public.
- Further development of European spatial spread model.
- Further development of European contact network models.
- Possible effectiveness of social distance measures.
- Understanding transmission of influenza (e.g. sub-clinical infections).

WP 5:
- More theory-based research into the determinants of health behaviours in different contexts and different epidemic phases.
- Research into tailored communication in different sub-groups of population in communication about infectious diseases.
- Consequences for the individual (patient or other persons affected) by an epidemic.

WP 6:
- Development of case studies of successful risk communication during infectious disease outbreaks.

WP 7:
- Behavioural response to epidemic risks; integrating epidemic and economic models.
- Estimating the opportunity costs of epidemics.

WP 8:
- What shapes/influences health policy (in infectious disease control)?
- How can research results on the prevention and control of infectious disease be communicated most effectively to be implemented.
- How to enhance evidence based-informed policy making in infectious disease control.
Reference List


4 Appendix

Workpackage 2: Risk Assessment

Risk assessment of SARS introduction from source infected region to uninfected destination
Aicha Goubar, Dounia Bitar and Jean-Claude Desenclos

Objective:
Develop a method to quantify the risk of introduction of infections such as SARS from an infected region to an uninfected region by air travel mean. Two scenarios were analyzed using 2003 SARS outbreak to predict the number of infected cases traveling and arriving from Beijing to Frankfurt and from Hong Kong to London.

Method:
Estimates could be obtained given that the epidemic curve is available under an ongoing outbreak assumption. This available data, given information on the incubation period, are back-calculated to estimate the distribution of individuals by time of infection. Then simulations of events are carried out individually for every case to shape his contribution to the overall risk of importation. According to the clinical state of the infected individual, the set of events include hospitalization (isolation), travel and detection by border screening at arrival.

Key Findings:
Given an epidemiological situation similar to the 2003 SARS outbreak, the results in the two scenarios show that the predicted number of cases arriving from the infected regions to the destinations during the outbreak increase exponentially over time in the same way as the epidemic growth. Importation depends thus on the time when the outbreak started in each source area and is related to the transmission dynamic in that areas. Intensity of travel traffic between regions is one of the key factors that might ease excess in importation of the infection. The predicted number of imported cases is unaffected by border screening applied to symptomatic travelers. This is because incubating travelers are unlikely to develop symptoms during flight and won’t be detected at arrival.

Conclusions:
The results confirm the possibility of introduction of SARS as was experienced in 2003 by several countries. It gives an indication on the risk of importation of SARS to other regions with similar travel volumes from the source regions. The method is applicable to other infection such Influenza given the availability of the required epidemiological data.

Recommendations:
- strengthen support for the affected regions to contain and control the epidemics
- Prepare the unaffected regions:
  - to be careful and conscientious about the threat when first cases notified in affected region.
To be ready for surveillance and early detection as well as early response

- Cooperation between public health organizations for a global control and containment of infections
- Ease access to the epidemiological data in particular in the beginning of outbreaks when uncertainty about the parameters needed for modeling works and risk assessment of importation and introduction of emerging infections.

**Reports and publications:**

D 2.2: Collect databases

D 2.3: Application of the risk assessment model for influenza
http://www2.eur.nl/fgg/mgz/SARSControl/Members/deliverables%20WP2/Why_Not_Influenza4finalJCD.pdf

D 2.5: Final report on risk assessment models

**Articles**

Goubar A et al. An Approach to estimate the number of SARS cases imported by international air travel. Submitted to Emerging Infectious diseases, 13/12/2007.

Workpackage 3: Chinese Data Analysis

The SARS Epidemic in Mainland China: Bringing Together All Epidemiological Data
Dan Feng, Sake J. de Vlas, Li-Qun Fang, Xiao-Na Han, Wen-Juan Zhao, Shen Sheng, Hong Yang, Zhong-wei Jia, Jan H. Richardus, Wu-Chun Cao

(article submitted)

An outbreak of severe acute respiratory syndrome (SARS) occurred in mainland China. WHO reported for China a total of 5327 cases, of which 348 died, but these numbers have often been questioned. Unawareness of the medical profession, lack of information, ubiquitous panic, limited unified organization, an imperfect reporting system and not responding timely has considerably hampered data collection. Furthermore, the data collection was complicated by changes in SARS case definition during the epidemic. We have integrated all existing Chinese SARS data sources into one final database. This involved removing non-probable and duplicate cases, adding cases at the final stage of the outbreak, and collecting missing information. The resulting database contains a total of 5328 probable SARS cases, of whom 343 had died, i.e. the case fatality ratio (CFR) equals 6.4%. These total numbers are not very different from the original official reports, but they do concern a considerable number of added and removed cases. The database is now ready for further analysis. Here, we report some summary figures and compare them with those from three other SARS-affected areas: Hong Kong Special Administrative Region of China, China Taiwan, and Singapore. In particular, the SARS epidemic in mainland China resulted in a considerably lower CFR than elsewhere. Furthermore, the Chinese cases were relatively younger and included fewer health care workers. To optimize future data collection during a large-scale outbreak of an emerging or re-emerging infectious disease, China must further improve the infectious diseases reporting system, enhance mechanism of collaboration among all levels of CDC, health departments, hospitals and institutes nationally and globally, and train the specialized staffs working at county CDC to professionalize routine data collection in order to improve the timeliness, accuracy and completeness of data collection. The SARS Epidemic in Mainland China

Mathematical modeling of SARS and other infectious diseases in China

X.N. Han, S.J. de Vlas, D. Feng, L.Q. Fang, W.C. Cao, J.D.F. Habbema

We give an overview of the recent history of publications on mathematical modeling of infectious diseases in the Chinese literature, and we provide a more detailed review of the models on SARS. The number of publications on mathematical modeling used to fluctuate between 12 and 20 per year, but since the SARS epidemic in 2003 this number has increased four to five-fold. This increase did not only include papers on SARS (63 until mid 2006), but also on modeling of various other infectious diseases, thereby indicating a substantial expansion of modelling experience in China. For a selection of the 17 most important SARS models we have further looked into their methodologies, objectives, main findings, and caveats. A typical problem for most modeling studies was availability and quality of data has to be improved, together with a lack of involvement of disease experts and decision-makers, making the studies having limited use for policies on control. Still, we expect that the recently obtained Chinese experience on modeling, together with the current better access to and exchange of epidemiological data, has paved the way for a more substantial role of this discipline during possible future outbreaks of infectious diseases. Also, we hope that our overview of Chinese modeling initiatives, thus far better accessibility for non-Chinese readers, will lead to more international collaboration.

http://www2.eur.nl/fgg/mgz/SARSControl/Members/deliverables%20WP3/Mathematical%20modeling%20of%20SARS%20and%20other%20infectious%20disease.pdf

Articles Published


Work package 4: Mathematical Modelling

Delving the international spread of pandemic influenza.
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BACKGROUND: The recent emergence of hypervirulent subtypes of avian influenza has underlined the potentially devastating effects of pandemic influenza. Were such a virus to acquire the ability to spread efficiently between humans, control would almost certainly be hampered by limited vaccine supplies unless global spread could be substantially delayed. Moreover, the large increases that have occurred in international air travel might be expected to lead to more rapid global dissemination than in previous pandemics.

METHODS AND FINDINGS: To evaluate the potential of local control measures and travel restrictions to impede global dissemination, we developed stochastic models of the international spread of influenza based on extensions of coupled epidemic transmission models. These models have been shown to be capable of accurately forecasting local and global spread of epidemic and pandemic influenza. We show that under most scenarios restrictions on air travel are likely to be of surprisingly little value in delaying epidemics, unless almost all travel ceases very soon after epidemics are detected.

CONCLUSIONS: Interventions to reduce local transmission of influenza are likely to be more effective at reducing the rate of global spread and less vulnerable to implementation delays than air travel restrictions. Nevertheless, under the most plausible scenarios, achievable delays are small compared with the time needed to accumulate substantial vaccine stocks.

Precautionary Behavior in Response to Perceived Threat of Pandemic Influenza


Faced with an epidemic of an infectious disease, persons may take precautionary actions to try to reduce their risk. Such actions include avoiding situations that persons perceive to be risky, which can have negative health and economic effects. Therefore, we conducted a population-based survey of persons' precautionary actions in response to a hypothetical influenza pandemic. For the 5 European and 3 Asian regions that had been affected by severe acute respiratory syndrome, the pattern of reported precautionary action was broadly similar across the regions; ≈75% of respondents reported that they would avoid public transportation and 20%–30% would try to stay indoors. Some regional differences were noted; Europeans were more likely than Asians to avoid places of entertainment, and Asians were more likely to avoid seeing physicians. This international survey provides insight into what might be expected during an influenza pandemic.

Reports
D4.2 Report on epidemiological, clinical and behavioural parameter values for both influenza and SARS
Work package 5: Risk Perception

SARS related risk perceptions in Europe and East Asia

Objectives

1. To analyse SARS-related risk perceptions and precautionary actions and compare these to risk perceptions and actions related to other infectious diseases and non infectious disease health risks in Europe and East Asia;

2. To identify determinants of risk perceptions and precautionary actions related to SARS, other infectious diseases and important health risks;

3. To explore which sources of information about SARS were used, and to assess the credibility and appreciation of these sources, in Europe and Eastern Asia;

4. To develop strategies for effective risk communication directed at realistic risk perceptions and precautionary actions in the populations.

Summary of results

- The pattern of risk perception between diseases appears to be similar across countries.

- Risk perceptions for SARS and a new influenza virus are high, especially when people are asked to envision a situation of an outbreak in their country of residence.

- Risk perceptions for SARS and influenza differ between countries and region and vary according to gender and age.

- Risk perception of SARS was highest in Poland, Hong Kong and the Netherlands, in both women and men. It was lowest in Singapore, the UK and Denmark.

- In line with most research on risk perceptions, women have higher risk perceptions than men for all diseases assessed.

- In Europe: risk perceptions are high; but efficacy beliefs are relatively low

- In Asia efficacy beliefs are higher, likely because of first hand experience with SARS

- Mass media such as television and newspapers are used most often as information sources for emerging infectious diseases, and are well trusted. Use of and confidence in both television and newspapers are higher in Asia than in Europe.

Recommendations:

- Risk communication should focus on: improving specific precautionary behaviour and the efficacy beliefs necessary for this; communicating about what people can do to appropriately and effectively reduce their risks.

- Governments and health agencies can use mass media to communicate risk management information to the general public. They should learn how to use the media effectively.
Reports

5.2 Survey study protocol: WP5_Survey Study Protocol (will be added to the SARSControl website)


D5.7 Country reports on risk perception, precautionary actions and information sources included in the Risk Perceptions Survey report (see D5.8)


D5.9 Recommendations for risk communication strategies and communication channels: http://www2.eur.nl/fgg/mgz/SARSControl/Members/deliverables%20WP5/SARSControl%20WP5%20and%20WP6%20Conclusions%20and%20Recommendations_06..pdf

Articles Published

Impact of SARS on vulnerable communities: the United Kingdom and the Netherlands

Objective: To explore SARS-related risk perceptions and protective behaviour among vulnerable populations in unaffected countries using the experiences of local Chinese communities in the United Kingdom (UK) and the Netherlands (NL) as a case study. The study results will inform improved public health response to emerging infections and reduce negative impacts on vulnerable populations.

Summary of results:

Learning about SARS

Sources of information with Chinese languages, depth of coverage, updates and proximity to the outbreak were preferred by respondents during the SARS outbreak. Mass media coverage from affected and unaffected regions was regarded as exaggerated and sensational. The perceived gap in European information on protective measures led respondents that felt vulnerable to SARS to adopt advice derived from affected regions. Rumours about returnees from affected regions fuelled anxiety.

Lower risk perceptions

News coverage demonstrating the lower death toll of SARS compared to flu / traffic accidents and reassurance from people in affected regions contributed to lower risk perceptions. A lower sense of vulnerability was informed by distance from the outbreak in the UK/NL and a belief that cooler climates were not conducive to SARS transmission. Trust in port controls and quarantine were also a feature of these respondents risk perceptions. Respondents that had lower levels of unfamiliar social contacts and lived in smaller towns with fewer tourists and Chinese felt less threatened as did those with fatalistic beliefs or unwillingness to allow external factors to hamper everyday life.

Higher risk perception

SARS was regarded as a serious threat by respondents that believed SARS was incurable, fatal, mysterious, highly transmissible, quick to develop, and with a high death toll. Such views were constructed from mass media coverage, particularly stories of how SARS originated and spread in Hong Kong. An absence of relevant local information on protective measures nourished a sense of vulnerability. People working in environments with prolonged contact with tourists and unfamiliar members of the Chinese public felt particularly vulnerable.

Precautionary behaviour

Trips to affected regions were postponed or cancelled and respondents avoided Chinese and tourist gathering places. Relatives and friends returning from affected regions were avoided and self-imposed or advised quarantine was regarded as a necessary precaution. Facemasks were mainly worn on visits to affected regions and during flights. Other measures included caution around anyone coughing, hand-washing, and healthy living in order to be fit enough to fight off any infection.

Efficacy

Low response-efficacy resulted from absent or conflicting information about protective behaviour in Europe self-efficacy was lower if protective measures were associated with other adverse outcomes. For example, concerns about attracting discrimination or harming relationships. Knowledge of practices in affected regions and the ease of undertaking
measures such as cancelling trips, avoiding public places and paying attention to hygiene informed a higher sense of self-efficacy. Higher self-efficacy was improved by respondents’ knowledge of avoiding infections such as colds or flu.

Adverse impacts of SARS

Chinatowns in major cities experienced a drop in tourists and local Chinese customers and attendance decreased in some Chinese community centres. Participants reported anxiety about families in affected regions and when making trips to these areas. Tensions between residents and visitors/returnees were reported in response to rumours about local SARS cases and failure of quarantine practices. The way in which the media linked SARS with Chinese people caused some to feel discriminated against.

Conclusions

The results confirm the presence of adverse economical, social and psychological impacts of emerging infections on communities living in unaffected regions that have ethnic, familial or business links with regions identified with the source of the outbreak. The global media had an impact on the formation of risk perceptions and protective behaviour in unaffected regions.

**Recommendations:**

- Timely risk communications detailing effective and non-effective protective behaviour are required that address specific risk perceptions and efficacy beliefs of communities originating from affected regions.
- A global media strategy is required and an infrastructure capable of utilising the multiple sources of information vulnerable communities are exposed to.
- Risk communications need to result from a dialogue with communities and make better use of new multi-platform technologies.

**Reports and publications**

D5.8 Work Package 5 Qualitative report (Impact of SARS on vulnerable communities: the United Kingdom and Netherlands)


D5.9 Recommendations for risk communication strategies and communication channels

http://www2.eur.nl/fgg/mgz/SARSControl/Members/deliverables%20WP5/SARSControl%20WP5%20and%20WP6%20Conclusions%20and%20Recommendations_06..pdf
Workpackage 6: Risk Communication

Summary of Results:
Deliverable 6.1 set out the parameters and methodology to be used for the study of risk communication policies followed during the SARS epidemic by the government and authorities in China, Taiwan, Hong Kong, Vietnam and Singapore (the countries and regions affected by SARS in Asia) as well as the risk communication policies followed by the European Union and the World Health Organization. It was decided to do a qualitative study looking at the institutions and structures used for risk communication and link them to the policies that were followed.

Deliverable 6.2 was the working document produced for the first integration workshop, and laid out the institutional frameworks, communication policies and communication dilemmas that the different governments faced. It made the following summary assessment: “The outbreak of an unknown disease spreading rapidly in hospitals and the general population, poses incredible challenges for any government or organization. Given the scale and gravity of the crisis, governments in the region on the whole responded rapidly to the challenge of providing the public with the information that they needed to fight the disease. The only exception was China, where for a considerable period after the disease broke out, the authorities failed to provide either their own people or the outside world with information on the disease, causing great harm both to China and the countries to which SARS spread. However, even in the case of China, once the decision was taken to communicate openly, information was provided clearly and efficiently to the public.”

Deliverable 6.3 made the following recommendations:

1. Build commitment at the highest political levels within countries for early and open communication. This is particularly important in countries and regions which do not have a tradition of open communication between government and public. It is only with the support of the highest political authorities that open communication will be possible, and it is important to secure this in advance. Here, the international community will have a role to play in encouraging countries to adopt open communication policies through dialogue and discussions on the benefits of such policies. Open communication about diseases is often difficult for governments, which fear the economic and political costs that might flow from such disclosure. There are examples from across the world to demonstrate this reluctance to communicate, from BSE in the United Kingdom to SARS in China. But as SARS demonstrated, diseases spread through lack of knowledge, and there is a high cost both to nations and to the international community in lack of early disclosure. It is important that governments across the world agree that they have an obligation to community rapidly about diseases.

2. Building an infrastructure for efficient communication and ensuring adequate resources for communication. Though all the countries and regions that were affected by SARS had effective mass communication networks, poorer countries will need help to strengthen their communication channels.

3. Ensuring regional and international coordination between health communicators. In today’s age of global news flows, people in one country are aware of what is happening in other countries, and if there are significant differences in messages being put out in different countries, this could lead to questions from the public.
4 Training programmes for health communicators. SARS exposed the challenges for both health communicators and journalists of explaining an unknown disease to an anxious public. There is a great deal of experience now available in the countries that faced SARS on the challenges faced by communicators, and the success and failures of their strategies. It is important to tap this expertise, and it is recommended that a training programmes and seminars be conducted to help disseminate some of this experience. Also, given that the mass media is the most effective way to get messages to large audiences, it is important that spokespersons be trained to work with the media and use the media to deliver messages.

5 Training programmes for the media. Journalists too found the requirements of reporting on SARS challenging. Given the lack of specialised health reporters in the region, many reporters who had never reported on health issues before found themselves reporting on a major infectious disease epidemic. Many journalists were unfamiliar with medical and technical terms that experts used, and where there were differing opinions and viewpoints, were unable to synthesise information in a way that readers could comprehend. Training programmes to familiarise journalists with basic concepts in epidemiology and public health should help ensure better quality media reporting.

6 Ensure that communications plans are place as soon as possible, given the unpredictability of infectious disease epidemics. These plans should include channels of communication to be used, templates for messages, and designated spokesmen to brief the press.

7 It is important to test the efficacy of messages, and put in place feedback mechanisms to see whether the messages that are being put out are getting through to the public clearly. If messages are not getting through effectively or are being misinterpreted, then mechanisms should be in place to fine tune messages.

**Core Recommendations:**

- Build commitment at highest political levels for open communication during outbreaks
- Ensure regional and international coordination between health communicators.
- Ensure communication plans are in place as soon as possible, given the unpredictability of disease epidemics.
- Test efficacy of your messages constantly through public feedback mechanisms to ensure they are getting through clearly.
Workpackage 7: Economic Analysis

Cost-effectiveness of Antiviral Stockpiling and Near-Patient Testing for Potential Influenza Pandemic

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A decision analytical model was developed to investigate the cost-effectiveness of stockpiling antiviral (AV) drugs for a potential influenza pandemic in the United Kingdom and the possible role of near-patient testing in conserving AV drug stocks. Under base-case assumptions (including a fixed stockpile that was smaller than the clinical attack rate), the treat-only option (treating all symptomatic patients with AV drugs) would be considered cost-effective (£1,900–£13,700 per quality-adjusted life year [QALY] gained, depending on the fatality scenario), compared with no intervention (nonintervention but management of cases as they arise). The test-treat option (testing all symptomatic patients but treating those with positive tests results only) would result in moderate gains in QALYs over the treat-only option but at relatively large additional costs. Stockpiling sufficient AV drugs (but not near-patient tests) to treat all patients with clinical cases would be cost-effective, provided AV drugs are effective at preventing deaths from pandemic influenza.
Partially wrong? Partial equilibrium and the economic analysis of public health emergencies of international concern

P. Beutels, W. J. Edmunds, R. D. Smith

Health Econ. 2008 [Epub ahead of print]

We argue that traditional health economic analysis is ill-equipped to estimate the cost effectiveness and cost benefit of interventions that aim at controlling and/or preventing public health emergencies of international concern (such as pandemic influenza or severe acute respiratory syndrome). The implicit assumption of partial equilibrium within both the health sector itself and - if a wider perspective is adopted - the economy as a whole would be violated by such emergencies. We propose an alternative, with the specific aim of accounting for the behavioural changes and capacity problems that are expected to occur when such an outbreak strikes.

Reports

D7.5. Review of SARS economics

http://www2.eur.nl/fgg/mgz/SARSControl/Members/deliverables%20WP7/D75revieweconomicimpact.pdf

D7.6 Report on macro-economic impact

http://www2.eur.nl/fgg/mgz/SARSControl/Members/deliverables%20WP7/Compact%20Paper%20for%20SARS%20website.pdf

Articles


Keogh-Brown MR and Smith RD. The economic impact of SARS: how does the reality match the predictions?. Health Policy (in revision).


Work package 8: Policy Evaluation

D8.1 Analyses of European strategies to control pandemic infections

Objective: The analysis focuses on the major strategies applied by European countries to manage pandemic infectious diseases. Both, measures implemented to control the 2002/2003 SARS outbreak and the level of preparedness to prevent and control pandemic influenza were reviewed.

The constantly increasing international travel and trade activities have made the spread of pandemic infectious diseases more likely than ever. Deficiencies in national disease management endanger not only the own population but also citizens of other countries. The 2002/03 SARS pandemic within a period of four months afflicted 29 countries worldwide including nine European nations. The aim of this study is to analyse European policies for controlling pandemic infections in order to identify strengths and weaknesses in outbreak control.

Three published surveys on SARS response and pandemic influenza preparedness were reviewed.

A survey on European strategies to control the 2002/03 SARS outbreak showed that countries applied a variety of disease control measures and outbreak management activities. Disease management guidelines and guidance for health authorities were available in most countries. Also inter-ministerial co-operation within a nation and the co-operation with international institutes, like WHO and the European Commission, was reported by most nations. However, the application of disease control measures was not consistent among the member states. For example, the legislation to place case contacts under quarantine was not provided by 35% of the countries. The review of influenza pandemic preparedness activities showed that the majority of European pandemic plans included guidelines for national disease management like for example plans for a national command and control structure, disease surveillance and risk communication etc. But the preparation of public health intervention measures was insufficiently implemented by some nations. For example, most nations refer to medical intervention strategies, without mentioning non-pharmaceutical control strategies in their preparedness plans. In addition, the survey showed that only 20% of the nations had run simulation exercises on their plans.

International studies for both SARS and pandemic influenza show that early detection of cases and rapid implementation of control measures are crucial to contain disease spread. Detailed guidelines for pharmaceutical intervention measures (like vaccination priorities or distribution of antivirals) exist in influenza pandemic preparedness plans, yet the application of non-pharmaceutical intervention measures are not described as comprehensively. To control an influenza pandemic, well planned non-pharmaceutical interventions are essential, also because vaccines and antiviral drugs may not be available in sufficient quantities or could be ineffective. In addition, mathematical modelling suggests that the sole application of medical intervention will not contain an influenza outbreak. Therefore, pandemic containment strategies should be based on both, pharmaceutical and non-pharmaceutical measures. Regular systematic analyses of national pandemic policies are an important tool for supporting policy makers in improving and updating their prevention and response system.
Core Recommendations:

- Focus on a clear description of non-pharmaceutical intervention strategies in preparedness planning, taking legal and ethical aspects into consideration.
- Discuss areas of co-operation with neighbouring countries and include joint outbreak control strategies in pandemic plans.
- Update pandemic preparedness plans regularly and conduct simulation exercises.

Reports and publications

D8.1 Report on European control strategies

http://www2.eur.nl/fgg/mgz/SARSControl/Members/deliverables%20WP8/D%208.1%20(first%20Version).pdf
D 8.2 Control Measures Implemented by the Non-European SARS affected countries

Objective: To identify the major SARS control strategies implemented by the Non-EU countries most severely affected by the 2002/03 SARS epidemic and to identify differences in their approach. The findings of this report would provide lessons to policy makers to improve preparedness leading to a better and timelier public health response in future.

An intensive literature search using the main control categories used in the EU Commission report of June 2003 on the “Measures undertaken by member states and accession countries to control the outbreak of SARS” provided the basis for the report on how the individual countries responded to SARS. The Countries included were China Mainland, Hong Kong (SAR-China), Taiwan (RoC), Singapore, Vietnam and Canada which experienced local SARS transmission (98% of SARS cases worldwide) and United States, Thailand, Malaysia and Australia affected by SARS due to imported SARS cases only.

As the new contagious respiratory disease ‘SARS’ began to spread outside China in 2003, national governments, public health authorities as well as international organizations began recommending and introducing measures to prevent the outbreak from spreading. WHO alerted the world health community to the appearance of a new contagious disease through its two global alerts on 12th & 15th March’03, by giving a case definition and name to the disease, by informing that it was also being transmitted via air travel and by recommending first treatment and control measures including isolation and barrier nursing of cases. The realization that the extent of spread was greater than expected, led to the introduction of measures like rapid dissemination of information to the health care providers, enhancing early case detection, active contact tracing, quarantine of contacts of SARS cases, entry and exit screening at airports, risk communication to raise public awareness and institution of even stricter infection control and barrier precautions in health care settings. Timely information followed by immediate institution of control measures has been vital in containing the SARS outbreak, calculations reveal that delaying the application of control measures by 1 week could result in an almost three fold increase in epidemic size and a 4 week longer duration. The control measures implemented by the countries closely resembled each other and were generally in line with the WHO recommendations. Differences among the countries were seen in the timeliness of implementation of control measures, in the mode and extent to which individual countries went to apply or enforce measures like for e.g. quarantine and the resources available. The co-operation among countries and specially the co-ordination and support extended by the WHO helped to organize a co-ordinated response based on evidence and information gathered through the WHO and other collaborating networks like the Global Outbreak Alert and Response Network (GOARN). Through its GOARN partners, WHO was able to rapidly mobilize expertise and resources and set-up networks of laboratories, clinicians and epidemiologists to find answers to the key epidemiologic parameters, identify the causative agent and send teams to affected areas.

Organizational Measures

All countries set-up SARS task forces for coordinating surveillance, response, and communication activities and made legislative amendments in their infectious disease acts making SARS a notifiable disease by end of March’03 except China where complete reporting started around mid of April’03.
Quarantine

Most of the severely affected countries made legislative amendments to legalise quarantine enforcement and placed close contacts under home quarantine yet in some instances China and Taiwan quarantined whole institutions like hospitals or universities etc. In countries affected by imported SARS cases, quarantine was generally voluntary. Retrospectively the effectiveness of quarantine in containing SARS spread considering that only a very small percentage of quarantined individuals developed SARS and that it is not transmitted by asymptomatic individuals is questionable.

Contact Tracing

All of the severely affected countries instituted contact tracing activities for close contacts. Hong Kong already began in late February’03 to trace contacts of atypical pneumonia cases and Singapore made intensive efforts to locate contacts within 24 hrs. of case notification. Singapore identified 25% and Hong Kong 14% of SARS cases by contact tracing activities, yet the percentage of contacts traced in most of the severely affected countries was generally very limited.

Case definition

Criteria for case definitions of new diseases evolve as information accumulates. In June 2003 at the WHO Global Meeting on SARS in Malaysia it become clear that many countries had adopted their own case definitions creating confusion. (15) The case definition was criticised for not being sensitive enough, for countries experiencing local transmission and too unspecific when applied to countries having only sporadic cases. Singapore expanded on the WHO case definition to also detect cases with atypical presentations as early as possible, while Canada included only contact to a setting associated with SARS clusters to the case definition. Cases considered as a SARS case in one country were not classified so in another.

Hospital containment measures

Health care facilities were the actual points of entry of SARS into a country as well as spread within the country as was seen in most of the countries which experienced local transmission. Apart from strict isolation of cases often in designated SARS hospitals, establishing separate triage facilities and guidelines and restricting hospital visitors many guidelines for e.g. hospital discharge guidelines, guidelines for performing high risk procedures like intubation etc. were developed.

As HCWs were specially vulnerable both to contracting the infection and also to transmitting it, most countries established active surveillance including daily temperature checks and maintaining contact registers as well as restricting them to work in one institution only. All countries developed detailed infection control guidelines to prevent nosocomial transmission. Shortage of personal protective equipment (PPE) supplies and inadequate use of PPE was a problem faced by many of the severely affected countries. The WHO with the help of its GOARN partners and various NGO’s assisted national health care institutions in training and provision of PPE supplies.

Surge capacity

Surge capacity was another problem as a large number of additional HCWs had to be recruited within a short time to work risking their own health. In many countries HCWs worked voluntarily but in some countries like Taiwan or China those who refused were punished or threatened with the withdrawal of practicing license etc.
Travel related measures

WHO’s travel advisories, maintaining a list of SARS affected countries and WHO’s recommendation for SARS affected countries to perform exit screening, significantly affected travel and trade activities but also served as a benchmark when it was safe to resume travel and to enhance public confidence. Detecting a rare disease like SARS with non-specific tools like health alert notices, health declaration cards or thermal scanners is very unlikely as was seen by the extremely low detection rate as a result of worldwide travel screening activities making the effectiveness questionable considering the immense resources involved. Yet maintaining passenger contact information and preventing ill passengers from air travel are effective preventive measures.

Media

Public dissemination of information was dealt with differently among the countries while some provided information as it became available others initially tried to restrict its flow. The means ranged from official press conferences, news casts, educational TV programs, TV channels solely devoted to SARS, seminars, telephone hotlines, print media, roving exhibitions, advertisements and billboards to SARS specific websites. Uncoordinated interaction with the media and sometimes divergent opinions also led to public confusion. WHO press officers and media experts assisted many of the affected countries to deal with the local and international media in a coordinated manner and provide regular information. Once the public became aware of the signs and symptoms of SARS, they were able to act taking appropriate preventive measures as recommended. In addition the interval between onset of symptoms to isolation of cases significantly reduced from >6 days in the 2nd week to < 2 days in the later phase both in Singapore and China.

All preparedness plans and containment activities would be futile both in developing and developed countries if the weaker countries are not supported in their quest and provided resources to strengthen their surveillance, preparedness and response systems.

Core Recommendations

1. To facilitate comparability, agree on a single international working case definition even if national case definitions are additionally applied within the country.

2. Establish standardized protocols and clear guidelines for case reporting, and pathways to be followed during reporting.

3. Learning from experiences by rapidly sharing information within and among nations to facilitate earlier and better preparedness and save time.

4. Surveillance in case of SARS should especially focus on vulnerable groups like health care workers, elderly, immuno-compromised patients and particularly on atypical presentations among these groups.

5. Promulgate trustworthy news early, preferably through a single known and trusted spokesperson, to avoid panic and contribute to early case detection and co-operation from the public.

6. Training of a core team of health care workers, with competencies in infectious disease control at hospital level and identification of communicable disease control experts who can be called upon when required

7. To develop an emergency and response team at national level which can be called upon by affected authorities/institutions to deal with infectious disease outbreaks.
Reports and publications

SARSControl Workpackage 8, D8.2: Report on Control Measures Implemented by the Non-European SARS affected countries

http://www2.eur.nl/fgg/mgz/SARSControl/Members/deliverables%20WP8/Non%20European%20SARSControl%20Measures%20D8%20Final.pdf

Article submitted
D8.3 & D 8.6 Analyses of national policies to manage pandemic infectious disease (HACCP Model)

Objective: To identify strengths and weaknesses in national pandemic disease policies in order to develop recommendations to improve pandemic preparedness and control

In order to identify critical control points of pandemic management, flowcharts of policy components, like disease surveillance, command and control system and implementation of community containment measures were developed. These flowcharts are based on a review of articles and guidelines for both, SARS and pandemic influenza (both pandemics need different containment strategies, but the national public health systems for managing these infections are comparable). All levels of a public health system that is national, local and institutional are involved in pandemic outbreak management. Therefore, clear pre-defined responsibilities and co-operation structures between these levels are essential to have a co-ordinated approach. Surveillance, hospital infection control, community containment measures as well as risk communication are examples of measures to be applied for controlling pandemic spread. In order to co-ordinate and harmonise these activities, pandemic plans need to specify tasks applied during the different pandemic phases. Pandemic plans should (i) provide specific guidelines for outbreak management activities, (ii) identify and name relevant outbreak management authorities, assign responsibilities and develop strategies for recruiting staff when required (e.g. HCWs), (iii) identify the national surge capacity informing about available resources (e.g. quantity of stockpiled drugs/vaccines, PPE etc.) and (iv) state strategies on how to deal with overwhelmed health systems (e.g. sharing laboratory resources with neighbouring countries). In order to ensure that the national pandemic control system is effective and can be activated at anytime, the plans should be updated regularly and authorities involved in the outbreak management process should participate in simulation exercises.

Core recommendations:
Separate action plans for all involved institutions/ministries have to be developed (at international, national and local level), in order to have predefined application standards and responsibilities

- Pandemic preparedness plans should consist of guidelines, define responsibilities of governmental organizations and institutions; state available resources and suggest alternate strategies (e.g. co-operation with neighbouring countries) in case health systems are overwhelmed
- Health care facilities should develop surveillance strategies for patients, visitors and staff to ensure fast contact tracing in case of an outbreak.
- Medical personnel should be trained in clinical evaluation of patients; proper infection control practice and the correct use of personal protective equipment
- Identify national laboratories capable of working within the “Multi-centre Collaborative Network” according to the WHO guidelines
- Pandemic plans should be updated and tested regularly
Reports and publications

D8.3 HACCP model

D8.6 Report on HACCP analysis and derived recommendations
http://www2.eur.nl/fgg/mgz/SARSControl/Members/deliverables%20WP8/D8.6%20HACCP%20_SDU_.pdf

Article submitted
D.8.4 & D.8.5 Analysis of Delphi rounds

Objective:
To gather expert opinions on policy issues concerning infectious disease management in order to develop best practice policy recommendations to control SARS and SARS-like diseases in the future.

Summary of the results:
The Delphi survey consisted of one pilot round, two written questionnaire rounds and a final face-to-face group meeting. Different policy issues and problem areas within international infectious disease management were selected for the questionnaire based on a literature review, results of a Hazard Analysis and Critical Control Points (HACCP) analysis and input from the other work packages. The questions were pilot tested and distributed electronically to a selected Delphi panel consisting of infectious disease experts from 22 countries. The response rate was 80% (n=38) in round one and 74% (n=28) in round two. The questions that did not reach consensus (less than 75% agreement) in the first round were included in the second round. In the final Delphi face-to-face meeting experts were presented with the results of the first two Delphi rounds and invited to debate the non-consensus issues identified. The latter experts (n=11) did not belong to the written Delphi panel.

The main results of the written Delphi rounds concerned implementation of operational Pandemic Preparedness Plans (PPP) on local, national and trans-national levels with a focus on: ensuring that the PPP are developed in close collaboration with relevant stakeholders; regularly testing of plans on all levels; information on the pandemic plans of a country’s direct neighbours to enable collaboration on outbreak strategies; develop and conduct table top exercises and stimulations between countries to enable smooth functioning of plans during pandemic outbreaks; listing of specific priority groups, for whom countries should have a plan to identify; in order to reduce confusion and misunderstandings during a pandemic, roles and responsibility of the national and local/regional levels need to be clearly defined in the national PPP and the development of local and regional plans need to be monitored by the national level.

Safe and reliable communication systems are recommended as there should be no delay in announcement of information to the media in order to avoid panic and distress, and information to the public should regard confirmed cases and not suspected cases. Correction of rumours in the media should be a communication priority as well as identifying population sub-groups for targeted communication channels.

Challenges of health care systems during an infectious disease outbreak such as scarcity of facilities, human resources, supplies and management capacities need to be anticipated in the pre-pandemic period. Also plans on the maintenance of other essential services such as food/water/gas/electricity/police/fire brigade during a pandemic has to be ascertained in the pre-pandemic period as well to best manage future outbreaks by way of e.g. cooperation between the different service authorities.

Non –medical interventions such as contact tracing, use of face masks by healthcare workers and health advice for travelers are seen to be the most effective control measure in case of SARS and SARS-like diseases.

The main results of the face-to-face Delphi meeting pointed to: a need to define criteria for testing pandemic preparedness plans on different regional levels; travel advice as the only
efficient AND feasible travel policy measure; a need to define priority groups for targeted communication, based on their risk of exposure; the need for defining community containment measures such as quarantine more clearly as well as; and enabling universal access to care in case of an epidemic outbreak. Further strategies mentioned to prevent and control future spread of SARS (and SARS like diseases) are public access to existing research results and securing research capacity on the EU-level. These measures would improve also transferability of the research-based knowledge from SARS to other potential infectious disease outbreaks.

Core recommendations:

- Develop operational Pandemic Preparedness Plans (PPP) at local, national and transnational levels based on regular table top exercises and stimulations of PPP in country as well as between countries.
- Ensuring accessibility and applicability of non-medical interventions like contact tracing strategies and proper use personal protection equipment (e.g. facemasks for healthcare workers).
- Transparent and reliable communication systems to ensure information flows between international organizations, governments, healthcare institutions, workers and the general public.
- Provision of health advice (HA) to travellers in order to prevent and reduce the spread of disease during an outbreak. HA should be published and distributed from credible sources and consist of information on disease symptoms and when, how and where to seek medical care.

Reports and publications:

D. 8.4 Interview questions ready for comments
http://www2.eur.nl/fgg/mgz/SARSControl/Members/deliverables%20WP8/D8.4._09.02.07_.pdf

D. 8.5 Report of interview summaries and Delphi rounds
http://www2.eur.nl/fgg/mgz/SARSControl/Members/deliverables%20WP8/D.8.5%20Delphi%20rounds.pdf
Modelling of SARS intervention scenarios

**Objective:** To identify effective intervention measures and their interactions in the control of SARS

Respiratory infectious diseases with pandemic potential like SARS and pandemic influenza can threaten the health of people at large. These diseases can be transmitted from person to person and spread globally by worldwide travel. A variety of intervention measures exist to prevent and control pandemic disease spread. They differ in their approaches and their effectiveness in reducing the number of cases getting infected.

The effects of different intervention measures were investigated by a mathematical modelling approach, with comparisons being based on the effective reproduction number ($R_e$).

The analysis showed that early case detection followed by strict isolation can control a SARS outbreak. Tracing close contacts of cases and contacts of exposed health care workers can additionally reduce the $R_e$. Yet, tracing of casual contacts and measures aiming to decrease social interaction were less effective in reducing the number of SARS cases.

The study emphasizes the importance of early identification and isolation of SARS cases to reduce the number of people getting infected. However, doing so transfers cases to health care facilities, making infection control measures in hospitals essential to avoid nosocomial spread. Therefore, medical equipment and well trained personnel is needed for maintaining infection control standards. Measures which decrease social interaction, like closing schools and cancelling public gatherings, had only a minor impact on reducing the $R_e$ of SARS. Furthermore, such measures cause economic loss and curtail social liberty.

**Core recommendations:**
- A well functioning surveillance infrastructure is needed to facilitate early case detection and contact tracing as soon as possible
- Isolation facilities and staff trained in infection control practice are needed in hospitals to reduce the number of secondary cases
- Measures to decrease social interaction, like banning mass gatherings, have only a minor effect in controlling SARS spread

**Reports and publications**
Article accepted (Feb. 2008): Int J Hyg Environ Health
Ethical Issues in SARS Control; a Framework for Decision Making in Public Health

Background: The political response to the 2002/03 SARS outbreak was associated with a multitude of ethical conflicts. So far, no agreed framework for public health ethics exists. The aim of this analysis is to identify ethical issues which arose during SARS control and to develop a framework for ethical decision making in public health.

Subject and method: A literature review of articles published between 11/2002 and 3/2006 in PubMed (search terms ‘SARS and ethics’) was conducted. The identified ethical issues were classified under clinical ethics; public health ethics, and global health ethics.

Results: Eleven major areas of ethical interest were identified, these were classified under clinical ethics (48% of issues); public health ethics (35% of issues); and global health ethics (17% issues) (Table 1). The framework for public health ethics is based on the four principles of biomedical ethics, which have been adapted to the collective level as follows: Autonomy of the patient – Autonomy of citizens; Beneficence for the individual – Beneficence for populations; Nonmaleficence towards individuals – Protecting societies; Justice – Equity.

Table 1: Ethical issues in SARS control identified by literature review

<table>
<thead>
<tr>
<th>Clinical Ethics</th>
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<tbody>
<tr>
<td>Duty of health care workers (HCWs) to care for patients versus duty to care for themselves to minimize the risk of transmitting disease to others</td>
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<tr>
<td>duty of health care institutions to maximize the safety of HCWs</td>
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<tr>
<td>equality between HCWs during an epidemic</td>
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<tr>
<td>Duty of physicians to act in the best interest of individual patients versus physician’s responsibility to public health in emergencies</td>
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<tr>
<td>Priority setting in health care institutions (collateral damage) versus equity in accessing health care</td>
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<table>
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<tr>
<th>Public Health Ethics</th>
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<tbody>
<tr>
<td>Common good of public health versus individual liberties</td>
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<tr>
<td>Disseminating information about disease spread versus privacy and confidentiality of information</td>
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<tr>
<td>Risk communication through media versus creating fear and panic in societies</td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>Global Health Ethics</th>
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</thead>
<tbody>
<tr>
<td>Applying travel and trade restrictions to control SARS versus economic losses</td>
</tr>
<tr>
<td>Global solidarity versus suppressing health care information with global interests intellectual property rights</td>
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</tbody>
</table>

Discussion: The literature review of articles published about the 2002/03 SARS outbreak highlighted ethical issues such as duty to care; civil liberties; collateral damage; privacy of information or global interdependence. The identified conflicts underline the need for adequate decisions in the control of pandemic diseases based on ethical fundaments since most public health interventions measures are affecting individual freedom. To strike the
balance between protection of the public good and protection of individual rights, the principles of biomedical ethics (Beauchamp and Childress) can be used as a tool for policy decision making when competing ethical interests are at play. Since epidemics demand a quick response these aspects should guide decision-making in public health from the very beginning.

**Core recommendations:**

- In general, more attention has to be paid to ethics in infectious disease control
- Enabling HCWs to make informed decisions and feel secure requires them to be well equipped with the tool of knowledge to deal with pandemic situations.
- Since most intervention measures impinge on personal freedom, communication during the pre-pandemic phase should be based on discussion and dialogue so as to develop publicly acceptable and sustainable measures.
- The diverse social and political contexts are a challenge for developing generally acceptable ethical guidelines on a global level, yet they have to be considered.
- The pros and cons of decisions with regard to public good versus individual rights to privacy, liberty, and freedom of movement, have to be carefully weighed and decisions taken in the light of the *Siracusa Principles* by choosing the least restrictive alternative
- Individual and collective interests have to be balanced
  - Patient’s autonomy vs. citizen’s autonomy
  - Beneficence of the individual vs. Beneficence of populations
  - Nonmaleficence towards individuals vs. Protecting societies
  - Justice vs. Equity

**Reports and publications**


Article submitted
Outcomes Workpackage 8: Policy Evaluation

Books


Finalised articles


Articles submitted


Ahmad A, Krumkamp R, Reintjes R. Controlling SARS: A review on China’s response compared to other SARS affected countries. (submitted)


Kathrin Hertramp K.; Weinberg J, Reintjes R. Hazard analysis and critical control points (HACCP) in public health and medicine: A systematic review. (submitted)


Articles in preparation
Syed AM, Hjarnoe L, Aro AR. Assessment of the Delphi technique in developing international health policies - experience from the SARSControl project. (in preparation)


Seehafer D, Krumkamp R, Reintjes R. Putting research into practice – structures of European Union’s Health Policy in the field of infectious diseases. (in preparation)