SARSControl

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Work package 8
Deliverable 8.6

Report on
HACCP analysis on SARSControl policies
(including recommendations)

University of Southern Denmark
Unit for Health Promotion Research
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Summary

The 2003/2003 outbreak of SARS pointed to the urgent need to plan and prepare appropriate response measures to a possible future threat. Countries and international organizations have put in considerable efforts to improve the current situation.

One of the aims of work package 8, of the European commission funded research project ‘SARSControl’, was to carry out policy evaluation on current SARS policies and develop recommendations to improve preparedness and response of SARS and SARS-like diseases.

To achieve this goal an evaluation study was carried out using the Hazard Analysis and Critical Control Points (HACCP) methodology. The HACCP methodology, initially developed by the U.S. Food and Drug Administration to ensure food safety, was adapted to evaluate policies on SARS response and management in order to develop recommendations. The first step in the process was to carry out an extensive literature review on the 2002/2003 SARS outbreak and identify measures, interventions and strategies used to control the outbreak. The following steps and principles of the HACCP were applied to identify weaknesses and gaps in the management of pandemic diseases like SARS. Building on these weaknesses and gaps recommendations were formulated.

The analysis was carried out based on key policy components identified by the Centre for Disease Control (CDC). The application of the HACCP proved to be an effective tool to identify gabs and put forward policy recommendations to enable effective preparedness and management of a future outbreak of SARS or SARS-like disease.
Introduction

This report is part of the research work on policy evaluation done by WP8 of the EU-funded SARSControl project. The aim of the work was to identify pitfalls/weaknesses in the way the 2002/2003 SARS outbreak was managed in different countries and develop recommendations based on the experiences. To achieve this, a *Hazard Analysis and Critical Control Point* (HACCP) methodology was applied. Key SARS policy components identified by the WHO were used and a literature review\(^1\) was conducted to develop flowcharts of preparedness and response processes. Finally recommendations were developed, suggesting possible ways to reduce or eliminate the hazards, thus minimizing the risk of spread of SARS in case of a future outbreak.

The HACCP method and its application in the SARSControl policy evaluation study is put forth in the following chapters. Chapter 1 describes the methodology of the HACCP and its adaptation for the SARSControl policy evaluation. In Chapter 2, a SARSControl HACCP analysis is done for 4 different policy component and the results are presented.

**List of acronyms and abbreviations**

<table>
<thead>
<tr>
<th>Acronym</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>SARS:</td>
<td>Severe Acute Respiratory Syndrome</td>
</tr>
<tr>
<td>HACCP:</td>
<td>Hazard Analysis and Critical Control Point</td>
</tr>
<tr>
<td>CCP:</td>
<td>Critical Control Point</td>
</tr>
<tr>
<td>WHO:</td>
<td>World Health Organisation</td>
</tr>
<tr>
<td>EC:</td>
<td>European Commission</td>
</tr>
<tr>
<td>CDC:</td>
<td>Centre for Disease Control (USA, Atlanta)</td>
</tr>
<tr>
<td>ECDC:</td>
<td>European Centre for Disease Control</td>
</tr>
<tr>
<td>PPP:</td>
<td>Pandemic Preparedness Plan</td>
</tr>
<tr>
<td>PPE:</td>
<td>Personal Protective Equipment</td>
</tr>
<tr>
<td>CCM:</td>
<td>Community Containment Measures</td>
</tr>
<tr>
<td>HCF:</td>
<td>Health Care Facilities</td>
</tr>
<tr>
<td>HCW:</td>
<td>Health Care Workers</td>
</tr>
<tr>
<td>GP:</td>
<td>General Practitioners</td>
</tr>
</tbody>
</table>

\(^1\) A listing of references used to study each of the policy components is available after each paragraph.
The HACCP method

*Hazard Analysis and Critical Control Points* (HACCP) is a method developed for controlling food production processes, by identifying possible hazards in manufacturing processes. The aim of this method is to identify strategies to prevent, eliminate, or reduce hazard occurrence. The HACCP methodology is adapted for the evaluation of benefits and threats of national prevention, control and response to pandemic infectious diseases (SARSControl-HACCP). The *National Advisory Committee on Microbiological Criteria for foods* has published HACCP application guidelines for an evaluation of food production processes [1]. These guidelines were reviewed and adapted for the analysis of infectious disease policies. The study protocol is on page 8 of this report.

Structure of a HACCP

The HACCP is divided into five main tasks. These are listed in the left hand column of the table below and the right hand column shows the equivalent tasks of the SARS-HACCP.

<table>
<thead>
<tr>
<th>HACCP-Tasks</th>
<th>SARS-HACCP</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>1. Assemble the HACCP team</strong></td>
<td>• Team comprises of WP8 members</td>
</tr>
<tr>
<td></td>
<td>• Support and experience gathered from other SARSControl partners</td>
</tr>
<tr>
<td>• Identify individuals with specific knowledge and experience – they are the HACCP-Team</td>
<td>• Clear definition of SARS and comparable infectious diseases</td>
</tr>
<tr>
<td>• Team has to be multidisciplinary and has to be assisted by experts of other disciplines which are related to the process</td>
<td>• Description of the control systems and the diseases they are applied for</td>
</tr>
<tr>
<td>• These experts have to verify the completeness of the hazard analysis</td>
<td>• The general population (as they are susceptible to infectious disease threats.)</td>
</tr>
<tr>
<td><strong>2. Describe the food and its distribution</strong></td>
<td>• Make a flow diagram of all components involved in the control of SARS. Such</td>
</tr>
<tr>
<td>• Description of food (ingredients, processing, distribution)</td>
<td>• Give a clear and simple overview of the steps involved in the process</td>
</tr>
<tr>
<td>• Clear definition of SARS and comparable infectious diseases</td>
<td>• Flow diagram has to cover all parts of the process</td>
</tr>
<tr>
<td>• Description of the control systems and the diseases they are applied for</td>
<td>• The general population (as they are susceptible to infectious disease threats.)</td>
</tr>
<tr>
<td><strong>3. Describe the intended use and consumers of the food</strong></td>
<td>• The general population (as they are susceptible to infectious disease threats.)</td>
</tr>
<tr>
<td>• Describe the normal consumers and the intended use of the food</td>
<td>• Make a flow diagram of all components involved in the control of SARS. Such</td>
</tr>
<tr>
<td><strong>4. Develop a flow diagram that describes the process</strong></td>
<td>• Make a flow diagram of all components involved in the control of SARS. Such</td>
</tr>
</tbody>
</table>
A block diagram is sufficiently descriptive. Flowcharts should be based on guidelines, plans, scientific literature and reports on SARS containment policies.

## 5. Verify the flow diagram

- Perform an on-site review of the operation to verify the accuracy of the diagram
- Experts should comment on the flowcharts

### The seven HACCP principles

The seven principles have to be accomplished to finalise a HACCP plan. The principles are described in the left hand column and their related aims for the SARS-HACCP are shown in the right hand column.

<table>
<thead>
<tr>
<th>Tasks</th>
<th>Approach for the SARS-HACCP</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Conduct a hazard analysis (principle 1)</strong></td>
<td>These points are all important and have to be applied</td>
</tr>
<tr>
<td>• Develop a list of hazards reasonably likely to cause injury or illness if not effectively controlled</td>
<td>• (i), (ii) by e-mail contact, telephone conferences and discussions</td>
</tr>
<tr>
<td>• All related parts of the process have to be considered in the analysis</td>
<td>• Identify hazards by reviewing publications and other documentary</td>
</tr>
<tr>
<td>• HACCP is not a quality control measurement; hazards are defined as limitation of safety</td>
<td>• Tables could be used to list hazards and their control measures</td>
</tr>
<tr>
<td>• If the Hazard analysis is not done correctly the HACCP-plan can not be effective</td>
<td>•</td>
</tr>
</tbody>
</table>
**Determine the critical control points (CCP) (principle 2)**

- Critical Control Points (CCP) is defined as a step at which control can be applied and is essential to prevent or eliminate hazards. The potential of hazard must be addressed by determining a CCP.
- Complete identification of hazards is essential to find the CCP’s. CCP decision tree is useful tool to determine whether a particular step is a CCP for a previously identified hazard.
- CCPs are located at every step were hazards can be prevented, eliminated or reduced.
- Identify CCP: at which step could hazards be controlled, and prevented and eliminated.
- Use CCP decision tree to demonstrate which steps led to a hazard.

**Establish critical limits (principle 3)**

- A critical limit is a maximum or minimum value to which parameter must be controlled at a CCP to prevent, eliminate or reduce to an acceptable level the occurrence of a food safety hazard. A critical limit distinguishes between safe and unsafe operation. Critical limit is no operational limit!
- The SARS related CCPs have with no values, because they are dichotomous: e.g. communication yes/no; identify case yes/no.

**Establish monitoring procedures (principle 4)**

- Evaluate whether a CCP is under control.
- Monitoring has three main proposes: (i) tracking of an operation – bring a process back intro control, (ii) to monitor if corrective actions have to be applied, (iii) documentation for use in verification.
- Monitoring should be continuous and accurate!
- The HACCP is used to identify critical points and shortcomings in policy processes in order to give recommendations. Monitoring of steps could be part of the recommendations but will not be applied in our model.

**Establish corrective actions (principle 5)**

- Develop corrective actions in advance for each CCP.
- Should be part of the recommendations.

**Establish verification procedures (principle 6)**

- Verification is applied to monitor the operability of an HACCP plan. It is crucial for the maintenance of an HACCP system.
- To ensure that the plan is working effectively all hazards need to be controlled.
- Could be recommended to control CCP - Is not part of our HACCP.

**Establish record-keeping and documentation procedures (principle 7)**

- Documentation of the HACCP: steps defined as CCP’s, hazards of concern, critical limits, monitoring, corrective actions.
- Will be include in the final report.
- Documentation of the HACCP development.
Study protocol for the HACCP of infectious disease policies

This chapter includes the description of the SARS-HACCP components, the evaluation of national and international policies for infectious disease with pandemic potential. The study protocol is based on the above outlined adaptation of the HACCP principles.

Preliminary tasks of a HACCP

1. Assemble the HACCP team
Members of WP8 are conducting the HACCP. Further input could be provided by project partners in order to get expert input on the analysed policy components.

2. Describe the content and its distribution
The HACCP is applied to evaluate public health policies for SARS or SARS-like disease. The data on the related policy parts are mainly taken from recommendations published by WHO [1, 3] and Centre for Disease Control and Prevention, Atlanta/USA (CDC) [2], as well as from articles on the 2002/03 SARS outbreak.

3. Describe the process and those affected
The whole public is susceptible to infectious diseases; more at risk are vulnerable groups.

4. Develop a flow diagram that describes the process
The flow diagrams of international/national/local infectious disease policies are drawn using information from policy recommendations, publications on outbreak control activities and other related publications.
A core chart will display the overall connection of all components of infectious disease policies (using information from the CDC-Guidelines [4]). Additional detailed policy flowcharts will display their functionality of the different components.

5. Verify the flow diagram
Different policy experts, e.g. members of the SARSControl project, will review the HACCP model.

The seven HACCP principles

Conduct a hazard analysis (principle 1)
The identification of hazards associated with the policy component will be carried out. This could be done using publications, reviews and guideline published on infectious disease policies and by brainstorming processes. The severity of hazards and the likelihood of their occurrence have to be evaluated. Policy tasks related to the hazard need to be identified in
order to get a picture of the related CCPs. Possible control measures and their influence on the hazards need to be listed.

**Determine the critical control points (principle 2)**
A CCP is a step in the process where a hazard can be prevented, eliminated or reduced. A CCP decision tree (flowchart) will be developed in order to determine whether a particular step is a CCP for a previously identified hazard.

**Establish critical limits (principle 3)**
The specific critical limit of a CCP has to be determined. However, most parts in the policy process have dichotomous characters (like applied – was not applied), for which no values can be defined.

The further principles - Establish monitoring procedures (principle 4); Establish corrective actions (principle 5); Establish verification procedures (principle 6); Establish record-keeping and documentation procedures (principle 7) - are not part of our analyses as they are used to implement a HACCP process. We apply this analysis in order to formulate recommendations for policy improvement. The principles 4 to 7 are used to establish monitoring and intervention actions for processes, which is not part of our analysis. However, principle 4 to 7 will be the basis for recommendations which could also include ongoing monitoring process of control and response activities.

**References:**


SARSControl HACCP analysis

In this chapter flowcharts of key policy component processes are illustrated. They have been developed based on literature reviews of the 2002/2003 SARS outbreak and were used in the identification of potential hazards in the preparedness and response evaluation of SARS control interventions. Based on the flowcharts a thorough process description has been produced for the following policy components:

1. Command and control (Flowchart 1, 2, 3)
2. Preparedness and response in Healthcare facilities (Flowchart 4)
3. Surveillance and laboratory diagnostics (Flowchart 5, 6)
4. Community containment (Flowchart 7)

Please note:
In the next section the flowcharts 1-7 will follow the description of the policy components and thus offer an illustrative overview of the process described. However the description may not follow the pattern of the flowcharts as more information has been retrieved since they were produced.

For a more detailed reading of the flowcharts in a high resolution format please access the SARCControl homepage: www.sarscontrolproject.org/start.html.

Command and Control

Rationale:
Command and control activities are relevant for guiding preparedness measures for pandemic diseases. Preparedness plans need to be formulated on different management levels and precautionary measures need to be applied in order to ensure effective response in case of a disease outbreak. It is recommended that national pandemic preparedness plans (PPP) are in place in each country in order to ensure strategies for disease containment in case of an outbreak situation. In addition to this, the capacity of disease response activities (e.g. surge capacity of laboratories or hospitals) needs to be estimated in order to have data on the national response capacity.

Description of the process:
International institutions, like WHO, European Commission (EC) and European Center for Disease Control (E-CDC) guide nations in their national preparedness planning [1,2,3]. In addition, preparedness plans for institutional, community and regional levels are suggested by WHO. Institutions like laboratories and health care facilities should prepare their own pandemic plan in order to have guidelines for emergency situations available [6].
1. Support by international institutions:

International institutions (WHO, EC and ECDC) are supporting nations in developing their preparedness planning for pandemic infections, like SARS or pandemic influenza [3, 4]. WHO has published guidelines and a checklist for national influenza preparedness planning [6] and guidelines for SARS preparedness and management [7]. In case of pandemic spread they will provide detailed information on disease control and co-ordinate an international disease response.

Possible Hazards

- Published guidelines are not used for national preparedness
- Guidelines are not adequate to be considered by nations
- Nations keep their pandemic preparedness activities confidential and do not participate on policy evaluation at a regional/international level.
- Nations do not participate on preparedness workshops, or do not conduct national preparedness workshops
- Nations do not want to discuss their current preparedness activities with external experts.
- Recommendations to improve national preparedness are not considered
- Research activities (like European framework programs) require time to produce applicable recommendations.

Critical Control Points

- Guidelines on national pandemic preparedness
- Inventory of national preparedness activities
- Support of national preparedness
- Research on Pandemic infections
**Recommendations for support by international institutions:**

- Overall Guidelines have to be written in a common manner, such that they can be adapted by all states and build an overall basis for national preparedness planning.

- Inventory and the support of national preparedness have to be undertaken in a “diplomatic” way in order to avoid unmasking nation’s preparedness activities. Also the public health policy support has to be organised in a diplomatic manner, to ensure nation’s co-operation.

- Research accomplished to improve disease response and preparedness activities have to be undertaken in a timely manner to assure a timely implementation of scientific findings.

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### 2. Identify authorities and institutions responsible in disease response

The relevant authorities in charge of pandemic response have to be identified. This might be organised differently among nations. Some nations co-ordinate disease response on national level and others will locate the decision making process on regional level (federal system). The communication structure among the responsible organisations and individuals has to be established. WHO recommends establishing a pandemic planning committee to give advice to the government in their disease preparedness, as well as in outbreak management [7].

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**Possible Hazards**

- Authorities in charge of decision making are not identified, which lead to an uncoordinated disease response and a delay in implementing control measures.

- The public does not trust the national disease management, because the response seems uncoordinated (e.g. due to unqualified spokesperson).

- Individuals dedicated for certain response activities are not qualified.

- The lack of scientific advice leads to a non-“science based” unorganized and ineffective outbreak management.

- The PPP is written without expert advice and thus parts are inapplicable.

- The lack of clearly defined command structure (who has to be informed and who is responsible to decide about what action has to be taken, etc) leads to a delay in response activities

- National epidemiological outbreak investigation teams are not prepared for an epidemic as they do not have sufficient capacity and equipment to carry out work.

- No specific hospitals/units in hospitals are designated for the isolation and triage of SARS cases. General hospitals have to care for SARS patients which could lead to inappropriate treatment and lack of infection control standards.

- A national reference laboratory which can perform the necessary laboratory tests is unavailable in the country, which leads to a time delay in specimen testing.

- Arrangements with partner laboratory, to verify diagnoses (recommended by WHO [6]), are not contacted, which delays case confirmation.
The national disease control institution is not prepared for pandemic outbreak surveillance with a possibly high number of cases, and institutions to assist a country are not identified.

National and regional spokespersons are not identified, which leads to inadequate public communication.

Critical Control Points

• Incorporate pandemic response in existing national public health structures for pandemic preparedness and response [7], as these systems have proved to be functional.

• Ensure that a staff pool to undertake community containment measures and to maintain essential public services is well trained and available for a possible epidemic. Alternative staff should be identified on demand in order to enhance the response capacity.

• Health care facilities appropriate for the treatment of infectious cases have to be identified. They should have sufficient isolation capacity available and personal protective equipment (PPE) need to be stockpiled.

• Agreements with national laboratory and laboratories of the “Multi-centre Collaborative Network” [7] should be made in order to undertake SARS diagnostic procedures according to the WHO guidelines [11].

• National and regional outbreak investigation teams should be available to undertake research on the origin and progression of an epidemic.

• Establish a Pandemic planning committee, to get expert advice on the outbreak management to ensure “science based” planning and response [7].

• Arrange co-operations with neighbouring countries in order to get or offer support if being overwhelmed by a pandemic outbreak.
3. Develop national pandemic preparedness plans and guidelines for relevant respond activities

Guidelines give instructions for standard procedures in critical situations. Therefore, guidelines should be available for the relevant outbreak management tasks. The general guideline for national pandemic policies is the PPP. WHO, EC and the ECDC are supporting nations in their effort to develop PPPs [3, 4]. Such plans should address the relevant components of pandemic preparedness and response. Countries with a federal response structure need to publish regional plans in addition to the national PPP.

Possible Hazards

- Components of the PPP are not applicable and can not be implemented.
- Guidelines for the treatment of SARS cases outside dedicated SARS wards are not in place. Large amount of patients can not be treated adequately and in a safe manner.
Legal issues to put containment measures into practice are not considered which lead to conflict with national law.

Ethical issues of outbreak management are not addressed, leading to a lack of public acceptance of outbreak management.

Communication to exchange information with international institutions and further countries is not organised.

Communication among different national hierarchical levels is not organised.

Communication to the public is not organised.

The role of media is not considered in the PPP.

**Critical Control Points**

- Components of PPPs
- Treatment in non dedicated SARS facilities
- Legal issues
- Ethical issues
- Communication

**Recommendations for national pandemic plans and guidelines:**

- Ensure that authorities on all policy levels are involved in pandemic planning and that they co-operate in applying the recommendations.

- The founding of response activities should be considered in pandemic planning.

- Write the PPP with relevant experts. Get advice from experts of various public health fields in order to ensure that different public health opinions are considered in the plan.

- Establish guidelines on how to act if standard treatment situations (SARS ward) are not available.

- Establish guidelines on how to act if capacities of services are overwhelmed.

- Identify quick and effective communication methods among all relevant institutions, levels and the public.

- Identify appropriate spokesperson(s) on national and regional level in order to maintain public’s trust.

- Consider legal, ethical and financial issues in the PPP.
4. Estimate impact of a pandemic on outbreak management, health care and other essential services (identify surge capacity):

In order to plan outbreak management, the impact of a possible pandemic has to be estimated. The capacities of institutions involved in the outbreak response, like labs and health care facilities, have to address the needs caused by a pandemic. Arrangements with neighbouring countries could be made to compensate nation’s restricted capacities.

Possible Hazards

- Modelling analyses are lacking, inadequate or not updated; therefore a wrong assumption of pandemic impact on public health services is made.
- Clinics appropriate for the treatment of SARS patients are not identified in a sufficient number.
- Medical ventilator/respirators or personnel protective equipment (PPE) are not stored to a necessary degree, which leads to a shortage in supply.
- Laboratory for the diagnoses of SARS are not able to analyse a high number of cultures, which lead to a delay in testing procedures and case confirmation.
- Implementing Community Containment Measures (CCMs) (like managing mass gatherings) requires a large number of trained staff. Such personnel need to be identified and trained ahead of an epidemic.
- Financial resources are not secured, which leads to a delay in recruiting staff and the application of intervention measures during an outbreak.
- Disease surveillance in outbreak situations could be overwhelmed in:
  a. Inappropriate way of case reporting (e.g. by fax is not suitable to manage a large number of cases)
  b. Data management programmes/software used is incompetent (not adequate to handle large datasets).

Critical Control Points

- Estimate the impact of an epidemic
- Infection control strategies at clinics and hospitals
- Laboratory capacity
- Community Containment Measures (CCM)
- Surveillance
5. **Institutional pandemic preparedness planning**

Institutions like healthcare facilities need their own pandemic plans addressing the specific institutional requirement and stating their tasks during a pandemic. These plans should include components like identification of responsibilities, communication ways and standards for various procedures like isolation and infection control measures.

**Possible Hazards**
- The plan does not include necessary components, which leads to a lack of needed guidelines.
- Individuals in charge are not suitable to manage the tasks allocated to them.
- Not all staff follow the plan, because they do not accept the guidelines.
- No staff pool for outbreak response is available to address the need caused by an outbreak.

**Critical Control Points**
- Identifying stakeholders
- Components of the plan
- Acceptance
- Staff pool
**Recommendations for institutional pandemic preparedness planning:**

- Ensure that the all institutions involved in outbreak response accept the preparedness planning so that outbreak containment can be immediately applied if needed.

- Identify reserve staff which could support the hospital during a pandemic

- Guide the institutions in the pandemic planning to ensure well functioning plans.

**Summary of recommendations for command and control**

The main results of the HACCP analysis of command and control point on to the need for a clear and smoothly functioning management structure to ensure an effective cooperation and coordination among organizations to prepare and respond to a pandemic outbreak. It is hence necessary to have plans and guidelines written in a common manner. Research activities need to be undertaken jointly and scientific findings need to be disseminated and implemented as soon as possible. Agreements with neighboring countries on support during a pandemic should be made. Arrangements with national and international reference laboratories should be made. It is important to identify authorities/institutions and clearly define their roles in the preparedness planning and response to a pandemic. A pandemic planning committee should be established to provide expert guidance on planning and response activities and plans should be made involving local institutions. Healthcare systems and other services should be evaluated to ensure that they will not be overwhelmed during an outbreak.

**References:**


   Eurosurveillance 2005; 10 (3): 050303


Organisation Chart: Control and response for SARS

- Pandemic Infection Preparedness
  - Command and control
    - Early case detection
      - Hospital management
      - Containment measures
      - Communication and education
      - Surveillance & Laboratory diagnostics
      - Management of zoonotic infections
Flowchart 2

Preparedness for SARS – Interpandemic period

International level

WHO
EU
EC
ECDC

support nations in their pandemic preparedness

National level

National Government
co-operation with further countries

Federal ministry of agriculture
control for zoonotic infections
develop guidelines

exercise guidelines

Federal ministry of the interior / health
develop guidelines – pandemic preparedness plan (PPP) for

exercise pandemic plan

Regional level

Regional Government

Federal disease control institution

develop guidelines (PPP) for

exercise pandemic plan

Health care facility

Facility management

prepare incident management system

case management
monitoring and control
interdisciplinary co-operation

case detection
case / outbreak management and control
interdisciplinary co-operation

disease control

early case detection
case / outbreak management and control
interdisciplinary co-operation

National pandemic planning (representing relevant authorities)
Flowchart 3

Control for SARS: Command and control system

Flowchart:

- Health care facilities
  - Diagnoses and treatment of cases
    - Care management

- Public office
  - Case management
    - Implementation of interventions
    - Advising and informing the public

- Federal ministry of the interior / health
  - Interpretation of all incoming data
  - Outbreak control
    - Outbreak investigation
    - Coordinating the applicable and relevant authorities
    - Public communication
    - Control

- National government
  - National pandemic planning committee
    - Advice to the health authorities

- Public relations department
  - Public communication
  - Informing the public using the media

- Military
  - National pandemic planning committee
  - Specific tasks as agreed upon

- Other governments
  - WHO
  - EU / ECDC

- Federal ministry of agriculture
  - Control and management of agricultural activities

Institutional Level

Local Level

Regional Level

National Level

International Level
Preparedness and response planning in health care facilities

Rationale
In the 2002/03 SARS outbreak, nosocomial spread in Healthcare facilities (HCFs) were the most common source of transmission in the affected countries [1, 2]. Preparedness and response planning in HCF is thus needed to ensure rapid and effective treatment and infection control practices in case of a new pandemic outbreak. The aim of preparedness and response planning in HCF is to give information about diagnosing and isolation procedures for potential/suspected and confirmed SARS cases, about implementation of effective infection control measures and about communication strategies within the HCF as well as between the HCF and the local/regional/national public health department. The aim of preparedness and response planning in HCF is to ensure that standardized control actions can be rapidly implemented.

Description of the process:
The National pandemic planning committee designates outbreak hospitals, at which treatment can be provided in case of a pandemic outbreak. Identification of outbreak hospitals needs to be done in collaboration with the hospital management. Each outbreak hospital appoints a multidisciplinary preparedness planning committee to ensure that plans can be rapidly implemented. Early detection and isolation of confirmed or probable/suspected SARS patients is important to prevent nosocomial spread, especially as currently no methods are available for fast diagnosis [5]. Studies show that SARS transmission measures designed to control respiratory droplets and secretions along with hand hygiene would offer significant protection to other patients and HCWs who have contact with cases [2]. Experiences from the Tan Tock Seng Hospital (TTSH) in Singapore showed that the main difficulties in containing the 2002/03 SARS outbreak were:

(i) late recognition of cases,
(ii) lack of knowledge about the disease,
(iii) inadequate infrastructure for supporting outbreak management,
(iv) lack of procedures to identify atypical cases and
(v) threat caused by super spreaders [3].

Transmission of SARS corona virus (SARS-CoV) in HCF was a key factor in the spread of SARS during the 2002/03 pandemic outbreak[2]. HCWs accounted for 25% of the cases in Hong Kong, 65% in Canada and hospital transmissions accounted for 72% of all cases in Toronto and 55% in Taiwan [2]. The CDC recommended the establishment of a multidisciplinary planning committee for each HCF in order to build up a planning and response structure. Representatives of this committee should be from the administration level, infection control level, public relations and materials management. The healthcare facility should designate a ‘SARS coordinator’ to lead pandemic preparedness planning and organize outbreak response activities [2]. In order to ensure effective communication between the HCF and the public health department, planning should be done in collaboration the public health department [2].

In the response to a SARS outbreak, the CDC-Atlanta has recommended HCFs to develop a SARS preparedness and response plan that focuses on the following components [1]:

- Surveillance and triage
- Clinical evaluation
- Infection control and respiratory Hygiene

23
1. **Surveillance and Triage**

Surveillance refers to systematic monitoring of diseases in a population, in order to detect cases as soon as possible and to have case data available for implementing control actions. Triage aims at categorising potential SARS patients according to their disease symptoms at specific triage wards in order to decide about the further treatment procedure [1, 2, 4, 5, 6].

**Possible Hazards**

- Unrecognized SARS patients might infect “healthy” patients/visitors/HCW during hospitalization or GP consultation.
- Monitoring is insufficient and undetected cases can spread the disease

**Critical Control Points**

- Special entrance ways/triage/ward for patients with specific symptoms.
- Educating the GP/physicians in correct case definition/diagnosis.
- Registration and monitoring of patients, health care workers and visitors with SARS-like symptoms (hospital logs).

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**Recommendations for surveillance and triage:**

- Development of a preparedness and response plan for each hospital/GP clinic/center.
- Distribution of consultation guidelines and triage procedures in case of a suspected SARS patient.
- Training of medical staff in use of PPE, hand hygiene, respiratory etiquette.
- Establish procedures within each HCF to monitor risk groups like staff, patients and visitors to enforce early detection of new cases of SARS.
- Develop guidelines and train staff on triage screening of patients in case of a SARS outbreak in order to use limited resources appropriately.

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2. **Clinical evaluation of symptomatic persons**

Clinical recognition of SARS refers to a combination of clinical and epidemiological features in order to distinguish SARS from other respiratory diseases [5].
Possible Hazards
- The patient is not diagnosed correctly and is not transferred to an isolation ward
- No appropriate diagnostic tests are available, which leads to late case identification or misdiagnoses.

Critical Control Points
- Establish procedures within each HCF to ensure access to relevant information (diagnoses, treatment, research)

Recommendations for clinical evaluation of symptomatic persons

- Establish procedures within each HCF and clinic to ensure correct and updated case definition/diagnosis
- Identify SARS hospitals, with appropriate diagnostic supplies.

3. Infection Control and Respiratory Hygiene

These activities aim at preventing nosocomial infection and SARS transmission from inpatients, healthcare workers to their contacts. Hospital infection control measures are e.g. enhanced hand hygiene and use of personal protective equipment (PPE) [1, 2, 3, 5].

Possible Hazards
- Transmission from HC personnel working on different wards or in different hospital settings
- PPE is not stockpiled and the resources are limited

Critical Control Points
- Infection control measures (Use of PPE, hand hygiene, respiratory etiquette)
- Designate specific SARS hospitals for treatment in case of an outbreak, with appropriate diagnostic supplies
Recommendations for infection control and respiratory hygiene:

- Provide clear guidelines about how to apply infection control measures, including proper use of PPE (masks or respirators, gloves, gowns and eye protection).

4. Patient isolation wards
The aim of isolation wards is separating groups of patients with similar symptoms from the other patients in a hospital, in order to prevent disease transmission [1, 4].

Possible Hazards
- Transfer of SARS patients from one ward to another might increases the likelihood of infection of other patients and HCW
- Insufficient isolation wards causing cross infection patients and HCW in HCFs

Critical Control Points
- Minimize risk of infection during transport of SARS patient; Infection control measures (Use of PPE, hand hygiene, respiratory etiquette )
- Isolation units at designated SARS hospitals

Recommendations for patient isolation wards:

- Identify specific SARS wards and paths separated from other hospital traffic to minimize the risk of transmission to patients, visitors, and staff.
- Develop guidelines for the isolation procedures and placement concerning: Triage wards, SARS evaluation clinics (fever clinics) and case diagnosis
- Development of strategies at HCFs to quickly implement appropriate isolation procedures, separating the suspected cases from the other patients.

5. Engineering and Environment Control
These measures refer to the optimal functioning of the HCF by estimating and preparing for the necessary capacity of rooms and units in case of a pandemic event.

Possible Hazards
- Spread of infection within the healthcare facility

Critical Control Points
- SARS treatment units
Recommendations for engineering and environment control:
- Improve the capacity of the facility to isolate SARS patients in designated Infection Control Units (IFU).
- Install infection isolation rooms (AIIRs)
- Develop guidelines about how an AIIRs will be modified if required

6. Exposure Reporting and Evaluation
Informing authorities in case of suspected exposure (patients + HCW)

Possible Hazards
- Late identification of cases in the HCF (which can lead to possible disease transmission)

Critical Control Points
- Exposure report

Recommendations for exposure reporting and evaluation
- Healthcare facilities should develop an exposure reporting procedure of all suspected and confirmed SARS cases
- Develop strategies for regular communication with the public health department in order to share information about possible case contacts

7. Health care personnel:
During an outbreak existing staff shortages may be amplified by enhanced need of HCW.

Possible Hazards
- Lack of extra staff to support the hospital in a crises situation

Critical Control Points
- Staff recruitment
**Recommendations for healthcare personnel**

- Develop staff recruitment plans (e.g. retired staff) to ensure the estimated need of staff required to manage a SARS outbreak.
- Ensure regular training in good infection control practices e.g. use of PPE, hand hygiene and respiratory etiquette.

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**8. Hospital access control**

The aim is to limit the access to HCFs in order to reduce the number of unprotected contacts in case of an outbreak.

**Possible Hazards**
- Unrecognized SARS patients might infect “healthy” patients/visitors/HCW during hospitalization/consultation

**Critical Control Points**
- Access control – symptom screening

**Recommendations for hospital access control:**

- HCF should develop criteria and plans for limiting access to the healthcare facility
- Develop guidelines for visitors and supplementary staff at the designated SARS HCF to self-monitor for SARS symptoms and information on health advice seeking.

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**9. Supplies and equipment:**

Refers to the availability/stock piling of PPE and other essential equipment/services during an outbreak.

**Possible Hazards**
- Insufficient amount of PPE is stockpiled according to estimated need.

**Critical Control Points**
- Develop strategies to estimate the need of extra equipment and services in case of an outbreak.
**Recommendations for supplies and equipments:**

- The HCF should determine the availability of supplies and equipment and maintain an appropriate stock of PPE.
- Public health departments should monitor the availability of PPEs. In crisis situation allocation of material could be organised using this data.
- Develop specific agreements with providers of essential services to ensure delivery during an outbreak.

**10. Communication and case reporting:**

During an outbreak it is important to report the status of patients and SARS transmission in HCF to the health department. In addition, media statements should be provided.

**Possible Hazards**

- Incorrect information is published in the media causing panic and distress in the community

**Critical Control Points**

- Appoint a responsible communication coordinator in charge of hospital statements, to ensure reliability.

**Recommendations on communication and case reporting:**

- The HCF should develop case reports and communication strategies
- A hospital spokesperson should be identified and trained in risk communication

**Summary of recommendations for preparedness and response planning in HCF**

The main results of the HACCP analysis of preparedness and response planning in healthcare facilities point to the need for prompt and decisive use of control measures in healthcare facilities in order to prevent infection among HCWs and also further spread into the community. To enable this, HCFs should establish surveillance activities, train medical personnel on clinical evaluation of patients, hygiene, and proper use of PPE and triage procedures. HCFs should also have facilities and units designated to isolated infected patients. Essential equipment such as PPE, respirators etc should be stockpiled. Access to hospitals should be controlled to prevent the spread of infection into and from the community. Strategies on communication and case reporting should be developed.
References:


Flowchart 4

Control for SARS: Health care facilities

1. Access control to HC facility
2. Monitoring HCW for SARS symptoms
3. Hospital isolation of HCW in case of SARS symptoms
4. Mobile hospital-outbreak management team
5. Epidemiological outbreak investigation

Admit suspected case to outpatient office

Forward case to fever clinic – Triage ward

Treatment of case

Confirm SARS case definition

Engineering team

Services to maintain isolation measures

Isolation of probable case

Order laboratory diagnoses

SARS negative

Step-down ward (end of isolation)

SARS positive

SARS follow-up clinic / SARS ward

Psychological support for staff and patients

Infectious-control service

Quality assurance monitoring
Surveillance and Laboratory diagnostics

Rationale
Modelling analyses of SARS and pandemic influenza outbreaks show that intervention measures have to be applied in a timely manner, in order to avoid large scale transmission chains (1,2,3). This makes disease surveillance a key component of pandemic outbreak management, because it is aiming on fast and complete detection of cases. Surveillance consists of correct data management, analyses and their interpretation, as well as the dissemination of these results to relevant organisations (4). Laboratory diagnostics is closely connected with surveillance, because laboratory testing of the disease is needed to confirm or verify cases. To support surveillance with interpretable data, the proper application of standard diagnostic tests is important. Furthermore, handling and transportation of specimens are critical parts in the laboratory process. Two infections after the 2002/03 SARS outbreak were linked with laboratory setting (5,6), which underlines the need for laboratory safety.

Description of the process
Probable SARS cases can be identified by different ways: general practitioners (GP), hospitals, monitoring of vulnerable groups (e.g. HCW) or by tracing of SARS contacts. Specimen samples of possible infected individuals are analysed using a three-tier process. A local laboratory whose results indicate a positive SARS-CoV infection will send the specimens to the national reference laboratory for confirmation and further investigation. In case of a positive test result by the national reference laboratory (preliminary positive) further analyses by the European verification network laboratory are requested to confirm these findings (7, 8, 9, 10). Information on place and time of infection, the laboratory data and data on case behaviour are used to analyse the outbreak progression. Usually, these data are collected and analysed by local public health office staff. Surveillance has to be as complete and timely as possible in order to apply control actions in a fast manner. Surveillance is connected with different outbreak management components and builds the basis to consider suitable outbreak control actions.

1. GP consultation & hospitalisation
An infected individual who has respiratory symptoms consults a GP/emergency room at a hospital and is admitted. A possible SARS case has to be reported to the local public health department (11).

Possible Hazards
- The GP does not consider SARS in the diagnosis and therefore no laboratory test is carried out.
- The GP misdiagnosis a case and request a laboratory test for respiratory diseases unlikely to be SARS, resulting in the decrease of laboratory capacity and causing unnecessary utilization of test material and expense.
- Possible SARS cases are not reported to the local public health office leading to further potential cases.
Critical Control Points

- First diagnoses
- Report of possible SARS cases

**Recommendations for GP consultation & hospitalization:**

- Provide clear guidelines to the public on how to behave in case of symptom onset
- Ensure that GPs use updated case definitions for diagnosis of potential cases to be considered of laboratory testing/Ways to inform GPs of updated case definitions should be put in place.
- Provide guidance for GPs and HCFs for their work during the pandemic period, to assist the handling of possible cases.
- During pandemic spread, atypical pneumonia cases should be reported to the local public health office as they could be possibly infected with SARS.

2. Taking specimen samples and shipment of specimen culture

Samples from infected individuals are taken for laboratory testing. Respiratory, stool as well as plasma or serum specimens are recommended to be taken from possible SARS cases (6). In case no qualified testing laboratory is available, the cultures need to be forwarded in a safe manner to a reference laboratory. Appropriate laboratories are biosafety facilities (level 3) with RT-PCR (reverse transcriptase-polymerase chain reaction) technology. The European laboratory network assists countries that do not have their own testing facilities (9). To avoid contamination during transportation, specimens need to be transported in a safe manner (7).

Possible Hazards

- HCW could become infected by handling specimens.
- Samples can not be tested as they were taken in an inappropriate manner.
- The specimen culture is not shipped in an appropriate way and contaminated material is discharged.
- Modes of transport used are time consuming hence extending the time for case confirmation.

Critical Control Points

- Sample taking
- Sample shipment
Recommendations on taking specimen samples and shipment of specimen culture:

- HCWs that have contact with possible SARS cases, or with infected material, need (i) strict guidelines for the handing of specimens, (ii) appropriate PPE’s and (iii) need to be well trained and educated to handle contaminated material.

- Guidelines and appropriate material/equipment for the shipment of samples have to be available (13)

3. Laboratory Testing

During the non-epidemic-period specimens are commonly tested by a local laboratory. If a SARS-CoV infection is suspected, the specimens are sent to a national reference laboratory or, in case no laboratory exists, specimens are tested in cooperation with a laboratory of a neighbouring country (12).

Possible Hazards

- Due to lack of safety standards laboratory staff could become infected. This especially matters during the non-endemic period because staff is unaware of a possible threat of an infectious disease like SARS.
- The reference laboratory has less capacity and is overwhelmed by the ordered sample tests and no alternative laboratory is identified
- The tests are done incorrectly, which has an impact on the sensitivity and specificity of results.
- Specimens are handled in an unsafe manner and laboratory staff may become infected.

Critical Control Points

- Local lab
- National reference lab
- Testing procedure

Recommendations on laboratory testing:

- Recommend high safety standards for the diagnoses of possible infective specimens generally.

- Consider laboratories for the diagnoses of SARS and designate alternative laboratory for an outbreak situation. Make sure that safety recommendations are considered in the diagnosing laboratory and for the shipment of specimens.

- Use only biosafety 3 laboratory for the analyses of possible SARS specimens.
4. Report of preliminary test result

The preliminary test results are reported to the facility where the case is hospitalized in order to assure appropriate treatment and isolation (12). Preliminary positive cases need to be reported to the national infections disease control institution. They need the data for their surveillance activities and to forward them to the relevant disease response institutions, like local public health offices as well as WHO and ECDC (12,4).

Possible Hazards

- Cases are reported late or incomplete and the data will be late or unavailable for the disease surveillance.
- Cases are reported late to WHO / ECDC. These data will be late or unavailable for international disease surveillance.

Critical Control Points

- Reporting preliminary positive cases to local / national public health office
- Report preliminary cases to WHO / ECDC

**Recommendations on report of preliminary test result:**

- Make sure that reporting algorithms are available and followed. Cases need to be reported as soon as possible to all relevant institutions to assure a complete and actual picture of the current disease situation. This is relevant for each level, regional, national and international.

5. Verification of positive results

WHO recommends verifying positive results by a reference lab outside the country (12). If a positive result is confirmed, a case is considered to be “confirmed positive”. The health care facilities, the national infectious disease control department as well as international organization need to be informed.

Possible Hazards

- Due to lack of safety standards lab staff could become infected. This especially matters during the non-endemic period because staff is unaware of a possible threat of an infectious disease like SARS.
- The reference laboratory has less capacity and is overwhelmed by the ordered sample tests and no alternative laboratory is identified
- The tests are done incorrectly, which has an impact on the sensitivity and specificity of results.
- Cases are reported lately or incomplete. These data will be late or not available for the disease surveillance.
- Cases are reported late to WHO / ECDC. These data will be late or not available for international disease surveillance.
Critical Control Points

- Sample shipment
- Laboratory diagnostics
- Result report

Recommendations for the verification of positive results:

- A safety shipment of the specimens is needed to avoid contamination.
- Correct interpretation of laboratory findings as defined by WHO is needed to secure high sensitivity and specificity (5). Current scientific evidence in laboratory diagnostics has to be applied for accurate results.
- As described in point 3 and 4, quick shipment, diagnoses and a timely dissemination of results are essential for timely disease surveillance.

6. Data transfer and management

Laboratory data should be reported quickly to the relevant institutions. Data on epidemiological confirmed cases need to be reported as well in order to get information on possible cases. This data need to be managed, analysed and the results forwarded to the relevant institutions, like regional and national public health departments and international institutions like WHO and ECDC [16, 17, 18].

Possible Hazards

- Data reporting procedures are too complicated which influences reporting speed and completeness of data [16].
- Laboratory / GPs / Hospitals report cases late, thus surveillance data is not up-to-date.
- Used computer programs are not appropriate to work with huge datasets (like in case of a pandemic), thus analysis of extensive outbreaks overwhelms data management capacity.
- Secondary case data, e.g. on case contacts, is collected inappropriately and do not provide the necessary information.
- Datasets can not be matched.
- Data set are inappropriate for the surveillance of SARS cases.
- Data reporting among the public health offices on different levels is organised bureaucratically, which leads to a delay in data exchange. Loss of data could be a caused due to complex data handling.
- No legal basis to report data to WHO or ECDC exist, thus data are not available for international surveillance.
- Data exchange is organised bureaucratically, which leads to a delay.

Critical Control Points

- Data reporting: laboratory/GP/hospital
• Data collection and analyses
• Data report: local / regional public health office
• Data report: to ECDC and WHO

Recommendations for data transfer and management

- Have reporting standards available for SARS or SARS-like diseases, which is applicable for each laboratory.
- During endemic spread apply active data collection.
- Use easy data management between the national public health offices (computer based).
- Generally, use data management programs that are appropriate to manage huge datasets.

7. Dissemination of results
Dissemination of laboratory results

Possible Hazards

- Results are not forwarded to the relevant authorities, thus relevant institutions are not aware about the extent of the outbreak.

Critical Control Points

- Forward results to public health authorities

Recommendations for dissemination of laboratory results

- Communication ways clearly structured and applicable in a quick manner in order to disseminate surveillance data fast to the relevant authorities.

Summary of recommendations for Surveillance and Laboratory diagnostics

The main results of the HACCP analysis of surveillance and laboratory diagnostics concern the need for guidelines ensuring updated information of case definitions for GPs, guidelines on precautionary behavior/actions to be taken by the public, and guidelines and education programs targeted for health care workers (HCW) on PPE and handling of specimens/contaminated material. The need to appoint specific biosafety 3 labs for SARS-testing in case of an outbreak and develop reporting procedures for timely dissemination of results to relevant institutions.
SARSControl project/WP8/L Hjarnø, AM Syed, R Krumkamp, R Reintjes, AR Aro.

References:


6. Parry J. Breaches of safety regulations are probable cause of recent SARS outbreak, WHO says. BMJ 2004;328:1222


Flowchart 5

Control for SARS: Early case detection

1. Individual develops SARS-like symptoms
   - Visit general practitioner
     - Identification of unexplained respiratory disease
       - Report suspected case to regional public health office
       - Establish containment measures
       - Take sample for laboratory diagnosis
       - Isolation of suspected case
   - Visit healthcare centre
     - Identification of unexplained respiratory disease
     - Forward case to dedicated hospital
     - Forward case to dedicated hospital ward
     - Exchange information with public health office
     - Identification of Public health risk
     - Threat: report case to national disease control institution
     - Send control team
     - Establish control measures
     - No threat: PH-office stays in contact with hospital
Flowchart 6

Laboratory diagnostics & surveillance

Institutional level

- specimen collection from suspected case
- send culture to national reference lab
- laboratory testing
- Probable case
- SARS negative
- unverifiable

- send culture to international verification network lab
- laboratory testing
- case confirmed
- SARS negative
- report case to public health office and hospital
- report result to the hospital
- forward data to federal disease control institution

National level

- National disease control institution
- interpretation of lab-data and further relevant information
- appropriate data management
- disseminate results to the responsible authorities / stakeholders

- public health reporting
- federal Ministry of the Interior / Health

14.07.2008; SARSControl – WP8
Community containment measures

Rationale

Community containment measures are necessary actions in preventing and controlling infectious diseases like SARS and influenza. Measures to prevent/control person-to-person spread of diseases include monitoring, quarantine, isolation and contact tracing. These are all basic infectious disease control measures that proved to be critically important for the control of SARS in 2003 [1, 2, 3, 4, 5].

Description of the process

Potential SARS cases are reported by the diagnosing laboratories at e.g. designated SARS hospitals to the national/regional/local Disease Control institutions (different from country to country), who initiate a case investigation, monitoring and contact tracing [1, 2, 3, 6]. Identification of persons exposed to confirmed or probable SARS cases is done by contact tracing, defined by the CDC as: “Identification and location of persons who may have been exposed to a person with SARS CoV infection; may result in regular monitoring for evidence of illness and strict or modified quarantine” [6, pp.2 ]. Identification of contacts is done by face to face- or telephone interviews with the patient and his/hers family members (based on structured questionnaires) [1, 2, 3, 4]. Depending on the health status of the contacts, they will be offered health advice/education, put under medical surveillance or referred to relevant hospital for treatment and isolation. Close contacts - defined by the WHO, as persons: “having cared for, lived with, or had direct contact with respiratory secretions or body fluids of a suspect or probable case of SARS” [5], - will be quarantined for 10 (Hong Kong, Singapore, Canada) to 14 days (China) after last exposure with a confirmed case. In some countries (Hong Kong, China (Beijing) and Singapore) quarantined persons were not allowed to leave the site of quarantine as per law. Contacts were not allowed to go out of the house without permission of the health officer (active monitoring with activity restrictions) enforcement and surveillance officers regularly monitored contacts [3, 8]. In Singapore a person with a home quarantine order (HQO) was offered a choice of place of quarantine,-home or at a special prepared quarantine centre [3]. In Hong Kong close contacts were quarantined at home [9]. In the UK contacts of confirmed cases are subjected to voluntary quarantine and monitored by health protection teams for 10 days after last exposure to the confirmed case [6]. Social contacts are given advice to contact authorities in case they develop symptoms (passive monitoring). Apart from contact tracing and quarantine other strategies, such as measures to decrease social interactions e.g. by closing of schools and businesses were conducted. Also management of people on travel to and from affected areas is regarded as an important measure in the prevention and control of SARS. Examples of travel measures are travel and health advice and visa restrictions for individuals from affected areas.

1. Interview of confirmed/suspected SARS case

A confirmed or suspected SARS patient is interviewed in order to identify and monitor every close contact the patient has had during the past 10 days. This procedure is done in order to
prevent further spread by control measures like monitoring, isolating and/or quarantine of contacts for the period of incubation [1, 2, 3, 8].

Possible Hazards
- Not all close contacts can be identified and might develop symptoms in the community with a chance of spreading the disease
- Case does not give out information/remember all the contacts he/she has had in the last 10 days, especially when suffering from strong disease symptoms.

Critical Control Points
- As part of the epidemiological investigation: interview family and relatives of the case using structured questionnaires.
- Review of patient or visitor logs from the hospital.

**Recommendations for interview of confirmed/suspected SARS case:**

- Guidelines for conducting structured interviews with confirmed and suspected SARS cases – questions should be framed to obtain information on:
  - Recent travel history (within the last 10 days) to suspected or confirmed source areas/countries
  - Close contact with travel history to suspected or confirmed source areas/countries.
  - Health status of close contacts for symptoms suggestive to SARS.
  - Employment in an occupation with an increased risk for SARS-CoV exposure, including e.g. exposed health care worker or laboratory staff.
- Interview of family members and close relatives in order to confirm the information provided by the cases.
- Review of patient journal, visitor log and employee schedules in institutions where SARS transmission occurs.

2. Identify contacts/Contact Tracing
Identification, location and evaluation of close contacts of confirmed and suspected SARS cases [1, 2, 4, 5, 8].

Possible Hazards
- Identified contact refuse to collaborate
• The risk of being infected with SARS as an identified contact shows symptoms and is admitted to designated SARS hospital for medical evaluation
• Stigmatization of identified close contacts

**Critical Control Points**
• Compulsory medical evaluation of identified close contacts
• PPE and Hygiene guidelines
• Risk communication guidelines (local and national)

**Recommendations for the identification of contacts/contact tracing**
- In case of an outbreak regulations on case control are necessary, including compulsory medical evaluation of identified close contacts.
- Guidelines for risk communication on local and national level in order to avoid stigmatization of suspected cases.

**3. Hospital isolation of confirmed SARS contacts**
Close contacts diagnosed with SARS are referred to isolation wards if clinically indicated or if home isolation or isolation in a designated community facility cannot be achieved safely and effectively [1, 2, 3].

**Possible Hazards**
• Confirmed SARS contacts refuse hospital isolation.
• The risk of being infected at the SARS ward during a medical evaluation.

**Critical Control Points**
• Compulsory case isolation
• Home isolation or isolation at a designated community facility
• PPE and hygiene guidelines

**Recommendations for hospital isolation of confirmed SARS contacts:**
- Hospital isolation for very ill SARS patients
- Isolation at home or at designated community facilities if safe and effective
4. Quarantine of asymptomatic contacts

Close contacts are quarantined at home and at designated quarantine sites for 10-22 days after last exposure with a potential case. Quarantine may be voluntary (UK) or mandatory (Singapore) [1, 2, 3, 8, 9].

Possible Hazards

- Home quarantined contacts do not comply with recommendations for home quarantine.
- Perceived asymptomatic contact develop SARS symptoms during/after end home quarantine

Critical Control Points

- Sanction home quarantine of suspected SARS cases e.g. by fines or enforcing quarantine regulations
- Follow up interviews by health care officials during and after the home quarantine period

Recommendations for the quarantine of asymptomatic contacts:

- Persons in quarantine should sleep separately from others; they should wear a mask when near someone else and not share personal items.
- Self monitoring of symptoms by home quarantined contacts, e.g. daily temperature check

5. Services for quarantined/isolated persons

Food and other essential supplies should be provided for home quarantined/isolated persons as well as people isolated/quarantined at designated community facility [1, 8].

Possible Hazards

- Service personnel attending home quarantined/isolated contacts might get infected by an unrecognized SARS case among the close contacts
- Contacts suffer from psychological stress caused by quarantine.

Critical Control Points

- Standard infection control measures; PPE and hygiene guidelines
- Follow up visits/contact by health care officials/hotlines
Recommendations on services provided to quarantined/isolated persons:
- Provide guidelines for home visits by service personnel attending to the care and supplies of quarantined contacts.
- Establish hotlines and “service corps” as a daily communication line for people in home quarantine/isolation or in designated facilities.

6. Measures to decrease social interaction
Identification of public events like e.g. concerts, football matches and public facilities like e.g. schools and businesses that are at risk of spreading the infection.

Possible Hazards
- Risk of transmission of SARS between members of the community during mass gatherings
- Risk of transmission of disease between the public in the public arena – like schools.

Critical Control Points
- Ban/restriction/reduction of mass gatherings
- Closure of public facilities, like schools and businesses: Strategy to prevent/minimize the risk of SARS transmission in the community, and to minimize the public interaction to prevent casual transmission in the population
- Educate the public in PPE and hygiene guidelines

Recommendations for measures to decrease social interaction:
- Provide guidelines for when, how and which gathering should be prohibited and decide possible sanctions
- Provide guidelines concerning when, how and which institutions should be closed in case of a SARS outbreak, in order to prevent / mitigate transmission of SARS.
- Conduct modeling analyses in order to have data on most effective intervention measures, considering the certain national situation (society structure and population density).

Summary of recommendations for community containment measures:
The main results of the HACCP analysis of community containment measures pointed to a need for structured case investigation and contact tracing procedures to ensure early case detection and disease control; guidelines for risk communication on local and national level to avoid public panic and distress; establishing hotlines and “service corps” for people in
quarantine/isolation at home or in designated facilities to prevent the psychological effects of isolation; developing guidelines for quarantine/isolation procedures and precautions at home and at designated community facilities for patients, relatives, neighbours as well as service providers; producing information campaigns or education programs about self monitoring procedures and finally; developing guidelines for social distancing in case of an outbreak.

References:


Control for SARS: Community containment measures
Conclusion:

The use of the HACCP methodology enables us to identify areas that need improvement to enhance preparedness and response capacities of SARS, based on previous experiences. It also helps us in keying out possible control points and developing recommendations to minimize the risk of spread of the disease. The method can be easily adapted and applied to evaluate the preparedness and response level of other similar infectious diseases.
Appendix 1: Table of results

<table>
<thead>
<tr>
<th>Hazards</th>
<th>Critical control points</th>
<th>Recommendations</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Support by international institutions</strong></td>
<td><strong>Guidelines on national pandemic preparedness</strong></td>
<td><strong>Overall Guidelines have to be written in a common manner, such that they can be adapted by all states and build an overall basis for national preparedness planning.</strong></td>
</tr>
<tr>
<td></td>
<td><strong>Inventory of national preparedness activities</strong></td>
<td><strong>Inventory and the support of national preparedness have to be undertaken in a “diplomatic” way in order to avoid unmasking nation’s preparedness activities. Also the public health policy support has to be organised in a diplomatic manner, to ensure nation’s co-operation.</strong></td>
</tr>
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<td></td>
<td><strong>Support of national preparedness</strong></td>
<td><strong>Research accomplished to improve disease response and preparedness activities have to be undertaken in a timely manner to assure a timely implementation of scientific findings.</strong></td>
</tr>
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<td></td>
<td><strong>Research on Pandemic infections</strong></td>
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<tr>
<td><strong>Identify authorities and institutions responsible in disease response</strong></td>
<td></td>
<td><strong>Use of existing national public health structures for pandemic preparedness and response, because these systems are proved already operative. Incorporate pandemic response in these structures.</strong></td>
</tr>
<tr>
<td>• Authorities in charge of decision making are not identified, which leads to an uncoordinated disease response and a delay in implementing control measures.</td>
<td>• Incorporate pandemic response in existing national public health structures for pandemic preparedness and response [7], as these systems have proved to be functional.</td>
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</tr>
<tr>
<td>• The public does not trust the national disease</td>
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HACCP results for the command and control

- Published guidelines are not used for national preparedness
- Guidelines are not adequate to be considered by nations
- Nations do not make their pandemic preparedness activities public and thus do not participate on policy evaluation, which is necessary to identify current status of areas to be improved.
- Nations do not participate on preparedness workshops, or do not conduct national preparedness workshops
- Nations do not want to discuss their current preparedness activities with external experts.
- Recommendations to improve national preparedness are not considered
- Research activities (like European framework programs) require time to produce applicable recommendations.

- Overall Guidelines have to be written in a common manner, such that they can be adapted by all states and build an overall basis for national preparedness planning.
- Inventory and the support of national preparedness have to be undertaken in a “diplomatic” way in order to avoid unmasking nation’s preparedness activities. Also the public health policy support has to be organised in a diplomatic manner, to ensure nation’s co-operation.
- Research accomplished to improve disease response and preparedness activities have to be undertaken in a timely manner to assure a timely implementation of scientific findings.
<table>
<thead>
<tr>
<th>Management, because the response seems uncoordinated (e.g. due to unqualified spokesperson)</th>
<th>Ensure that a staff pool to undertake community containment measures and to maintain essential public services is well trained and available for a possible epidemic. Alternative staff should be identified on demand in order to enhance the response capacity.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Individuals dedicated for certain response activities are not qualified.</td>
<td>Make sure that a staff pool, to undertake community containment measures and to maintain essential public services, is available and well trained for a possible epidemic. Alternative staff should be identified on demand in order to enhance the response capacity.</td>
</tr>
<tr>
<td>The lack of scientific advise leads to a non-“scientific based” outbreak management.</td>
<td>Health care facilities appropriate for the treatment of infectious cases have to be identified. They should have sufficient isolation capacity available and personal protective equipment (PPE) need to be stockpiled.</td>
</tr>
<tr>
<td>The PPP is written without expert advice and thus parts are inapplicable.</td>
<td>Arrangements with national laboratories and laboratories of the “Multi-centre Collaborative Network” [8] should be contracted in order to undertake SARS diagnoses procedures according the WHO guidelines [11].</td>
</tr>
<tr>
<td>The lack of clearly defined command structure (who has to be informed and who is responsible to decide about what action has to be taken, etc) leads to a delay in response activities</td>
<td>National and regional outbreak investigation teams should be available to undertake research on the origin and progression of an epidemic.</td>
</tr>
<tr>
<td>National epidemiological outbreak investigation teams are not prepared for an epidemic; have insufficient capacity and equipment for their work.</td>
<td>Establish a Pandemic planning committee, to get expert advice on the outbreak management to ensure “scientific based” planning and response [7].</td>
</tr>
<tr>
<td>No specific SARS facilities with dedicated isolation and triage wards are established. Common hospitals have to care for SARS patients which could lead to inappropriate treatment and lack of infection control standards.</td>
<td>Arrange co-operations with neighbouring countries in order to get or offer support if being overwhelmed by a pandemic outbreak.</td>
</tr>
<tr>
<td>An national reference laboratory, able to perform the needed laboratory-tests, is not available, which leads to a delay in specimen testing.</td>
<td></td>
</tr>
<tr>
<td>Arrangements with partner laboratories, to verify diagnoses (recommended by WHO [6]), are not contacted, which delays case confirmation.</td>
<td></td>
</tr>
<tr>
<td>The national disease control institution is not prepared for pandemic outbreak surveillance, with a possibly high number of cases, and institutions to assist a country are not identified.</td>
<td></td>
</tr>
<tr>
<td>Develop national pandemic preparedness plans and guidelines for relevant response activities</td>
<td></td>
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<tr>
<td>---</td>
<td></td>
</tr>
<tr>
<td>• Components of the PPP are not applicable and can not be implemented.</td>
<td></td>
</tr>
<tr>
<td>• Guidelines for the treatment of SARS cases outside dedicated SARS wards are not in place. Large amount of patients can not be treated adequately and in a safe manner</td>
<td></td>
</tr>
<tr>
<td>• Legal issues to put containment measures into practice are not considered which leads to conflict with national law.</td>
<td></td>
</tr>
<tr>
<td>• Ethical issues of outbreak management are not addressed, leading to a lack of public acceptance of outbreak management.</td>
<td></td>
</tr>
<tr>
<td>• Communication to exchange information with international institutions and further countries is not organised.</td>
<td></td>
</tr>
<tr>
<td>• Communication among different national hierarchical levels is not organised.</td>
<td></td>
</tr>
<tr>
<td>• Communication to the public is not organised.</td>
<td></td>
</tr>
<tr>
<td>• The role of media is not considered in the PPP.</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Components of PPPs</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Treatment in non dedicated SARS facilities</td>
</tr>
<tr>
<td>• Legal issues</td>
</tr>
<tr>
<td>• Ethical issues</td>
</tr>
<tr>
<td>• Communication</td>
</tr>
</tbody>
</table>

| Ensure that authorities on all policy levels are involved in pandemic planning and that they co-operate in applying the recommendations. |
| • The founding of response activities should be considered in pandemic planning. |
| • Write the PPP with relevant experts. Get advice from experts of various public health fields in order to ensure that different public health opinions are considered in the plan. |
| • Establish guidelines on how to act if standard treatment situations (SARS ward) are not available. |
| • Establish guidelines on how to act if capacities of services are overwhelmed. |
| • Identify quick and effective communication methods among all relevant institutions, levels and the public. |
| • Identify appropriate spokesperson(s) on national and regional level in order to maintain public’s trust. |
| • Consider legal, ethical and financial issues in the PPP. |

<table>
<thead>
<tr>
<th>Estimate impact of a pandemic on outbreak management, health care and other essential services (identify surge capacity)</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Modelling analyses are lacking, inadequate or not updated; therefore a wrong assumption of pandemic impact on public health services is made</td>
</tr>
<tr>
<td>• Estimate the impact of an epidemic</td>
</tr>
<tr>
<td>• Clinics and Hospitals</td>
</tr>
<tr>
<td>• Laboratory capacity</td>
</tr>
<tr>
<td>• Community Containment Measures</td>
</tr>
</tbody>
</table>

<p>| Conduct national epidemic modelling analysis regularly to have updated data of the situation. Such analyses should be the basis to identify the outbreak impact on the health system in order to plan necessary response activities. |</p>
<table>
<thead>
<tr>
<th>Institutions</th>
<th>Capacity</th>
<th>Institutional pandemic preparedness planning</th>
</tr>
</thead>
<tbody>
<tr>
<td>SARSControl project/WP8/L Hjarnø, AM Syed, R Krumkamp, R Reintjes, AR Aro.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Clinics appropriate for the treatment of SARS patients are not identified in a sufficient number.</td>
<td>• Implementing CCMs (like managing mass gatherings) requires a large number of trained staff. Such personnel need to be identified and trained ahead of an epidemic.</td>
<td>• Define alternative treatment options (like mobile triage facilities) in case SARS wards are overcrowded.</td>
</tr>
<tr>
<td>• Ventilators or PPE are not stored to a necessary degree, which leads to a shortage in supply.</td>
<td>• Financial resources are not secured, which lead to a delay in recruiting staff and the application of intervention measures during an outbreak</td>
<td>• Arrange agreements with laboratories (neighbouring countries) if high number of samples need to be tested.</td>
</tr>
<tr>
<td>• Laboratory for the diagnoses of SARS are not able to analyse a high number of cultures, which leads to a delay in testing procedures and case confirmation.</td>
<td>• Disease surveillance in outbreak situations could be overwhelmed in:</td>
<td>• Update PPP regularly to address political and social changes.</td>
</tr>
<tr>
<td>• Implementing CCMs (like managing mass gatherings) requires a large number of trained staff. Such personnel need to be identified and trained ahead of an epidemic.</td>
<td>• Way of case reporting (e.g. by fax is not suitable to manage a large number of cases)</td>
<td>• Surveillance data should be computer-based, in order to ensure fast and easy analysis.</td>
</tr>
<tr>
<td>• Financial resources are not secured, which lead to a delay in recruiting staff and the application of intervention measures during an outbreak</td>
<td>• Data management programmes (not adequate to handle large datasets).</td>
<td>• Legal and financial issues of outbreak response have to be planned in beforehand.</td>
</tr>
</tbody>
</table>

**Institutional pandemic preparedness planning**

- The plan does not include necessary components, which leads to a lack of needed guidelines.
- Individuals in charge are not suitable to manage the tasks allocated to them.
- Not all staff follows the plan, because they do not accept the guidelines.
- No staff pool for outbreak response is available to address the need caused by an outbreak.

- Identifying stakeholders
- Components of the plan
- Acceptance
- Staff pool

- Ensure that the all institutions involved in outbreak response accept the preparedness planning so that outbreak containment can be immediately applied if needed.
- Identify reserve staff which could support the hospital during a pandemic
- Guide the institutions in the pandemic planning to ensure well functioning plans.
### HACCP results for the *Preparedness and response planning in health care facilities* component

<table>
<thead>
<tr>
<th>Hazards</th>
<th>Critical control points</th>
<th>Recommendations</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Surveillance and Triage</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Unrecognized SARS patients might infect “healthy” patients/visitors/HCW during hospitalization or GP consultation.</td>
<td>• Special entrance ways/triage arrears/ward for patients with specific symptoms</td>
<td>• Development of a preparedness and response plan for each Hospital/GP clinic/center.</td>
</tr>
<tr>
<td>• Monitoring work insufficient and undetected cases can spread the disease</td>
<td>• Educating the GP/physicians in correct case definition/diagnosis</td>
<td>• Distribution of consultation guidelines and triage procedures in case of a suspected SARS patient.</td>
</tr>
<tr>
<td></td>
<td>• Registration and monitoring of patients, health care workers and visitors with SARS-like symptoms (hospital logs)</td>
<td>• Training of medical staff in use of PPE, hand hygiene, respiratory etiquette</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Establish procedures within each HCF to monitor risk groups like staff, patients and visitors to enforce early detection of new cases of SARS.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Develop guidelines and train staff on triage screening of patients in case of an SARS outbreak in order to use limited resources appropriately.</td>
</tr>
<tr>
<td><strong>Clinical evaluation of symptomatic persons</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>• The patient is not diagnosed correctly and is not transferred to an isolation ward</td>
<td>• Establish procedures within each HCF to ensure access to relevant information (diagnoses, treatment, research)</td>
<td>• Establish procedures within each HCF and GP/physicians clinic to ensure correct and updated case definition/diagnosis</td>
</tr>
<tr>
<td>• No appropriate diagnostic tests are available, which leads to late case identification or misdiagnoses</td>
<td></td>
<td>• Identify SARS hospitals, with appropriate diagnostic supplies.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Infection Control and Respiratory Hygiene</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Transmission from HC personnel working on different wards or in different hospital settings</td>
<td>• Infection control measures (Use of PPE, hand hygiene, respiratory etiquette)</td>
<td>• Provide clear guidelines about how to apply infection control measures, including proper use of PPE (masks or respirators, gloves, gowns and eye protection).</td>
</tr>
<tr>
<td>• PPEs are not stockpiled and the resources are limited</td>
<td>• Designate specific SARS hospitals for treatment in case of an outbreak, with appropriate diagnostic supplies</td>
<td></td>
</tr>
</tbody>
</table>
## SARSControl project/WP8/L. Hjarnø, AM Syed, R Krumkamp, R Reintjes, AR Aro.

### Patient isolation wards

<table>
<thead>
<tr>
<th>Transfer of SARS patients from one ward to another might increases the likelihood of infection of other patients and HCW</th>
<th>Minimize risk of infection during transport of SARS patients; Infection control measures (Use of PPE, hand hygiene, respiratory etiquette)</th>
<th>Identify specific SARS wards and paths separated from other hospital traffic to minimize the risk of transmission to patients, visitors, and staff.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Insufficient isolation wards causing infection of fellow patients and HCW</td>
<td>Isolation units at designated SARS hospitals</td>
<td>Develop guidelines for the isolation procedures and placement concerning: Triage wards, SARS evaluation clinics (fever clinics) and case diagnosis</td>
</tr>
</tbody>
</table>

### Engineering and Environment Control

<table>
<thead>
<tr>
<th>Spread of infection within the healthcare facility</th>
<th>SARS treatment units</th>
<th>Improve the capacity of the facility to isolate SARS patients in designated Infection Control Units (IFU).</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Install infection isolation rooms (AIIRs)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Develop guidelines about how an AIIRs will be modified if required</td>
</tr>
</tbody>
</table>

### Exposure Reporting and Evaluation

<table>
<thead>
<tr>
<th>Late identification of cases in the HCF (which can lead to possible disease transmission)</th>
<th>Exposure report</th>
<th>Healthcare facilities should develop an exposure reporting procedure of all suspected and confirmed SARS cases</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Develop strategies for regularly communication with the public health department in order to share information about possible case contacts</td>
</tr>
</tbody>
</table>

### Health care personnel

<table>
<thead>
<tr>
<th>Lack of extra staff to support the hospital in a crises situation</th>
<th>Staff recruitment</th>
<th>Develop staff recruitment plans (e.g. retired staff) to ensure the estimated need of staff required to manage a SARS outbreak.</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Ensure regularly training in good infection control practices e.g. use of PPE, hand hygiene and respiratory etiquette.</td>
</tr>
</tbody>
</table>

### Hospital access control

<table>
<thead>
<tr>
<th>Unrecognized SARS patients might infect “healthy” patients/visitors/HCW during hospitalization/consultation</th>
<th>Access control – symptom screening</th>
<th>HCF should develop criteria and plans for limiting access to the healthcare facility</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Develop guidelines for visitors and supplementary staff at the designated SARS HCF to self monitor for SARS symptoms and information on health advice seeking.</td>
</tr>
</tbody>
</table>
**Supplies and equipment**

- Insufficient amount of PPE is stockpiled according to estimated need.
- Develop strategies to estimate the need of extra equipment and services in case of an outbreak.
- The HCF should determine the availability of supplies and equipment and maintain an appropriate stock of PPE.
- Public health departments should monitor the availability of PPEs. In crisis situation allocation of material could be organised using these data.
- Develop specific agreements with providers of essential services to ensure delivery during an outbreak.

**Communication and case reporting**

- Incorrect information is published in the media causing panic and distress in the community
- Appoint a responsible communication coordinator in charge of hospital statements, to ensure reliability.
- The HCF should develop case reports and communication strategies
- A hospital spokesperson should be identified and trained in risk communication

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**HACCP results for the *Surveillance and Laboratory diagnostics* component**

<table>
<thead>
<tr>
<th>Hazards</th>
<th>Critical control points</th>
<th>Recommendations</th>
</tr>
</thead>
</table>
| The GP does not consider SARS in the diagnosis and therefore no laboratory test is carried out. | First diagnoses
Report of possible SARS cases | Provide clear guidelines to the public on how to behave in case of symptom onset
Ensure that GPs use updated case definitions for diagnosis of potential cases to be considered of laboratory testing/Ways to inform GPs of updated case definitions should be put in place. |
| The GP misdiagnoses a case and request a laboratory test for respiratory diseases unlikely to be SARS resulting in the decrease of laboratory capacity and causing unnecessary utilization of test material and expense. | Provide guidance for GPs and HCFs for their work during the pandemic period, to assist the handling of possible cases. |
| Possible SARS cases are not reported to the local public health office leading to further potential cases. | During pandemic spread, atypical pneumonia cases should be reported to the local public health office as they could be possibly infected with SARS. |
### Taking specimen samples and shipment of specimen culture

- HCW could become infected by handling specimens
- Samples can not be tested as they were taken in an inappropriate manner.
- The specimen culture is not shipped in an appropriate way and contaminated material is discharged
- Modes of transport used are time consuming hence extending the time for case confirmation.

- Sample taking
- Sample shipment

- HCWs that have contact with possible SARS cases, or with infected material, need (i) strict guidelines for the handing of specimens, (ii) appropriate PPE’s and (iii) need to be well trained and educated to handling contaminated material.

- Guidelines and appropriate material/equipment for the shipment of samples have to be available (13)

### Laboratory Testing

- Due to lack of safety standards laboratory staff could become infected. This especially matters during the non-endemic period because staff is unaware of a possible threat of an infectious disease like SARS.
- The reference laboratory has less capacity and is overwhelmed by the ordered sample tests and no alternative laboratory is identified
- The tests are done incorrectly, which has an impact on the sensitivity and specificity of results.
- Specimens are handled in an unsafe manner and lab staff may become infected.

- Local laboratory
- National reference lab
- Testing procedure

- Recommend high safety standards for the diagnoses of possible infective specimens generally.
- Consider laboratories for the diagnoses of SARS and designate alternative laboratory for an outbreak situation. Make sure that safety recommendations are considered in the diagnosing labs and for the shipment of specimens.
- Use only biosafety 3 laboratory for the analyses of possible SARS specimens

### Report preliminary test result

- Cases are reported late or incomplete. These data will be late or not available for the disease surveillance.
- Cases are reported late to WHO / ECDC. These data will be late or not available for international disease surveillance

- Reporting preliminary positive cases to local / national public health office
- Report preliminary cases to WHO / ECDC

- Make sure that reporting algorithms are available and followed. Cases need to be reported as soon as possible to all relevant institutions to assure a complete and actual picture of the current disease situation. This is relevant for each level, regional, national and international
### Verification of positive results

- Due to lack of safety standards laboratory staff could become infected. This especially matters during the non-endemic period because staff is unaware of a possible threat of an infectious disease like SARS.

- The reference laboratory have less capacity and is overwhelmed by the ordered sample tests and no alternative laboratory is identified.

- The tests are done incorrectly, which has an impact on the sensitivity and specificity of results.

- Specimens are handled in an unsafe manner and laboratory staff may become infected.

- Cases are reported late or are incomplete. These data will be late or not available for the disease surveillance.

- Cases are reported late to WHO / ECDC. These data will be late or not available for international disease surveillance.

- A safety shipment of the specimens is needed to avoid contamination.

- Correct interpretation of laboratory findings as defined by WHO is needed to secure a high sensitivity and specificity (9). Current scientific evidence in laboratory diagnostics has to be applied for accurate results.

- As described in point 3 and 4, quick shipment, diagnoses and a timely dissemination of results are essential for timely disease surveillance.

### Data transfer and management

- Data reporting procedures are too complicate which influences reporting speed and completeness of data [16].

- Labs / GPs / Hospitals report cases late, thus surveillance data is not up-to-date.

- Used computer programs are not appropriate to work with huge datasets (like in case of a pandemic), thus analysis of extensive outbreaks overwhelms data management capacity.

- Secondary case data, e.g. on case contacts are

- Data reporting: Laboratory/G/ Hospital
  - Data collection and analyses
  - Data report: local / regional public health office
  - Data report: to ECDC and WHO

- Have reporting standards available for SARS or SARS-like diseases, which is applicable for each laboratory.

- During endemic spread apply active data collection.

- Use easy data management between the national public health offices (computer based).

- Generally, use data management programs that are appropriate to manage huge datasets.
collected inappropriately and do not provide the necessary information.
- Datasets can not be matched.
- Dataset are inappropriate for the surveillance of SARS cases.
- Computer programs are not appropriate to handle big datasets.
- Data reporting among the public health offices on different levels is organised bureaucratically which leads to a delay in data exchange. Also loss of data could be a caused due to complex data handling.
- No legal basis to report data to WHO or ECDC exists, thus data are not available for international surveillance.
- Data exchange is organised bureaucratically which leads to a delay.

<table>
<thead>
<tr>
<th>Dissemination of results</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Results are not forwarded to the relevant authorities, thus relevant institutions are not aware about the extent of the outbreak.</td>
</tr>
<tr>
<td>• Forward results to public health authorities</td>
</tr>
<tr>
<td>• Communication ways clearly structured and applicable in a quick manner in order to disseminate surveillance data fast to the relevant authorities.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>HACCP results for community containment</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Hazards</strong></td>
</tr>
<tr>
<td>Interview of confirmed/suspected SARS case</td>
</tr>
<tr>
<td>• Not all close contacts can be identified and they might develop symptoms in the community with a chance of spreading the disease</td>
</tr>
<tr>
<td>• Case does not give out information/remember</td>
</tr>
<tr>
<td>• As part of the epidemiological investigation: interview family and relatives of the case using structured questionnaires</td>
</tr>
<tr>
<td>• Review of patient or visitor logs from</td>
</tr>
<tr>
<td>• Guidelines for conducting structured interviews with confirmed and suspected SARS cases – questions should be framed to obtain information on:</td>
</tr>
<tr>
<td>• Recent travel history (within the last 10 days) to suspected or confirmed source areas/countries</td>
</tr>
<tr>
<td>• Close contact with travel history to suspected or confirmed source areas/countries.</td>
</tr>
</tbody>
</table>
Identify contacts/Contact Tracing

- Identified contacts refuse to collaborate
- The risk of being infected with SARS as an identified contacts show symptoms and is admitted to designated SARS hospital for medical evaluation
- Stigmatization of identified close contacts

- Compulsory medical evaluation of identified close contacts
- PPE and Hygiene guidelines
- Risk communication guidelines (local and national)

- In case of an outbreak regulations on case control are necessary, including compulsory medical evaluation of identified close contacts.
- Guidelines for risk communication on local and national level in order to avoid stigmatization of suspected cases.

Hospital isolation of confirmed SARS contacts

- Confirmed SARS contact refuse hospital isolation.
- The risk of being infected at the SARS ward during a medical evaluation.

- Compulsory case isolation
- Home isolation or isolation at a designated community facility
- PPE and Hygiene guidelines

- Hospital isolation for very ill SARS patients
- Isolation at home or at designated community facilities if safe and effective

Quarantine of asymptomatic contacts

- Home quarantined contacts do not comply with recommendations for home quarantine.
- Perceived asymptomatic contact develops SARS symptoms during/after end home quarantine

- Sanction home quarantine of suspected SARS cases e.g. by fines or enforcing quarantine regulations
- Follow up interviews by health care officials during and after the home quarantine period

- Persons in quarantine should sleep separately from others; they should wear a mask when near someone else and not share personal items.
- Self monitoring of symptoms by home quarantined contacts, e.g. daily temperature check

Services for quarantined/isolated persons

- Service personnel attending home quarantined/isolated contacts might get infected by an unrecognized SARS case among the close contacts
- Contacts suffer from psychological stress

- Standard infection control measures; PPE and hygiene guidelines
- Follow up visits/contact by Health care officials/Hotlines

- Provide guidelines for home visits by service personnel attending to the care and supplies of quarantined contacts.
- Establish hotlines and “service corps” as a daily communication line for people in home quarantine/isolation or designated facilities
caused by quarantine.

<table>
<thead>
<tr>
<th>Measures to decrease social interaction</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Risk of transmission of SARS between members of the community during mass gatherings</td>
</tr>
<tr>
<td>• Risk of transmission of disease between the public in the public arena – like schools.</td>
</tr>
<tr>
<td>• Ban/restriction/reduction of mass gatherings</td>
</tr>
<tr>
<td>• Closure of public facilities, like schools and businesses: Strategy to prevent/minimize the risk of SARS transmission in the community, and to minimize the public interaction to prevent casual transmission in the population</td>
</tr>
<tr>
<td>• Educate the public in PPE and Hygiene guidelines.</td>
</tr>
<tr>
<td>• Provide guidelines for when, how and which gathering should be prohibited and decide possible sanctions</td>
</tr>
<tr>
<td>• Provide guidelines concerning when, how and which institutions should be closed in case of a SARS outbreak, in order to prevent / mitigate transmission of SARS.</td>
</tr>
<tr>
<td>• Conduct modeling analyses in order to have data on most effective intervention measures, considering the certain national situation (society structure and population density).</td>
</tr>
</tbody>
</table>