Severe Acute Respiratory Syndrome (SARS)

A Global Threat

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Objectives

At the conclusion of this module, the learner will be able to:

1. Recognize the clinical manifestations of severe acute respiratory syndrome (SARS).
2. Identify how the SARS-associated coronavirus is transmitted.
3. Define the precautions to reduce the spread of SARS among pre-hospital and hospital personnel.
4. Identify treatment options for SARS.
5. Identify the overall history of the SARS-associated coronavirus.
6. Awareness that SARS may reemerge.
What is SARS?

Severe Acute Respiratory Syndrome (SARS)

- A viral respiratory illness caused by a coronavirus, called the SARS-associated coronavirus (SARS-CoV).

- Coronavirus – group of similar viruses, some of which cause the common cold. Appearance of a virus particle surrounded by a crown gives its name.

- SARS-CoV has distinct genetic and antigen features from other human coronaviruses.
Where Did SARS Originate?

- SARS was first identified in November 2002 in the Chinese province of Guangdong.

- Over the next nine months SARS cases were reported throughout the world.

- Major outbreaks followed in mainland China, Hong Kong, Vietnam, Singapore, Canada, and Taiwan.

- July 2003 brought an end to the SARS outbreak.
  - As reported by the World Health Organization (WHO) 8,098 people were infected with SARS worldwide, of which 774 died.
What Are the Symptoms?

- **Asymptomatic or mild respiratory illness**
- **Moderate respiratory illness**
  - Temperature of > 100.4°F (>38°C), and
  - One or more clinical findings of respiratory illness (e.g., cough, shortness of breath, difficulty breathing, or hypoxia).

- **Severe respiratory illness**
  - Temperature of > 100.4°F (>38°C), and
  - One or more clinical findings of respiratory illness (e.g., cough, shortness of breath, difficulty breathing, or hypoxia), and
    - Radiographic evidence of pneumonia, or
    - Respiratory distress syndrome, or
    - Autopsy findings consistent with pneumonia or respiratory distress syndrome without an identifiable cause
    - AND appropriate epidemiologic findings
What Are the Symptoms?

- Symptoms may also include:
  - Headache
  - Overall feeling of discomfort, body aches
  - Diarrhea
  - Loss of appetite
  - Confusion

- Clinical Features
  - Incubation period of 4 to 6 days
  - Most patients become ill within 2 to 10 days post exposure
  - Respiratory symptoms typically develop 2 to 7 days after onset of systemic symptoms (e.g., headache, fever).
  - Clinical signs and symptoms alone are not enough to diagnose SARS, must consider epidemiology.
What Are the Symptoms?

**Pediatric Patients**

- The following approach to pediatric patients has been developed as a guide by The Hospital for Sick Children for the management of pediatric patients. [www.sickkids.on.ca](http://www.sickkids.on.ca)

- Infectious diseases present differently between infants, young children, older children, and adults.

- Rhinitis alone that does not progress to other symptoms is not considered to be consistent with SARS.
What Are the Symptoms?

Symptoms for *infants* and *young children* may include:

- Fever > 100.4° F (> 38°) oral, tympanic, or rectal equivalent
- Cough, respiratory distress, tachypnea
- Lethargy, irritability, loss of appetite.

Symptoms for *older children* may include:

- Fever > 100.4° F (> 38°) oral, tympanic, or rectal equivalent
- Cough, respiratory distress, tachypnea, dyspnea, difficulty breathing.
- Loss of appetite, diarrhea, confusion
What Are the Symptoms?

In some pediatric cases…

– The headache may resolve, however, fever, chills, and shakes may begin shortly after.

– Respiratory symptoms may begin 2-3 days later.

– Fever may resolve with patient improvement for 24-36 hours; however fever returns and symptoms worsen.
What Are the Symptoms?

Infection Control

- Pediatric SARS patients should be cared for using the same body substance isolation (BSI) precautions and personal protective equipment (PPE) as with adult patients.

  - e.g., frequent hand hygiene, gloves, N-95 mask, eye protection, surgical mask on patient, isolation room.

  - Clinical features such as incubation period and onset are similar to that of adults.
What Are the Symptoms?

**Pediatric Case Definition & Treatment**
- As with the adult patient, there is no current treatment regimen for pediatric patients.
- The Hospital for Sick Children has identified a broad definition for children with possible or confirmed SARS.

**Clinically Suspect** – normal x-ray and NO hypoxia.

**Clinically Probable** – abnormal x-ray OR hypoxia.
- It is suggested that clinically and suspect cases are treated “as you would for diseases other than SARS.”

Refer to facility and local guidelines for treating pediatric patients.
Epidemiologic Criteria

■ **Travel**
  - Includes transit in airports
  - Within 10 days of onset of symptoms to an area with current or recently documented or suspected community transmission of SARS, or
    ■ Areas with documented or suspected community transmission of SARS include mainland China and Hong Kong Special Administrative Region, People’s Republic of China; Singapore; Taiwan; Toronto, Canada; and Hanoi, Vietnam.

■ **Close contact** – within 10 days of onset of symptoms with a person known or suspected to have SARS infection
How is SARS Transmitted?

How Close is “Close Contact”?

- A person who has cared for or lived with a person infected with SARS, or
- Direct contact with respiratory secretions of body fluids of patients with SARS, or
- Talking with a SARS patient within 3 feet, or
- Kissing or Hugging, or
- Sharing eating or drinking utensils, or
- Directly touching someone, or

Exclusions:

- Walking by a person or sitting across a room from someone with SARS for a short time are not considered close contact.
How is SARS Transmitted?

- SARS is primarily transmitted through droplets and close personal contact.

- Evidence suggests the SARS virus can live for days on objects, which can increase transmission.

- Most transmission occurs late in the illness.

- According to epidemiologic data, SARS is not indicated to be transmitted before symptoms occur in the infected person.
Isolation & Quarantine

**Isolation** — separates persons with an infectious illness from persons who are not infected. Isolation usually occurs in a health care facility, but it may also occur in the home.

**Quarantine** — restricts persons who may have been exposed to an infectious illness but are not currently ill. Quarantine usually occurs in the home, but may also occur in a health care facility, with the restriction of movement between buildings and in public.
How is SARS Isolated?

Isolating the SARS patient in a healthcare facility:

- Develop a plan to triage and admit SARS patients with the minimal amount of staff to decrease risk of transmission.

- Develop a plan to move SARS patients within the facility through dedicated hallways and elevators away from main facility traffic.

- Isolate patients in airborne infection isolation rooms (AIIR) with negative pressure, independent air-handling system, and attached restroom. If AIIR’s are not available, isolate patients to a particular floor or wing.

- Communication within and between healthcare facilities and health departments.
How is SARS Isolated?

- Home isolation is appropriate when it is able to be conducted safely and effectively, otherwise admit to a health care facility.

- Isolation in the home should limit the risk to the patient and primary caregiver. All others should be relocated if possible.

- Limit public interaction with suspected or confirmed SARS patients from school, work, out-of-home child care, etc.

- The room in the home should be able to be enclosed, including a door that can be closed at all times, separate bathroom, and isolated central air-conditioning unit.
How is SARS Isolated?

- Infection control must be sufficiently maintained at all times during home care.

- Gloves do not replace proper hand hygiene.

- Inform healthcare providers prior to evaluation of the SARS patient that any household members accompanying the patient are close contacts of the SARS patient.

- Notification will help prevent transmission to others in the healthcare setting if necessary.
How is SARS Treated?

- Currently*, there is **NO** prophylaxis or treatment for the SARS-CoV.

- No anti-viral treatment has shown to be effective.

- No controlled clinical trials have been conducted* to assess the effectiveness of medications (such as ribavirin and corticosteroids).

- It is still unclear if persons who recover from the SARS-CoV develop protective immunity or if they are susceptible to becoming infected again.

*As of February 2004.
How Can SARS be Prevented?

CDC recommendations to aid in preventing the spread of SARS:

- Educate the public and healthcare workers about the signs, symptoms, and prevention strategies for SARS.

- Appropriately evaluate and manage current SARS cases.

- Utilize person protective equipment (PPE) and body substance isolation (BSI) (e.g., gloves, gown, N95 respirator, eye protection).

- Frequent hand hygiene.

- Screen incoming travelers from areas affected by SARS.

- Heed travel alerts and advisories issued by the CDC & WHO.
The following flowchart displays the sequence in which information is gathered and disseminated.

The process begins with health care providers and their findings after screening patients.

Reports are then sent to local and state health officials who conduct further tests and screening.

Information then flows to the CDC who then contacts the WHO.

Finally, after applying the newly gathered information to previous knowledge and data, it is applied to form updated case definitions and SARS risk factors that are released to health officials and the community.
Approach to surveillance and reporting

- Community
- Health care facilities
- Providers
  - Screening
- State and local health departments
  - Screening
  - Updated case definitions, lab evaluation, SARS risk factors
  - CDC
  - WHO

Travel

- The CDC issues two types of notices for individuals traveling to areas with SARS. For the most current updates visit www.cdc.gov/ncidod/sars/travel.htm.

- Travel Advisory – the recommendation to defer nonessential travel.

- Travel Alert – Informs travelers of a health concern as well as provide advice about specific precautions. Travel is still indicated.
Testing for SARS-CoV

- A test developed by the CDC has been established to identify the serum antibody of the SARS-CoV.
  - Detecting the SARS-CoV antibody is considered by the CDC to be a reliable indicator of infection, but when tested > 28 days post onset.
    - A negative test, absence of SARS-CoV antibody, is NOT a definitive test when conducted < 28 days.
  - Increasing the amount of specimens taken throughout the illness increases the likelihood of detecting the virus.
  - Specimens are collected from respiratory tract, stool, and serum.
  - Limitations of the test include low serum levels or low antigen levels because the body has not had enough time to produce the antigen.
  - Testing may change as more is learned about the SARS-CoV.
Pre-hospital Care

Ground Transport

- Transport of suspected SARS patients should be with the minimum number of EMS personnel and without passengers.

- Notify receiving facility prior to arrival of suspected SARS patients.

- Maintain infection control by donning protective equipment throughout the transport of a suspected SARS patient.
Pre-hospital Care

- Remove and replace gloves when soiled, damaged, between patients, or when patient care is complete and discard in biohazard bag.

- Place any dry, saturated waste, or disposable equipment (e.g., gloves, dressings, sharps, etc.) in the appropriate biohazard bag or container.

- Wash hands immediately after removing gloves or disinfect with a waterless hand sanitizer.
  - Wearing gloves does not replace proper hand hygiene.

- Wear an N-95 (or greater) mask and eye protection when in the same compartment as the patient.
  - The driver of the vehicle should also wear an N-95 mask if the drivers cab is not separate from the patient care area.
Pre-hospital Care

- Mechanically ventilated SARS patients should have a HEPA or equivalent filtration on ventilator exhaust airflow.
  - Contact your ventilator equipment manufacturer for appropriate filtration capability.

- Concerns regarding transport of possible or confirmed SARS patients in the United States should contact local, state, and federal health authorities including the CDC via their 24 hour response number 770-488-4100.
Pre-hospital Care

Cleaning and Disinfecting the Transport Vehicle and Equipment

- Personnel cleaning the patient care area should wear gloves, disposable gown, and eye protection.

- Use an EPA-registered hospital disinfectant for cleaning stretchers, railings, radio, equipment, walls, floors, and other surfaces that may have been in contact during patient care.

  Avoid cleaners with compressed air as it may re-aerosolize infectious particles.

Currently, the CDC states “there are no disinfectant products currently registered by the US Environmental Protection Agency (EPA) specifically for the inactivation of the newly identified viruses associated with SARS.” EPA-registered antimicrobial agents can be found at [www.epa.gov](http://www.epa.gov).
EMS Follow-Up

- If personnel who have transported a suspected or confirmed SARS patient, and develop symptoms within the 10 day post-exposure period should seek medical evaluation.

- Cases should be reported to local, state health officials, and the CDC.

- If personnel are NOT exhibiting any symptoms of fever or respiratory illness during the 10 day post-exposure, they may continue working.
In China, Taipei, the Taipei Times has reported the development and unveiling of two negative-pressure ambulances that were donated to the National Fire Administration (NFA) in June 2003.

The ambulances were developed in two weeks by China Motor and the Industrial Technology Research Institute; the first to be manufactured locally.

Standard ambulances are fitted with negative pressure equipment.

Imported ambulances range in price from USD 86,000 to USD 114,000, however the locally manufactured was approximately USD 36,000.
Healthcare Providers

Healthcare providers are likely to be the first exposed to individuals with the SARS-CoV

- Undiagnosed or delayed identification of the SARS-CoV resulted in a higher percentage of healthcare workers to be infected in the 2002/2003 outbreak.

- A significant amount of cases were reported to be healthcare workers.

- The following chart identifies the total number of SARS cases, in various countries, and the percentage of these cases that were of healthcare providers who were affected.
Total SARS Cases and % Healthcare Workers by Country

Case Study

A study published in the *Annals of Emergency Medicine* (Oct. 8, 2003), conducted by Kum-Ying Tham, MBBS, FRCSed, examined the application of an emergency department’s disaster response plan in a hospital in Singapore.

The hospital became the central location for any and all SARS patients only; allowing hospital resources to be devoted to SARS patients.
Case Study

- The emergency department became the national screening center for the CDC in Singapore.

- Clinical features were assessed as well as the administration of a questionnaire by medical staff on each patient.

- Patients were then admitted to the hospital based on findings for further tests and monitoring.
Case Study

- Over the approximately two months of the outbreak, 11,461 people were screened through the ED.

- 1,386 people were admitted to rule out SARS.

- 235 were confirmed to have SARS.

- No patients contracted SARS while visiting the ED.

- 1 nurse in the ED was treated for suspected SARS.
Case Study

Take Home Points!

- The hospital’s disaster response plan was able to be applied to a non-bioterrorism event.

- By focusing resources and patients to one hospital (without the normal patient flow) assisted in the containment of SARS.

- The ED was able to effectively screen, treat, and discharge patients with the use of a screening questionnaire and following criteria for admission.
The Outbreak

February 11, 2003 – WHO was informed by Chinese health officials of 305 atypical pneumonia with 5 deaths in the Guangdong Province since November 2002.

February 21, 2003 – A Chinese physician unknowingly infected with SARS travels to Hong Kong and stays in a hotel.

– Over the next two days, the physician develops severe respiratory symptoms and is hospitalized.

– The physician later dies in the hospital.
The Outbreak

Travelers from the same hotel as the physician, also unknowingly infected with SARS, traveled to other areas such as:

– Vietnam, Hong Kong
– Singapore, Canada

– Areas affected by SARS experienced severe economic effects as well as social disruption.
The Outbreak

- Hospitals contributed a vast majority of outbreaks as well as the introduction of the illness into the community.

- Initial outbreaks were among the highest in healthcare workers, patients, and visitors in countries with the largest outbreaks.
Reported SARS Cases

Massachusetts

- April 1, 2003 – The Massachusetts Department of Public Health reports a baby was being treated for SARS, the state’s third suspected case, at Baystate Medical Center.

- The baby was released shortly after.

- In Massachusetts, as of October 1, 2003, there were a total of 8 cases of SARS, all of which were suspected, with no confirmed cases.
Reported SARS Cases

Nationally

- In data reported to the World Health Organization (WHO) as of October 1, 2003, United States statistics are as follows:

  8  confirmed SARS cases
  19  probable SARS cases
+ 137  suspected SARS cases
  164  total SARS cases reported

0 deaths in the U.S. were found to be associated with SARS outbreak of 2002/2003.
Reported SARS Cases

- Internationally
  - As of September 26, 2003, the WHO has reported probable SARS cases with onset from November 1, 2002 to July 31, 2003 worldwide.

- 8,098 cases worldwide

- 774 deaths worldwide

- 1,707 healthcare workers affected (21% of SARS cases)
Can SARS Return?

**YES!**
- The CDC has identified the potential for SARS to reemerge still exists.

**Possible sources include:**
- Animal reservoir
- Humans with persistent infection
- Transmission in humans that is unrecognized
- Laboratory exposure
Can SARS Return?

- Areas outside the United States will most likely see SARS reemerge.
- Global surveillance will aid in detecting the first cases.
- All patients with CXR-confirmed pneumonia should be screened.
Can SARS Return?

Screen all persons being hospitalized for CXR-confirmed pneumonia:

1. In the last 10 days, have you *traveled* to mainland China, Hong Kong or Taiwan, or been in close contact with other ill persons who have?

2. “Are you employed as a *healthcare worker* with direct patient contact?”

3. “Do you have *close contacts* who have been told they have pneumonia?”

Can SARS Return?

- If patient answers yes to one of the three screening questions, providers should:
  - Contact local or state health department.
  - Consider SARS testing if no other diagnosis has been identified within 72 hours.
  - Conduct SARS-CoV testing in conjunction with public health officials.
Healthcare Facilities

- Healthcare facilities were a critical area in the management of SARS even though they felt the largest impact.

- Unprotected exposures and unrecognized cases contributed to the high transmission in healthcare facilities.

- Strict infection control played a key role in preventing transmission.

- Preplanning will help combat future outbreaks.
Early detection, diagnosis, and surveillance will protect against further outbreaks.

The high unlikelihood of contracting SARS and non-specific presentation create challenges for healthcare workers to identify the illness in its early stages.

Communication among healthcare workers, facilities, local and state health officials.

Educating and training healthcare workings about SARS and to take appropriate control measures.

Reacting quickly and effectively will help prevent future outbreaks of SARS.
Role of Public Health Officials

- Obtain the most current, global information on SARS to aid in risk assessment in the community.

- Contact Tracing – Although many resources are required, it is essential in containing the infection.
  - Contact tracing – involves identifying, evaluating, counseling, and monitoring patients who may have been exposed to the SARS-CoV.

- Communication in a timely manner of information to providers and health officials.
Role of Public Health Officials

- Review reports of SARS to assess risk.
- Detect increases of pneumonia.
  - In-depth look at cases of high suspicion
    - Travelers exposed to pneumonia
    - Healthcare workers exposed to patients with unexplained pneumonia.
Current SARS Information

Where Can Current Information on SARS be Found?

- For the most current information regarding the SARS-CoV and cases visit:
  - Centers for Disease Control and Prevention (CDC) www.cdc.gov
  - World Health Organization (WHO) www.who.int
  - Contact local and state health officials for information in your area.
References


References


SARS ambulances ready to hit the road, NFA says. [Electronic Version]. *Taipei Times*, 2.
References


www.cdc.gov

www.who.int