Severe Acute Respiratory Syndrome (SARS)

Report Immediately

✓DISEASE AND EPIDEMIOLOGY

Clinical Description:

SARS is a viral respiratory illness that typically begins with a high fever (temperature >100.4°F [>38.0°C]). Other symptoms may include chills, headache, general malaise, and body aches. Some people also develop mild respiratory symptoms at the onset of illness. About 10–20% of patients have diarrhea. After 2–7 days, symptoms may worsen. SARS patients may develop a non-productive cough, shortness of breath, and respiratory distress; most patients develop pneumonia and many develop acute respiratory distress syndrome (ARDS). Respiratory relapses may occur.

Causative Agent:

SARS is a serious, potentially life-threatening viral infection caused by a previously unrecognized virus from the Coronaviridae family. This virus has been named the SARS-associated coronavirus (SARS-CoV). Previously, Coronaviridae were best known as the second most common cause of the common cold.

Differential Diagnosis:

Typically, viruses cause upper respiratory infections/bronchitis. Other possible illnesses causing upper respiratory illnesses include influenza, legionella, and viral or bacterial pneumonia.

Laboratory identification:

The laboratory tests discussed below can help confirm the diagnosis of SARS per CDC and WHO parameters. Laboratory confirmation of SARS infection is obtained when any one of the following criteria is met:

- Detection of antibodies to SARS-CoV in specimens obtained during acute illness or more than 28 days after illness onset
- Detection of SARS-CoV RNA by reverse transcriptase-polymerase chain reaction (RT-PCR) and confirmed with a second PCR assay using a second aliquot of the specimen
- Isolation of SARS-CoV in culture, with confirmation using a test validated by the CDC

SARS-CoV infection is unconfirmed when any one of the following criteria is met:

- The absence of antibodies to SARS-CoV in convalescent serum obtained 28 days or more after symptom onset
- Laboratory testing is not performed or is incomplete.

Data from the 2002-2003 outbreak indicate that SARS may be associated with the following laboratory findings:

- Modest lymphopenia, leukopenia, and thrombocytopenia: Series have shown WBC counts of less than 3.5 X 10^9/L and lymphopenia of less than approximately 1 X 10^9/L.

- Mild hyponatremia and hypokalemia
- Elevated lactate dehydrogenase, alanine aminotransferase, and hepatic transaminase levels
- Elevated creatine kinase level

Testing for SARS-CoV is as follows:

- Coronavirus antibody testing methods: These include indirect fluorescent antibody or enzyme-linked immunosorbent assays, which test for specific antibodies after infection. Although these antibodies can be noted in some patients during the acute phase (ie, within 14 d of onset), a definitive negative test finding for these antibodies cannot be derived from a sample that has been obtained less than 28 days after symptom onset.
- RT-PCR: Results can be positive in some patients within the first 10 days of fever. RT-PCR can detect SARS-CoV in serum, stool, and nasal secretions.
- Viral culture: SARS-CoV can also be isolated in viral cultures.
- A negative SARS-CoV antibody test finding less than 28 days after symptom onset, a negative PCR finding, and a negative viral culture finding do not exclude the diagnosis of SARS. Obtaining convalescent serum to make a final antibody determination 28 days or more after symptom onset is critical to the diagnosis of SARS.

Initial tests for patients thought to have SARS include pulse oximetry, blood cultures, sputum Gram stain and culture, and viral respiratory pathogen tests, notably influenza A and B viruses and respiratory syncytial virus.

- *Legionella* and pneumococcal urinary antigen testing should also be considered. Specimens should also be made available for antibody testing (as outlined earlier), PCR, and viral culture/isolation tests.
- Acute and convalescent (>28 d after symptom onset) serum samples should be collected. Paired sera and other clinical specimens can be forwarded through state and local health departments for testing at the CDC.
- Some SARS patients have had positive test results for human metapneumovirus, a virus genetically related to respiratory syncytial virus. Although human metapneumovirus was considered as a potential etiology for SARS, the role of this finding is unclear. Investigators initially found paramyxoviruslike particles in patients in Hong Kong and Frankfurt; however, the relative importance of this finding is not clear and past studies elucidating SARS-CoV as the causative virus appear definitive.

The following are the CDC's guidelines for the laboratory diagnosis of SARS-CoV infection as of January 8, 2004. Diagnosis is achieved with detection of any of the following by a validated test, with confirmation in a reference laboratory:

- Serum antibodies to SARS-CoV in a single serum specimen
- A 4-fold or greater increase in SARS-CoV antibody titer between acute- and convalescent-phase serum specimens tested in parallel
- Negative SARS-CoV antibody test result on acute-phase serum and positive SARS-CoV antibody test result on convalescent-phase serum tested in parallel
- Isolation in cell culture of SARS-CoV from a clinical specimen, with confirmation using a test validated by the CDC

- Detection of SARS-CoV RNA by RT-PCR validated by the CDC, with confirmation in a reference laboratory, from (a) 2 clinical specimens from different sources or (b) 2 clinical specimens collected from the same source on 2 different days

Specimens for SARS-CoV Testing:
Priority Specimens and Timing for Collection

The likelihood of detecting infection is increased if multiple specimens, e.g., stool, serum, and respiratory tract specimens, are collected during the course of illness.

Specimen, by test type	<1 week after symptom onset	1-3 weeks after symptom onset	>3 weeks after symptom onset
RT-PCR[1] for viral RNA detection			
Sputum[2]	√[3]	√√	√
Bronchoalveolar lavage, tracheal aspirate, or pleural fluid tap[4]	√	√√	√
Nasopharyngeal wash/aspirate	√	√√	√
Nasopharyngeal and oropharyngeal swabs	√	√√	√
Serum (serum separator tube)	√√	√	not recommended
Blood (plasma) (EDTA/purple top tube for plasma)	√√	√	not recommended
Stool (minimum 10 cc specimen)	√	√√	√√
EIA[1] for antibody detection			
Serum[5] (serum separator tube)	√√	√√	√√

[1]Because of the investigational nature of both the SARS RT-PCR (reverse transcription-polymerase chain reaction) and the SARS EIA (enzyme immunoassay), it is recommended that the clinician obtain a signed informed consent form from the patient. The consent form for the RT-PCR test can be found at: www.cdc.gov/ncidod/sars/lab/rtpcr/consent.htm. The consent form for the EIA test can be found at: www.cdc.gov/ncidod/sars/lab/eia/consent.htm.
[2]A sputum specimen is preferred if the patient has a productive cough.
[3]The more checks, the better the results from a particular specimen at a specific point in the illness.
[4] Consider these specimen types if sputum is not available.
[5]Also collect a convalescent specimen >28 days post onset.

Treatment:

Currently, no definitive medication protocol specific to SARS has been developed, although various treatment regimens have been tried without proven success. Currently, the CDC recommends that patients suspected or confirmed as having SARS receive the same treatment they would be administered if they had any serious community-acquired pneumonia.

Isolate patients confirmed or suspected to have SARS as outlined below, and provide aggressive treatment in a hospital setting. Mechanical ventilation and critical care treatment may be necessary during the illness. An infectious disease specialist, pulmonary specialist, and/or a critical care specialist should direct the medical care team. Communication with local and state health agencies, the CDC, and the WHO is critical.

- Antibiotics: Because SARS is a viral infection, antibiotics are not indicated. In some of the early cases, antibiotics were administered as part of the treatment regimen, but no positive effect was noted.
- Steroids: Various steroid regimens have been used around the world as part of the initial SARS treatment cocktail. In the initial Hong Kong cohort of patients, corticosteroids were first given (with ribavirin) because of the similarity of the clinical and radiographic findings of SARS to those of bronchiolitis obliterans-organizing pneumonia. Anecdotal reports of success were received, but they have not subsequently been confirmed in a clinical trial. Future SARS patients treated in the United States may possibly receive corticosteroids early on, and dosages would likely reflect those used in patients with bronchiolitis obliterans-organizing pneumonia. The role of steroids in the treatment of SARS will probably not be fully defined until further clinical experience is obtained with their use.
- Antiviral agents: Several antiviral medications have been tried as part of the SARS treatment regimen.
    - The most widely used of these to date is ribavirin (usually in conjunction with steroids). Despite anecdotal reports of early SARS patients improving while on both ribavirin and steroids, this antiviral agent does not have proven activity against Coronaviridae members, and its use should be strongly discouraged.
    - Preliminary screening and testing of thousands of other antiviral compounds for an effect against SARS has been performed in the United States (eg, by the US Army) and internationally.
- Interferon: Preliminary testing at the US Army's biodefense laboratory has indicated that interferon may have an anti-SARS effect.
- SARS-CoV vaccine: Clinical trials are planned in China for testing of a candidate SARS vaccine in 2004. Results of this trial have not yet been published.

Case fatality:

SARS can result in significant illness and medical complications requiring hospitalization, intensive care treatment, and mechanical ventilation.

- The mortality rate of SARS is higher than that of influenza or other common respiratory tract infections.

- The overall mortality rate for SARS has been approximately 10%. According to the CDC and WHO, the death rate for individuals older than 65 years exceeds 50%.
- **In the US:** Eigth laboratory-confirmed cases of SARS have occurred in the United States. No SARS-related deaths have been reported in the United States.
- **Internationally:** Worldwide numbers of SARS cases from the original outbreak (November 2002 through July 2003) included 8098 cases, 774 deaths, and 7324 recoveries. Individual country statistics are as follows:
    - Mainland China - 5327 cases, 349 deaths
    - Hong Kong - 1755 cases, 299 deaths
    - Taiwan - 346 cases, 37 deaths
    - Canada (primarily around Toronto, Ontario) - 251 cases, 43 deaths

Reservoir:

The reservoir for SARS-CoV is not definitively known. Initial studies in Guangdong Province, China showed similar coronaviruses in some animal species sold in markets (e.g., masked palm civet cat). Recently, two independent studies have demonstrated infection of a relatively high percentage of horseshoe bats in China with viruses that have nucleotide sequences nearly identical to SARS. Genome sequencing has demonstrated that bat SARS-like viruses share overall sequence identity of 88 to 92 percent with SARS isolates from humans or civets. These findings raise the possibility that bats may be a primary reservoir for this disease.

Transmission:

SARS appears to be spread from person to person through infectious respiratory secretions, droplet-borne transmission, or close person-to-person contact. Close person-to-person contact is typically described as having cared for, lived with, or had direct contact with respiratory secretions and/or body fluids of a person with SARS. SARS-CoV is thought to be transmitted most effectively by respiratory droplets produced when an infected individual coughs or sneezes (droplet-borne spread). Droplet spread can happen when droplets from the cough or sneeze of an infected person are propelled a short distance (generally up to 3 feet) through the air and deposited on the mucous membranes of the mouth, nose, or eyes of persons who are nearby. The virus also can spread when a person touches a surface or object contaminated with infectious droplets and then touches his or her mouth, nose, or eye(s).

It appears that some SARS-CoV-infected individuals are capable of transmitting SARS-CoV through a mechanism more closely resembling airborne transmission, and these so-called “super-spreaders” can efficiently infect large numbers of individuals in hospitals and other similar settings. Other modes of transmission for SARS-CoV are possible, including zoonotic transmission from infectious reservoir animals and transmission via feces, but there is little information at present regarding these. Laboratory-acquired SARS has been reported.

SARS patients pose a risk of transmission to close household contacts and health care personnel. The period before or after the onset of symptoms during which a SARS patient is infectious is unknown. In household or residential settings, infection control measures,

as described below, are recommended. These recommendations are based on preliminary experience and may be revised as more information becomes available.

- SARS patients should limit interactions outside the home and should not go to work, school, out-of-home child care facilities, or other public areas until 10 days after the resolution of fever, provided respiratory symptoms are absent or improving. During this time, infection control precautions should be used to minimize the potential for transmission.
    - All members of a household with a SARS patient should carefully follow recommendations for hand hygiene (eg, frequent hand washing, use of alcohol-based hand rubs), particularly after contact with body fluids (eg, respiratory secretions, urine, feces).
    - Disposable gloves should be used for any direct contact with the body fluids of a SARS patient. However, gloves are not intended to replace proper hand hygiene. Immediately after activities involving contact with body fluids, gloves should be removed and discarded, and hands should be cleaned. Gloves must never be washed or reused.
- Each SARS patient should be advised to cover his or her mouth and nose with a facial tissue when coughing or sneezing. If possible, SARS patients should wear surgical masks during close contact with uninfected persons in order to prevent the spread of infectious droplets. If a SARS patient cannot wear a surgical mask, his or her household members should wear surgical masks when in close contact.
    - Sharing of eating utensils, towels, and bedding between SARS patients and others should be avoided, although such items can be used by others after routine cleaning (eg, washing with soap and hot water). Environmental surfaces soiled by body fluids should be cleaned with a household disinfectant according to manufacturer's instructions; gloves should be worn during this activity.
    - Household waste soiled with body fluids of SARS patients, including facial tissues and surgical masks, may be discarded as normal waste.

Susceptibility:

Susceptibility is universal. Older adults, as well as those with suppressed immune systems may be at higher risk of death. Traveling to (including visiting an airport) an area with current or recently documented or suspected community transmission of SARS (ie, within 10 d symptom onset in that area) is a risk factor.

Incubation period:

The exposure and incubation (asymptomatic) period is 2-7 days, although it may be as long as 10 days. An incubation period of up to 14 days has been reported.

Period of communicability:

The communicable period for SARS is not yet completely defined. Some studies suggest that transmission generally does not occur prior to the onset of clinical signs and symptoms and that the maximum period of communicability is less than 21 days.

Epidemiology:

SARS was first described in February 2003. It is thought to have originated in the Guangdong Province of China, with initial infectious human cases occurring sometime around November 2002. By July 2003, multiple major international outbreaks of SARS had resulted from spread from an initial outbreak in Hong Kong to other countries, including Canada, China, Taiwan, Singapore, and Vietnam. The disease then spread to 20 other major locations following standard airline travel routes. The largest proportion of cases occurred within hospitals and among hospital workers and their families. According to the World Health Organization (WHO), a total of 8,098 people worldwide were diagnosed with SARS during the 2003 outbreak. Of these cases, 774 died (9.6%). In the U.S., eight people had laboratory-confirmed evidence of SARS-CoV infection. All of these cases appeared to have been imported from other countries where SARS was widespread. One case was identified in Utah. Further spread of SARS within the U.S. did not occur.

In 2004, although several cases of SARS were reported in China, there were no documented cases of human-to-human transmission.

Individuals at greatest risk for SARS-CoV infection include those who have recently traveled to a country where community-wide spread of SARS has been documented and those who have had direct, close contact with someone who is ill with SARS.

✓PUBLIC HEALTH CONTROL MEASURES

Public health responsibility:

- To rapidly identify imported cases of SARS with the goal of preventing secondary cases.
- Provide education to the general public (regarding disease transmission) and to clinicians (regarding disease diagnosis, reporting, and prevention)
- Monitor disease trends

Prevention:

The primary method of SARS prevention is through isolation and good hand hygiene.

SARS-CoV disease provides a reminder of the risks of nosocomial transmission of respiratory pathogens and an opportunity to improve overall infection control in healthcare facilities. All healthcare facilities need to re-emphasize the importance of basic infection control measures for the control of SARS-CoV disease and other respiratory illnesses. Facilities should also consider adopting a "respiratory hygiene/cough etiquette" strategy to help limit nosocomial transmission of respiratory pathogens. To contain respiratory secretions, all persons with signs and symptoms of a respiratory infection, regardless of presumed cause, should be instructed to:

- Cover the nose and mouth when coughing or sneezing.
- Use tissues to contain respiratory secretions.
- Dispose of tissues in the nearest waste receptacle after use.

- Perform hand hygiene after contact with respiratory secretions and contaminated objects and materials.

Healthcare facilities should ensure the availability of materials for adhering to respiratory hygiene/cough etiquette in waiting areas for patients and visitors:

- Provide tissues and no-touch receptacles for used tissue disposal.
- Provide conveniently located dispensers for alcohol-based hand rug.
- Provide soap and disposable towels for hand washing where sinks are available.

During periods of increased respiratory infection in the community, healthcare facilities should offer procedure or surgical masks to persons who are coughing and encourage coughing persons to sit at least 3 feet away from others in waiting areas. Healthcare workers should practice Droplet Precautions, in addition to Standard Precautions, when examining a patient with symptoms of a respiratory infection. Droplet precautions should be maintained until it is determined that they are no longer needed (see www.cdc.gov/ncidod/hip/ISOLAT/Isolat.htm).

Chemoprophylaxis:

None.

Vaccine:

None.

Isolation and quarantine requirements:

Isolation: The most important element of infection control in the community is for patients with suspected SARS to stay at home and not go out for any reason. The CDC advises that the patient remain at home for a full 10 days after the resolution of fever and other symptoms. Symptomatic persons with SARS Co-V (confirmed, probable, or RUI) shall be excluded from school or childcare settings until 10 days following resolution of fever (given respiratory symptoms are absent or resolving). Voluntary isolation from work and other settings where close contact may transmit the disease is desirable. Such restriction of activity would be very difficult to legally enforce if involuntary. Educate patient that isolation should occur until 10 days following resolution of fever (given respiratory symptoms are absent or resolving).

Hospital: Hospitalized patients should be isolated in negative pressure rooms; healthcare workers and visitors should wear masks (preferably N-95 respirator such as used for tuberculosis precautions) to prevent airborne and droplet acquisition and gowns, gloves, and protective eyewear to guard against contact transmission. For more extensive information regarding ICU patients, see Appendix A.

Infection Control and Clinical Evaluation

- Healthcare facilities should re-emphasize the importance of basic infection control measures for respiratory infections and consider adopting a "respiratory hygiene/cough etiquette" strategy.

- All patients admitted to the hospital with radiographically confirmed pneumonia should be:
    - Placed on Droplet Precautions
    - Screened for risk factors for possible exposure to SARS-CoV
    - Evaluated with a chest radiograph, pulse oximetry, complete blood count, and etiologic workup as indicated.

- If there is a high index of suspicion for SARS-CoV disease (by clinicians and health department), the patient should immediately be placed on SARS isolation precautions, and all contacts of the ill patient should be identified, evaluated, and monitored. Prompt SARS-CoV laboratory diagnostics should be arranged through the health department.

Quarantine: Asymptomatic contacts should practice personal surveillance for fever and respiratory symptoms and report them to their health care provider immediately, should one or the other occur within ten days of the individual's last contact with the case. Febrile contacts or contacts with respiratory symptoms only shall be treated the same as a case for 72 hours, after which further management shall be in consultation with the LHD or the UDOH. For household contacts of the infected patient, careful hand-washing should be practiced in the home, and gloves can be used for contact with bodily fluids. Utensils and bedding should not be shared without proper washing. Surgical masks should be considered for close contact between the SARS patient and uninfected contacts; either the patient or those with whom he or she is in contact can wear the mask. Similar to healthcare workers, contacts of SARS patients may leave the home as long as they are asymptomatic.

✓CASE INVESTIGATION

Reporting:

Report any illness to public health authorities that has NO identifiable cause of clinical or autopsy findings AND meets any of the following criteria:

- A person with a positive diagnostic test specific for SARS-CoV (see Table VI-B)

- A person who meets the clinical criteria for early, mild-to-moderate, or severe illness (see Table VI-B) AND who had either (1) close contact with a person with confirmed SARSCoV disease, *or* (2) close contact with a person with mild-to-moderate or severe respiratory illness and history of travel in the 10 days before onset of symptoms to a foreign or domestic location with documented, or

suspected recent transmission of SARS-CoV

- A person who meets the clinical criteria for mild-to-moderate or severe illness (see Table VI-B) AND who either (1) traveled to a foreign or domestic location with documented or suspected recent transmission of SARS-CoV within 10 days before onset of symptoms, *or* (2) had close contact with a person with mild-to-moderate or severe respiratory illness and history of travel in the 10 days before onset of symptoms to a foreign or domestic location with documented, or suspected recent transmission of SARS-CoV

- A person who meets the clinical criteria for severe illness (see Table VI-B) AND who either (1) traveled to mainland China, Hong Kong, or Taiwan, or close contact with an ill person with a history of recent travel to one of these areas, (2) worked in an occupation associated with a risk for SARS-CoV exposure (e.g., health-care worker with direct patient contact and worker in a laboratory that contains live SARS-CoV), *or* (3) was part of a cluster of cases of atypical pneumonia without an alternative diagnosis

- A person whose healthcare record contains a diagnosis of SARS.

- A person whose death certificate lists SARS as a cause of death or a significant condition contributing to death.

Other recommended reporting procedures

- All cases of SARS should be reported immediately.
- Reporting should be ongoing and routine.

Table of criteria to determine whether a SARS case should be reported to public health authorities

Criterion	**Reporting**			
Clinical Presentation				
Early illness (two or more of the following clinical findings must be present):				
Fever (any)		O †		
Chills		O †		
Rigors		O †		
Headache		O †		
Diarrhea		O †		
Sore throat		O †		
Myalgia		O †		
Mild-to-moderate respiratory illness (fever and one or more clinical findings of lower respiratory illness):				
Fever (>100.4° F or >38° C)			N	N
Cough			O	
Shortness of breath			O	
Difficulty breathing			O	

Severe respiratory illness (meets clinical criteria for mild-to-moderate respiratory illness and one more of the following findings):				
Radiographic evidence of pneumonia				O
Acute respiratory distress syndrome				O
Autopsy evidence of pneumonia				O
Autopsy evidence of acute respiratory distress syndrome				O
Healthcare record contains a diagnosis of SARS	S			
Death certificate lists SARS as a cause of death or a significant condition contributing to death	S			
Identifiable cause of clinical or autopsy findings		A	A	A
Laboratory Findings‡				
Detection of serum antibody to SARS-CoV by a test validated by CDC	S			
Isolation in cell culture of SARS-CoV from a clinical specimen	S			
Detection of SARS-CoV RNA by a reverse transcription polymerase chain reaction test validated by CDC and with subsequent confirmation in a reference laboratory	S			
No detection of antibody to SARS-CoV in a serum specimen obtained >28 days after onset of illness (if obtained)		A	A	A
Epidemiological Risk Factors				
Likely exposure to SARS-CoV (one or more of the following in the 10 days before onset of symptoms)				
Close contact with a person with confirmed SARS-CoV disease		O	O	
Close contact with a person with mild-to-moderate or severe respiratory illness and history of travel in the 10 days before onset of symptoms to a foreign or domestic location with documented, or suspected recent transmission of SARS-CoV		O	O	
Possible exposure to SARS-CoV (one or more of the following in the 10 days before onset of symptoms)				
Travel to a foreign or domestic location with documented or suspected recent transmission of SARS-CoV within 10 days before onset of symptoms				O
Close contact with a person with mild-to-moderate or severe respiratory illness and history of travel in the 10 days before onset of symptoms to a foreign or domestic location with documented, or suspected recent transmission of SARS-CoV				O
If SARS-CoV re-emerges, consider SARS-CoV in the differential diagnosis for persons requiring hospitalization				

for pneumonia confirmed radiographically or acute respiratory distress syndrome without identifiable etiology and who have one of the following risk factors in the 10 days before the onset of illness:				
Travel to mainland China, Hong Kong, or Taiwan, or close contact with an ill person with a history of recent travel to one of these areas				
Employment in an occupation associated with a risk for SARS-CoV exposure (e.g., health-care worker with direct patient contact and worker in a laboratory that contains live SARS-CoV)				
Part of a cluster of cases of atypical pneumonia without an alternative diagnosis				

Notes:
S = This criterion alone is sufficient to report a case
N = All "N" criteria in the same column—in conjunction with at least one of any "O" criteria in each category (e.g., clinical presentation and laboratory findings) in the same column—are required to report a case.
O = At least one of any "O" criteria in each category (e.g., clinical presentation and laboratory findings) in the same column—in conjunction with all other "N" criteria in the same column—is required to report a case.
A = This criterion must be absent (i.e., NOT present) for the case to meet the case definition. †Two or more "O" of the clinical criteria for early illness are required to report or confirm a case.
‡ For additional information and guidance on laboratory testing for SARS-CoV, see CDC 2004b, CDC 2005a, CDC 2005c, Erdman 2006.
RUI = Report Under Investigation

Case management:

Actions to be taken with the case patient – Refer to Flow Chart

FLOW CHART FOR SARS SURVEILLANCE
May 1, 2003

Situation	If…	LHD response	Advice	UDOH notification
SARS case[1]		Daily[7] active surveillance[3] during and 10 days after symptom resolution	Isolate from work/school/household contacts until 10 days following resolution of symptoms[8]	M-F email update to epi@utah.gov, case number (or prelim local NETSS ID#), date, health status, contact made, location of patient, adherence to isolation recommendations
Health Care Worker[2] with definite exposure[6] to SARS case	If no symptoms develop	Daily active surveillance by ICP/LHD for 10 days after exposure	No restrictions on work/school/household, Advise about symptoms, Inform about daily active surveillance	Report to epi@utah.gov at completion of 10 day period
	If EITHER fever[5] OR respiratory symptoms develop	Consult with ICP and UDOH Daily active surveillance for 72 hours or until resolved.[9]	Strong recommendation to isolate from work/school/household contacts[10]	Report to epi@utah.gov upon occurrence, conclusion, or development of additional symptoms
	If both fever and respiratory symptoms develop – move to SARS case			
Non-Health Care Worker with definite exposure[6] to SARS case	If no symptoms develop	Passive surveillance[4] for 10 days after exposure. Recommend one active follow up notification at the end of the 10-day period.	No restrictions on work/school/household, Advise about symptoms, ask them to report if any symptoms occur	Report to epi@utah.gov upon occurrence, conclusion, or development of additional symptoms. The reports can be done for a group.
	If EITHER fever OR respiratory symptoms develop	Daily active surveillance for 72 hours or until resolved.[9]	Recommend isolation from work/school/ household contacts[10]	Report to epi@utah.gov upon occurrence or development of additional symptoms, or at end of surveillance period.
	If both fever and respiratory symptoms develop – move to SARS suspect case			
People returning from an affected country		No surveillance	No restrictions on work/school/household	
	If LHD or UDOH notified of illness by patient or physician – one symptom – doesn't meet case definition	LHD preliminary investigation of possible case – passive surveillance for 3-5 days, Recommend one active follow up notification at the end of the 5 day period.	Recommend isolation from work/school/ household contacts	Report to epi@utah.gov upon occurrence, conclusion, or development of additional symptoms
	If both fever and respiratory symptoms develop – move to SARS suspect case			

[1]Asymptomatic SARS-CoV infection or clinical manifestations other than respiratory illness might be identified as more is learned about SARS-CoV infection.

[2]Health care worker that had direct exposure to a suspect SARS case and did not use adequate respiratory protection (ie N95 or P100 mask), or had mucous membrane exposure to body fluids.
[3]Daily contact with person
[4]Advise person to self-monitor for fever, respiratory symptoms, and notify public health for either
[5]Fever must be measured with a thermometer
[6]Definite exposure includes household contact, a health care worker in a room with patient without adequate respiratory protection, or exposure to body fluids, respiratory secretions, urine, or stool without adequate precautions; other exposures may be considered definite exposure based on individual circumstances.
[7]Daily refers to both normal weekdays, as well as weekends and holidays
[8]Symptom resolution is defined as resolution of fever, providing that the cough has resolved or is improving
[9]Surveillance may be discontinued after 72 hours if symptoms have resolved. If symptoms progress or fail to resolve, continue infection control measures and active surveillance as if the patient is a suspect SARS until SARS has been ruled out.
[10]Continue recommended isolation measures until either it has been conclusively demonstrated that the individual doesn't have SARS, or until measures consistent with those recommended for SARS cases have been completed.

Case definition: SARS (2010)

Clinical Criteria

Early illness

Presence of two or more of the following features: fever (might be subjective), chills, rigors, myalgia, headache, diarrhea, sore throat, or rhinorrhea

Mild-to-moderate respiratory illness

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

Severe respiratory illness

- Meets clinical criteria of mild-to-moderate respiratory illness, **and**
- One or more of the following findings:
  - Radiographic evidence of pneumonia, **or**
  - Acute respiratory distress syndrome, **or**
  - Autopsy findings consistent with pneumonia or acute respiratory distress syndrome without an identifiable cause

Epidemiologic Criteria

Possible exposure to SARS-associated coronavirus (SARS-CoV)

One or more of the following exposures in the 10 days before onset of symptoms:

- Travel to a foreign or domestic location with documented or suspected recent
- transmission of SARS-CoV†, or
- Close contact§ with a person with mild-to-moderate or severe respiratory illness and history of travel in the 10 days before onset of symptoms to a foreign or domestic location with documented, or suspected recent transmission of SARS-CoV†

Likely exposure to SARS-CoV

One or more of the following exposures in the 10 days before onset of symptoms:

- Close contact§ with a person with confirmed SARS-CoV disease, or
- Close contact§ with a person with mild-to-moderate or severe respiratory illness for whom a chain of transmission can be linked to a confirmed case of SARS-CoV disease in the 10 days before onset of symptoms

Laboratory Criteria

Tests to detect SARS-CoV are being refined and their performance characteristics assessed¶;
therefore, criteria for laboratory diagnosis of SARS-CoV are changing. The following are general criteria for laboratory confirmation of SARS-CoV:

- Detection of serum antibody to SARS-CoV by a test validated by CDC (e.g., enzyme immunoassay), or
- Isolation in cell culture of SARS-CoV from a clinical specimen, or
- Detection of SARS-CoV RNA by a reverse transcription polymerase chain reaction test validated by CDC and with subsequent confirmation in a reference laboratory (e.g., CDC)

Information about the current criteria for laboratory diagnosis of SARS-CoV is available at http://www.cdc.gov/ncidod/sars/labdiagnosis.htm

Exclusion Criteria

A case may be excluded as a SARS report under investigation (SARS RUI), including as a CDC-defined probable SARS-CoV case, if any of the following apply:

- An alternative diagnosis can explain the illness fully**, **or**
- Antibody to SARS-CoV is undetectable in a serum specimen obtained >28 days after onset of illness††, **or**
- The case was reported on the basis of contact with a person who was excluded subsequently as a case of SARS-CoV disease; then the reported case also is excluded, provided other epidemiologic or laboratory criteria are not present.

Case Classification

SARS Report Under Investigation

Reports in persons from areas where SARS is not known to be active

- SARS RUI-1: Cases compatible with SARS in groups likely to be first affected by SARS-CoV§§ if SARS-CoV is introduced from a person without clear epidemiologic links to known cases of SARS-CoV disease or places with known ongoing transmission of SARS-CoV

Reports in persons from areas where SARS activity is occurring

- SARS RUI-2: Cases meeting the clinical criteria for mild-to-moderate illness and the epidemiologic criteria for possible exposure (spring 2003 CDC definition for suspect cases¶¶)
- SARS RUI-3: Cases meeting the clinical criteria for severe illness and the epidemiologic criteria for possible exposure (spring 2003 CDC definition for probable cases¶¶)
- SARS RUI-4: Cases meeting the clinical criteria for early or mild-to-moderate illness and the epidemiologic criteria for likely exposure to SARS-CoV

SARS-CoV disease

Probable: meets the clinical criteria for severe respiratory illness and the epidemiologic criteria for likely exposure to SARS-CoV

Confirmed: clinically compatible illness (i.e., early, mild-to-moderate, or severe) that is laboratory confirmed

---

Notes:

*A measured documented temperature of >100.4° F (>38° C) is expected. However, clinical judgment may allow a small proportion of patients without a documented fever to meet this criterion. Factors that might be considered include patient's self-report of fever, use of antipyretics, presence of immunocompromising conditions or therapies, lack of access to health care, or inability to obtain a measured temperature. Initial case classification based on reported information might change, and reclassification might be required.

†Types of locations specified will vary (e.g., country, airport, city, building, or floor of building). The last date a location may be a criterion for exposure is 10 days (one incubation period) after removal of that location from CDC travel alert status. The patient's travel should have occurred on or before the last date the travel alert was in place. Transit through a foreign airport meets the epidemiologic criteria for possible exposure in a location for which a CDC travel advisory is in effect. Information about CDC travel alerts and advisories and assistance in determining appropriate dates are available at http://www.cdc.gov/ncidod/sars/travel.htm.

§Close contact is defined as having cared for or lived with a person with SARS or having a high likelihood of direct contact with respiratory secretions and/or body fluids of a person with SARS (during encounters with the patient or through contact with materials contaminated by the patient) either during the period the person was clinically ill or within 10 days of resolution of symptoms. Examples of close contact include kissing or embracing, sharing eating or drinking utensils, close (i.e., <3 feet) conversation, physical examination, and any other direct physical contact between persons. Close contact does not include activities such as walking by a person or sitting across a waiting room or office for a brief time.

¶The identification of the etiologic agent of SARS (i.e., SARS-CoV) led to the rapid development of enzyme immunoassays and immunofluorescence assays for serologic diagnosis and reverse transcription polymerase chain reaction assays for detection of SARS-CoV RNA in clinical samples. These assays can be very sensitive and specific for detecting antibody and RNA, respectively, in the later stages of SARS-CoV disease. However, both are less sensitive for detecting infection early in illness. The majority of patients in the early stages of SARS-CoV disease have a low titer of virus in respiratory and other secretions and require time to mount an antibody response. SARS-CoV antibody tests might be positive as early as 8–10 days after onset of illness and often by 14 days after onset of illness, but sometimes not until 28 days after onset of illness. Information about the current criteria for laboratory diagnosis of SARS-CoV is available at http://www.cdc.gov/ncidod/sars/labdiagnosis.htm.

**Factors that may be considered in assigning alternate diagnoses include the strength of the epidemiologic exposure criteria for SARS-CoV disease, the specificity of the

alternate diagnostic test, and the compatibility of the clinical presentation and course of illness with the alternative diagnosis.
††Current data indicate that >95% of patients with SARS-CoV disease mount an antibody response to SARS-CoV. However, health officials may choose not to exclude a case on the basis of lack of a serologic response if reasonable concern exists that an antibody response could not be mounted.
§§Consensus guidance is in development between CDC and CSTE on which groups are most likely to be affected first by SARS-CoV if it reemerges. SARS-CoV disease should be considered at a minimum in the differential diagnoses for persons requiring hospitalization for pneumonia confirmed radiographically or acute respiratory distress syndrome without identifiable etiology and who have one of the following risk factors in the 10 days before the onset of illness:

- Travel to mainland China, Hong Kong, or Taiwan, or close contact with an ill person with a history of recent travel to one of these areas, or
- Employment in an occupation associated with a risk for SARS-CoV exposure (e.g., health care worker with direct patient contact and worker in a laboratory that contains live SARSCoV), or
- Part of a cluster of cases of atypical pneumonia without an alternative diagnosis.

Guidelines for the identification, evaluation, and management of these patients are available at http://www.cdc.gov/ncidod/sars/absenceofsars.htm.
¶¶During the 2003 SARS epidemic, CDC case definitions were the following:
Suspect case

- Meets the clinical criteria for mild-to-moderate respiratory illness and the epidemiologic criteria for possible exposure to SARS-CoV but does not meet any of the laboratory criteria and exclusion criteria; or
- Unexplained acute respiratory illness that results in death of a person on whom an autopsy was not performed and that meets the epidemiologic criteria for possible exposure to SARS-CoV but does not meet any of the laboratory criteria and exclusion criteria

Probable case

- Meets the clinical criteria for severe respiratory illness and the epidemiologic criteria for possible exposure to SARS-CoV but does not meet any of the laboratory criteria and exclusion criteria.

Proposed table of criteria to determine whether a case is classified.
Note: The following criteria are proposed for evaluation before general implementation. For purposes of current notification, the narrative description in VII-A, should be used.

	Case Classification					
			Reports Under Investigation (RUI)			
Criterion	**Confirmed**	**Probable**	**RUI - 1**	**RUI - 2**	**RUI - 3**	**RUI - 4**
Clinical Presentation						
Early illness (two or more of the following clinical findings must be present):						

Fever (any)	O †							O †
Chills	O †							O †
Rigors	O †							O †
Myalgia	O †							O †
Headache	O †							O †
Diarrhea	O †							O †
Sore Throat	O †							O †
Rhinorrhea	O †							O †
Criterion	**Confirmed**			**Probable**	**RUI - 1**	**RUI - 2**	**RUI - 3**	**RUI - 4**
Mild-to-moderate respiratory illness (fever and one or more clinical findings of lower respiratory illness):								
Fever (>100.4° F or >38° C)		N	N	N	N	N	N	O
Cough		O				O		O
Shortness of breath		O				O		O
Difficulty breathing		O				O		O
Severe respiratory illness (meets clinical criteria for mild-to-moderate respiratory illness and one more of the following findings):								
Radiographic evidence of pneumonia			O	O	O		O	
Acute respiratory distress syndrome			O	O	O		O	
Autopsy evidence of pneumonia			O	O	O		O	
Autopsy evidence of acute respiratory distress syndrome			O	O	O		O	
Healthcare record contains a diagnosis of SARS								
Death certificate lists SARS as a cause of death or a significant condition contributing to death								
Identifiable cause of clinical or autopsy findings				A	A	A		A
Laboratory Findings‡								
Detection of serum antibody to SARS-CoV by a test validated by CDC	O	O	O					
Isolation in cell culture of SARS-CoV from a clinical specimen	O	O	O					
Detection of SARS-CoV RNA by a reverse transcription polymerase chain reaction test validated by CDC and with subsequent confirmation in a	O	O	O					

reference laboratory								
No detection of antibody to SARS-CoV in a serum specimen obtained >28 days after onset of illness (if obtained)					A	A	A	A
Epidemiological Risk Factors								
Likely exposure to SARS-CoV (one or more of the following in the 10 days before onset of symptoms)								
Criterion	**Confirmed**			**Probable**	**RUI - 1**	**RUI - 2**	**RUI - 3**	**RUI - 4**
Close contact with a person with confirmed SARS-CoV disease				O				O
Close contact with a person with mild-to-moderate or severe respiratory illness and history of travel in the 10 days before onset of symptoms to a foreign or domestic location with documented, or suspected recent transmission of SARS-CoV				O				O
Possible exposure to SARS-CoV (one or more of the following in the 10 days before onset of symptoms)								
Travel to a foreign or domestic location with documented or suspected recent transmission of SARS-CoV within 10 days before onset of symptoms						O	O	
Close contact with a person with mild-to-moderate or severe respiratory illness and history of travel in the 10 days before onset of symptoms to a foreign or domestic location with documented, or suspected recent transmission of SARS-CoV						O	O	
If SARS-CoV re-emerges, consider SARS-CoV in the differential diagnosis for persons requiring hospitalization for pneumonia confirmed radiographically or acute								

respiratory distress syndrome without identifiable etiology and who have one of the following risk factors in the 10 days before the onset of illness:								
Travel to mainland China, Hong Kong, or Taiwan, or close contact with an ill person with a history of recent travel to one of these areas					O			
Criterion	**Confirmed**			**Probable**	**RUI - 1**	**RUI - 2**	**RUI - 3**	**RUI - 4**
Employment in an occupation associated with a risk for SARS-CoV exposure (e.g., health-care worker with direct patient contact and worker in a laboratory that contains live SARS-CoV)					O			
Part of a cluster of cases of atypical pneumonia without an alternative diagnosis					O			

Notes:
N = All "N" criteria in the same column—in conjunction with at least one of any "O" criteria in each category (e.g., clinical presentation and laboratory findings) in the same column—are required to classify a case.
O = At least one of any "O" criteria in each category (e.g., clinical presentation and laboratory findings) in the same column—in conjunction with all other "N" criteria in the same column—is required to classify a case.
A = This criterion must be absent (i.e., NOT present) for the case to meet the case definition.
†Two or more "O" of the clinical criteria for early illness are required to report or classify a case.
‡For additional information and guidance on laboratory testing for SARS-CoV, see CDC 2004b, CDC 2005a, CDC 2005c, Erdman 2006.

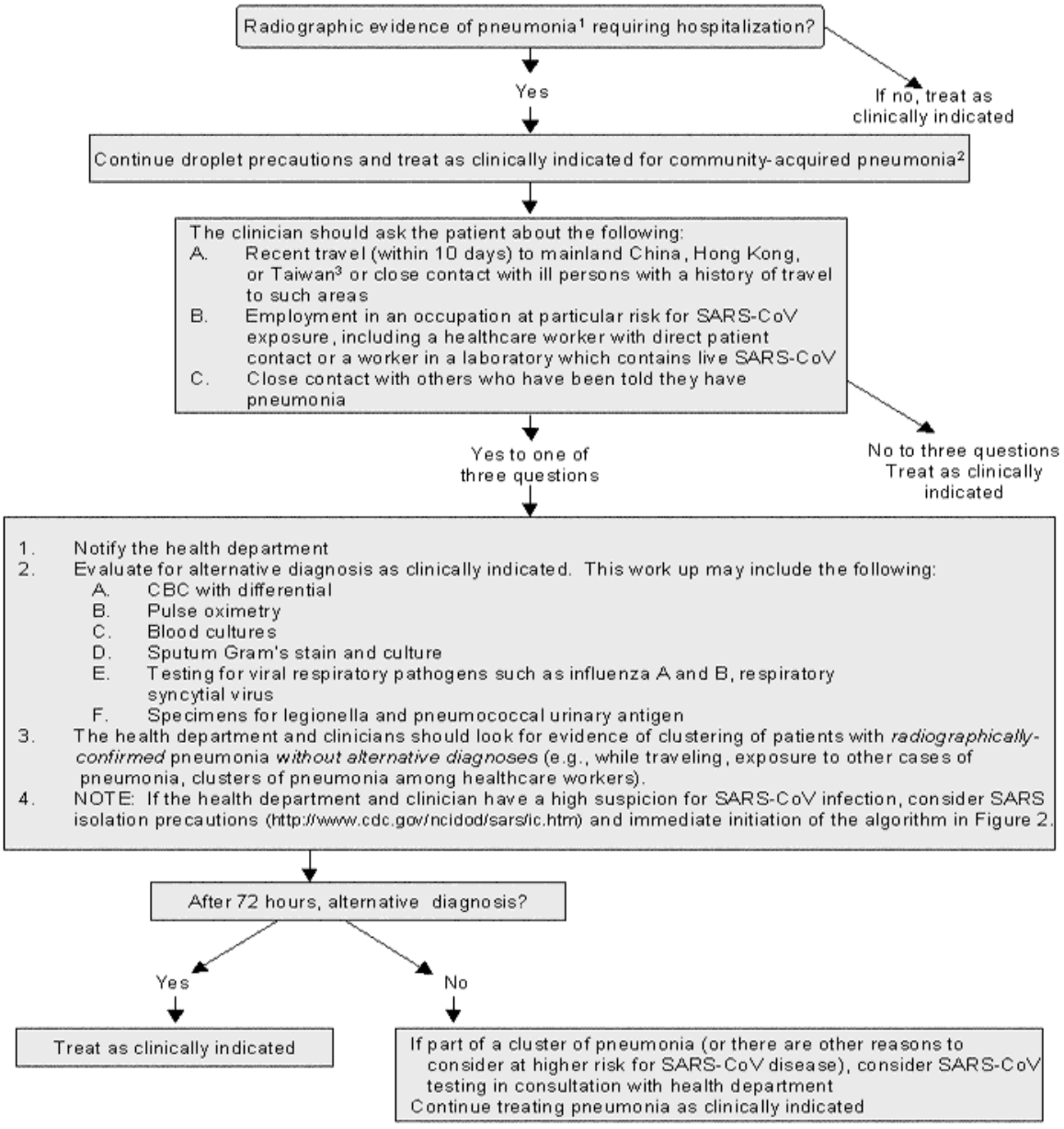
Case Investigation Process:

Key Clinical Features of SARS-CoV Disease

- Incubation period of 2-10 days
- Early systemic symptoms followed within 2-7 days by dry cough and/or shortness of breath, often without upper respiratory tract symptoms
- Development of radiographically confirmed pneumonia by day 7-10 of illness
- Lymphopenia in most cases

In the absence of SARS worldwide, refer to the following algorithm (see below) for evaluation and management of individuals hospitalized with pneumonia.

Figure 1. Algorithm for evaluation and management of patients requiring hospitalization for radiographically confirmed pneumonia, in the absence of person-to-person transmission of SARS-CoV in the world



Footnotes for Figure

[1]Or acute respiratory distress syndrome (ARDS) of unknown etiology

[2]Guidance for the management of community-acquired pneumonia is available from the Infectious Diseases Society of America (IDSA) at: www.journals.uchicago.edu/IDSA/guidelines/.

[3]The 2003 SARS-CoV outbreak likely originated in mainland China, and neighboring areas such as Taiwan and Hong Kong are thought to be at higher risk due to the high volume of travelers from mainland China. Although less likely, SARS-CoV may also reappear from other previously affected areas. Therefore, clinicians should obtain a complete travel history. If clinicians have concerns about the possibility of SARS-CoV disease in a patient with a history of travel to other previously affected areas (e.g., while traveling abroad, had close contact with another person with pneumonia of unknown etiology or spent time in a hospital in which patients with acute respiratory disease were treated), they should contact the health department.

Outbreaks:

A single case of SARS in a Utah resident will be considered an outbreak.

Declaration of an outbreak can be useful to elicit media coverage and support from physicians for improved interventions including case detection, reporting, and administration of prophylaxis and treatment. When an outbreak is declared, additional public health resources may need to be allocated to control the situation. Local health departments are urged to consult with the Utah Department of Health during outbreaks in order to develop situation-specific control measures and identify additional resources.

Identification of case contacts:

At high risk of SARS-CoV infection are health care workers, family members, caregivers, or any other individuals having close personal contact with a known or suspected SARS patient within 10 days of symptom onset.

- Close contact is defined as caring for or living with a person known to have SARS or having a high likelihood of direct contact with respiratory secretions or body fluids of a patient known to have SARS. Examples of close contact include kissing, embracing, sharing eating or drinking utensils, close conversation (<3 ft [1 m]), physical examination, and any other direct physical contact between persons. Close contact does not include walking by a person or sitting across a waiting room or office for a brief period.

Close contacts are people who have the following contact with the case patient during the infectious period (defined as 10 days following resolution of fever (given respiratory symptoms are absent or resolving).

- Household and immediate family members (those who spend many hours together or sleep under the same roof);
- Those who have direct contact with respiratory secretions;
- Healthcare workers with extensive face-to-face contact with a patient;
- Those who share confined space (within 3 feet) for > 1 hour during the communicable period. Such contacts may include:
    - Core groups of close friends, social contacts, boyfriends, girlfriends,
    - Students sitting within 3 feet at school,
    - Contacts at church activities and employment,
    - Participants in extracurricular activities (such as fieldtrips),
    - Children attending after-school care or a playgroup.

- If patient is a healthcare worker, notify the facility in which they work. That facility should identify and refer all exposed and symptomatic co-worker and patient contacts for medical evaluation immediately.

Case contact management:

(Refer to Flow Chart for Surveillance above)

Asymptomatic contacts:

- No restrictions on work/school/household, Advise about symptoms, ask them to report if any symptoms occur.
- **Surveillance:** Passive surveillance 4 for 10 days after exposure. Recommend one active follow up notification at the end of the 10-day period.

Symptomatic contacts:

- If EITHER fever OR respiratory symptoms develop recommend isolation from work/school/ household contacts
- Daily active surveillance for 72 hours or until resolved.
- If both fever and respiratory symptoms develop – move to SARS suspect case.

✓REFERENCES

Control of Communicable Diseases Manual (18th Edition), David L. Heymann MD, Ed., 2004.

Red Book: 2003 Report of the Committee on Infectious Diseases (26th Edition), Larry K. Pickering MD, Ed. 2003.

Principles and Practice of Infectious Diseases (6th Edition), Gerald L. Mandell, John E. Bennett, and Raphael Dolin Eds., 2005.

Severe Acute Respiratory Syndrome (SARS)
http://www.emedicine.com/med/topic3662.htm

Guideline for Isolation Precautions in Hospitals
http://www.cdc.gov/ncidod/dhqp/gl_isolation.html

Public Health Guidance for Community-Level Preparedness and Response to Severe Acute Respiratory Syndrome (SARS) Version 2
http://www.cdc.gov/ncidod/sars/guidance/I/index.htm

In the Absence of SARS-CoV Transmission Worldwide: Guidance for Surveillance, Clinical and Laboratory Evaluation, and Reporting Version 2, CDC. December 2003

Official reprint from *UpToDate*® http://www.uptodate.com/