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Severe Acute Respiratory Syndrome:
Preparing for the Possibility of an Outbreak

Whether the Severe Acute Respiratory Syndrome (SARS) will recur and lead to sustained person-to-person transmission is not known. The etiologic agent of SARS, a newly recognized coronavirus, may have a seasonal predominance and could re-emerge during the winter respiratory viral season. Given the extensive international travel into New York City, introduction and transmission in the City could occur if initial SARS cases in other countries are not recognized promptly. A single unrecognized, highly contagious case may lead to widespread outbreaks, particularly within health care settings.

To prevent an outbreak in New York City, immediate recognition, isolation, and reporting of potential cases is essential. This issue of *City Health Information* provides guidelines for identifying patients who may have SARS, including the clinical and epidemiologic criteria to be used a) when there is no evidence of person-to-person transmission of SARS anywhere in the world, or b) if person-to-person transmission of SARS does recur, after which travel history to an affected area and/or exposure to a suspect or probable SARS patient can be used to identify potential cases. Laboratory testing for SARS is now available at the New York City Public Health Laboratory, and will be offered free of charge for all patients who meet the surveillance criteria described in this issue. Clinicians should report potential cases to the New York City Department of Health and Mental Hygiene (NYC DOHMH) immediately by calling the Provider Access Line at (866) NYC-DOH1/(866) 692-3641 during business hours and the Poison Control Center at (212) POISONS/(212) 764-7667 or (800) 222-1222 during non-business hours.

If SARS does recur, surveillance guidelines and recommendations regarding management of cases and contacts may change as the outbreak evolves. Health care providers should stay up to date by visiting the Web sites of the Centers for Disease Control and Prevention (CDC) and the NYC DOHMH, as well as by registering for the NYC DOHMH Health Alert Network. The Health Alert Network is the NYC DOHMH's primary mechanism for alerting health care providers to acute public health issues in the City, such as SARS (see Resources).

In mid-February, 2003, the World Health Organization (WHO) began investigating an international outbreak of severe pneumonia, which was termed Severe Acute Respiratory Syndrome, or SARS. The outbreak most likely began in November 2002, in the Guangdong Province of China. This outbreak eventually spread throughout the world, with cases reported from 29 countries. The People's Republic of China, including the mainland, the Special Administrative Region of Hong Kong, and Taiwan, as well as Singapore, Vietnam, and Toronto, Canada, were particularly affected and had evidence of significant nosocomial and household transmission. In total, 8,098 cases were reported to WHO, with 774 deaths (case-fatality rate of 9.6%). In the United States, there were only 8 laboratory-confirmed cases, and there was no significant secondary transmission to household members or health care workers. Although 27 patients were reported to the NYC DOHMH last spring with a history of recent travel to an affected area and clinical symptoms compatible with SARS, none were laboratory confirmed. Since the outbreak subsided last June, there have been only 2 isolated cases of SARS, acquired in research facilities in Singapore and Taiwan where SARS-associated coronavirus (SARS-CoV) was being studied.

Epidemiology of SARS

The incubation period for SARS ranged from 2–10 days (median of 4–6 days). The primary mode of transmission appeared to be via respiratory droplets during close person-to-person contact. Additional routes of spread may have included fomite and fecal transmission and, in rare circumstances, aerosolization (especially during high-risk procedures such as intubation or sputum induction). Most cases involved persons who lived with or provided care for someone with SARS or had direct contact with infectious material from a SARS patient, such as family members or health care workers; only limited spread in community settings was reported.

Patients were most infectious when symptoms were severe, usually during the second week of illness, the period of peak viral shedding from the respiratory tract. Secondary spread was much less likely when patients were isolated promptly after illness onset. There were no reports of SARS transmission from asymptomatic individuals.

Clinical Presentation and Management

The recognition of SARS can be challenging, as there are no definitive clinical findings or rapid laboratory tests that can distinguish SARS from disease caused by

Table 1: Guidelines for reporting potential cases of SARS* when there is NO confirmed person-to-person transmission of SARS anywhere in the world

To ensure ability to detect cases that may represent the first indication that SARS has re-emerged, the NYC DOHMH reminds providers to remain alert to and report patients who meet the following criteria during the winter respiratory viral season:

Patients who are being HOSPITALIZED WITH RADIOGRAPHIC EVIDENCE of pneumonia or acute respiratory distress syndrome (ARDS) without an identifiable etiology who have the following risk factors:

- **Travel in the 10 days prior to illness onset to mainland China, Hong Kong, or Taiwan** or close contact, within the 10 days prior to illness onset, with an ill traveler who had recently returned from one of these 3 areas.**
- **Employment in an occupation at particular risk for SARS exposure** Includes **health care workers** employed in acute care hospitals or primary medical care settings who have direct contact with patients (e.g., nurses, respiratory therapists, or physicians) due to the possibility that, during the 10 days prior to their illness onset, they may have had an unrecognized exposure to a patient with SARS. Also includes **laboratory workers** who work in a research or clinical laboratory with live SARS-CoV virus.
- **Part of a cluster** of 2 or more members of a family or other group of people in close contact, such as work or social contacts, who developed an unexplained pneumonia within 10 days of each other.

Health care providers should ask all patients being admitted to the hospital with pneumonia about recent travel, employment history, and/or exposure to another person who was recently diagnosed with pneumonia of unknown cause to ensure that potential cases are recognized as soon as possible. In the absence of any evidence of person-to-person transmission of SARS worldwide, the CDC recommends that *droplet* precautions be used for patients meeting the criteria outlined above, pending further clinical and laboratory evaluation. (**Addendum:** On January 5, 2004, a 32 year old male in the Guangdong Province of mainland China was confirmed by WHO to have SARS infection. Although no person-to-person transmission had been identified when this case was confirmed by WHO, CDC recommends *airborne* and *contact* precautions for patients who meet the above criteria after travel to Guangdong Province. As the situation with SARS may rapidly evolve, providers are urged to frequently visit the CDC and NYC DOHMH Web sites and the Health Alert Network [HAN] for the most up-to-date information on SARS.)

How to Report Immediately report any patients meeting the above criteria to the NYC DOHMH by calling the Provider Access Line at (866) NYC-DOH1/(866) 692-3641 during business hours and the Poison Control Center at (212) POI-SONS/(212) 764-7667 or (800) 222-1222 during non-business hours.

*Providers are required to report suspected or confirmed cases of SARS to the NYC DOHMH in accordance with the New York State Sanitary Code, Sections 2.1(a) and 2.10.

**If SARS recurs, it is most likely to do so in mainland China, where it is thought to have originated. Taiwan and Hong Kong are also thought to be at higher risk due to the high volume of travelers from mainland China. Although less likely, SARS may also reappear from other areas affected during the Spring 2003 outbreak. Ill travelers from other previously affected areas only need to be reported if they are hospitalized with radiographic evidence of pneumonia without an identifiable etiology AND have an epidemiologic risk factor that further raises the index of suspicion for SARS (e.g., during travel in these areas they spent time in a hospital where patients with acute respiratory disease were treated).

other respiratory pathogens. SARS usually begins with an influenza-like prodrome, including fever, chills, myalgia, and headache; respiratory symptoms often develop 2–7 days after illness onset and typically include a nonproductive cough and shortness of breath. Upper respiratory symptoms such as rhinorrhea and sore throat may occur but are rare. Diarrhea has been reported in approximately 20% of patients and has been a prominent and early manifestation in some cases.

Some patients may become hypoxic (oxygen saturation [SaO_2] < 95% on room air) and progress to pneumonia or acute respiratory distress syndrome (ARDS), requiring mechanical ventilation. The chest radiograph may be normal early in the course of illness, but later films typically reveal lobar consolidation or either focal or diffuse interstitial infiltrates. Most SARS cases have radiographic evidence of pneumonia within 7–10 days of illness onset. Cavitation, lymphadenopathy, and/or pleural effusions are uncommon.

The most common laboratory abnormality is lymphopenia (present in 70–90% of cases), but leukopenia, thrombocytopenia, and elevated transaminases or lactate dehydrogenase may also occur; however, the presence or absence of these findings is not diagnostic.

The overall case-fatality rate was approximately 10% during the Spring 2003 outbreak; however, it approached 50% in persons age 60 years or older. There is no known effective treatment for SARS. Empiric therapy should include antibiotic coverage for community-acquired pneumonia and supportive care. Guidelines for the management of community-acquired pneumonia have been developed by the Infectious Diseases Society of America and are available at www.journals.uchicago.edu/IDSA/guidelines/.

Much less is known about SARS-CoV disease in

Table 2: Guidelines for reporting potential cases of SARS IF person-to-person transmission of SARS is confirmed anywhere in the world

If person-to-person transmission of SARS re-emerges, the criteria for reporting potential cases will expand to include patients with milder illness (fever and respiratory symptoms even without radiographic evidence of pneumonia or if the illness is not severe enough to require hospitalization), as well as epidemiologic links to areas currently affected by SARS or exposures to persons who meet current suspect, probable, or laboratory-confirmed criteria for SARS. Providers should ask all patients presenting with fever and respiratory symptoms about recent travel history or exposure to someone who may have SARS to ensure that potential cases are recognized as soon as possible.

SUSPECT CASE A person presenting with a respiratory illness of unknown etiology, defined as an illness with a measured temperature > 38°C (100.4°F) AND one or more respiratory signs or symptoms (including cough, shortness of breath, or difficulty breathing), who reports one of the following risk exposures:

- Travel to or transit through an airport in an area with recently documented or suspected community transmission of SARS within the 10-day period before the person's onset of symptoms OR close contact, within the 10 days prior to illness onset, with an ill traveler who had recently returned from one of these areas*

OR

- Close contact, within the 10-day period before onset of symptoms, with a person known to be a suspect, probable, or laboratory-confirmed SARS case (providing care for, living with, or having direct contact with respiratory secretions and/or body fluids of a patient known to be a suspect, probable, or laboratory-confirmed SARS case).

PROBABLE CASE A person meeting the suspect case definition with one or more of the following:

- Radiographic evidence of pneumonia or ARDS
- Autopsy findings consistent with pneumonia or ARDS without an identifiable cause.

In addition to the criteria above, the NYC DOHMH requests reporting of health care workers with unexplained pneumonia and any clusters of unexplained pneumonia among 2 or more members of a family or others who have close contact with each other.
Patients who meet the above criteria for suspect or probable cases should be placed immediately under *airborne* and *contact* precautions.

How to Report Immediately report any patients meeting the above criteria to the NYC DOHMH by calling the Provider Access Line at (866) NYC-DOH1/(866) 692-3641 during business hours and the Poison Control Center at (212) POISONS/(212) 764-7667 or (800)222-1222 during non-business hours.

*If a recurrence of SARS has been confirmed, visit the CDC Web site at www.cdc.gov/ncidod/sars/ for the most up-to-date information on regions with suspected or documented community transmission (excludes areas which had secondary cases only in health care workers or direct household contacts).

children. Infants and children only accounted for a small percentage of cases last spring. In general, they had milder illness with better outcome, and were less likely to spread the disease to others. No outbreaks in school or daycare settings were reported last spring.

Surveillance for SARS and Criteria for Reporting to the NYC DOHMH

It is possible that SARS could re-emerge this winter, especially in mainland China, where the outbreak most likely originated last year. Taiwan and Hong Kong are also thought to be at higher risk due to the high volume of travelers from mainland China. Possible mechanisms for the re-emergence of SARS include re-introduction from an as-yet unidentified animal reservoir(s) or from persistence in previously ill persons or other asymptomatic human carriers.

During the Spring 2003 outbreak, epidemiologic risk factors, including recent travel to an affected area or direct contact with another SARS case, were used to identify potential SARS cases among patients presenting with fever and respiratory symptoms. However, in the absence of any evidence of person-to-person transmission of SARS worldwide, these epidemiologic criteria cannot be used. Additional challenges to SARS surveillance in the winter season include the non-specific clinical features of SARS, the lack of reliable rapid diagnostic testing to detect SARS-CoV in the first few days of illness, and the occurrence of other seasonal respiratory diseases, including influenza, which may confound surveillance for SARS.

Last spring, most cases had a clear link to another SARS case or cluster of cases suggestive of SARS, and most SARS transmission occurred when patients were seriously ill with pneumonia and required hospitalization. Early recognition of SARS will rely on a combination of clinical and epidemiologic features. The surveillance criteria outlined in Tables 1 and 2 are based on the level of SARS activity worldwide, as

Table 3: Guidelines for the triage and management of potential SARS patients in emergency departments and acute care clinics when there is NO confirmed person-to-person transmission of SARS worldwide

1. **SCREEN ALL PATIENTS** presenting with fever and respiratory symptoms (e.g., cough, shortness of breath) for SARS risk factors using the following methods:
   - Place posters for patients in the waiting and triage areas instructing patients with fever and respiratory symptoms who are health care workers or have recently traveled to promptly identify themselves. Consider placing similar signs at all hospital entrances.*
   - Place educational posters for providers in staff work areas reminding health care providers to screen for SARS.*
   - Prompt receptionist, triage, and clinical staff to ask SARS screening questions by use of a special form or sticker in all charts. The following are examples of screening questions:

   Do you have fever and cough? If yes,
   - Have you traveled within the 10 days before your fever or respiratory symptoms began? If so, where?
   - Have you had contact within the past 10 days with an ill person who has traveled to mainland China, Hong Kong, or Taiwan?
   - Are you a health care worker? If so, do you have direct contact with patients?
   - Do you work with the SARS virus in a clinical or research laboratory?
   - Have you had recent close contact with a person who is hospitalized with pneumonia of unknown cause?

2. **ADHERE TO THE FOLLOWING INFECTION CONTROL PRECAUTIONS** if the patient has one or more SARS risk factors (pending further clinical evaluation):
   - **Isolate the patient immediately.** Put a surgical mask on the patient and place him or her in a private room.
   - **Use personal protective equipment with strict adherence to *droplet* precautions.** This applies to all staff who come into contact with the patient.
     The CDC has recommended that droplet precautions be used during the initial management of patients with fever and respiratory symptoms until it is determined that the cause of illness is an infectious agent that does not require measures beyond standard precautions. However, if SARS is documented to have re-emerged anywhere in the world, suspect cases should be managed with *airborne* and *contact* precautions.
   - **Avoid aerosolizing procedures if possible.** Procedures that generate aerosols significantly increase the risk of transmission of SARS-CoV.
     - Aerosolizing procedures include aerosolized medication treatments, airway suctioning, diagnostic sputum induction, bronchoscopy, and endotracheal intubation.
     - Inform your infection control department if one of these procedures is planned or performed.
     - If an aerosolizing procedure is indicated, ensure that it is performed in an airborne infection isolation room with negative pressure. Only the minimum number of staff needed for the procedure should be allowed in the room. All staff should wear full personal protective equipment (including N95 or higher level respirators with goggles or face shields) and strictly adhere to both *airborne* and *contact* precautions.

3. **EVALUATE THE PATIENT** to determine if (a) there is radiographic evidence of pneumonia or ARDS **and** (b) the patient requires hospitalization. **If yes:**
   - **Notify your infection control department immediately.**
   - **Report the patient to the NYC DOHMH immediately** by calling the Provider Access Line at (866) NYC-DOH1/(866) 692-3641 during business hours and the Poison Control Center at (212) POISONS/(212) 764-7667 or (800) 222-1222 during non-business hours.

4. **RULE OUT OTHER CAUSES OF THE PATIENT'S ILLNESS.** If appropriate laboratory testing supports an alternative diagnosis, SARS-CoV may be excluded as the cause of illness.
   - Consider rapid diagnostic testing for both influenza and respiratory syncytial viruses (avoid viral culture unless performed in a Biosafety Level [BSL]-3, or higher, facility).
   - Consider routine bacteriologic testing as indicated by the patient's clinical presentation (including both *Legionella* and pneumococcal urinary antigen testing, if appropriate).

5. **OBTAIN CLINICAL SAMPLES FOR SARS-CoV TESTING,** if the initial evaluation does not identify an etiology for the illness within 72 hours of hospital admission, once approved by the NYC DOHMH (see Table 4). Testing can be arranged sooner if the patient is considered to be at higher risk for SARS (including travel to Guangdong Province in mainland China).

* Posters for patients (available in multiple languages) and for clinicians are available at www.nyc.gov/html/doh/html/cd/sars1.html or by e-mailing sarshealth@health.nyc.gov.

well as the severity of illness and the presence of a potential SARS risk exposure.

(A) In the ABSENCE of Known Person-to-Person Transmission of SARS Worldwide (see Table 1): In the absence of any documented person-to-person transmission worldwide, the likelihood is exceedingly low that a patient with fever and respiratory symptoms has SARS. The presence of both typical clinical findings in a patient ill enough to be hospitalized and suggestive epidemiologic factors would, however, raise the possibility of SARS-CoV infection.

To ensure the ability to rapidly detect both imported cases and persons who may represent the first evidence of nosocomial or community transmission, it is crucial that providers immediately report patients who are hospitalized with radiographic evidence of pneumonia or ARDS without an identifiable etiology and who have any of the risk factors listed in Table 1.

(B) Surveillance Criteria IF Person-to-Person Transmission of SARS is Confirmed Anywhere in the World (see Table 2): If person-to-person transmission of SARS does re-emerge, the probability will increase that a febrile respiratory illness among persons with travel to affected areas does represent SARS. Accordingly, in addition to the criteria listed in Table 1, reporting criteria will be expanded to also include (1) milder illness (fever and respiratory symptoms even in the absence of radiographic findings) that may not be severe enough to require hospitalization and (2) epidemiologic risk factors, including exposure to known or suspected SARS-affected areas, or direct contact with a suspect, probable, or laboratory-confirmed SARS patient. As the situation with SARS may rapidly evolve once it re-emerges, providers are urged to frequently visit the CDC and NYC DOHMH Web sites and the Health Alert Network (HAN) for the most up-to-date information on SARS-affected areas and criteria for reporting to the NYC DOHMH.

Triage and Initial Evaluation of Potential SARS Patients (Table 3)

Substantial morbidity, and some fatalities, occurred among hospital staff in the most severely affected areas last spring; several facilities were temporarily closed in order to control nosocomial outbreaks. Their experience highlights the potential impact if even one highly infectious SARS patient (a "superspreader") is not immediately identified and placed in isolation. Therefore, the NYC DOHMH urges all health care facilities ensure that triage procedures are in place to rapidly recognize and isolate any potential SARS patients, and that all staff strictly adhere to infection control precautions.

From the first point of contact, health care providers and other employees (e.g., receptionists) should ask all patients presenting with fever and respiratory symptoms about SARS risk factors; specifically, recent travel, close contact with an ill traveler, or employment either as a health care worker providing direct patient care or a laboratorian working with live SARS-CoV. Facilities should ensure that potential cases are recognized as soon as possible and isolated immediately, pending further clinical evaluation. Signs or posters asking patients to promptly notify staff if they have fever, respiratory illness, and potential SARS exposures should be placed in triage areas and waiting rooms and at entrances to acute care clinics and emergency departments. (Posters developed by the NYC DOHMH in multiple languages are available at www.nyc.gov/html/doh/html/cd/sars1.html or by e-mailing sarshealth@health.nyc.gov.)

Even in the absence of person-to-person transmission of SARS anywhere in the world, any patient who reports potential risk factors for SARS (see Table 1) should immediately be isolated in a private room, and all persons entering the room should adhere strictly to droplet precautions. Droplet precautions are deemed sufficient in this setting, as the likelihood of SARS is small and droplet precautions should provide sufficient protection against most respiratory pathogens. If, after an initial evaluation, the patient is found to (1) have radiographic evidence of pneumonia and (2) require hospitalization, the case should be reported immediately to the NYC DOHMH. If SARS is diagnosed based on laboratory testing or if there is an increased index of suspicion for SARS based on epidemiologic or clinical criteria (including travel to Guangdong Province; see Addendum, Table 1), the patient should then be placed under airborne and contact precautions.

Initial diagnostic testing should include chest radiography, pulse oximetry, complete blood count, blood cultures, Gram stain and culture of sputum, and testing for viral respiratory pathogens, notably influenza A and B and respiratory syncytial virus (RSV). Specimen collection for *Legionella pneumophila*, *Mycoplasma pneumoniae* and pneumococcal urinary antigen testing should also be considered based on the clinical and epidemiologic features of the patient's illness.

Laboratory Testing for SARS-CoV

In the absence of person-to-person transmission of SARS worldwide, judicious use of SARS-CoV testing is recommended due to the potential ramifications of a false-positive result. When there is no evidence of person-to-person transmission of SARS, the positive predictive value of diagnostic testing (proportion of patients with positive tests who truly have SARS) is extremely low. Accordingly, testing for SARS-CoV should only be

Table 4: How to arrange laboratory testing for SARS

Any patient who meets the criteria in Table 1 (or Table 2 if SARS re-emerges) MUST first be reported to the NYC DOHMH before any clinical specimens are accepted for SARS testing. When you call to report a potential case, NYC DOHMH staff will help determine whether testing is necessary, and if so, help your laboratory arrange it. Please call to report the case and discuss the need for testing BEFORE collecting and sending laboratory specimens to the New York City Public Health Laboratory (PHL). Once testing is approved, the NYC DOHMH Laboratory Submission Forms will be provided and transportation of clinical specimens to the PHL will be arranged by the NYC DOHMH.

Which specimens to obtain for diagnostic testing for SARS The likelihood of recovering most viral respiratory pathogens diminishes markedly > 72 hours after symptom onset. In contrast, the amount of SARS-CoV in respiratory specimens may increase later in the course of illness, peaking 10–14 days post onset. Therefore, obtain specimens as early as possible to test for alternative pathogens, such as influenza virus and RSV, as well as SARS-CoV. When possible, it is preferable to collect multiple respiratory specimens for testing. Initial specimens should include serum (for serology), plasma (for PCR), and an oropharyngeal swab and nasopharyngeal aspirate/swab (for PCR) during the first week of illness. If no alternative etiology is found and the initial SARS tests are negative, stool and additional nasopharyngeal and oropharyngeal specimens should be obtained 7–21 days post-illness onset for PCR testing. A convalescent serology should also be obtained at 28 days.

UPPER RESPIRATORY TRACT* Samples should be refrigerated at 4°C until transported.

- **Nasopharyngeal wash or aspirate** A nasopharyngeal wash or aspirate is the specimen of choice for detecting respiratory viruses. Collect 1–2 mL from each nostril in sterile vials using non-bacteriostatic saline (pH 7.0).
- **Nasopharyngeal and oropharyngeal swabs** Collect each specimen with a sterile Dacron®**/nylon swab with a non-wooden shaft (Do NOT use calcium alginate swabs or swabs with wooden sticks). Place swabs immediately into sterile vials containing 2 mL of viral transport media. Break applicator stick off near the tip and close vial tightly.
  - **Nasopharyngeal swab** Insert swab into each nostril parallel to the palate and leave in place for a few seconds to absorb secretions. Swab both nostrils.
  - **Oropharyngeal swab** Swab both posterior pharynx and tonsillar area, avoiding the tongue.

LOWER RESPIRATORY TRACT* Samples should be refrigerated at 4°C until transported.

- **Bronchoalveolar lavage (BAL), tracheal aspirate, or pleural tap** After specimens are obtained, half should be centrifuged and the cell-pellet fixed in formalin. Remaining unspun fluid should be placed in sterile vials with external caps and internal O-ring seals or sealed tightly with the available cap and secured with Parafilm®.**
- **Sputum** Have the patient rinse mouth with water and then expectorate deep-cough sputum directly into a sterile screw-cap sputum collection cup or sterile dry container.

BLOOD COMPONENTS Samples should be refrigerated at 4°C until transported.

- **Serum** Collect 5–10 mL of whole blood in a serum separator tube. Allow blood to clot, then centrifuge briefly and aliquot resulting serum. Acute specimens should be collected as soon as possible; convalescent specimens should be obtained 28 days after illness onset.
- **Whole blood (plasma)** Collect 5–10 mL of whole blood in an EDTA-containing (purple top) tube.

STOOL Samples should be refrigerated at 4°C until transported. Collect 10–50 mL of stool in a tightly sealed, leak-proof, clean, dry stool cup or urine container.

TISSUE (from surgical or autopsy specimens)

- **Fixed tissues** (formalin-fixed or paraffin-embedded) from all major organs.
- **Fresh frozen tissues** from lung and upper airway.

PLEASE USE PROPER LABELING, STORAGE, AND PACKAGING Each specimen must be labeled with the patient's name, medical record number, specimen type, and date collected. The NYC DOHMH SARS Laboratory Submission Form should be included with the specimens. Please package each specimen in a separate biohazard bag. Place bagged specimens in a non-breakable/leak-proof container packed with at least one cold pack or ice bag. Please label the container "For NYC DOHMH PHL – Room 1173 on 11th Floor." The NYC DOHMH will pick up the specimens from the hospital laboratory. Packaged specimens should be placed in a cooler that will be provided by the NYC DOHMH transport staff. All hospital laboratory staff should observe the CDC's "Interim Biosafety Guidelines for Handling and Processing Specimens Associated with SARS," available on the CDC Web site at www.cdc.gov/ncidod/sars.

* Nasal aspirates and lower respiratory specimens should be collected with strict attention to airborne and contact precautions, in an airborne infection isolation room.
** Use of brand names is for informational purposes only and does not imply endorsement by the New York City Department of Health and Mental Hygiene.

considered for patients who meet the surveillance criteria outlined in Table 1 if the initial evaluation does not identify an alternative etiology within 72 hours of hospital admission; testing may be arranged sooner if the patient is deemed to be at higher risk for SARS (including travel to Guangdong Province; see Addendum, Table 1).

Laboratory testing for SARS is offered free of charge at the NYC DOHMH Public Health Laboratory using experimental assays developed by the CDC, including an enzyme immunoassay (EIA) for determining serum antibody titers to SARS and polymerase chain reaction (PCR) tests for detection of viral RNA in respiratory, blood, and stool specimens. Specimens will be accepted only if the patient is first reported to the NYC DOHMH and meets the current CDC and NYC DOHMH case criteria. Guidance on specimen collection and transport is provided in Table 4.

Interpreting SARS Laboratory Findings

PCR Analysis Positive specimens have been obtained in the first several days after the onset of illness; however, unlike with testing for many other respiratory viruses, the sensitivity for SARS-CoV appears to peak 1–2 weeks after illness onset. Virus may be detected for up to 4 weeks in stool.

Any positive test will need confirmation at the CDC as false-positive PCR results can occur. For a patient to be designated PCR-positive, SARS-CoV RNA should be detected using a validated assay on (1) at least 2 different types of clinical specimens or (2) the same type of clinical specimen collected on 2 or more occasions. Positive PCR results should also be confirmed by antibody testing.

Conversely, a negative PCR result does not rule out SARS-CoV. False-negative results may occur if a low titer of virus is present in the specimen (e.g., if specimens are tested too early in the course of illness). Re-testing in 1–2 weeks is recommended when there is a high index of suspicion for SARS based on clinical and epidemiologic criteria, and if no alternative etiology is identified.

EIA EIA antibodies may appear early (within the first 8–10 days of illness), but serologic tests have their greatest sensitivity when convalescent specimens are taken at least 28 days after symptom onset. Both acute and convalescent specimens are recommended.

Viral Culture Viral culture should not be used at this time for diagnostic purposes. Although it is possible to isolate SARS-CoV, it should be done only in laboratories with Biosafety Level (BSL)-3 capability.

Commercial or hospital laboratories may be offering SARS-CoV testing in the near future. Considering the low positive predictive value of SARS-CoV testing in the absence of any evidence of SARS re-emergence, any positive commercial or hospital laboratory test should be confirmed at a reference laboratory. Report any positive PCR or EIA test results immediately to the NYC DOHMH.

Infection Control

SARS is a reminder of the risk of nosocomial transmission of respiratory pathogens; all health care facilities need to re-emphasize the importance of basic infection control measures for patients presenting with febrile respiratory illnesses. During the SARS outbreak last spring, a significant proportion of secondary cases occurred among health care workers in acute care hospitals and ambulatory settings, due to unprotected exposures during the evaluation and care of unrecognized SARS patients (approximately 20% of all SARS cases occurred among health care workers). Lapses in infection control practices during high-risk procedures (e.g., endotracheal intubation, respiratory treatment, sputum induction, and other aerosol-generating procedures) also have been implicated in health care worker infections.

Prompt implementation of and strict adherence to infection control measures prevent transmission of SARS-CoV. Clinicians should review recommended procedures for standard, contact, droplet, and airborne precautions, available on the CDC Web site at www.cdc.gov/ncidod/hip/isolat/isolat.htm. All clinical staff should undergo individualized fit testing and training for respirator use, including education on the importance of performing a "fit check" (conforming the mask to the face and checking for air leaks) immediately after donning an N95 respirator and before entering the patient's room. Fit testing should be repeated if a change in weight, new facial hair growth, or change in facial structure has occurred since the initial fit test. Emphasis should be placed on strict adherence to hand hygiene measures (www.cdc.gov/handhygiene/).

In the absence of any person-to-person transmission of SARS worldwide, patients who meet the criteria for potential cases as outlined in Table 1 should be cared for using *droplet* precautions combined with eye protection if indicated. Patients with travel from Guangdong Province in mainland China should be cared for using *airborne* and *contact* precautions (see Addendum, Table 1). If and when person-to-person transmission re-emerges, the level of respiratory protection should be enhanced to *airborne* and *contact* precautions for patients meeting the surveillance criteria outlined in Table 2, as the likelihood will increase that a patient with risk factors and compatible symptoms has SARS.

During the Spring 2003 outbreak, there were anecdotal reports of health care workers who became infected despite the use of appropriate personal protective equipment (PPE). The CDC recommends that all health care workers review the correct sequence and methods for both *donning* and *removing* PPE to avoid any possibility of inadvertent exposure to infected secretions when removing contaminated equipment.

Universal Respiratory Precautions

The CDC and NYC DOHMH strongly recommend that health care facilities adopt universal respiratory precautions for all patients presenting with fever and respiratory symptoms to help decrease the risk of transmission of potential respiratory pathogens, such as influenza virus, adenovirus, respiratory syncytial virus, *Mycoplasma pneumoniae*, or SARS-CoV. (See the CDC guidelines at www.cdc.gov/ncidod/sars/.) These recommendations include identifying patients with fever and respiratory symptoms on arrival at the facility, providing them with face masks (i.e., simple paper or surgical masks or providing tissues to patients unable to wear face masks) and placing these patients in private rooms as soon as possible. Also ensure that hand hygiene materials (alcohol-based hand gels) are available in patient waiting areas. All health care personnel should use droplet precautions during the evaluation of patients with fever and respiratory symptoms until it is determined that the cause of illness is an infectious agent that does not require measures beyond standard precautions.

For more detailed guidelines, visit www.cdc.gov/ncidod/sars/ic.htm. Wearing appropriate PPE, using care in removing PPE, routinely performing appropriate hand hygiene, and decontaminating equipment and surfaces will be critical to protect both health care workers and other patients from known infectious diseases as well as SARS or other newly emerging diseases in the future.

RESOURCES

NYC DOHMH

- All NYC DOHMH patient and provider materials can be accessed by visiting www.nyc.gov/html/doh/html/cd/sars1.html.
- If SARS recurs, suspect, probable, or laboratory-confirmed SARS case-patients treated as outpatients or discharged from a hospital must receive the NYC DOHMH "SARS Discharge Instructions to Prevent Transmission to Close Contacts." These instructions are available in English, Chinese, Vietnamese, and Spanish.
- **NYC DOHMH Health Alert Network (HAN)** The NYC DOHMH encourages all NYC health care practitioners to register with the HAN, as it facilitates emergency notification of local health care providers on issues of public health concern. The HAN will provide rapid notification if SARS re-emerges anywhere in the world, including NYC. If you would like to receive medical alerts directly via e-mail or fax, send your contact information to HAN@health.nyc.gov.

Centers for Disease Control and Prevention
www.cdc.gov/ncidod/sars/

World Health Organization
www.who.int/en

ONLINE SARS CME/CNE ACTIVITIES

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REFERENCES ONLINE To view references for this publication, visit www.nyc.gov/html/doh/html/chi/chi.html.

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