

SEVERE ACUTE RESPIRATORY SYNDROME (SARS):

A GLOBAL IMPACT

by

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ABSTRACT

On March 12, 2003, the World Health Organization (WHO) issued a global alert for Severe Acute Respiratory Syndrome (SARS). This is a deadly infectious disease with a rapid onset that is spread by person-to-person contact. WHO and the Centers for Disease Control and Prevention (CDC) immediately started an intense coordinated investigation that resulted in the identification of the SARS-associated coronavirus (SARS-CoV) as the causative agent (CDC, 2003a). By the time this outbreak was brought to an end, more than 8,000 cases and 780 deaths had been reported (CDC, 2004b). Numerous workers in the healthcare industry, laboratories, universities, and airports were among the morbidity and mortality statistics. As a result, occupational health professionals have been reminded of the necessity to develop policies and procedures to ensure surveillance, prompt recognition of infectious illnesses, immediate treatment, and protection of the workforce.

The SARS outbreak illustrated the potential for a new disease to emerge and spread quickly in today's global economy where there is daily international travel and interaction. The emergence of SARS also allowed the world to see that traditional public health measures to control disease spread, including surveillance, infection control, isolation, and quarantine are productive and effective. It also demonstrated the necessity of preplanning for such disease outbreaks.

The role of occupational and environmental health nurses was expanded to include more surveillance for the re-emergence of SARS or the emergence of new infectious diseases this year or next. The American Association of Occupational Health Nurses (AAOHN) has assumed a leadership role in monitoring the emerging infectious diseases and issuing information to its members. WHO and CDC continue to be global leaders in the efforts to quickly identify newly emerging infectious diseases and find a vaccine for those infectious diseases already identified. Many other professional organizations are working to promote research in the field of infectious respiratory diseases.

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Severe Acute Respiratory Syndrome: A Global Impact

CHAPTER 1

INTRODUCTION

Severe Acute Respiratory Syndrome (SARS) is a highly contagious respiratory disease that infected 8,098 persons and led to more than 780 deaths between November 1, 2002 and July 31, 2003 (World Health Organization (WHO), 2003b). The case fatality ratio worldwide was 9.6% (Shapiro & McCauley, 2004). Due to the volume of international travel, emerging infectious diseases such as SARS are difficult to contain within the borders of a country or geographic area and pose a high risk of spread to many countries with one outbreak.

The SARS outbreak in 2003 along with the recurrent outbreaks in China in April 2004 have presented the public health community with an opportunity and a challenge to identify an emerging infectious disease rapidly and respond quickly and appropriately to prevent further spread of the disease. The World Health Organization (WHO) and the Centers for Disease Control and Prevention (CDC) developed a case definition for SARS and immediately began developing a series of recommendations and guidelines for the healthcare community to use to control the spread of the virus, identify potential new cases and close contacts, and educate healthcare workers to protect themselves from contracting SARS.

Occupational and environmental health nurses (OEHNs) are being thrust into roles of disease prevention, symptom detection, and management of SARS and other emerging infectious disease outbreaks. Infectious disease control measures must include engineering, administrative, environmental, and personal protective equipment (PPE). OEHNs will be involved in education and training of the workforce both in hospital and industrial settings.

This paper will focus on the SARS outbreak of 2003 along with the new outbreak in China in April 2004 that resulted in nine cases with one fatality. The guidelines issued by the CDC to prevent further outbreaks of the disease and to promptly identify and report potential new cases and close contacts of cases will be reviewed. The paper will also consider the impacts of SARS on select populations such as healthcare workers, laboratory workers, customs and airport personnel, and frequent business travelers. The role of OEHNs will be explored in the prevention, detection, and management of SARS and other emerging infectious disease outbreaks.

CHAPTER 2

LITERATURE REVIEW

In 2003, there was limited information published about SARS as it was a new infectious disease. Then an explosion of information occurred to identify, control, and prevent the disease.

Case Definition

When SARS first emerged as a new infectious disease, the medical community struggled to quickly develop a case definition for the syndrome and the definition went through several revisions. The CDC established case definitions for healthcare workers to identify individuals with SARS (CDC, 2003a). Reported cases are classified into two categories based on clinical presentation –“suspect” and “probable”. The case definition criteria are (1) fever greater than 100.4° F, (2) respiratory symptoms (cough, shortness of breath, and/or difficulty breathing), and (3) travel to an area known to be endemic for SARS or close contact with a known SARS patient (Khare, Wachter, & Barnosky, 2004). The case definition of SARS was updated on July 17, 2003 with a negative antibody titer for SARS-related coronavirus necessary to rule out a suspected or probable case (CDC, 2004e).

Causative Agent

SARS is caused by a previously unrecognized and newly described coronavirus called SARS-associated coronavirus (SARS-CoV) (National Institute of Allergy and Infectious Diseases, 2004). Prior to SARS, these viruses with a spiky, crown-like appearance had caused only mild respiratory infections. The coronavirus that causes SARS is in the same virus family as the common cold,

and because of this, the winter months are a period of high risk of SARS infection (Khare et al., 2004). The genetic material contained in the SARS-CoV is highly pathogenic; however, the RNA must be studied to determine the structure and function of the viral proteins. Researchers are attempting to determine how the immune system responds to the SARS-CoV and if there are human genetic variations that make one person more susceptible than another. Studies are also being done on inflammation and airway hypersensitivity and the ways SARS-CoV may evade destruction by immune system cells (National Institute of Allergy and Infectious Diseases, 2004).

The virulence of the SARS-CoV is thought to be that it multiplies rapidly, killing cells in the lungs and this causes an immune response that destroys more lung cells (Khare et al., 2004). According to two studies in China published May 2004, the SARS coronavirus and the receptor protein it latches on to are found in multiple organs throughout the body, such as the intestines, lungs, stomach, kidneys, sweat glands, parathyroid, pituitary, pancreas, adrenal gland, and liver (MedlinePlus, 2004b). These studies imply that the virus may be excreted in sweat, urine, and feces.

Mode of Transmission

Person-to-Person

Transmission of SARS appears to result mostly from close person-to-person contact and contact with large respiratory droplets emitted when a person sneezes or coughs (Kanof, 2003). Infected persons are contagious when symptomatic and that is when they tend to seek medical attention and come into

contact with healthcare workers. One characteristic of the SARS outbreak was the high rate of infection among healthcare workers (Kanof, 2003). The disease can also spread rapidly in the community due to person-to-person contact. Close contact is usually described as having cared for, lived with, or having contact with bodily secretions of an infected person (Kanof, 2003).

Droplet

The transmission of SARS appears to be spread most often by large droplets (Shapiro & McCauley, 2004). Droplets containing SARS-CoV can be released into the air when an infected person sneezes, coughs, or talks. Some medical procedures performed on infected persons can also cause the droplets to be released into the air. After contact, the incubation period for SARS – the time it takes for symptoms to appear – is generally within a 10-day period and often about 4 – 6 days (Kanof, 2003). It is not known how long after symptoms appear that SARS patients transmit the virus to others. There is no evidence that SARS can be transmitted from persons who are asymptomatic (Kanof, 2003).

Contaminated Objects

SARS may be spread if an uninfected person touches infected respiratory droplets that have been deposited on objects such as tables, chairs, office equipment and handrails. Touching a SARS-CoV infected surface, such as a doorknob or telephone, and then touching the fingers to the mouth, nose, or eyes may transfer the virus.

Airborne

Airborne contact is defined as “contact with small droplets (5 micrometers

or smaller) or dust particles containing the microorganism, which are suspended in air” (Kanof, 2003, p. 7). Some clusters of disease have been spread by “superspreader events” in which transmission occurred from a single case to multiple secondary cases (Shapiro & McCauley, 2004). The CDC has not ruled out the possibility that SARS may be spread broadly through the air.

Signs and Symptoms

SARS usually begins with flu-like symptoms that include a high fever, chills, headache, muscle aches, and an overall feeling of discomfort (CDC, 2004e). The initial symptoms may be quite mild and gradually increase in intensity, peaking during the second week of the illness.

Respiratory

Respiratory complaints often develop 2 to 7 days after illness onset and usually include a non-productive cough and dyspnea. Upper respiratory symptoms are less common but may develop and include rhinorrhea and sore throat. Most SARS patients with laboratory evidence of SARS-CoV disease will develop radiographic evidence of pneumonia by day 7-10 of illness and most develop lymphopenia (CDC, 2004g). In some cases, the disease progresses to the point where there is insufficient oxygen in the blood (Kanof, 2003). Ten to twenty percent of SARS patients will require mechanical ventilation to maintain adequate oxygen levels in the blood and the CDC estimates that approximately four percent of SARS cases will result in death (CDC, 2003c; Kilpatrick, Stockton LLP, 2003).

Fever

SARS usually begins with a fever, a temperature greater than 100.4° F (CDC, 2004e). “The increased body temperature intensifies the effects of interferons, inhibits the growth of some microbes, and speeds up body reactions that aid repair” (Tortora & Grabowski, 1993, p. 697).

Other

Up to 20% of infected persons may develop diarrhea (National Institute of Allergy and Infectious Diseases, 2004). Some other symptoms associated with the illness include headaches and myalgias prior to or in conjunction with the respiratory symptoms (Shapiro & McCauley, 2004).

One specific life-threatening symptom associated with SARS is acute respiratory distress syndrome (ARDS), a medical condition where the lungs are unable to function properly due to inflammation causing fluids to leak into the lungs (Medical Library, 2003). A few SARS patients developed ARDS and required mechanical ventilation.

Evaluation and Diagnosis**Screening History**

The early diagnosis of SARS relied mostly on the presenting symptoms of the person and travel history to locations with known SARS cases. During the assessment, OEHNs should be alert for patterns of morbidity among clients, family members, and communities. OEHNs need to learn as much information as possible about exposure sources.

The travel history is extremely important in determining if any viral illness could be SARS. It is important for OEHNs to determine if there has been travel to an area with documented or suspected community transmission of SARS or if the client has had close contact with a person who traveled to a SARS area.

A careful symptom history is also critical to correctly assess a viral illness as SARS. The onset of symptoms usually occurs within 10 days of contact with an infected individual and includes fever, chills, muscle aches, and a dry cough.

It is important to determine if the client has had contact with a person with a respiratory illness who has traveled to a SARS infected area or a person who is a suspect or known case of SARS.

Tests

Because the symptoms of SARS are similar to those of influenza, healthcare workers must have fast and accurate tests to identify and isolate persons with SARS. Currently, there is no definitive test to identify SARS during the early phase of the illness and this makes early diagnosis difficult (Kanof, 2003). SARS-CoV testing should be considered if no alternative diagnosis is identified 72 hours after initiation of the clinical evaluation and the client is thought to be at high risk for SARS disease. Providers should immediately report all positive SARS-CoV test results to the local or state health department. Confirmatory testing at an appropriate test site should be arranged through the local or state health department. The CDC developed guidelines for the collection and transport of specimens for SARS-CoV testing and these are available on the CDC website. Negative laboratory results obtained within 21 days of illness do

not rule out coronavirus infection. In these cases, an antibody test of a specimen obtained more than 21 days after illness begins is needed to determine infection (CDC, 2004c).

Reverse Transcription Polymerase Chain Reaction Test

The Reverse Transcription Polymerase Chain Reaction Test (RT-PCR) test can detect SARS-CoV in clinical specimens, including blood, stool, and nasal secretions (Johns Hopkins, 2003). This is a laboratory method for detecting the genetic material of an infectious disease agent in specimens from patients. Figure 2.1 illustrates the clinical SARS cases that were positive using the RT-PCR test and shows that this test is most effective from the 10th to 20th day after the onset of illness using both stool and nasopharyngeal aspirates.

Serologic Testing

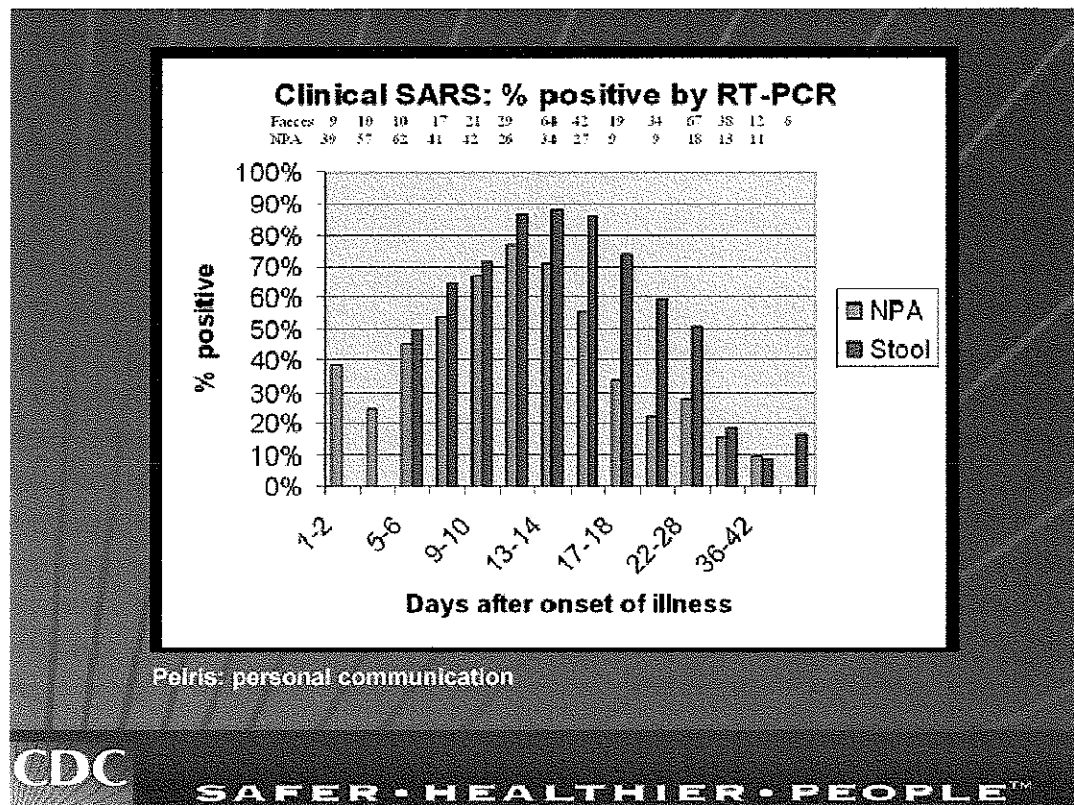
Serologic testing also can be performed to detect SARS-CoV antibodies produced after infection (Johns Hopkins, 2003). This is a laboratory method for detecting the presence and/or level of antibodies to an infectious agent in serum from an exposed person.

Viral Culture

Viral culture has been used to detect SARS-CoV. A small sample of tissue or fluid that may be infected is placed in a container along with cells in which the virus can grow. Changes in cells caused by the virus can then be viewed under a microscope (Johns Hopkins, 2003).

Figure 2.1

Clinical SARS % Positive by RT-PCR



Source: CDC. (2003a). Public Health Guidance for Community-Level Preparedness and Response to SARS, Slide 14.
http://www.cdc.gov/ncidod/sars/pdf/sarsplanslides_diagnostics_103003.pdf

Chest Radiographs

Chest x-rays show lung infiltrates develop in nearly 100% of laboratory confirmed cases, with 66% of them being abnormal by day three (Srinivasan, 2003). The infiltrates are initially focal and in the peripheral lower lobes, but 75% of them progress to involve multiple lobes or both lungs (Srinivasan, 2003).

Scope of the Problem

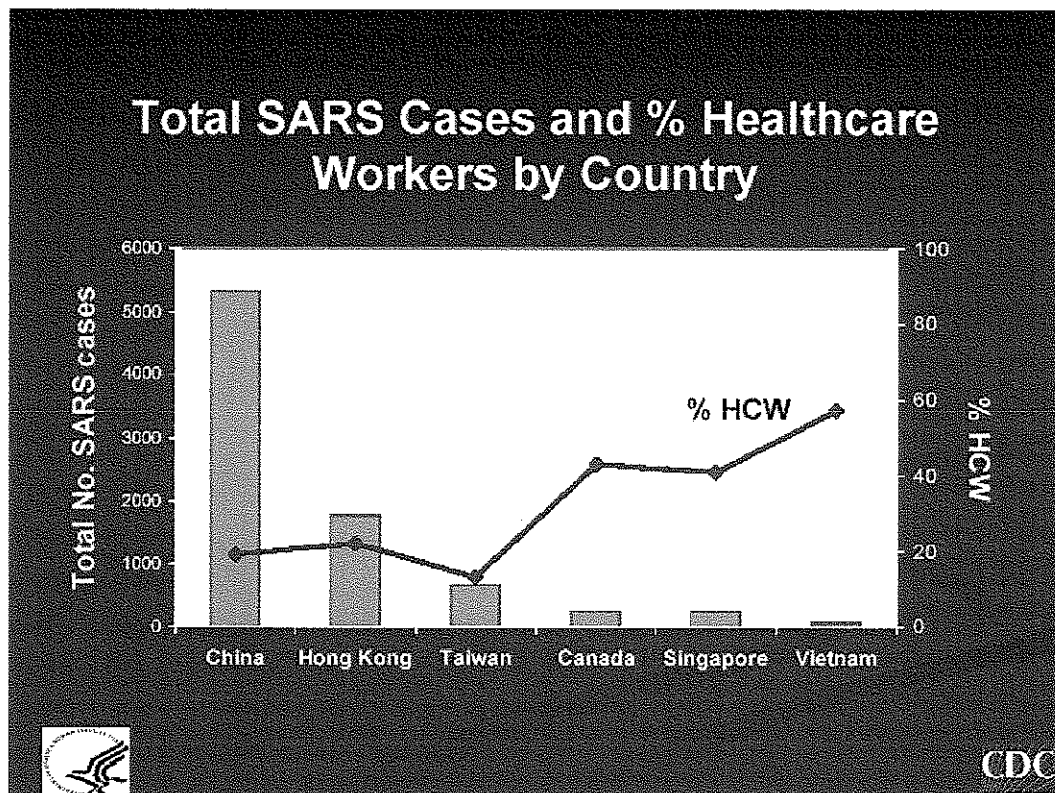
Case reports often provide the first clues in the identification of new diseases such as SARS and ultimately lead to epidemiologic investigations. In most areas with large SARS outbreaks in 2003, healthcare facilities accounted for a large proportion (often > 50%) of cases (CDC, 2003b) (Figure 2.2). In addition to healthcare workers who cared for patients, other hospital patients and visitors were often affected. Most people with SARS were adults, with those over the age of 40 and with chronic diseases at increased risk.

During the November 1, 2002 to May 14, 2003 outbreak of SARS, a total of 7,628 SARS cases were reported to WHO from 29 countries; 587 deaths (case-fatality proportion: 7.7%) were also reported (MMWR, 2003c). When the diagnosis of exclusion clause was added to the case definition for SARS, the numbers of cases changed and the numbers continued to change as knowledge grew.

In the 2003 outbreak, there were 8,098 cases of SARS worldwide with 774 deaths with an approximate 9% mortality rate (National Institute of Allergy and Infectious Diseases, 2004). Endemic SARS areas include China, Singapore, Hong

Figure 2.2

Total SARS Cases and % Healthcare Workers by Country



Source: CDC. (2003a). Public Health Guidance for Community-Level Preparedness and Response to SARS, Slide 5.

http://www.cdc.gov/ncidod/sars/pdf/sarsplanslides_surveillance_103003.pdf

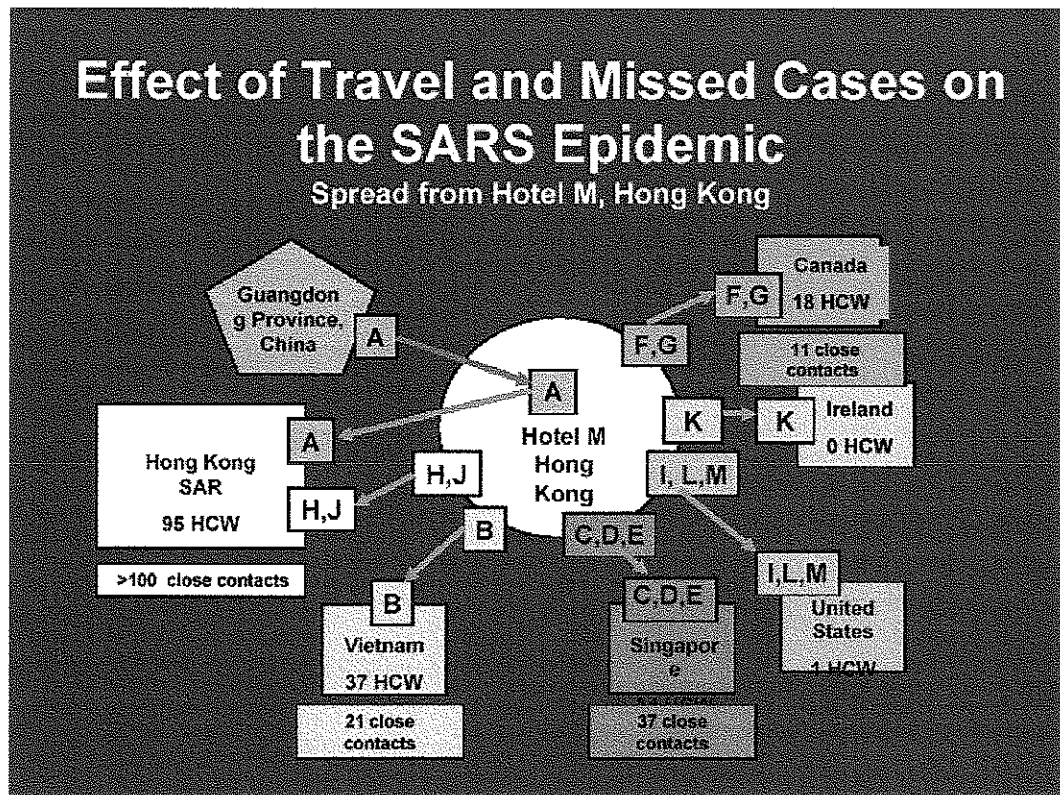
Kong, and Vietnam (Khare et al., 2004). Over a two month period, the illness spread to more than 25 countries in North America, South America, Europe, and Asia (Khare et al., 2004). The rapidity of the spread of the disease and the high levels of morbidity and mortality associated with SARS require healthcare providers to be vigilant in their efforts of early recognition of cases. As of July 11, 2003, the mortality rate for SARS was 10%, but the mortality rate in those over age 60 was near 50% (Kanof, 2003). Eight confirmed cases were identified in the United States but there were no deaths.

China

“SARS is believed to have originated in the Guangdong Province, China in mid-November 2002” (Kanof, 2003, p. 3). Early cases of the disease were not reported which delayed the identification and treatment of the disease and allowed it to spread. WHO received its first official report of an atypical pneumonia outbreak in China on February 11, 2003 (Kanof, 2003). The report stated there were 305 cases of atypical pneumonia and 5 deaths (Kanof, 2003). SARS was transmitted out of China by a physician who became infected while treating patients in the province and then traveled to a hotel in Hong Kong, where he began suffering flu-like symptoms (Kanof, 2003). After several days, other hotel guests became infected with SARS and then began to travel to other countries and spread the virus globally (Figure 2.3). From November 2002 until April 2003, a total of 1,454 clinically confirmed cases and 55 deaths occurred with healthcare workers making up 24% of the cases (Xu et al., 2004). The crude case-fatality rate was 3.8% for all ages and 12.7% in those over 65 years of age. The epidemic

Figure 2.3

Effect of Travel and Missed Cases on the SARS Epidemic



Source: CDC. (2003a). Public Health Guidance for Community- Level Preparedness and Response to SARS, Slide 3.

http://www.cdc.gov/ncidod/sars/pdf/sarsplanslides_surveillance_103003.pdf

peak occurred in the first half of February with approximately 55 new cases daily (Xu et al., 2004).

Forty healthcare workers in a community hospital in Hong Kong were studied by a group of researchers. They looked at records of hospital workers infected with SARS between March 25 and May 5, 2003 to determine when and where they were infected and what protective measures they had used (Ho, Sung, & Chan-Yeung, 2003). They found that during the early weeks of the outbreak, 8% of healthcare assistants, 5% of doctors, and 4% of nurses got SARS, mostly from direct contact with SARS patients and while wearing only masks (Ho et al., 2003).

Asia

SARS was first reported in Asia in February 2003. Over the next few months the illness spread to more than 24 countries in North America, South America, Europe, and other parts of Asia before the outbreak was contained (CDC, 2004b). During the SARS outbreak, over \$60 billion was lost in Asia alone (Srinivasan, 2003).

Canada

Canada had the highest prevalence of SARS cases in North America (Kanof, 2003). Of the 144 cases in Canada, 73 were healthcare workers (WHO, 2003b). Nine healthcare workers (HCW) were infected following a difficult intubation of a critically ill SARS patient, even though all HCWs reported wearing recommended protective equipment (Srinivasan, 2003). Toronto health officials had everyone entering a hospital answer a screening questionnaire and

have their temperature checked before they could enter. They also established SARS assessment clinics, also known as fever clinics, for persons to go to rather than to the local hospitals in an attempt to control the outbreak (Kanof, 2003). They later designated four hospitals as SARS hospitals and directed all SARS patients to go there (Kanof, 2003).

During the 2003 outbreak, Toronto fielded more than 316,000 hotline calls, quarantined 23,000 people, investigated more than 2,000 potential cases, confirmed 358 of them as SARS, and suffered 38 deaths (WHO, 2003b).

United States

As of July 15, 2003, the U.S. had identified 211 SARS cases in 39 states with no related deaths (WHO, 2003a). Of the cases, 175 were classified as “suspect” cases and 36 were classified as “probable”. Thirty-four of the 36 “probable” cases contracted SARS through international travel with California and New York having the greatest number of cases. Only 8 persons in the U.S. had laboratory confirmed evidence of SARS-CoV infection (Table 2.1) (CDC, 2004e).

Trends

Practitioners were the first to notice trends and patterns of SARS-CoV infection from the individual cases that formed a pattern of occurrence in China. Several guests from the same hotel became ill with similar symptoms, then workers at the same hospital, who had close contact with these patients, became ill.

Data collected during a disease outbreak can be an invaluable source for

Table 2.1

SARS Cases in the United States, Spring 2003

SARS Cases in the United States, Spring 2003				
Type of Case	No.	CoV+*	CoV-*	Pending
Probable	74	8	38	28
Suspect	344	0	169	175

*Based on presence of absence of SARS antibody at ≥ 28 days

Source: CDC. (2003a). Public Health Guidance for Community-Level Preparedness and Response to SARS, Slide 8.
http://www.cdc.gov/ncidod/sars/pdf/sarsplanslides_surveillance_103003.pdf

recognizing trends in the illness pattern and identifying interventions to minimize risk. Healthcare facilities were disproportionately affected by SARS-CoV and healthcare workers were among the first and most severely affected groups in every large outbreak reported (CDC, 2004e). During the 2003 global outbreaks of SARS, infants and children accounted for only a small percentage of SARS cases and had a much milder disease and better outcome than adults (CDC, 2004e). In most instances, SARS outbreaks were localized to specific communities and often to specific locations or facilities in a community. For example, in Canada, most SARS cases occurred in Toronto, and in Toronto, most cases occurred in hospitals (CDC, 2004a).

Reoccurrence in 2004

In China, between December 16, 2003 and January 31, 2004 there were four cases of SARS but no deaths. Between April 22 and 29, 2004 there were nine new cases with one death (WHO, 2004b). Seven of the patients were from Beijing and two were from Anhui Province in east-central China. Two of the nine patients were graduate students who worked at the National Institute of Virology Laboratory in Beijing, which is known to conduct research on SARS-CoV. The illness was first reported in a postgraduate student. The virology lab was closed on April 23, 2004 and remains closed while the investigation continues (Manning, 2004). As of May 10, WHO announced the outbreak was under control after nine persons were confirmed cases and all were linked to the National Institute of Virology (Medline Plus, 2004a). WHO has strongly recommended that work

using the live SARS virus be conducted in Biosafe facilities to minimize the risk of laboratory-acquired infections (WHO, 2004b).

While no one knows whether there will be another resurgence of SARS, federal, state, and local healthcare officials agree that it is necessary to prepare for the possibility. The chain of transmission is considered broken at an outbreak site when 20 days have passed since the last probable case was placed in isolation, left the area, or died (WHO, 2003a). The goal of public health is to maximize the early detection of cases and clusters of respiratory infections that might signal the re-emergence of SARS-CoV disease. If SARS recurs, practitioners must maintain prompt identification and reporting of potential cases to assure outbreak control. They must also identify and monitor contacts of cases to enable early detection of illness in persons at risk. Possible sources for reintroduction of SARS in the population include animal reservoirs, persistent infection in humans, laboratory acquired, and dynamic outbreaks.

Original Animal Reservoir

Because its sequence data differ from that of known human coronaviruses, SARS-CoV is suspected to have crossed the species barrier between an animal host and humans (MMWR, 2003a). Detection of SARS-like coronavirus had been reported previously in masked palm civets (sometimes called civet cats) and a raccoon dog for sale in a live animal market (MMWR, 2003a). Approximately 75% of emerging infectious diseases are zoonotic and evidence suggests an animal origin for SARS is possible (Xu et al., 2004).

Healthcare workers, laboratory workers, and people in close contact with certain animals are at risk of contracting a range of infectious diseases with outbreak potential (WHO, 2004a). A potential source of virus for a recurrence of person-to-person spread of SARS-CoV includes reintroduction to humans from an animal reservoir. Since SARS-CoV currently exists in the animals in southern China – the apparent source of the 2003 outbreak- this area remains under scrutiny for SARS-CoV disease activity.

Persistent Infection in Humans

The 2003 global outbreaks demonstrated the ease with which SARS-CoV can spread in human populations when cases remain undetected or when infected persons are not cared for in controlled environments that reduce the risk of transmission to others. A potential source for reoccurrence of person-to-person spread of SARS-CoV is persistent infection in previously ill persons. Large cities that are international hubs connecting to locales that might harbor persistent infections in humans could be sources of reoccurrence.

Laboratory Acquired

The April 2004 cases of SARS linked to exposures in research laboratories have prompted concerns about the role of laboratories as a reservoir for the reintroduction of SARS into the community. Laboratory personnel in facilities performing diagnostic tests on patients suspected to be infected with SARS should follow biosafety preventive guidelines established by the CDC's *Interim Laboratory Biosafety Guidelines for Handling and Processing Specimens Associated with Severe Acute Respiratory Syndrome (SARS)* (WHO, 2004a).

They should also follow OSHA's bloodborne pathogens (29 CFR 1910.1030) and respiratory protection standards (29 CFR 1910.134).

Dynamic Outbreaks

Communicable and infectious diseases are constantly changing. The changes in disease-producing organisms present challenges for healthcare professionals. SARS could recur as a result of changes in the genetic structure of the virus which makes it more virulent.

Management of International Travel-Related Transmission

The CDC's *Public Health Guidance for Community-Level Preparedness and Response to SARS, Supplement E: Managing International Travel-Related Transmission Risk* established the following goals:

- Prevent the introduction of SARS-CoV into the U.S. from SARS-affected areas,
- Prevent exportation of SARS-CoV from the U.S. if domestic transmission presents an increased risk of exportation,
- Reduce the risk of SARS-CoV disease among outbound travelers to SARS-affected areas, and
- Prevent the transmission of SARS-CoV to passengers on a conveyance with a SARS patient, and evaluate and monitor other passengers to detect SARS-like illness and prevent further spread (CDC, 2004c).

Agency/Government Response

In the U.S., the Healthcare Infection Control Practices Advisory Committee (HICPAC), a federal advisory committee made up of 14 infection

control experts, develops recommendations and guidelines regarding infectious disease control measures for CDC (Kanof, 2003). No new infectious disease control measures were introduced in the U.S. to contain the SARS outbreaks. Instead, strict adherence to the use of current infection control measures was sufficient. The control measures used were case identification, contact tracing, transmission control, and exposure management (Kanof, 2003).

WHO and CDC

On March 17, 2003, WHO asked 11 laboratories in 9 countries to form a network to discover the etiology of SARS, where all samples were shared among the laboratories and any information discovered was posted immediately on a secure site and instantly available to all the others (Srinivasan, 2003). WHO issued a global alert for the first time in more than ten years when SARS became a global health problem, but cancelled the alert in July 2003 when the outbreak was controlled. WHO scheduled numerous press conferences that updated the health community about the status of international SARS containment and prevention efforts (Kanof, 2003) (Appendix A). WHO, with CDC support, sponsored a videoconference broadcast globally to discuss the latest findings of the outbreak and prevention of transmission in healthcare settings (Kanof, 2003). During a two-week period early in the outbreak, CDC conducted nine telephone press conferences with the media to keep the public informed about the latest SARS information, laboratory and surveillance findings, travel advisories, and CDC's efforts nationally and worldwide (Kanof, 2003). CDC activated its Emergency Operations Center and devoted over 800 medical experts and support

personnel worldwide to provide round-the-clock coordination and response to the SARS outbreak (Kanof, 2003).

Council of State and Territorial Epidemiologists (CSTE)

During the 2003 epidemic of SARS, CSTE worked with the CDC to develop surveillance criteria to identify persons with SARS (MMWR, 2003a). The surveillance case definition changed throughout the epidemic as increased knowledge of the clinical, laboratory, and transmission characteristics of SARS-CoV became available (MMWR, 2003a).

On June 26, 2003, CSTE adopted a position statement to add SARS-CoV disease to the National Notifiable Disease Surveillance System (NNDSS) (MMWR, 2003a). This statement included criteria for defining a SARS case for national reporting. On November 3, 2003, CSTE issued an interim position statement with a revised SARS case definition. The revised case definition modified the clinical, epidemiologic, laboratory, and case-exclusion criteria in the U.S. case definition used during the 2003 epidemic.

Case Definition

Case identification is the process of determining whether or not a person meets the specific definitions for a given disease (Kanof, 2003). The CDC case definition has both clinical and epidemiological components. The clinical component includes an asymptomatic or mild respiratory illness, a fever greater than 38° C (100.4° F), and some findings of respiratory illness such as cough or shortness of breath (CDC, 2004a). The epidemiological criteria involve assessing the exposure to SARS via travel to areas known to have SARS cases, or through

close contact with someone known to or suspected to have the illness (Shapiro & McCauley, 2004).

A “suspect” case of SARS includes the following criteria:

- High fever,
- Respiratory illness,
- Recent travel to an area with current or previously documented suspected transmission of SARS, and/or
- Close contact within 10 days of the onset of symptoms with a person known or suspected to have SARS (CDC, 2003a).

A “probable” case of SARS includes the following criteria:

- All the criteria for “suspect” cases, and
- Evidence in the form of chest x-ray findings of pneumonia, acute respiratory distress syndrome (ARDS), or an unexplained respiratory illness resulting in death with autopsy findings of ARDS (CDC, 2003a).

The final determination of whether cases meeting the definitions for “suspect” or “probable” are due to infection with the SARS virus is based on results of testing a blood specimen obtained 28 days after the onset of illness (CDC, 2003a).

Clinical Criteria

The clinical criteria were revised after several months to have “early” illness replace “asymptomatic” or “mild” illness (MMWR, 2003d).

Epidemiologic Criteria

The epidemiologic criteria were revised to include the following new categories: 1) possible exposure to SARS-CoV and 2) likely exposure to SARS-CoV (MMWR, 2003d).

Laboratory Criteria

The laboratory criteria were revised several times during the course of the outbreak to include advances in new testing technology.

Exclusion Criteria

These have been revised to allow for exclusion when a serum sample collected more than 28 days after onset of symptoms is negative for antibodies to SARS-CoV (MMWR, 2003a).

Surveillance Criteria

The revised case definition also classifies each SARS case as either a SARS report under investigation (SARS RUI) or SARS-CoV disease (MMWR, 2003b). The SARS RUI is based solely on clinical or epidemiologic criteria and includes cases previously classified as probable or suspect. The SARS-CoV disease cases are based on selected clinical and epidemiologic criteria plus laboratory confirmation (MMWR, 2003b).

On-Site Investigations

The CDC deployed medical officers, epidemiologists, and other specialists to assist with onsite investigations around the world (CDC, 2004e). They also provided assistance to state and local health departments in investigating possible cases of SARS in the U.S. (CDC, 2004e). The New York City health department

hosted a symposium specifically for healthcare workers, to share the latest available SARS information. Hospital officials offered training seminars for their healthcare personnel on the signs and symptoms of SARS, recommended screening questions, and appropriate infectious disease control measures (Kanof, 2003).

The CDC conducted extensive laboratory testing of clinical specimens from SARS patients to identify the cause of the disease. SARS diagnostic assays are sensitive and specific, but may not provide definitive diagnosis early in the illness. Changes in the quantity, type, and timing of specimens collected may improve detection of SARS-CoV infection (CDC, 2004e) (Table 2.2). Interpretation of test results must take into consideration the possibility of false positives and negatives.

Health Alert Notices

The CDC distributed more than two million health alert notices to travelers entering the U.S. from China, Hong Kong, Singapore, Taiwan, Vietnam, or Toronto (Kanof, 2003). These cards, printed in eight languages, asked individuals to monitor their health for at least 10 days and to contact their healthcare provider if they exhibited SARS symptoms (Figure 2.4).

There are three categories of Health Alert messages:

- **Health Alert:** conveys the highest level of importance; warrants immediate action or attention.
- **Health Advisory:** provides important information for a specific incident or situation; may not require immediate action (Figure 2.5).

Table 2.2

SARS Diagnostics: Specimen Selection and Timing

SARS Diagnostics
Specimen Selection and Timing

Specimen	<1 week post symptom onset	1 - 3 weeks post symptom onset	>3 weeks post symptom onset
Serum (separator tube)	++	++	++
Blood plasma (EDTA)	++	+	-
Respiratory (BAL, sputum, nasal aspirate & wash, np/op swabs)	+	++	+
Stool	+	++	++

CDC SAFER • HEALTHIER • PEOPLE™

Source: CDC. (2003a). Public Health Guidance for Community-Level Preparedness and Response to SARS, Slide 15.
http://www.cdc.gov/ncidod/sars/pdf/sarsplanslides_diagnostics_103003.pdf

Figure 2.4

CDC Health Alert Notice

HEALTH ALERT NOTICE
for International Travelers
arriving in the United States from areas with SARS

TO THE TRAVELER: During your recent travel, you may have been near people who have a disease called SARS (severe acute respiratory syndrome). Please follow these steps:

- Please pay close attention to your health for the next 10 days.
- If you get sick with a fever or cough or have trouble breathing, make an appointment with a doctor.
- Before your visit, tell your doctor about your recent travel. This way steps can be taken to keep others from getting sick.
- Save this card and give it to your doctor if you become ill.

TO THE PHYSICIAN: The patient presenting this card may have recently traveled to an area where cases of SARS have been identified. If you suspect that this patient may have SARS, please contact your city, county, or state health officer (see <http://www.cdc.gov> or call the CDC Emergency Operations Center at 770-488-7100).

Source: CDC. (2003a). Public Health Guidance for Community-Level Preparedness and Response to SARS.
http://www.cdc.gov/ncidod/sars/travel_alert.htm

Figure 2.5

CDC Health Advisory

TRAVELERS ALERT**HEALTH ADVISORY
SEVERE ACUTE RESPIRATORY SYNDROME
(SARS)**

Please notify the ER or clinic personnel immediately

If you have traveled within the last 10 days from these high prevalence areas for SARS

- Mainland China or Hong Kong
- Singapore
- Hanoi, Vietnam
- Toronto, Canada

OR

If you have been in close contact with an individual(s) who have been diagnosed as having SARS

AND

If you have a fever or respiratory symptoms such as cough or shortness of breath.

Please wear a mask as you enter the area.

Source: CDC. (2003a). Public Health Guidance for Community-Level Preparedness and Response to SARS.

http://www.who.int/csr/sars/conference/june_2003/healthadvisory

- Health Update: provides updated information regarding an incident or situation; unlikely to require immediate action (CDC, 2004e).

Recommendations and Guidelines

CDC prepared guidelines for transmission control measures for both inpatient (hospitals) and outpatient (such as physician's offices) healthcare settings. There is no specific treatment for SARS, therefore, the CDC currently recommends that individuals suspected of having SARS be managed the same as any person with serious atypical pneumonia (2003a). Mild cases may be managed at home while more severe cases will require hospitalization including intravenous medication and oxygen supplementation. Ten to twenty per cent of patients will require mechanical ventilation (Kanof, 2003). The SARS-specific guidelines developed by the CDC will also improve the healthcare system's capacity to respond to other infectious disease outbreaks such as influenza.

Hospital infection control policies related to SARS should be guided by the level of SARS activity in the community and the hospital. The goals of the hospital, according to CDC, will include:

- Rapidly identify and isolate all potential SARS patients,
- Implement infection control practices and contact tracing to interrupt SARS-CoV transmission, and
- Ensure rapid communication within healthcare facilities and between healthcare facilities and health departments (CDC, 2004b).

Priority activities for hospitals include:

- Organize a planning committee to develop an institutional preparedness and response plan and a clear decision-making structure,
- Develop surveillance, screening, and evaluation strategies for various levels of SARS-CoV transmission,
- Develop plans to rapidly implement effective infection control measures and contact-tracing procedures,
- Determine the current availability of resources to care for SARS patients and strategies for meeting increasing demands,
- Develop strategies for meeting staffing needs for SARS patient care and management,
- Develop strategies to communicate with staff, patients, health departments and the public, and
- Develop strategies to educate staff and patients about SARS and SARS control measures (CDC, 2004b).

Community containment strategies are basic infectious disease control measures. Isolation of SARS patients separates them from healthy persons and restricts their movement to prevent transmission to others. It also allows for the delivery of specialized healthcare to ill persons. Quarantine of persons who have been exposed but who are not ill is intended to prevent further transmission in the event that they develop disease.

Impacts**Social and Economic**

The social and economic impact of the SARS outbreak in 2003 was tremendous. The cost incurred to determine the identification of the causative agent was great and research has been underway since then to expand the knowledge base and to discover a vaccine for the virus. WHO and CDC spent huge sums of money related to the SARS outbreak. Many staff were committed to writing and publishing documents on their web sites so all public health practitioners would have the latest information available. CDC also spent large sums of money publishing the notices for travelers in eight languages.

Business and industry felt tremendous impact from the outbreak as travel to many areas of the world was restricted and business decisions had to be delayed until travel could resume. The healthcare industry was particularly hard hit because of the increased numbers of staff needed to care for the large numbers of sick patients, the number of staff needed for out-patient clinics serving as screening facilities, and the significant number of healthcare providers that were among the really sick patients.

The social impact of the SARS outbreak centered around the large numbers of people who were either isolated or quarantined in an effort to control the spread of the disease. Closing schools, canceling gatherings, and implementing other measures for increasing social distance to slow disease transmission had an impact on families, workplaces, and entire communities.

Occupational Health Concerns/Issues

There were a number of occupational health concerns and issues related to changes in policies and procedures in a number of occupational settings. The big concern for worksites was how to provide a safe workplace while continuing to do the travel necessary to continue the business relationships with partners in all parts of the world. There was also a tremendous need for education and training for workers such as healthcare workers, dock/port workers, border patrol and customs personnel, airport personnel, business travelers, and laboratory personnel.

Healthcare Workers

The large numbers of healthcare workers who were infected with SARS had profound implications for occupational and environmental health nurses, especially those working in hospitals and other healthcare settings (Shapiro & McCauley, 2004). Two geographic areas that were affected were Hong Kong, where 386 healthcare workers contracted SARS and 8 of them died, and Canada, where more than 100 were affected (Shapiro & McCauley, 2004). The high rate of infection was likely caused by treatments such as bag-valve-mask ventilation, endotracheal intubation, cardiopulmonary resuscitation, and giving aerosolized medications without adequate PPE (Shapiro & McCauley, 2004). The disease spread rapidly because little information was available to the workers regarding the isolation required to contain the disease. As the disease progressed, gowns, masks, and gloves were in short supply. This created work force issues, especially in Canada, for the healthcare agencies and for the workers who were

unable to earn income during the quarantine period. Healthcare workers may have experienced a mix of feelings including guilt for possibly exposing their families to the disease, isolation, depression, and guilt feelings about missing work when they were sick or quarantined.

Emergency Medical Technicians deal with large numbers of persons who have symptoms of fever, headache, and other respiratory symptoms who are not infected with SARS. Physical isolation of a SARS infected patient is problematic for those in ambulances, although some vehicles have a separate ventilation system for the client and driver compartments. Both the driver and the client should be wearing respiratory PPE if there is shared ventilation. In Taiwan, of the 193 emergency department workers exposed to SARS, 4.7% were infected (Chang et al., 2004). Although universal precautions should be strictly followed when emergency department staff have contact with patients with a variety of symptoms, implementing infection control measures is more difficult in the emergency department than on the floors or intensive care units. Persons infected with SARS-CoV might present with only a mild febrile illness and minimal respiratory illness or be completely free of any clinical symptoms.

Border Patrol and Customs Personnel

Border patrol and customs personnel were asked to conduct health screening of travelers at posts of entry to prevent the spread of SARS among travelers during the SARS outbreak. They distributed SARS Health Alert Notices at major ports of entry to arriving passengers from areas known to have SARS

cases. These workers must protect themselves from exposure to SARS infected persons by utilizing infection control measures.

Airport Personnel

During the 2003 outbreak, the CDC and OSHA recommended that flight crews traveling to affected areas visit their healthcare providers 4 to 6 weeks before traveling to ensure that they were up to date on their shots. Flight crews were also advised to avoid large crowds while in affected areas and to wash their hands frequently with soap and water or alcohol-based hand rubs. CDC and OSHA recommended gloves be worn by airline ground personnel and cleanup crews as well as airport security and immigration workers. The CDC also recommended use of respirators and protective clothing by employees involved in the air transportation of SARS patients (2003a). Both OSHA and CDC developed guidelines that apply to laboratory workers, healthcare workers, and employees who handle the human remains of SARS patients. If a passenger is suspected of having SARS, providing additional information for crews cleaning that airplane is necessary. OSHA advised that personnel follow the recommendations published by the CDC, *Interim Guidance for Cleaning of Commercial Passenger Aircraft Following a Flight with a Passenger with Suspected Severe Acute Respiratory Syndrome (SARS)* (CDC, 2004f).

Business Travelers

Travel to SARS-affected areas creates the greatest health risk to U.S. employees. CDC issued a travel advisory recommending travelers postpone any nonessential trips to mainland China, Hong Kong, and Singapore during the 2003

outbreak. The Department of State warned U.S. residents to defer nonemergency travel to China and Vietnam. An interim travel alert was issued advising U.S. travelers to Canada to use caution when visiting Toronto. Employers have a legal obligation under the OSH Act to take affirmative steps to protect the health of employees traveling to SARS-infected areas on business. The OSH Act General Duty 5(a)(1) Clause requires employers to provide a workplace “free from recognized hazards that are causing or are likely to cause death or serious physical harm.” Employers can be cited for violating the General Duty Clause if they do not take reasonable steps to abate or address such a recognized hazard as employee exposure to an infectious disease such as SARS.

Screening and evaluating passengers for SARS like symptoms, educating them about SARS, and reporting illnesses in travelers can decrease the risk of travel-associated infections.

Laboratory Workers

After the April 2004 reoccurrence of SARS in China, the CDC sent a letter to laboratories that had been mailed live SARS-CoV alerting them to the laboratory-acquired infections. The letter reminded laboratories of the need to strictly adhere to biosafety level 3 procedures while working with the virus and provided web links to documents that outline laboratory procedures to be followed while working with SARS-CoV (CDC, 2004b).

WHO emphasized that scientists working with SARS virus need to handle inactivated material with caution and recommended that:

- Researchers use appropriate and internationally accepted methods for validating the inactivation of live viruses,
- Inactivated material be handled only in laboratories at biosafety level 2 or above,
- Researchers wear appropriate personal protective equipment,
- New inactivation methods be adopted only after rigorous testing, and
- Clear and comprehensive protocols available for inactivation techniques (WHO, 2004b).

Health of Geographic Areas

The health of an entire geographic area may be impacted by an outbreak of SARS, as was demonstrated in China. The large numbers of healthcare professionals who became ill and/or died greatly impacted the capacity of the system to care for the increasing numbers of infected individuals.

In the CDC document, *In the Absence of SARS-CoV Transmission Worldwide: Guidance for Surveillance*, early case detection is summarized,

In the absence of person-to-person transmission of SARS-CoV worldwide, the goal of domestic surveillance is to maximize early detection of cases of SARS-CoV disease while minimizing unnecessary laboratory testing, concerns about SARS-CoV, implementation of control measures, and social disruption (2004b, p. 3).

Communities must have plans in place to control a SARS outbreak such as establishment of designated sites for evaluation of possible SARS patients; screening of incoming and departing travelers at airports, ports, and border

crossings; and quarantine of close contacts of cases or of persons potentially exposed to SARS (CDC, 2004e).

SARS Research

The National Institute of Allergy and Infectious Diseases (NIAID), a component of the National Institutes of Health, is encouraging grant applications on the immunopathology of SARS, including studies on inflammation and airway hypersensitivity (2004). NIAID scientists have developed a mouse model of SARS which will allow the study of both the course of SARS infection and potential vaccines against the disease. NIAID is participating in a project to screen up to 100,000 antiviral drugs and other compounds, such as alpha interferon, for activity against SARS-CoV (2004).

In 2003, NIAID awarded contracts to Baxter Healthcare and Aventis Pasteur to produce experimental inactivated whole virus SARS vaccines. Once these vaccines are ready, clinical trials will be conducted. Scientists at NIAID's Vaccine Research Center in Bethesda, MD have developed an experimental SARS vaccine that prevents the SARS-CoV from replicating in laboratory mice. They are seeking the Food and Drug Administration approval to begin safety and immunology studies in people. NIAID and foreign scientists are collaborating to develop and test a variety of vaccines including standard killed virus vaccines and molecularly designed vaccines.

CHAPTER 3

EXPOSURE MANAGEMENT AT WORKSITES

Exposure management is the separation of infected persons from noninfected persons. This may be managed utilizing a number of techniques including surveillance, infection control, isolation, quarantine, preparedness plans, and communication.

Surveillance

“Surveillance, as defined by CDC and the CSTE, is an ongoing systematic collection, analysis, and interpretation of health data essential to the planning, implementation, and evaluation of public health practice and dissemination of information” (Rogers, 2003, p. 305). Decision makers need guidance for developing and implementing the best strategies for disease prevention and control programs.

The goals of surveillance are to maximize early detection of cases and clusters of respiratory infections that might signal the global re-emergence of SARS-CoV disease; maintain prompt and complete identification and reporting of potential cases to facilitate outbreak control; and identify and monitor contacts of cases of SARS-CoV disease to enable early detection of illness in persons at greatest risk (CDC, 2004e).

Lessons learned from the 2003 outbreaks have identified three features of SARS-CoV disease that can determine surveillance activities during periods when there are no worldwide transmission outbreaks:

- Most infected patients develop radiographic evidence of pneumonia.

- Most transmission occurs when patients are seriously ill and hospitalized.
- Most infected patients have an identifiable exposure source to a known SARS case or a location with known SARS cases (CDC, 2004d).

Surveillance then, should be aimed at identifying patients who require hospitalization for pneumonia or acute respiratory distress syndrome without identifiable etiology, and who have risk factors in the 10 days before the onset of illness that include: travel to mainland China, Hong Kong, or Taiwan or close contact with someone traveling to these areas or are part of a cluster of cases of atypical pneumonia (CDC, 2004d). Hospital infection control nurses and other healthcare personnel should be alert for clusters of pneumonia among two or more healthcare workers from the same facility (CDC, 2004d).

Public health officials and healthcare providers need to be informed about any changes of existing infectious disease control measures, the geographic progressions of an outbreak, and reports of disease occurrence (Kanof, 2003). Educating the public about an infectious disease and its symptoms will allow infected persons to seek medical attention as soon as possible to contain the spread. The news media can communicate to the public through government publications, direct inquiry, and by targeting sub-sets of the population such as groups or associated businesses or vocations (CDC, 2003b).

Rapid Identification of Infected Persons

During the 2003 SARS outbreak, healthcare providers identified cases by screening persons for fever, cough, and recent travel to a country with active cases of SARS. Public health officials worked to identify every person who

might have been infected with the disease. The lack of an effective and timely diagnostic test during the early stages of the disease outbreak was an obstacle in halting its spread. The incubation period of SARS helped U.S. healthcare workers to identify cases and close contacts of cases before those who actually had the SARS virus could spread the disease to others (Kanof, 2003). During the 2003 outbreak, hospital emergency room and other waiting room staff used questionnaires to screen incoming patients for fever, cough, and travel to a country with active cases of SARS. Individuals were asked to identify themselves to hospital staff if they met these criteria. A person identified as a potential SARS case was given a surgical mask and moved into a separate area for further evaluation. All healthcare workers should be empowered to initiate effective measures to protect themselves and others from potentially contagious diseases. This means that healthcare workers should be aware of potential clinical and epidemiological risk factors; have ready access to the equipment and knowledge needed to protect themselves and others; and be allowed to initiate the most appropriate infection-control measures immediately (WHO, 2004a).

Pneumonia Clusters

Quickly identifying possible clusters of respiratory illness is important in the control and detection of new or rare infectious diseases such as SARS (WHO, 2004a). Healthcare professionals need to consider SARS-CoV disease in patients who require hospitalization for radiographically confirmed pneumonia of unknown etiology *and* who have one of the following risk factors in the 10 days before illness onset:

1. 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
2. Employment in an occupation associated with a risk for SARS-CoV exposure, or
3. Part of a cluster of cases of atypical pneumonia without an alternative diagnosis (CDC, 2004e).

To assist healthcare providers working in fever clinics and emergency departments during the SARS outbreak, who routinely worked in other areas of healthcare, many hospitals developed treatment algorithms (Figure 3.1). Mechanisms for information exchange such as this is essential during an infectious disease outbreak.

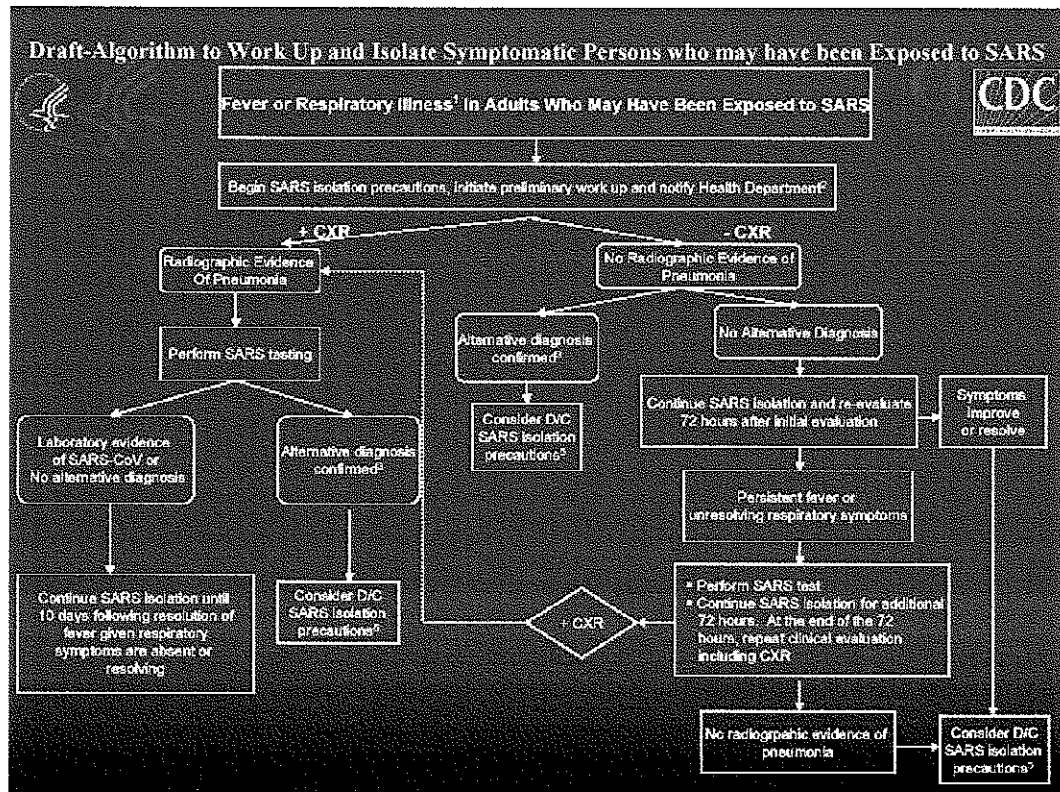
Infection Control Measures

Healthcare personnel in the workplace will also need to take infection control measures. These measures fall into three categories: standard, contact, and airborne (Khare et al., 2004).

- Standard precautions include hand washing with soap and water or alcohol-based cleansers and eye protection.
- Contact precautions consist of wearing a gown and gloves when contacting the employee and the employee's surroundings.
- Airborne precautions include placing the employee in an isolated, negative-pressure room and wearing an N-95 respirator.

Figure 3.1

Draft-Algorithm to Work Up and Isolate Symptomatic Persons Who May Have Been Exposed to SARS



Source: CDC. (2003a). Public Health Guidance for Community-Level Preparedness and Response to SARS.

http://www.cdc.gov/ncidod/sars/pdf/sarshealthcareprep_oct2003.pdf

WHO suggests that any medical equipment (i.e., stethoscope) with which a SARS patient has had contact also has the potential to transmit infection, and thus recommends cleaning these with disinfectant solutions (Khare et al., 2004). If there is a high index of suspicion for SARS disease, the patient should immediately be placed on SARS isolation precautions and all contacts of the ill patient should be identified, evaluated, and monitored.

Employers should consider the risk of workplace transmission of SARS by individuals who have recently traveled to SARS-infected areas or have had contact with a SARS patient. Employees who have had such contact and develop symptoms should be excluded from duty while fever and respiratory symptoms are present and for 10 days after symptoms disappear.

Hand Washing

Transmission control measures for SARS include contact precautions, especially hand washing after contact with someone who is sick. Hand washing must be done after each client contact and before the next client contact as well. Hands should be cleansed before putting on gloves, when removing gloves, and before each client contact.

Ventilation

Control of exposure is accomplished through the application of industrial hygiene principles such as ventilation approaches using high efficiency particulate aerosol (HEPA) filters. Primary containment of droplets containing SARS-CoV help prevent transmission in air.

It is important for hospitals to identify the best location in the hospital to establish a SARS unit in which patients and staff caring for them can be located (CDC, 2004g). Ideally this unit will have an air-handling system that allows the unit to be negative pressure to surrounding areas and allows for a pressure gradient with air flow from the “cleanest” (nurses area) to the “least clean” (patient room) areas (CDC, 2004g).

WHO recognizes that negative-pressure rooms are not always available in hospitals and almost never available at industrial sites. WHO suggests the following alternate isolation techniques in descending order: (1) single room with its own bathroom, (2) cohort placement in an area with an independent air supply, exhaust system, and bathroom facilities, or (3) place employee in a room in which the air conditioning can be turned off and the windows opened to a non-public area (Khare et al., 2004). Individuals suspected of having SARS should be placed in a negative pressure room as soon as possible after arriving at the facility.

Contact Tracing

Contact tracing is important in determining who is at risk for developing SARS. It is the identification and tracking of persons who have had close contact with someone who is infected or suspected of being infected with SARS-CoV. Healthcare workers need to be aware of the importance of asking about the health of close contacts of anyone with a potentially contagious respiratory illness.

The process of contact tracing is labor intensive and time consuming. Standardized forms, electronic contact, and case databases help the nursing staff manage contact tracing. Weekly meetings with staff from other hospital and

health department units ensure assistance is available if needed and everyone is up-to-date on information. Procedure manuals were developed in New York City to allow staff from other departments to be trained quickly if needed to assist members of the communicable disease department (Kanof, 2003).

Isolation and Quarantine

Exposure management practices such as isolation and quarantine were used in both healthcare and home settings to contain the SARS outbreak. In the U.S., the President signed an executive order on April 4, 2003, adding SARS to the list of quarantinable diseases (Appendix B). This executive order provides CDC with the legal authority to implement isolation and quarantine measures for SARS as part of its transmissible disease control measures (CDC, 2004f). The CDC's Division of Global Migration and Quarantine works with federal agencies, state and local health departments, the travel industry, and other organizations to prevent the introduction of communicable disease into the U.S. CDC has eight fully staffed quarantine stations that are part of the United States Public Health Service (USPHS) (CDC, 2004e). In North Carolina, local health directors and the state health director are empowered to exercise isolation and quarantine authority G.S. 130A-145. "Isolation authority" is the authority to limit the freedom of movement or action of a person or animal who actually *has* a communicable disease or condition G.S. 130A-2(3a). "Quarantine authority" most often refers to the authority to limit the freedom of movement or action of a person or animal that has been *exposed* to a communicable disease or condition, or to limit the freedom of movement or action of unimmunized persons during an outbreak G.S.

130A-2(7a). Quarantine and isolation orders cannot exceed 10 days. During the SARS outbreak in 2003, North Carolina did not need this legal authority but the measures were reviewed and ready for use if needed.

During the March – July 2003 outbreak of SARS, approximately 30,000 Beijing residents were quarantined in their homes or specified sites to control the epidemic (Li, Zeng, & Ou, 2003). When quarantine is used as part of a comprehensive SARS-control program, it should only be used for persons who have contact with an actively ill SARS patient in the home or hospital. If these guidelines had been used in China, the quarantine measures would have been reduced by 66% and this would have reduced resources expended for quarantine (Li, et al., 2003).

By the end of the SARS epidemic in Taiwan in 2003, 131,132 persons had been placed in quarantine, including 50,310 close contacts of SARS patients and 80,813 travelers from WHO-designated SARS-affected areas (MMWR, 2003d).

Exposure Reduction

During the 2003 SARS outbreak in China, many schools, daycares, and workplaces other than hospitals had to be closed for days and weeks due to the widespread nature of the disease. In Toronto, there was also closure of some schools and some floors of hospitals as well as clinics due to the large numbers of people affected by the outbreak.

During outbreaks of infectious diseases such as the SARS outbreak in 2003, it is often in the best interest of the public to cancel large gatherings of people such as concerts, ballgames, etc. because of the close personal contact that

these events cause and the likelihood of disease transmission. The SARS outbreak did result in many events being cancelled or rescheduled in China, Singapore, and Toronto. Non-essential workers were also asked to stay home from work.

If an employee has been diagnosed with SARS but is not hospitalized, the person still must not be allowed to return to the workplace because of the risk of transmission. The CDC suggests that even after the fever and other symptoms have resolved, the recovering employee should remain at home for at least 10 days (Khare et al., 2004).

Preparedness

Although SARS is not considered a traditional occupational disease, physicians and other healthcare workers practicing in occupational health settings may be the first healthcare professional with whom an individual with SARS comes in contact. It is important for all employers to have a SARS protocol for the workplace.

A consideration for SARS preparedness planning is the rapid identification of SARS cases and implementation of control measures (CDC, 2003a). Other important aspects are training, education, and information available to guide the public, public health professionals, clinicians, and healthcare communities to respond appropriately. Professionals in the area must also be educated including first responders, public safety professionals such as police, and even political leaders. The quality of the communications is very important. They must be accurate, science based, timely, comprehensible,

appropriately targeted, credible, and coordinated from a central point (CDC, 2003a).

It is important for each hospital, industrial site, government agency, and country to have written policies and procedures to follow in case another outbreak of SARS occurs. These written plans will outline the lines of authority and the responsibilities of each department or entity. Written policies and procedures will assure that the outbreak is quickly contained with much less impact than occurred with the 2003 outbreak.

The United States Government Interagency SARS Concept of Operations Plan (CONPLAN) outlines the Federal government's strategy for a timely, coordinated response by federal agencies to a SARS emergency and serves as the foundation for the development of operational plans and procedures at the local, state, and national levels (CDC, 2004c). Implementing the plan during an outbreak may be difficult due to limitations in both hospital and workforce capacity that could result in overcrowding as well as shortages in healthcare workers and medical equipment, particularly respirators.

The document is divided into four levels of increasingly detailed information: executive summary, core plan, stand-alone supplements that address the key measures for SARS preparedness and response, and appendices to each supplement that provide guidance and tools for local-level preparedness (CDC, 2004c). The document provides guidance on each of the following key components of SARS preparedness and response (CDC, 2004c):

- Command and control,

- Surveillance and information technology,
- Preparedness and response in healthcare facilities,
- Community containment measures, including non-hospital isolation and quarantine,
- Management of international travel-related transmission risk,
- Laboratory diagnostics,
- Communication and education,
- SARS investigations and epidemiologic research, and
- Infection control.

CDC Website

The CDC has maintained a website to communicate information since the early days of the SARS outbreak. The purpose of the information sharing is to instill and maintain the public confidence, contribute to order, minimize irrational fear or panic, facilitate public protection and mitigate stigma against individuals or groups (CDC, 2003b). The CDC facilitates public protection by providing consistent, comprehensible information that addresses information needs at all levels and clarifies inaccuracies, rumors, and misperceptions. The information on the CDC website provides clear guidance for minimizing personal risk and timely implementation of infection control measures including personal protection practices. CDC's *Public Health Guidance for Community-Level Preparedness and Response to SARS* (2003a) outlines an approach to assist public health officials in preparing for and responding quickly to the appearance of SARS-CoV in a community.

CDC assembled its SARS Preparedness Committee to prepare for the possibility of future SARS outbreaks. The Committee included eight working groups, each of which addressed a component of SARS preparedness and response: Surveillance, Clinical Management, Preparedness in Healthcare Facilities, Community Response, Laboratory Diagnostics, Information Technology, Communication and Education, and Special Studies (CDC, 2004b). The Committee prepared the document *Public Health Guidance for Community-Level Preparedness and Response to SARS*, which is posted on the CDC website.

Communication

The state/local communications plan must be ready to meet the communication needs during a SARS outbreak. An inventory of communications resources must be done to determine what printing or graphic design contracts are needed, the availability of cell phones, laptops, etc., and the surge capacity for hotlines and web servers. The status of the media relations must be considered along with the number of trained personnel.

The goal is to instill and maintain public confidence in the nation's public health system and its ability to respond to and manage the reappearance of SARS-CoV. Communication with the public will contribute to the maintenance of order, minimization of public panic and fear, and facilitation of public protection through the provision of accurate, rapid, and complete information before, during, and after a SARS outbreak. Another goal of communication is to address rumors and misperceptions as quickly as possible.

Education

The CDC provided guidance for persons traveling to areas where SARS cases had been reported. The following instructions were provided to travelers before they leave home.

- Assemble a travel health kit containing basic first aid and medical supplies. Be sure to include alcohol-based hand rub for hand hygiene.
- Inform yourself and others who may be traveling with you about SARS. Information about SARS is provided on CDC's SARS website www.cdc.gov/sars/.
- Be sure you are up to date with all of your shots, and see your healthcare provider at least 4-6 weeks before travel to get any additional shots or information you may need. Information on CDC's health recommendations for international travel is provided on CDC's Travelers Health website www.cdc.gov/travel/.
- You may wish to check your health insurance plan or get additional insurance that covers medical evacuation in the event of illness. Information about medical evacuation services is provided on the website of the U.S. Department of State www.travel.state.gov/medical.html.
- Identify in-country healthcare resources in advance of your trip (CDC, 2004f).

Other guidance was given if the traveler visited an area where SARS cases have been reported.

- As with other infectious illnesses, one of the most important and appropriate preventive practices is careful and frequent hand washing. Cleaning your hands often using either soap and water or a waterless, alcohol-based hand rub removes potentially infectious materials from your skin and helps prevent disease transmission.
- To minimize the possibility of infection, observe precautions to safeguard your health. This includes avoiding settings where SARS is most likely to be transmitted, such as healthcare facilities caring for SARS patients (CDC, 2004f).

Collaboration

Collaboration between federal, state, and local health agencies as well as the medical community was crucial to containing the spread of SARS. Through the collaboration of all the appropriate players, coordination of prevention activities could be maintained, roles could be identified and assigned, available resources could be shared, and subsequent evaluations could be conducted (Kanof, 2003). In the United States, the Department of Health and Human Services (DHHS) is the government's lead agency for the preparation, planning, and response to a SARS outbreak. As part of DHHS, the CDC has primary responsibility for tracking a SARS outbreak and managing the operational aspects of the public health response. The CDC will assist local and state resources for disease surveillance, epidemiologic response, diagnostic laboratory services,

education and communication, and disease containment and control (CDC, 2004f). The public health workforce consists of state and community agencies along with international agencies such as WHO and some nongovernmental agencies and organizations including professional societies, colleges, academic collaborators, and advocacy groups.

Dissemination of Information

The New York City and California Health Departments used e-mail health alert notices to inform private physicians about case identification procedures (Kanof, 2003). These notices directed physicians to information posted on the health departments' web sites. The health departments also provided information during meetings of the medical community. Physicians and other primary care givers needed advice on diagnostics, therapy, infection control precautions, and case management. Hospital administrators and infection control specialists needed education on infection control, engineering controls, and policies and procedure to institute. Healthcare workers needed education on infection control practices as well. Hospitals and clinics posted information for patients to read as soon as they arrived with instructions on how to proceed.

CHAPTER IV

ROLE OF OCCUPATIONAL AND ENVIRONMENTAL HEALTH NURSES

Prevention of the spread of SARS during a global outbreak is challenging for all public health practitioners, including occupational and environmental health nurses. In the workplace, OEHNs may be the first healthcare professional contacted by an individual exposed to the SARS virus. They must know the risk factors and signs and symptoms of SARS to make a nursing diagnosis and refer as needed. Because early recognition with appropriate treatment is the most powerful tool in preventing death, occupational and environmental health nurses are on the front line. Due to the virulence and short incubation period of this pathogen, SARS-CoV can potentially affect a large populated area in just a few days. The employee health departments in hospitals are particularly challenged to prevent spread within the clinical areas and must collaborate with area health departments and physicians to contain an outbreak quickly.

Assessment

During influenza season, occupational and environmental health nurses are faced with the task of evaluating clients with influenza-like symptoms and deciding when to refer the client for further evaluation. Recording a careful history is essential because SARS may appear similar to many systemic illnesses such as influenza. Knowledge of risk factors, occupational exposures, recent travel, and other health history can help in evaluation. Often clients may not

share information they do not think important. Therefore, a history must incorporate investigative inquiry to capture essential information.

Planning

OEHNs must be involved in the planning phase of the hospital or industrial site's response to an outbreak of SARS in the area. The plan must be written and must address all aspects of infectious disease control. OEHNs will spend a good amount of time coordinating the efforts of the various disciplines of public health during the planning phase and when a SARS outbreak occurs. OEHNs can bring together the ideas and concerns of safety, industrial hygiene, and administration to plan for a SARS outbreak.

Policy

A number of policy issues will need to be resolved during the planning phase and during the outbreak as well. Some of the issues concern return to work after travel to areas with active SARS cases, business travel being cancelled into areas with active SARS cases, and absence from work due to quarantine when family members are sick and employees have been exposed.

Budget

The budget for an industrial site or a hospital facility must allow for the extra expenses that will be incurred with an outbreak of SARS or any other emerging infectious disease. The SARS outbreak was very costly in some areas because of the need to purchase large quantities of masks and respiratory protection for patients, family members, and staff members. Because these items were in short supply, the price escalated quickly.

Staff

During an outbreak such as SARS, the strain placed on hospital staff was enormous. As more and more healthcare workers became sick, there were less and less workers to provide care. This resulted in hours of overtime for some healthcare workers. Staff had to be flexible and willing to transfer to departments in hospitals where the needs for staffing were greatest. Staff also had to be willing to work in areas in which they were less trained and care for those patients. This same scenario could occur in an industrial setting if an outbreak occurred where workers would need to operate pieces of machinery they were not accustomed to or work on a shift they were not normally assigned. This emphasizes the need for some cross-training in industry.

Training/Education

All employees with potential exposure should receive training. Training should cover hazards and protocols at the worksite to reduce exposures. The safety training that is conducted annually must include training on disease transmission and measures to protect against infectious diseases should there be an outbreak. Proper hand washing technique must be taught since it is a primary control measure for infectious diseases.

OEHNs must be well prepared and current with continuing education training to be able to prepare for and deal with an outbreak of an infectious disease. They must be familiar with concepts in industrial hygiene, safety, occupational health, loss prevention, toxicology, epidemiology, case management, human behavior and motivation, and research and statistics (Rogers, 2003).

OEHNs must also be educated and trained on the presenting symptoms of the infectious disease, such as SARS, and on routes of transmission. They also must be educated regarding the CDC guidelines for the disease and how to obtain the latest information and statistics for the disease. OEHNs must also be educated on the proper reporting protocol for infectious diseases.

Worksite Assessment/Analysis

SARS infections do not necessarily arise “out of and in the course of employment,” but many SARS cases have been work-related such as those occurring among laboratory technicians working with the virus (Khare et al., 2004). It is important for healthcare workers in occupational health settings to be familiar with the criteria for identifying potential SARS cases. OEHNs, safety specialists, and industrial engineers should perform a workplace assessment to identify rooms that have negative pressure or rooms that could be used to hold a SARS infected employee until he/she could be transferred to another facility or sent home.

Documentation

Early identification of an employee with SARS in the workplace is very critical for management of the symptoms and control of disease transmission. However, SARS should be considered as a possibility only if the employee’s symptoms meet the case definition of the CDC and WHO. SARS was added to the list of reported diseases in June 2003 and all healthcare workers must know how to properly report the disease both internally within their particular organization and externally to the proper authorities. Communication is important

to assure OEHNs in other nearby settings are aware of the levels of exposure and infection among workers in the area.

If the employee has mild respiratory symptoms with a temperature less than 100.4° F, but has recently traveled to an endemic area for SARS or had contact with a SARS patient, then the employee should be considered a potential case and considered as “possible SARS” (Khare et al., 2004). Unnecessary contacts between the “possible SARS” infected person and others in the workplace must be avoided.

The employee must be transferred to a healthcare facility for initiation of care without delay. The appropriate county and/or emergency department personnel should be notified (Khare et al., 2004). Workers who experience symptoms of SARS should be excluded from duty and referred to a healthcare provider.

Control Measures

It is important for OEHNs to have an outline of the control measures to use during an outbreak including engineering, administrative, environmental, and personal protective equipment. The rapid institution of the control measures may mean the difference between a single case of SARS and an outbreak in a facility.

Engineering

Engineering controls are designed to reduce employee exposure in the workplace by either removing or isolating the hazard or isolating the worker from exposure (Rogers, 2003). Resuscitation equipment, ventilation devices, and negative pressure rooms are all examples of engineering controls for SARS.

Administrative

Under the right circumstances, employers should consider asking employees and other individuals in the workplace to disclose nonbusiness travel to SARS-affected areas or contact with SARS patients. Employees may be allowed to work from home or required to remain away from work for ten days after returning from a SARS-affected area or after exposure to a SARS patient. Employee fears regarding SARS, particularly in workplaces with employees who have been exposed to the virus or who have traveled to SARS-infected areas, may result in attendance issues that can be combated with training regarding the illness. Employers must use caution however, to avoid violating one of the federal or state employment laws, particularly those governing the use of employee health information and prohibiting discrimination on the basis of perceived disability. Wage and hour laws may also present issues for employers who prohibit employees return to work after travel to SARS-infected areas.

Environmental

The employee should be placed in isolation, preferably a negative-pressure room, but if not available, then in a place separate from other employees. Having hand washing facilities readily available for employees along with antiseptic towelettes help to eliminate or minimize employee exposure.

Personal Protective Equipment

When there is occupational exposure, appropriate personal protective equipment such as gloves, gowns, aprons, masks, and eye protection will be provided to the employee. The employee's mouth and nose should be covered by

an N-95 mask. If this type mask is not available, then a surgical mask may be used (CDC, 2004h). Masks must be fitted to the individual, used and removed properly, and discarded after single use. Eye protection is an essential component of the PPE with SARS. OEHNs must monitor and enforce the use of personal protective equipment by employees.

Implementation

This includes maintaining the most current guidelines for managing SARS infections in the workplace. The guidelines address individual worker responsibility for monitoring and reporting. OEHNs should bookmark the CDC website for Public Health Guidance for Community-Level Preparedness and Response to SARS as this documents the lessons learned from the 2002-2003 outbreak and gives steps for implementing suggested practices (CDC, 2003a). It includes legal considerations, communications, laboratory functions, and other information for a community response.

It is important for OEHNs to have the current case definition of SARS and be aware of the prevalence of the disease both worldwide and in the community. OEHNs should be involved in educating and training workers within healthcare settings and industries to clarify the risks of infections if SARS reemerges.

OEHNs must be familiar with the presenting signs and symptoms of SARS, have excellent assessment skills, be able to quickly establish a relationship with the client and begin gathering data. OEHNs working in healthcare facilities need to track those staff members who may have been exposed to SARS-CoV through either a breach of infection control precautions or through unprotected

exposure during activities such as administration of aerosol respiratory treatment, emergency intubation, or bag-valve-mask resuscitation (Shapiro & McCauley, 2004). These employees need to be instructed to monitor their temperature twice daily for 10 days. Symptomatic workers in all settings should not return to work until 10 days after fever resolves, the respiratory symptoms have resolved, and full medical clearance is obtained (Shapiro & McCauley, 2004).

The co-workers of sick employees may need to be referred to the Employee Assistance Program or other counseling services to be able to resolve interpersonal or situational problems that have arisen and may be nonoccupational in origin. The issues may affect both the employees and their family members during an outbreak. Many employees may need to learn coping strategies to deal with the high stress levels created by a disease process in a family member. If isolation or quarantine were necessary, then counseling may be needed for employees to deal with feelings associated with those measures. There is always a need for counseling when a family member dies as a result of illness.

Triage

The level of surveillance and monitoring that occurred in Toronto during the SARS outbreak required as many as 1,800 individuals to be screened and triaged in one day (Shapiro & McCauley, 2004). This created a logistical nightmare for the staff. Possibly exposed workers in most settings may continue to work if they are afebrile, but healthcare workers with high risk exposures should not be permitted in any healthcare setting for 10 days following exposure (Shapiro & McCauley, 2004).

Procedures

Procedures must be written during the planning phase and then carefully followed during the outbreak phase. OEHNs in management positions must be involved in establishing procedures for the occupational health unit. "Procedures define specific actions to be taken to standardize the work and increase productivity" (Rogers, 2003, p. 489). Procedures should be dated, written in a consistent format that considers definition, purpose, materials/equipment, steps in the procedure, and documentation (Rogers, 2003). An example of a procedure related to a SARS patient is collection of biological specimens for testing.

Evaluation

Follow-up evaluations of the plan and implementation of the plan after an outbreak is over are crucial to improving the process. Follow-up evaluations of hospitals following the 2003 outbreak revealed they needed additional equipment and capital improvements including medical stockpiles, personal protective equipment, quarantine and isolation facilities, and handling and filtering equipment to enhance preparedness (Kanof, 2003). According to a survey of over 2000 hospitals, few have the equipment and supplies needed to handle a large-scale infectious disease outbreak (Kanof, 2003). Workforce capacity issues may also hinder implementation of infectious disease control measures since there is a lack of qualified and trained personnel, including epidemiologists.

CHAPTER V

CONCLUSIONS/RECOMMENDATIONS

During the 2003 outbreak there were a number of problems and lessons to be learned. Several affected areas had difficulty in providing necessary resources such as food, medicines, masks, and thermometers to individuals under isolation or quarantine. Many lessons were learned that could be helpful to the U.S. in the event of a resurgence of SARS.

Public health professionals, and particularly occupational and environmental health nurses, learned the importance of early identification of infected persons and their contacts to prevent an outbreak of an infectious disease such as SARS. They also realized how important it is to stay current regarding emerging infectious diseases and their early recognition and control. The effectiveness of safety precautions to control transmission and ensure the protection of healthcare workers was very evident in hospitals and clinics where infected clients were treated without staff becoming infected. OEHNs also learned that isolation and sometimes quarantine were necessary to contain emerging infectious diseases.

The workplace assessment and emergency preparedness plan are vital tools for OEHNs and the team of professionals charged with providing a safe and healthy workplace. It is critical that the entire plan and individual policies and procedures be reviewed annually to be certain that the worksite is ready to deal with an infectious disease outbreak such as SARS.

The SARS outbreak brought the healthcare professionals to the reality that there are implications for practice as well as research opportunities regarding emerging infectious diseases. Worldwide disease surveillance would facilitate prompt identification of a resurgence of SARS, allowing rapid implementation of infectious disease control measures that would reduce both the spread of SARS and the risk of a large outbreak (Kanof, 2003).

Future Research

As more is learned about the actions of SARS-CoV, it will be possible to design vaccines to prevent the disease. One such project is developing an “entry inhibitor” that prevents SARS-CoV from infecting human cells. The National Institute of Allergy and Infectious Diseases (NIAID) is funding development of humanized antibodies against SARS-CoV in hopes that they could be used to prevent infection from gaining hold in healthcare workers (2004). In 2003, NIAID awarded contracts to Baxter Healthcare and Aventis Pasteur to produce experimental vaccines (2004). Scientists have already developed a SARS vaccine that prevents the SARS-CoV from replicating in laboratory mice (National Institute of Allergy and Infectious Diseases, 2004). Researchers from the NIAID have found that an experimental vaccine, based on a piece of the SARS virus protein, protects mice from SARS infection (National Institutes of Health, 2004).

WHO will be working with expert groups to develop country and regional strategies to strengthen biosafety including:

- A containment policy to reduce the number of laboratories storing and working with SARS coronavirus,

- A legislative body to assist in the development, implementation, and evaluation of a national biosafety program and in the investigation of biohazard incidents and the dissemination of lessons learned to the global scientific community,
- A laboratory accreditation system based on standardized biosafety criteria,
- An occupational health service to monitor the well-being of laboratory workers, and
- Comprehensive biosafety and training programs in all diagnostic and research institutes (WHO, 2004a).

Swift communication among healthcare workers, public health officials, government agencies, as well as the public is necessary to contain an infectious disease. State and local health departments are enhancing existing surveillance systems and developing new systems to better detect outbreaks through public health surveillance.

Dr. Mike Magee summed up the SARS outbreak for *Health Politics* in the following words,

"SARS spread because it was initially unrecognized, not because it was untreatable or impossible to contain. Once it was recognized, infection control measures worked to contain it. The infection control strategies included: aggressive pursuit of contacts, shutting down the sources, quarantining potential future cases, and effectively interfacing public health specialty teams with clinical hospital leadership. For the future, we now

know that team readiness, a high index of suspicion, close monitoring, good planning, and vigilance are key to controlling outbreaks like the one in 2003” (Magee, 2004, p. 2).

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APPENDIX A

WHO Update

Update 11 - WHO recommends new measures to prevent travel-related spread of SARS

27 March 2003

WHO is today recommending new measures, related to international travel, aimed at reducing the risk of further international spread of severe acute respiratory syndrome (SARS).

The recommended measures include screening of air passengers departing from a small number of affected areas on flights to another country. The affected areas, where transmission of the SARS infectious agent is known to be spreading in a human-to-human chain, are kept under constant review and posted each day on the WHO web site. At present, only four countries are concerned. (see affected areas)

No additional precautions for the screening of departing passengers at airports in any other parts of the world are called for in today's recommendations.

The screening measures, recommended for consideration by national health officials and port authorities, involve an interview with passengers, departing from a limited number of areas, to detect illness with symptoms that give reason to suspect that a passenger may be infected with SARS.

National authorities may wish to advise travelers with fever, departing on international flights from the few areas where SARS transmission has been documented, to postpone travel until they feel better. All international travelers should be aware of the symptoms of SARS and seek immediate medical attention should symptoms occur. Clinicians hold virtual conference on management of SARS patients

Since global surveillance of SARS began at the end of February, some evidence suggests that a small number of suspected and probable cases of SARS have departed from the small number of affected countries on flights to other countries.

Most cases continue to occur in persons in close face-to-face contact with SARS patients. Close face-to-face contact could conceivably occur in an aircraft among persons seated close to a person infected with SARS and coughing or sneezing.

WHO has also issued detailed recommendations to airlines on steps to take should a suspected case of SARS be detected in flight. The WHO recommendations include advice on step-by-step procedures for following up fellow passengers on

APPENDIX A (Continued)**WHO Update**

the flight who may have had close contact with the possible case and the specific advice that should be given to these travelers and their families.

WHO recommends that contacts of a person be allowed to continue to travel so long as they do not have symptoms compatible with SARS.

The WHO case definition, which is being widely used for surveillance purposes, is posted at the WHO web site and is kept under constant review. Case Definitions for Surveillance of Severe Acute Respiratory Syndrome (SARS)

Many national health authorities have also issued SARS-related advice to international travelers.

Source: WHO. (2003c). Update 11 – WHO recommends new measures to prevent travel-related spread of SARS, http://www.who.int/csc/sars/archive/2003_03_27/en

APPENDIX B**Legal Code for Isolation and Quarantine****UNITED STATES CODE****TITLE 42 - THE PUBLIC HEALTH AND WELFARE****CHAPTER 6A - PUBLIC HEALTH SERVICE****SUBCHAPTER II - GENERAL POWERS AND DUTIES****Part G - Quarantine and Inspection****§ 264. Regulations to control communicable diseases****(a) Promulgation and enforcement by Surgeon General**

The Surgeon General, with the approval of the Secretary, is authorized to make and enforce such regulations as in his judgment are necessary to prevent the introduction, transmission, or spread of communicable diseases from foreign countries into the States or possessions, or from one State or possession into any other State or possession. For purposes of carrying out and enforcing such regulations, the Surgeon General may provide for such inspection, fumigation, disinfection, sanitation, pest extermination, destruction of animals or articles found to be so infected or contaminated as to be sources of dangerous infection to human beings, and other measures, as in his judgment may be necessary.

(b) Apprehension, detention, or conditional release of individuals

Regulations prescribed under this section shall not provide for the apprehension, detention, or conditional release of individuals except for the purpose of preventing the introduction, transmission, or spread of such communicable diseases as may be specified from time to time in Executive orders of the President upon the recommendation of the National Advisory Health Council and the Surgeon General.

(c) Application of regulations to persons entering from foreign countries

Except as provided in subsection (d) of this section, regulations prescribed under this section, insofar as they provide for the apprehension, detention, examination, or conditional release of individuals, shall be applicable only to individuals coming into a State or possession from a foreign country or a possession.

(d) Apprehension and examination of persons reasonably believed to be infected

On recommendation of the National Advisory Health Council, regulations prescribed under this section may provide for the apprehension and examination

APPENDIX B (continued)**Legal Code for Isolation and Quarantine**

of any individual reasonably believed to be infected with a communicable disease in a communicable stage and (1) to be moving or about to move from a State to another State; or (2) to be a probable source of infection to individuals who, while infected with such disease in a communicable stage, will be moving from a State to another State. Such regulations may provide that if upon examination any such individual is found to be infected, he may be detained for such time and in such manner as may be reasonably necessary. For purposes of this subsection, the term "State" includes, in addition to the several States, only the District of Columbia.

265. Suspension of entries and imports from designated places to prevent spread of communicable diseases

Whenever the Surgeon General determines that by reason of the existence of any communicable disease in a foreign country there is serious danger of the introduction of such disease into the United States, and that this danger is so increased by the introduction of persons or property from such country that a suspension of the right to introduce such persons and property is required in the interest of the public health, the Surgeon General, in accordance with regulations approved by the President, shall have the power to prohibit, in whole or in part, the introduction of persons and property from such countries or places as he shall designate in order to avert such danger, and for such period of time as he may deem necessary for such purpose.

§ 266. Special quarantine powers in time of war

To protect the military and naval forces and war workers of the United States, in time of war, against any communicable disease specified in Executive orders as provided in subsection (b) of section 264 of this title, the Surgeon General, on recommendation of the National Advisory Health Council, is authorized to provide by regulations for the apprehension and examination, in time of war, of any individual reasonably believed (1) to be infected with such disease in a communicable stage and (2) to be a probable source of infection to members of the armed forces of the United States or to individuals engaged in the production or transportation of arms, munitions, ships, food, clothing, or other supplies for the armed forces. Such regulations may provide that if upon examination any such individual is found to be so infected, he may be detained for such time and in such manner as may be reasonably necessary.

§ 267. Quarantine stations, grounds, and anchorages

(a) Control and management Except as provided in title II of the Act of June 15, 1917, as amended (50 U.S.C. 191 et seq.), the Surgeon General shall control, direct, and manage all United States quarantine stations, grounds, and anchorages,

APPENDIX B (continued)**Legal Code for Isolation and Quarantine**

designate their boundaries, and designate the quarantine officers to be in charge thereof. With the approval of the President he shall from time to time select suitable sites for and establish such additional stations, grounds, and anchorages

in the States and possessions of the United States as in his judgment are necessary to prevent the introduction of communicable diseases into the States and possessions of the United States.

(b) Hours of inspection The Surgeon General shall establish the hours during which quarantine service shall be performed at each quarantine station, and, upon application by any interested party, may establish quarantine inspection during the twenty-four hours of the day, or any fraction thereof, at such quarantine stations as, in his opinion, require such extended service. He may restrict the performance of quarantine inspection to hours of daylight for such arriving vessels as cannot, in his opinion, be satisfactorily inspected during hours of darkness. No vessel shall be required to undergo quarantine inspection during the hours of darkness, unless the quarantine officer at such quarantine station shall deem an immediate inspection necessary to protect the public health. Uniformity shall not be required in the hours during which quarantine inspection may be obtained at the various ports of the United States.

Source: U.S. Codes (2003). *Title 42: Regulations to Control Communicable Diseases*. Retrieved November 12, 2004 from [http://caselaw.lp.findlaw.com/cascode/uscodes/42/chapters/6a/subchapters/ii/part s/g/section_264.html](http://caselaw.lp.findlaw.com/cascode/uscodes/42/chapters/6a/subchapters/ii/part%20s/g/section_264.html)