The War on Severe Acute Respiratory Syndrome: United States Forces Korea's Campaign Plan

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A mysterious new respiratory illness known as severe acute respiratory syndrome (SARS) has become the most perplexing infectious disease to emerge in the 21st century. From March to May 2003, it competed daily with the war in Iraq as the most sensational media event of the moment. U.S. personnel serving in the Republic of Korea represented the largest U.S. military population at risk for SARS. With tensions growing between Pyongyang and Washington, the United States/Republic of Korea alliance could not afford to be rendered combat ineffective by SARS. To remain mission ready, the U.S. Forces Korea (USFK) commander declared a "War on SARS" and directed his medical staff to develop a plan to prevent a SARS outbreak among USFK personnel. This article outlines the USFK campaign plan for the SARS epidemic and documents lessons learned for future outbreaks of highly infectious diseases.

Introduction

 $\bf S$ evere acute respiratory syndrome (SARS) is a viral respiratory illness that first emerged in China in November 2002. SARS is caused by a coronavirus, called SARS-associated coronavirus. 1 The 2003 emergence of this disease in the Pacific Rim was especially concerning to U.S. Forces Korea (USFK), which serves as the world's first line of defense against an attack from North Korea. During a time when North Korea continues to antagonize the world with its nuclear program, USFK personnel must be ready to transition to hostilities at a moment's notice and cannot afford to be debilitated by illness. By treating SARS as an enemy that had to be defended against, USFK presented a uniquely proactive response to this emerging threat and was able to successfully institute a major program to mitigate the impact of this disease if significant Korean importation occurred. USFK regarded the date of the global alert for the SARS virus (March 12, 2003) as Epidemic Day or "E-Day," which represented the day the epidemic began.

Background

In its infancy, SARS was a relatively obscure phenomenon and received little attention outside medical surveillance programs. It was not until a medical professor who treated SARS patients in China's Guangdong Province became ill while spending the night of February 21, 2003, in the Metropole Hotel in Hong Kong that the disease migrated outside southern China. Twelve other guests from the hotel subsequently were infected and became the initial patients to spread the disease globally. By late March, the virus was rampant in other countries within

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the Pacific Rim, and the mysterious new virus started receiving international media attention.² The USFK commander expressed his concerns to the USFK command surgeon on March 29, 2003, and declared the "War on SARS."

Initial Response

The areas struggling most with SARS (Hong Kong, Mainland China, and Vietnam) are popular vacation destinations for USFK personnel and their families. With "spring break," a popular travel period, quickly approaching, the USFK command surgeon realized prudent action was critical to prevent an outbreak on the Korean Peninsula among USFK personnel (USFK personnel are defined as soldiers, sailors, airmen, Marines, Department of Defense [DoD] civilian personnel, family members, DoD Schools employees, and DoD contractors). He directed his preventive medicine officer and his intelligence officer to form a SARS surveillance team, to monitor the SARS situation, and to establish direct communication with the Korean Armed Forces Medical Command, the Korean National Institute of Health, and the U.S. Armed Forces Medical Intelligence Center (AFMIC) to keep abreast of the situation. This SARS surveillance team closely tracked the spread of the virus and established direct communication with the U.S. military liaison officer to both the World Health Organization (WHO) and the Centers for Disease Control and Prevention (CDC), to receive the most up-to-date information and latest developments on SARS.

Medical Intelligence

During the last 2 weeks of March 2003, SARS began to spread throughout the Pacific Rim, as well as North America and Europe, prompting the U.S. State Department to issue a travel advisory on March 28, 2003, urging people planning elective or nonessential travel to Mainland China, Hong Kong, Singapore, or Vietnam to postpone their trips until further notice.³ USFK immediately disseminated this travel advisory, recommending that service members and their families not visit these locations except for mission-essential activities. However, the recommendation to the USFK command surgeon from his SARS surveillance team was that the USFK commander should issue a travel restriction for Mainland China and Hong Kong, because of local transmission of the virus in those two locations. This recommendation was approved on April 3, 2003, and stated, "All DoD personnel, including DoD civilians assigned to or working in Korea, are prohibited from official travel to, or through, Mainland China and Hong Kong until further notice. All DoD military personnel are prohibited from unofficial travel to, or through, Mainland China and Hong Kong until further notice. USFK

family members, DoD Schools employees, and DoD contractors are strongly encouraged to cancel or postpone travel to these regions until further notice."⁴

USFK Criteria for Travel Restrictions and Advisories

The SARS surveillance team determined that there was a need to develop criteria upon which to base recommendations to the USFK commander regarding adding new countries to the travel restriction and travel advisory lists. The SARS surveillance team developed three indicators to be monitored, namely, new cases and deaths, local transmission, and USFK travel patterns and AFMIC assessment. (One of the primary missions of the AFMIC is to assess foreign medical capabilities and to rate them as excellent, good, fair, or poor. More details on the program are available at http://mic.afmic.detrick.army.mil/.) If certain thresholds were met for any one of these, then a recommendation would be made to the commander. The thresholds for these criteria were intentionally set lower than those of the WHO, CDC, or any other organization, to ensure maximal protection for USFK personnel. (1) For new cases and deaths, a travel advisory would be issued for a country if the number of new cases was >5 per day for 2 consecutive days or if the cumulative number of deaths exceeded 10. A travel restriction would be implemented for a country if the number of new cases was >10per day for 2 consecutive days or if the cumulative number of deaths exceeded 20. (2) For local transmission, a travel advisory would be issued if the WHO reported the presence of local transmission. A travel restriction would be implemented if the WHO reported the presence of sustained local transmission. (3) For USFK travel patterns and AFMIC assessment, a travel advisory would be issued for countries frequently traveled to by USFK personnel that also had an overall AFMIC host nation medical assessment of fair. A travel restriction would be implemented for countries frequently traveled to by USFK personnel that also had an overall AFMIC host nation medical assessment of poor.

Because some individuals might wish to risk traveling to SARS-affected locations not identified as restricted, the following guidelines were disseminated at all military travel offices and ticketing agencies in Korea by the 18th Medical Command Preventive Services Division. (1) Avoid crowds or persons who are coughing or have flu-like symptoms. (2) Perform frequent handwashing, especially after being out in public and before eating. (3) Report for medical examination/evaluation if any of the following symptoms appear: temperature of >100.4°F or symptoms similar to flu (headache, muscle aches, sore throat, cough, shortness of breath, or difficulty breathing).

The SARS surveillance team also developed criteria for removing countries from the travel advisory and restriction lists. Again, these criteria were much more limiting than those used by the WHO. The intent was to be very cautious, to ensure that USFK personnel remained safe and combat ready.

Crisis Action Team

The rapid spread of the disease and the increasing mortality rates of SARS worldwide prompted the USFK command surgeon to assemble his staff and consultants to draft a detailed response plan for a potential SARS outbreak on the Korean Peninsula. On March 15, 2003, medical planners and clinicians

from three levels of command (USFK, Eighth U.S. Army, and 18th Medical Command), as well as three military services (Army, Air Force, and Navy), came together and formed a medical crisis action team (CAT). The initial guidance from the commander was to prevent a USFK epidemic and to take any and all reasonable, feasible, and logical measures to prevent an outbreak. In the eventuality that an outbreak occurred, then the CAT was to contain the spread of SARS before it could significantly affect the health and readiness of USFK servicemen, their family members, and civilians on the Peninsula. The CAT convened on Friday, April 4, 2003, and began the military decisionmaking process designed to give the commander various courses of action to respond to the crisis. The commander issued a mission statement that stated, "Take proactive actions to prevent an outbreak of SARS within the USFK population, and if prevention fails, contain an outbreak before it affects unit readiness or community health, so that there is no interruption of USFK missions, operations, or training."5

Understanding the Enemy

Because SARS was a new viral respiratory illness of unknown origin, development of a comprehensive response was difficult. The CAT, along with the rest of the world, had little initial information on the virus. SARS was described among patients throughout Asia, North America, and Europe beginning as early as November 2002. Various sources, including the WHO, reported that SARS generally began with fever and other flu-like symptoms and often progressed to respiratory problems such as dry cough and difficulty breathing. In retrospect, the illness sometimes did not progress to a severe respiratory phase, with the severity of the illness widely ranging from mild illness to death. SARS was primarily transmitted through close contact with an infected person, although some cases of transmission were found to have occurred through only indirect contact. Air travel appeared to be the primary source for the spread internationally.6

Identifying Key Tasks

The CAT identified several key tasks that became critical to accomplishing its mission and meeting the commander's intent of protecting all USFK personnel from the spread of SARS. These key tasks were (1) to recommend travel restrictions; (2) to encourage travel advisories; (3) to disseminate public information/education; (4) to screen all at-risk individuals immediately; (5) to quarantine all high-risk exposures locally; (6) to develop prehospital, transportation, and hospitalization plans; (7) to develop agent-specific responses for both naturally occurring and biological warfare-induced episodes of disease outbreak; (8) to conduct daily battle update briefs for the USFK command surgeon; and (9) to keep the USFK commander informed daily.

This initial response plan was released as a USFK operations order on April 8, 2003.⁵ This operations order tasked USFK component (U.S. Air Forces Korea, Eighth U.S. Army, U.S. Naval Forces Korea, U.S. Marine Forces Korea, and U.S. Special Operations Command Korea) commanders (1) to promote coordination with Korean civilian and military agencies for SARS prevention; (2) to produce component service containment plans to limit exposure and cross-contamination; (3) to develop intrath-

eater movement plans for infected or exposed personnel; (4) to educate personnel on improving their sanitary procedures; (5) to develop isolation, hospitalization, and surgical plans; (6) to protect medical personnel; (7) to educate health care providers; and (8) to prevent undue anxiety.

After the initial operations order was published, the CAT began to develop tactics, techniques, and procedures for accomplishing the key tasks identified above. These tactics, techniques, and procedures are summarized in the USFK SARS Protocol Matrix used by all USFK health care providers (Fig. 1).

Medical Screening

The CAT realized that, despite the SARS travel restrictions, there would be a need for certain people to travel to SARS-infected countries for official duty, and it recognized that some civilians might ignore the travel advisories and restrictions. Consequently, it was decided that a robust preventive medicine initiative was the key to limiting the spread of SARS. This initiative included health surveillance, medical screenings, contact tracing, data collection, reporting, and follow-up surveillance. Following through with this initiative required the USFK surgeon's cell to establish a mandatory medical screening policy for all individuals who returned from a SARS-infected country. This policy directed commanders to identify all personnel who had traveled to restricted or advisory locations within the past 30 days and to ensure that they were expeditiously screened for SARS symptoms by trained medical personnel. This created a

monumental challenge for the medical staff members currently providing health care across the Peninsula. They met the challenge by establishing the 18th Medical Command 24-hour SARS hotline (737-SARS). All U.S. personnel who traveled from Korea to a SARS-infected country were identified by their commanders. The hotline allowed trained medical personnel to telephonically screen people who traveled to SARS-infected countries and cities immediately upon their return, without requiring them to physically see a health care provider. If any of these individuals were found to meet the criteria for significant exposure, suspect SARS, or probable SARS, then they would immediately be referred to their nearest medical treatment facility (MTF). A stay in a SARS-affected country for >2 weeks was considered presumptively to be a significant exposure requiring a mandatory 10-day well quarantine (see below) even for persons without any symptoms, including personnel deployed to these locations for official duty.

USFK Definitions of SARS

USFK classified the threat of SARS into three distinct categories, i.e., significant exposure, suspect, and probable, whereas the WHO and the CDC only defined suspect and probable SARS.⁷ A traveler could be classified as having significant exposure by USFK (or by military health care personnel) if, in the medical opinion of the health care provider, it was determined that they had visited a hospital that cares for SARS patients, had concerning contact or proximity with someone with SARS,

Classification Categories	Diagnostic Criteria	Management Measures	Laboratory Studies	Treatment Guidelines	Release Criteria
Normal Exposure Unlikely {No Quarantine}	N/A	•Public Education •Preventive Measures •Avoid Exposure - Travel Restrictions - Travel Advisories	N/A	N/A	N/A
Exposed SARS Significant Exposure {Well Quarantine}	*Requires HCP Screen *Meets Exposure Criteria: 1. Contact with an ill or sick appearing person 2. Lived with ill person at home, apt or hotel 3. Visit to SARS Hospital 4. Travel & /or Stay in a SARS Area > 2 wks {may meet any criteria above}	•Well Quarantine {no visitors} - Home / Individual's Residence - Installation Location {On-Post} •Q3Day CHN Phone Assessment •Education for Patient, Family & Support/Housekeeping Personnel •Notify Unit Commander •Reported to Preventive Med Svcs •Reported to USFK Surgeon	None	None	•10 days post SARS exposure <u>and</u> SX-free for 3 days •Cleared by CHN •F/U Instructions •RTD Slip DD 689 •Signed SF600 •Notify Unit CDR •SARS Registry
Suspect SARS Exposure with Signs and Symptoms {Sick Quarantine}	*Requires HCP Screen *Meets Syndrome Criteria: 1. Fever > 100.4 2. Respiratory SXs / Cough 3. Within 10 days contact of; - suspect / probable SARS - travel to SARS Area {must meet all 3 criteria above}	-Sick Quarantine {no visitors} - Home / Individual's Residence - Installation Location (On-Post) - Hospitalize at 121, Osan or HN - Ql Day CHN Phone Assessment - Education for Patient, Family & Support/Housekeeping Personnel - Notify Unit Commander - Reported to PMS & USFK Surg - Reported to CSEOUL	CBC, CHEM 12, UA Blood/Sputum Cultures Stored Serum - Acute & Conv Titers - Future Studies Pulse Oximetry Chest X-Ray Others as necessary - clinically determined	•Supportive Care •Clinically Guided Treatment Protocols	•SX-free for 10 days •Cleared by CHN •F/U Instructions •RTD Slip DD689 •Signed SF600 •Notify Unit CDR •SARS Registry
Probable SARS {Sick Quarantine or Hospital Admission}	•Requires HCP Screen •Meets "Suspect SARS" Criteria •In addition, must have: Positive CXR Or Positive PCR Test	Use Suspect SARS Mgmt Plus:	•CBC, CHEM 12, UA •Blood/Sputum Cultures •Stored Serum - Acute & Conv Titers - Future Studies •Pulse Oximetry •Chest X-Ray •Others as necessary	•Supportive Care •Clinically Guided Treatment Protocols •Hospital Care •En Route Care	•SX-free for 10 days •Cleared by PMS Eval •Discharge Instructions •RTD Slip DD689 •Signed SF600 •Notify Unit CDR •SARS Registry

KEY: HCP = Health Care Provider | CHN = Community Health Nurse | CXR = Chest X-Ray | F/U = Follow Up | PCR = Polymerace Chain Reaction | RTD = Return To Duty | PMS = Preventive Medicine Services | Q3D = Every 3 Days | SX = Symptoms | SARS = Severe Acute Respiratory Syndrome

Fig. 1. USFK SARS Protocol Matrix, published by the Surgeon's Section, USFK, in collaboration with the 18th Medical Command. HCP, health care provider; CHN, community health nurse; CXR, chest X-ray; F/U, follow-up; PCR, polymerase chain reaction; RTD, return to duty; PMS, Preventive Medicine Services; Q3D, every 3 days; SX, symptoms; N/A, not applicable; CBC, complete blood count; CHEM, chemical panel; UA, urinalysis; CDR, commander; HN, host nation; CCSEOUL, Command Center Second

or had visited a SARS-afflicted country for >2 weeks. Consistent with the mostly universally followed WHO definition, a suspect case of SARS existed when a person had a fever of ≥100.5°F in conjunction with respiratory symptoms such as a cough or difficulty breathing, along with the establishment of a known epidemiological link to another SARS patient or travel to a SARS-affected area. A probable case of SARS was determined when chest X-rays indicated there was radiographic evidence of infiltrates consistent with pneumonia or respiratory distress syndrome, with previous exposure, or a laboratory confirmation of the presence of SARS-associated coronavirus was made with either polymerase chain reaction or enzyme-linked immunosorbent assay specimen testing.

Quarantine Procedures

The SARS Protocol Matrix (Fig. 1) outlined the USFK response to the virus and identified the need to establish quarantine procedures for personnel with significant exposure to the SARS virus. Local medical personnel, through a detailed screening process, determined whether quarantine was warranted. Three types of quarantine were established for USFK personnel. (1) Well quarantine was reserved for persons with significant exposure but no SARS symptoms. This would require individuals to remain at home or persons living in barracks to be housed at a designated location at their installation for a period of 2 weeks. These persons would receive daily telephonic check-ups by medical personnel, to ensure that no symptoms developed. (2) Sick quarantine was reserved for persons with significant exposure and SARS symptoms not requiring hospitalization. This would also require individuals to remain at home or personnel living in barracks to be housed at a designated location, separate from well quarantine facilities, at their installation. However, these persons would receive daily health screenings from medical personnel, to ensure that symptoms did not become life threatening. (3) Hospitalization and isolation were reserved for persons with significant exposure and significant SARS symptoms requiring hospital care.

Installation commanders in charge of military facilities had to be prepared to provide the necessary support and resources in support of a decision to quarantine or isolate individuals. In fact, all installations were required to submit their quarantine plans to the USFK command surgeon for approval. The decision to remove personnel from quarantine, isolation, or hospitalization would be made by the attending physician.

Education and Public Awareness

In an effort to minimize anxiety among USFK personnel and their families, USFK public affairs, along with designated medical personnel, implemented a multimedia public information campaign to educate USFK personnel on SARS. This campaign was designed to ensure that all levels of USFK leadership communicated a coordinated military position to internal audiences, the media, and the general public regarding SARS within Korea and referred them to the SARS hotline if they had any questions concerning the virus. This campaign plan encompassed local newspapers, television and radio broadcasts, town hall meetings, and commander's forums, as well as a SARS page on the USFK web site.

Increasing Infection Rates

As the infection rate of SARS patients continued to increase in April 2003, a frightening trend was discovered. The infection rate among health care workers was nearly 30% worldwide. The fear that routine infection control methods were not sufficient to prevent the spread of the deadly new virus gripped the medical community. On April 10, 2003, USFK medical personnel implemented more-stringent standards for dealing with potential SARS patients. Signs warning persons who had traveled to SARS-active areas not to enter the hospital but to proceed to a specially designated SARS evaluation area outside were posted at all entrances to MTFs (Fig. 2). Appointment clerks were educated to ask about SARS possibility for all patients requesting appointments and referred those with SARS concerns to the SARS evaluation area. Front-desk personnel were trained to screen for SARS concerns among patients initially entering the clinic. Because of the fear of infection, all health care providers were required to use the following during all contact with potential SARS-infected patients⁸: (1) respirators, i.e., an approved N95 respirator (mask) that had been properly fit-tested; (2) gloves, i.e., two layers of clean nonsterile gloves that provided a snug fit over the wrist, as an additional measure and not as a substitute for proper hand hygiene; (3) disposable coveralls with hoods, i.e., long-sleeved gowns or laboratory coats with hoods were required when entering the room of a patient with suspect or probable SARS and needed to be removed before leaving the patient's room; (4) shoe covers, i.e., shoe covers would be worn in conjunction with the coveralls, and disposable clothing would be used whenever possible; and (5) eye protection, i.e., goggles or full-face masks were required when providing direct patient care, even if the patient was wearing a mask.

Quarantine Facilities

From the beginning, the USFK command surgeon made it clear that he did not want any patients with suspect or probable



Fig. 2. SARS warning sign outside the 121 General Hospital, Seoul, South Korea.

SARS treated within existing MTFs. Medical surveillance indicated that health care facilities were the most notorious for spreading the virus. Therefore, the CAT recognized the immediate need to establish alternative locations to treat potential SARS patients. A temporary solution was to erect climate-controlled temper tents located in the vicinity of major military medical facilities throughout the Peninsula. This would reduce the threat of a SARS patient spreading the virus to other patients and health care providers within the hospitals. However, the SARS epidemic highlighted the need to construct a permanent biohazard isolation/treatment facility designed to house and to treat multiple, highly infectious patients simultaneously. The CAT researched numerous locations to establish this facility and decided on a partially vacant building only a few blocks from the 121 General Hospital in Seoul, the largest U.S. military hospital in Korea. Funding for the facility was quickly obligated, and the project took only 7 days from initial design to construction, which began on April 30, 2003. The total expense, including construction costs, was \$350,000, which included equipment, supplies, and civilian employee overtime labor associated with getting the facility constructed quickly. A large majority of the equipment (nearly \$240,000) for this new facility was transferred from U.S. Air Force war-contingency stocks in Kimhae, providing the facility with state-of-the-art equipment including two negative-pressure rooms providing eight beds each, with a positive-pressure nurses station. The new biological isolation ward was prepared to receive infected patients on May 9, 2003.

Lessons Learned

This experience provided numerous lessons for military personnel stationed in Korea. The most important was the need for command emphasis and commitment from senior leaders to support proven control measures, including travel advisories and restrictions, contact tracing and follow-up surveillance, and quarantine and isolation. Other lessons learned during the War on SARS included (1) ensuring that the entire Joint Staff is represented during the initial military decision-making process; this ensures that all aspects of the crisis, specifically intelligence, legal, public affairs, and logistics issues, are considered; (2) ensuring that installation commanders identify potential quarantine facilities and understand their requirements to man and maintain these facilities for extended durations; (3) maintaining a dedicated medical surveillance team trained to monitor outbreaks, to analyze trends, and to make timely recommendations to the commander based on predictive analysis; (4) establishing professional working relationships between U.S. military and host nation military and civilian health care agencies before a disease outbreak; this ensures that there is little lag time in passing on critical medical information in times of crisis; (5) erring on the side of caution when issuing travel advisories, restrictions, and quarantine orders; and (6) developing agent-specific responses for both naturally occurring and biological warfare-induced episodes of disease outbreak.

Conclusions

By the 100th day, SARS had infected >8,000 persons worldwide and caused >800 deaths. Nearly 90% of these infections occurred in the Pacific Rim.9 Although international travel did import probable SARS cases to the Korean Peninsula and 42 USFK personnel were quarantined, not a single suspect or probable case emerged among USFK personnel. We may never truly know the reason why the SARS epidemic avoided Korea, but the immediate recognition of the threat by medical surveillance team members, the rapid production of a SARS response plan by the CAT, and the tremendous command emphasis on control measures at all levels acknowledge the commitment by USFK personal to respond to this threat. The global outbreak of SARS seems to be under control. However, the need for vigilance has not diminished. As long as there is limited knowledge of the illness and no effective vaccine, there is a risk of a rapid reoccurrence. Although SARS was the first severe and readily transmittable new disease to emerge in the 21st century, the infection and mortality rates were minimal, compared historically with other highly infectious diseases. It is imperative that USFK personnel, as well as other U.S. forces stationed around the world, continue to improve their response plans and to incorporate these lessons learned.

Acknowledgments

The majority of the information presented in this article was derived from the daily SARS battle update briefs provided to COL Philip Volpe, the USFK command surgeon, between March and June 2003.

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