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## American Journal of Infection Control

journal homepage: [www.ajicjournal.org](http://www.ajicjournal.org)

## Major Article

## A Middle East respiratory syndrome screening clinic for health care personnel during the 2015 Middle East respiratory syndrome outbreak in South Korea: A single-center experience

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## Key Words:

Middle East respiratory syndrome  
coronavirus  
infection control  
health facilities  
symptom assessment

**Background:** Transmission of Middle East respiratory syndrome (MERS) to health care personnel (HCP) is a major concern. This study aimed to review cases of MERS-related events, such as development of MERS-like symptoms or exposure to patients.

**Methods:** A MERS screening clinic (MSC) for HCP was setup in the National Medical Center during the MERS outbreak in 2015. Clinical and laboratory data from HCP who visited the MSC were retrospectively reviewed. Additionally, these data were compared with the results of postoutbreak questionnaire surveys and interviews about MERS-related symptoms and risk-related events.

**Results:** Of the 333 HCP who participated in MERS patient care, 35 HCP (10.5%) visited the MSC for MERS-like symptoms. No one was infected with MERS, and the most common symptom was fever (68.6%) followed by cough (34.3%). However, 106 of 285 postoutbreak survey participants experienced at least 1 MERS-related symptom and 26 reported exposure to patients without appropriate personal protective equipment, whereas only 4 HCP visited the MSC to report exposure events.

**Conclusions:** Although a considerable number of HCP experienced MERS-related symptoms or unprotected exposure during MERS patient care, some did not take appropriate action. These findings imply that for infection control strategy to be properly performed, education should be strengthened so that HCP can accurately recognize the risk situation and properly notify the infection control officer.

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## BACKGROUND

The largest outbreak of Middle East respiratory syndrome (MERS) outside the Middle East occurred in South Korea in 2015. During the outbreak, 186 patients were confirmed to have MERS, of which 37 died.<sup>1,2</sup> Isolated strains were typed as clade B MERS-coronavirus (CoV) and were closely related to the viruses circulating in the Middle

East.<sup>3</sup> The distinct feature of the MERS outbreak in South Korea was that the transmission was hospital-related, with transmission within the hospital and from hospital to hospital, resulting in the exposure of a high number of health care personnel (HCP) to MERS-CoV.<sup>4</sup> In general, HCP form a considerable proportion of confirmed MERS cases as observed during previous outbreaks. In the 2014 outbreak in Jeddah, Saudi Arabia, 81 of 255 patients (31%) were HCP.<sup>5</sup> In the 2015 MERS-CoV outbreak in South Korea, 30 of 166 confirmed patients (18%) were HCP.<sup>6</sup>

A number of HCP reported several symptoms compatible with CoV infection during a MERS outbreak<sup>5,7,8</sup>; this raises concerns about nosocomial spread and loss of competency in the medical service. Hospitals have instituted screening clinics for HCP with symptoms suggestive of CoV infection during outbreaks. The World Health Organization and U.S. Centers for Disease Control and Prevention

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Funding/support: Supported by the research program funded by the National Medical Center, Research Institute, Seoul, Republic of Korea (grant no. NMC2015-MS-03).

Conflicts of interest: None to report.

developed a guide to determine who is eligible for MERS-CoV evaluation.<sup>9,10</sup> Typically, MERS-infected individuals seek medical care for symptoms such as fever, chills, cough, shortness of breath, and myalgia. However, several asymptomatic cases or patients with minimal symptoms have been reported.<sup>11,12</sup>

The National Medical Center (NMC) was a designated institution for MERS patient care during the 2015 outbreak in South Korea. A total of 30 of 186 confirmed MERS patients were referred to the NMC from May–July in 2015. During this period, the NMC instituted a screening clinic for HCP involved in MERS patient care to ensure rapid detection, isolation, and management of HCP who were possibly infected with MERS. The aim of this study was to review the HCP who visited the screening clinic for MERS-related symptoms or exposure events. Additionally, we compared the data of this HCP group with the results of the postoutbreak survey and interviews focusing on the overall HCP population that participated in MERS patient care.

## MATERIALS AND METHODS

### *Study population*

All HCP who participated in MERS patient care between May 20, and July, 31, 2015, were included in this study. We conservatively defined participation in MERS patient care as presence within 1 m of a patient with confirmed MERS, irrespective of use of personal protective equipment (PPE). During the MERS outbreak period, log data were filed for every HCP who entered the isolation unit, and eligible HCP were selected based on these data.

### *Infection control measures in the NMC*

Patients with MERS were admitted to a negative pressure isolation room, and airborne transmission precautions were applied. The expected risk of exposure to MERS was considered when selecting PPE. In general, HCP wore gloves, a fluid-resistant coverall, a face shield that completely covered the face, and an N95 respirator. When the exposure risk was higher because of aerosol-generating procedures or mechanical ventilator care, HCP wore inner and outer gloves, an impermeable coverall, a powered air purifying respirator (PAPR) with external belt-mounted blower, a full face shield (hood), inner and outer boot covers, and an apron.<sup>13</sup> PPE was single-use and disposable, except some units of PAPR. Because only sparse data from Saudi Arabia were available regarding the transmission of MERS-CoV within health care facilities, the NMC adopted a higher infection precaution level than that generally recommended.

During the MERS outbreak, tympanic temperature measurements using a digital thermometer and checkups for MERS-like symptoms were conducted by clinical staff twice a day for every HCP who was engaged in patient care inside the isolation room.

### *Screening and management of HCP with suspected MERS-CoV infection*

During the MERS outbreak in Korea, the NMC managed the isolation and treatment of confirmed MERS patients referred from other hospitals nationwide, and suspected MERS cases identified at a community or medical facility other than the NMC were referred to other medical facilities designated for MERS diagnosis. Therefore, the MERS screening clinic (MSC) in the NMC was operated solely for HCP with MERS-related symptoms. Few non-HCP visitors for MERS-like symptoms were managed in a separate section of the emergency room. Retrospective chart review of clinical and laboratory data was performed for HCP who visited the MSC because of MERS-like symptoms or accidental exposure to MERS patients without appropriate PPE.

As previously mentioned, tympanic temperature measurements and checkups for MERS-like symptoms were performed regularly. When an HCP developed clinical features suggestive of MERS (fever  $\geq 37.5^{\circ}\text{C}$  or respiratory symptoms) and had contact with MERS patients within 2 weeks before symptom onset, the chief infection control officer quarantined the HCP to their home or an isolated room in the hospital according to the guidelines of the Korea Centers for Disease Control and Prevention. Droplet precaution was applied during the quarantine, and a nasopharyngeal swab specimen was sent to the Korea National Institute of Health for MERS-CoV reverse-transcription polymerase chain reaction testing. If the first test result was negative, a second test was performed 48 hours later. If both consecutive tests were negative, the quarantine was released.

Asymptomatic HCP reporting unprotected exposure (ie, without appropriate PPE) to a patient with MERS were self-quarantined at home for 14 days. Surveillance was maintained during quarantine with self-measurement of tympanic temperature twice a day and telephonic checkups for MERS-like symptoms. The HCP was also instructed to report immediately to the infection control officer in case of development of MERS-like symptoms.

### *Analysis of the characteristics of HCP who participated in MERS patient care*

Although there was no documented MERS case among the HCP of the NMC, a serosurvey was performed to measure subclinical infections among the HCP after the end of the MERS outbreak; there was no evidence of MERS among HCP in the NMC.<sup>13</sup> A questionnaire survey was performed during the serosurvey regarding the risk factors related to MERS acquisition and the presence of subjective symptoms (ie, fever, general weakness, cough, sore throat, myalgia, diarrhea, chill, sputum, abdominal pain, dyspnea, nausea, vomiting) during the MERS outbreak. These questionnaire survey data were used in this study. Informed consent was obtained from all HCP who agreed to participate in the serosurvey. To investigate the risk factors for exposure to MERS, HCP participants were asked to answer the questionnaire covering the following items: type and length of contact with confirmed MERS patients, places of duty within the hospital, PPE status, exposure events without appropriate PPE, and symptoms possibly related with MERS infection that developed during the care of MERS patients. If the subject answered that they had been exposed without appropriate PPE in the questionnaire, and the HCP had not visited the MSC during the outbreak, we conducted a detailed questionnaire on the exposure events. The in-depth interview included the type and time of exposure, reasons for the exposure without appropriate PPE, and reasons for not notifying the exposure event to the infection control officer.

### *Ethical review*

The study was approved by the NMC Institutional Review Board. We conducted this study in compliance with the principles of the Declaration of Helsinki.

## RESULTS

### *Characteristics of HCP at the MSC*

In total, 46 HCP visited the MSC during the MERS outbreak. Of these, 5 HCP confirmed that there had been no contact with MERS patients and 4 HCP visited the clinic for exposure to confirmed MERS patients without appropriate PPE regardless of MERS-like symptoms. Two visits were a repeat from the same HCP. Therefore, 35 individual HCP visits were made to the MSC for newly developed MERS-like symptoms.

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