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Communication

Emerging Infectious Diseases Require Biosafety Awareness and Procedures

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In 2015, there was a Middle East respiratory syndrome (MERS) outbreak in Korea. Interestingly, most of the cases were nosocomial infection and significant numbers of healthcare workers (HCWs) were infected. There were various causes, but this study focused on HCWs and their ability to self-protect from infectious materials. HCWs did not receive sufficient instruction or training on biosafety, including how to use personal protection equipment and risk assessment at the beginning of the outbreak. Previous experience from an outbreak of severe acute respiratory syndrome or Ebola showed that HCWs must self-protect from infection sources, but HCW infection occurred again with this MERS outbreak. Therefore, the concept of biosafety self-protection must be emphasized so that HCWs can protect themselves from diseases and avoid spreading them.

Key Words: Healthcare worker, Biosafety, Risk assessment, Middle East respiratory syndrome, Infectious diseases outbreak

A 68-year-old man was diagnosed with Middle East respiratory syndrome (MERS) coronavirus (MERS-CoV) on May 20, 2015 for the first time in Korea. Since then, MERS-CoV has spread across the country and became an outbreak (1). Korea's Ministry of Health and Welfare (MOHW) and the World Health Organization (WHO) reported that the number of patients was 186 and the death toll was 36 as at July 14, 2015. There were no new infected patients after July 4 (2). MERS-CoV is one of the emerging diseases, first identified in humans in 2012 in Saudi Arabia (3). MERS is an endemic infection capable of causing community and healthcare facility outbreaks, and has been reported in Egypt, Jordan, United Arab Emirates, Yemen, America, United Kingdom, France, Tunisia, Italy, Malaysia, Philippines, Greece, Netherlands, Algeria, Austria, and Turkey, whose citizens have travelled to the Middle East or were Middle East residents (4, 5). Since September 2012, WHO has been notified of 1,368 laboratory confirmed MERS-CoV cases, including at least 490 deaths (2, 3). The first patient diagnosed with MERS in Korea was a farmer who stayed in Bahrain from April 18 to May 3. He returned to Incheon Airport, Korea, via Qatar on May 4. Seven days after returning, he presented with symptoms of fever and cough, and visited hospitals A, B, and C from May 11 to 17 without realizing he was infected with MERS-CoV. He was first hospitalized at B and then moved to hospital D, where

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polymerase chain reaction confirmed on May 20 that he was infected with MERS-CoV. While the patient was hospitalized at hospital, patients who used the same room and 4 other healthcare workers (HCWs) were infected, forming a cluster. A fourteenth patient was hospitalized at B at the same time for pneumonia and was transferred to an emergency room at hospital D prior to knowing that he had been infected by MERS-CoV, forming a second cluster of subjects who had contacted this patient directly and indirectly. It is very important to observe the rapid spread of MERS-CoV within the infected hospitals, even though these hospitals are high state of the art technologically and practice advanced medical standards. Thirty-nine HCWs were infected by MERS-CoV, of a total 186 infected patients in Korea. In particular, 91 confirmed infections occurred at hospital D, including 15 HCWs.

It is not easy to identify MERS infected patients, because the initial symptoms are similar to many other respiratory tract infections. However, in this case, dozens of HCWs were infected even though they knew their patients were infected by MERS-CoV and treated them in quarantine conditions. Various issues contributed to this infection rate, including a lack of swift immediate measures against the MERS-CoV infection, insufficient supply of high level personal protection equipment (PPE), limited numbers of quarantine wards, etc. The major problem was that HCWs did not receive sufficient biosafety instruction or training, including PPE use, and there was no risk assessment at the beginning of the outbreak. This raises a number of concerns regarding HCWs. In general, HCWs are well aware of the importance to obtain proper training to maintain working place sanitation since commencing working at hospitals. However, in this case they were exposed to risks because they were unfamiliar with appropriate safety facilities and how to wear and use appropriate PPE. It was difficult for them to accept biosafety to protect themselves because of their working habits over many years, even though they were given brief training to protect themselves from an outbreak caused by emerging infectious diseases.

Critically, HCWs were unfamiliar with conducting a risk assessment at the hospital. Risk assessment identifies the specific hazardous characteristics of a known or potential infectious agent or material, activities that could result in exposure to an agent, the likelihood that such exposure could cause laboratory associated infections (LAIs), and the probable consequences of such an infection. The risk assessment provides a guide for selecting appropriate biosafety levels, microbiological practices, safety equipment, and facility safeguards to prevent LAIs (6). Accordingly, the administrator of infectious disease management and the person in charge of handling infectious substances in the hospital must be trained to conduct effective the risk assessment.

There was an outbreak in 2003 of severe acute respiratory syndrome (SARS) worldwide starting from East Asia. Five months after the SARS coronavirus (SARS-CoV) began to spread, 8,439 people were affected with 812 deaths from the outbreak. A total of 20% of HCWs, including doctors and employees working in the respiratory disease research laboratory, were infected particularly in the Guangdong area (7). SARS was a predominately hospital acquired pathogen in Canada, Singapore, and Vietnam, where between 40% and 57% of cases were reported among HCWs (8, 9). In 2014, over 170 health professionals were infected by an Ebola outbreak, with more than 80 deaths, highlighting that HCWs were exposed to high risk (10, 11). WHO reported that HCWs were 21~32 times more likely to be infected by Ebola than general adults in Guinea, Liberia, and Sierra Leone (12). Therefore, training is essential to recognize the potential for infection among HCWs and minimize their risk exposure. WHO and the Centers for Disease Control and Prevention (CDC) engaged infection preventive and control specialists to train HCWs using a standardized training package to improve biosafety awareness (13, 14).

Recently, the Korean government established legal devices to strengthen biosafety in the bioresearch field (15). The devices specify that the government must validate higher biosafety security level facilities, and provide designated institutional biosafety committees and biosafety officers for controlling research facilities. Research centers have established guidelines for safe management of highly dangerous pathogens in accordance with the new laws regarding epidemic diseases and prevention regulation, and training and

practices accordingly the guidelines. However, there are a few laws covering infection control because medical community and healthcare facility are focused on disease control and the spread of infected patients. In outbreaks of SARS, Ebola, MERS, etc., many patients are infected within hospitals as well as HCWs and diagnostic medical workers within the hospitals and laboratories. This particular case of a MERS outbreak, provided an important lesson to HCWs that biosafety must be introduced at the hospital. It is vitally important mandatory to provide professional training to protect HCWs at community and healthcare facility centers. Guidelines and professional training for HCWs must be provided regarding maintaining appropriate facilities and management methods, management of contaminated (or potentially) samples, and sample transportation. The design of biosafety strategies for HCWs has attracted rising attention in many countries (16, 17). In the US, the CDC has offered online biosafety training for emergency room HCWs dealing with emerging infectious disease patients since the Ebola outbreak. Developed by Johns Hopkins University, the training includes PPE preparation and emergency room guidelines to assist HCWs dealing with infected patients (18).

With the wide acceptance of domestic air travel, the world is highly connected, and people can travel from one side of the world to another within the same day. Therefore, all HCWs must recognize and adopt biosafety concepts and guidelines to keep them safe from newly emerging highly infectious diseases such as SARS or MERS. These guidelines are required for patient treatment worldwide as well as Korea.

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