Study maps transmission of MERS virus in South Korean hospital from one 'super-spreader' patient

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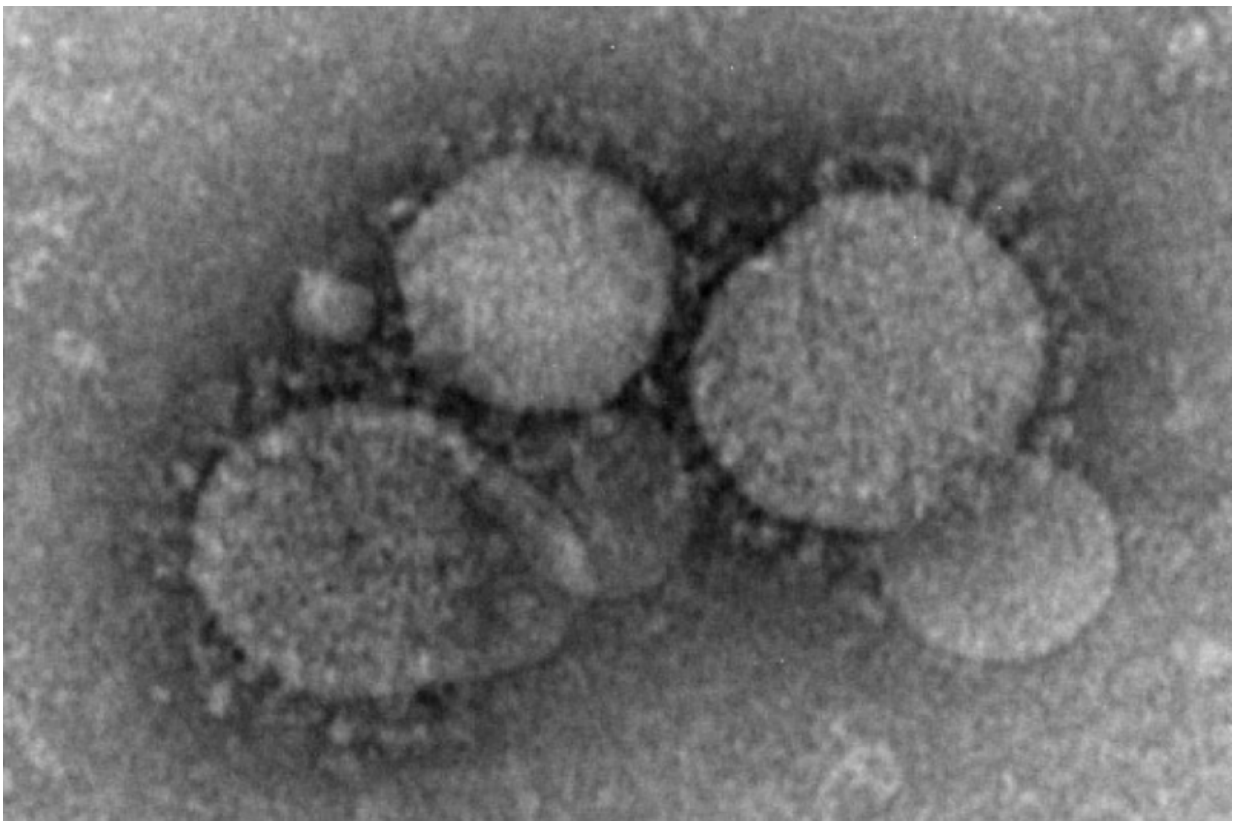

MERS is a viral infectious disease caused by a coronavirus and results in pneumonia and respiratory distress syndrome. The disease has been localized in Middle Eastern countries, most notably, Saudi Arabia, Qatar and United Arab Emirates, mainly transmitted from dromedary camels to humans. Human-to-human transmission is rare, but can occur in close contact. Coronaviruses have a protective protein capsule and what appears to be a "crown" of projections from

the surface of the virus, visible in this image. Credit: Public domain

Tracing the movements of patients at a South Korean hospital has helped identify how Middle East Respiratory Syndrome (MERS) virus was transmitted from a single super-spreader patient in an overcrowded emergency room to a total of 82 individuals over three days including patients, visitors and health-care workers. The study, published today in *The Lancet*, maps the transmission of South Korea's first outbreak of MERS virus and the case of highest transmission of MERS virus from a single patient outside the Middle East.

The study demonstrates the potential for outbreaks of MERS Coronavirus (MERS-CoV - the virus behind MERS) from a single spreader, as has been previously documented for SARS (Severe Acute Respiratory Syndrome). The authors say that as long as the MERS transmission in the Middle East continues, governments and health-care providers should be prepared for emerging infections.

Since it was first identified in 2012, MERS-CoV has spread to 27 countries. Patients develop severe acute respiratory illness with symptoms of fever, cough and shortness of breath. Approximately 3-4 out of every 10 patients reported with MERS-CoV have died, most of whom had an underlying medical condition.

Previous studies have suggested that the potential for MERS-CoV to spread to large numbers of people was low. However, an outbreak in Saudi Arabia in 2013 saw one patient transmit the virus to seven others, raising concerns about so-called super-spreaders - patients who infect disproportionally more secondary contacts than others also infected with the same disease.

In between May and July 2015, there was a MERS-CoV outbreak in South Korea, where 186 cases were confirmed within 2 months. The 'index patient' (where the outbreak originated) was a man aged 68, otherwise known as Patient 1, who had travelled to Bahrain, the United Arab Emirates, Saudi Arabia and Qatar between 18 April and 3 May 2015 before returning to South Korea. He first visited the Samsung Medical Center in Seoul on 17 May, and was isolated on 18 May under the suspicion of MERS and finally diagnosed with MERS on 20 May. However, before arriving at Samsung Medical Centre, Patient 1 had already transmitted the virus to several individuals in other hospitals, including another man (Patient 14), aged 35 with whom he shared a ward. Patient 14 was admitted to Samsung Medical Center with no information on possible exposure to MERS-CoV on 27 May - and it was this patient who led to the hospital outbreak at Samsung.

Samsung Medical Center is a large 1982-bed hospital with an emergency room that sees more than 200 patients a day. The research team did a retrospective investigation of the outbreak at the hospital, including a review of closed-circuit security video footage and electronic medical records.

A total of 1576 people were estimated to have been exposed to Patient 14 in the emergency room and a total of 82 people - 33 patients, 8 health-care workers, and 41 visitors - were infected between 27-29 May (table 1). Exposed people were classified into different groups depending on their proximity to Patient 14 (table 1, figure 4). Patients staying in the same zone of the emergency room as Patient 14 had the highest risk of infection (20% [23/117 patients]), compared with 5% (3/58) in those with brief exposure to Patient 14 at the registration area or the radiology suite of the emergency room, and 1% (4/500) in other patients who stayed in different zones. The risk of infection was 2% (5/218) in health-care workers, and 6% (38/683) in visitors. Nine cases were not included in the analysis due to a lack of reliable data.

On average, the incubation period was 7 days but there was wide variation depending on the proximity to Patient 14 - 5 days for patients in the closest proximity to Patient 14 (group A) to 11 days for patients further away (group C). There were no confirmed cases of patients or visitors who visited the emergency room on 29 May, after Patient 14 had been isolated, and who were exposed only to potentially contaminated environment.

In contrast, Patient 1 was in contact with 285 other patients and 193 health-care workers but no further transmissions occurred at the hospital between presenting to the emergency room on 17 May and being isolated on 18 May. However, Patient 1 had previously infected 28 other patients in another hospital. The authors say that the difference in transmissibility between Patient 1 and Patient 14 could be caused by a number of factors such as time from onset of disease, symptoms, duration of contact, pattern of movement and the spread of the virus itself.

Study authors Professor Doo Ryeon Chung and Yae-Jean Kim, Division of Infectious Diseases at the Samsung Medical Center, Seoul, South Korea, warn that the results of this study need to be interpreted with caution due to the retrospective nature of the analysis but say: "This study is the first to document the spread of MERS-CoV virus through a hospital by providing specific infection risk depending on the proximity of patients to the infected patient. Our results show the increased potential of MERS virus infection from a single patient in an overcrowded emergency room. Overcrowding is an important issue for this outbreak but also a common feature of modern medicine which should be of concern to governments and health-care providers in the context of future possible outbreaks. Emergency preparedness and vigilance in hospitals, laboratories, and government agencies are crucial to the prevention of further large outbreaks not only of MERS-CoV infections, but also other emerging infectious diseases."

Writing in a linked Comment, Professor David S Hui from the Department of Medicine & Therapeutics and Stanley Ho Center for Emerging Infectious Diseases, The Chinese University of Hong Kong, China, says: "The data suggest that the location (and hence the timing) of exposure to Patient 14 was an important factor in determining the attack rate and incubation period. Several other predisposing factors to this superspreading event included failure to implement strict isolation of patients and quarantine of contacts at the first outbreak hospital (Pyeongtaek St Mary's Hospital), poor communication and knowledge of patient movement between hospitals, overcrowding in the emergency room, inadequate ventilation with only three air changes per h, and limited availability of isolation rooms in the emergency room... Failure in infection control and prevention in health-care facilities has resulted in large numbers of secondary cases of MERS-CoV infection involving health-care workers, existing patients, and visitors in Saudi Arabia and several other countries in the past few years. Common risk factors include exposure to contaminated and overcrowded health-care facilities, poor compliance with appropriate personal protection equipment when assessing patients with febrile respiratory illness, application of potential aerosol generating procedures (eg, resuscitation, continuous positive airway pressure, nebulised drugs), and lack of proper isolation room facilities."

More information: *The Lancet*, www.thelancet.com/journals/lan … (16)30623-7/abstract

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