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## Middle East Respiratory Syndrome Coronavirus and Children: What Pediatric Health Care Professionals Need to Know

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### Introduction

As of December 31, 2015, 1621 laboratory-confirmed cases of Middle East respiratory syndrome coronavirus (MERS-CoV) had been reported to the World Health Organization (WHO), with 584 deaths in 26 countries (<http://www.who.int/emergencies/mers-cov/en/>). Two imported MERS-CoV cases were identified in the United States in May 2014.<sup>1</sup> WHO has not declared this disease to constitute a Public Health Emergency of International Concern. However, sporadic MERS-CoV cases could continue to be imported into the United States. This article provides background information on MERS-CoV and MERS-CoV infections in children for pediatric health care providers in the United States. MERS-CoV infections among children have been reported, and severe respiratory illnesses have been documented in children with underlying conditions. United States health care providers should be vigilant in assessing children with severe respiratory illnesses and history of recent travel in or near the Arabian Peninsula for MERS-CoV infections.

### Background on MERS-CoV

MERS-CoV was first identified in a patient who was hospitalized in Saudi Arabia in June 2012. Since then, the majority of MERS-CoV cases have been identified in the Arabian Peninsula, but exported cases and outbreaks have been reported by other countries.

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#### Author Contributions

MB conceived the idea for the manuscript, authored the initial draft, and conducted research. SG, TU and GP provided critical review of the manuscript and contributed to draft development. SIG provided critical review of the manuscript and conducted research.

#### Authors' Note

The findings and conclusions in this report are those of the authors and do not necessarily represent the official position of the Centers for Disease Control and Prevention.

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Dromedary camels, especially young camels, have been increasingly implicated as a potential source of MERS-CoV.<sup>2</sup> MERS-CoV transmission from dromedary camels to humans is not well understood but may result from direct contact with camels. Person-to-person MERS-CoV transmission most likely occurs via large respiratory droplets and close contact. Much of MERS-CoV person-to-person spread has occurred within health care facilities or, to a much lesser extent, within households.<sup>3</sup> The mean incubation period has been estimated to be approximately 5 days, with a range of 2 to 14 days.<sup>4</sup> The clinical spectrum varies from asymptomatic infection to pneumonia with respiratory distress. MERS-CoV has been identified in upper-respiratory-tract specimens collected from individuals with subclinical infection for up to 6 weeks.<sup>5</sup> Typical signs and symptoms include fever, cough, and shortness of breath. MERS-CoV-infected patients with severe disease have generally been older adults or have had at least 1 underlying health condition.<sup>4</sup> Currently, there are no approved MERS-CoV therapeutics. Clinical management is focused on supportive care<sup>6</sup> and implementation of infection prevention and control measures.<sup>7</sup>

## What Is Known About MERS-CoV in Children?

### Transmission

As of November 2015, at least 35 MERS-CoV cases in children (< 18 years) have been reported to WHO. The majority of reported pediatric MERS-CoV cases have been household contacts of adult cases, suggesting that acquisition of MERS-CoV infection in children is occurring in households.<sup>8</sup> Clinicians and public health professionals should use caution when drawing conclusions from MERS-CoV surveillance data, which best captures occurrence of severe disease. Larger MERS-CoV outbreaks are often associated with adult hospital settings, limiting the opportunity for children to be exposed to MERS-CoV.

### Manifestations

There are few clinical descriptions to inform clinicians about common presentations or signs and symptoms of MERS-CoV infection in children. A recent review of the literature by Thabet et al<sup>9</sup> described 14 reported cases of MERS-CoV infection in children 9 months to 16 years old; 9 cases were asymptomatic, and 5 exhibited symptoms. One additional symptomatic case occurred in the United Arab Emirates (UAE) in 2015.<sup>10</sup> Of the 6 symptomatic cases, 2 died. Reported signs and symptoms included fever (3), mild respiratory symptoms (3), and severe respiratory distress (2). Three of the 6 symptomatic cases had chest X-ray results reported; all 3 reported bilateral diffuse infiltrates. The 2 fatal pediatric MERS-CoV cases had comorbidities (infantile nephrotic syndrome and cystic fibrosis). A 14-year-old with Down syndrome and underlying cardiac disease required oxygen and survived. The 9 asymptomatic cases had no reported comorbidities.<sup>8</sup>

## Considerations for the Pediatric Health Care Professional

MERS-CoV infection in children can range from asymptomatic infection to severe respiratory distress leading to death. Risk factors for MERS-CoV infection include travel to the Arabian Peninsula or other affected areas, contact with someone infected with MERS-CoV, or presence in a facility with suspected cases of MERS-CoV within the past 14 days.

In children presenting with severe respiratory symptoms, especially for patients without a specific etiological diagnosis and those with underlying comorbidities, these risk factors should be considered. As seen in published reports, young children may not exhibit fever. In the United States, common detected pathogens in patients under investigation<sup>11</sup> who were tested for MERS-CoV included influenza A and rhinovirus/enterovirus.<sup>12</sup> As of January 2016, MERS-CoV-affected countries include those in and around the Arabian Peninsula: Iran, Jordan, Kuwait, Lebanon, Oman, Qatar, Saudi Arabia, the UAE, and Yemen. The Centers for Disease Control and Prevention (CDC) issues Health Alert Network (HAN) notifications informing clinicians of major outbreaks around the world, including MERS-CoV, and will provide updates if new countries become affected. The HAN archive and subscription information is available at <http://emergency.cdc.gov/han/>. Clinicians should work diligently with public health departments to ensure timely notification of all suspected cases of MERS-CoV infection, so that proper testing of respiratory specimens at state health department laboratories can be performed, and all contacts can be identified and located quickly. If MERS-CoV is suspected, the patient should be isolated immediately, and recommended infection control precautions should be implemented. Guidance for health care workers on MERS-CoV patient and contact evaluation and management, including laboratory testing, infection control, and reporting, is available on CDC's website at <http://www.cdc.gov/coronavirus/mers/interim-guidance.html>. Balancing infection control precautions with family-centered care principles could be a challenge for pediatric health care providers, as it was during the SARS and Ebola outbreaks.<sup>13,14</sup> Clinicians caring for confirmed MERS-CoV pediatric cases should also determine if such patients are eligible for any available investigational therapies through a clinical trial protocol.<sup>15</sup>

## Conclusions

MERS-CoV infection can result in asymptomatic to severe and fatal illness, with more severe illness reported in children with underlying comorbidities. More epidemiological, clinical, immunological, and virological data are needed to understand MERS-CoV transmission to exposed children and optimal clinical management strategies. Pediatric health care providers must be vigilant in eliciting an epidemiological link to endemic areas and countries that are experiencing ongoing transmission, and identifying suspected cases of MERS-CoV in children can serve an important role in preventing additional cases by prompt reporting to public health authorities.

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