TRACIE

HEALTHCARE EMERGENCY PREPAREDNESS INFORMATION GATEWAY

SARS/ MERS
Topic Collection
10/2/2015

ASPR

ASSISTANT SECRETARY FOR PREPAREDNESS AND RESPONSE

Topic Collection: SARS/MERS

Healthcare facilities and emergency medical professionals need to be able to recognize and treat disease caused by novel respiratory pathogens, such as Severe Acute Respiratory Syndrome (SARS) and Middle East Respiratory Syndrome (MERS). This Topic Collection contains resources that can help medical emergency planners and health care professionals: learn more about managing patients experiencing illness from novel respiratory pathogens; understand related infection control principles in healthcare and community settings; and benefit from lessons learned from past outbreaks.

Each resource in this Topic Collection is placed into one or more of the following categories (click on the category name to be taken directly to that set of resources). Resources marked with an asterisk (*) appear in more than one category.

Must Reads

Braden, C.R., Dowell, S.F., Jernigan, D.B., and Hughes, J.M. (2013). Progress in Global Surveillance and Response Capacity 10 years After Severe Acute Respiratory Syndrome. Emerging Infectious Diseases. (Podcast also available.) 19(6):864-869.

Ten years after the World Health Organization (WHO) issued their first global alert for severe acute respiratory syndrome (SARS), the authors reviewed the critical gaps that remain in the global surveillance and response capacity for similar public health threats. Of 194 WHO member states that signed on to the International Health Regulations (2005), fewer than 20% had achieved compliance with the core capacities required by the deadline in June 2012. The authors emphasize the lessons learned from the global SARS outbreak (e.g., avoid complacency, use all available 21st century tools to strengthen capacity building efforts, and support research).

Brouqui, P. (2009). Facing Highly Infectious Diseases: New Trends and Current Concepts. 15(8):700-5.

This article includes guidelines for the care of patients with highly infectious diseases, with an emphasis on droplet precautions, isolation units, and need for healthcare worker

training. The author advocates that protective measures for isolation units be modeled after those for biosafety level laboratories. Pediatric considerations are also included.

Centers for Disease Control and Prevention. (2015). Middle East Respiratory Syndrome (MERS).

This web page contains links to information on MERS for the public, healthcare providers and laboratory professionals including a frequently asked questions resource. Preparedness checklists for providers and healthcare facilities are included.

Centers for Disease Control and Prevention. (2015). Severe Acute Respiratory Syndrome (SARS).

This web page contains links to information on SARS for healthcare providers and laboratory professionals. Preparedness checklists for providers and healthcare facilities are included.

Cheng, V.C., Chan, J.F., To, K.K., and Yuen, K.Y. (2013). Clinical Management and Infection Control of SARS: Lessons Learned. Antiviral Research. 100(2):407-19.

The authors review the 2003 SARS outbreak and discuss lessons learned, particularly with regard to treatment and containment activities. Summaries of studies conducted to identify risk factors and infection control measures, as well as to describe nosocomial outbreaks for affected countries, are included.

Koplan, J.P., Butler-Jones, D., Tsang, T., and Yu, W. (2013) Public Health Lessons from Severe Acute Respiratory Syndrome a Decade Later. Emerging Infectious Diseases. 19(6): 861-863.

The authors summarize the eight "national and international policy, operational, and systems needs identified by public health officials and emphasize the value of having a national public health institute in the preparedness and response phases of a public health emergency.

Milne-Price, S., Miazgowicz, K.L., Munster, V.J. (2014). The Emergence of the Middle East Respiratory Syndrome Coronavirus (MERS-CoV). Pathogens and Disease. 71(2):121-36.

The authors provide a review of the knowledge base pertaining to the current MERS-CoV outbreak, including detection, clinical features, and interventions.

Public Health England. (2015). Treatment of MERS-CoV: Information for Clinicians Clinical Decision-making Support for Treatment of MERS-CoV Patients.

This document from the UK public health service summarizes a literature review (based on SARS experience) for evidence-based treatment guidelines for MERS-CO-V patients in the United Kingdom.

Puro, V., Fusco, F.M., Lanini, S., et al. (2008). Risk Management of Febrile Respiratory Illness in Emergency Departments. The New Microbiologica. 31(2):165-73.

The authors use data from prior infectious disease outbreaks, including SARS in 2003, to emphasize how important it is for emergency departments to have effective screening and isolation protocols in place for febrile respiratory illness. Such protocols are critical to avoid possible disease transmission by infected patients in the waiting room to others also waiting to be seen.

Trust for America's Health. (2015.) Issue Brief: Top Actions the United States Should Take to Prepare for MERS-CoV and Other Emerging Infections.

This document discusses gaps in preparedness for responding to emerging infectious diseases, and provides recommendations for health care facilities to prepare to identify and care for patients with MERS-CoV or other novel respiratory infections.

World Health Organization. (2014). Infection Prevention and Control of Epidemic- and Pandemic-Prone Acute Respiratory Infections in Health Care: WHO Guidelines.

This document provides recommendations, best practices and principles for infection prevention and control for acute respiratory infections in health care, particularly those that present as epidemics or pandemics. It includes information on PPE and aerosol-generating procedures. There are also summaries of literature and research reviews on physical interventions for infection control; risk of transmission from aerosol-generating procedures; and effectiveness of vaccination of health care workers to protect patients.

Clinical Management and Research

Al-Tawfiq, J.A., Momattin, H., Dib, J., and Memish, Z.A. (2014). Ribavirin and Interferon Therapy in Patients Infected with the Middle East Respiratory Syndrome Coronavirus: An Observational Study. International Journal of Infectious Diseases. 20:42-6.

The authors reviewed the therapeutic schedule and outcomes for five MERS patients who received ribavirin and interferon combination therapy an average of 19 days post-admission. None of the patients responded to therapy and all died, suggesting that this therapy is ineffective in patients with co-morbidities who start treatment late in the course of their illness.

Assiri A, Al-Tawfiq JA, Al-Rabeeah AA, et al. (2013). Epidemiological, Demographic, and Clinical Characteristics of 47 Cases of Middle East Respiratory Syndrome Coronavirus Disease from Saudi Arabia: A Descriptive Study. (Abstract only.) Lancet Infectious Disease. (9):752-61.

The Saudi Arabian Ministry of Health provided an analysis of 47 individuals with laboratory-confirmed MERS-CoV disease. Data suggest that the clinical presentation of MERS-CoV infection ranges from asymptomatic to severe pneumonia with the acute

respiratory distress syndrome, septic shock and multi-organ failure resulting in death. At least two cases had a consumptive coagulopathy during the course of their illness.

Braden, C.R., Dowell, S.F., Jernigan, D.B., and Hughes, J.M. (2013). Progress in Global Surveillance and Response Capacity 10 years After Severe Acute Respiratory Syndrome. Emerging Infectious Diseases. (Podcast also available.) 19(6):864-869.

Ten years after the World Health Organization (WHO) issued their first global alert for severe acute respiratory syndrome (SARS), the authors reviewed the critical gaps that remain in the global surveillance and response capacity for similar public health threats. Of 194 WHO member states that signed on to the International Health Regulations (2005), fewer than 20% had achieved compliance with the core capacities required by the deadline in June 2012. The authors emphasize the lessons learned from the global SARS outbreak (e.g., avoid complacency, use all available 21st century tools to strengthen capacity building efforts, and support research).

*Brouqui, P. (2009). Facing Highly Infectious Diseases: New Trends and Current Concepts. Clinical Microbiology and Infection. 15(8):700-5.

This article includes guidelines for the care of patients with highly infectious diseases, with an emphasis on droplet precautions, isolation units, and need for healthcare worker training. The author advocates that protective measures for isolation units be modeled after those for biosafety level laboratories. Pediatric considerations are also included.

Centers for Disease Control and Prevention. (2005). Clinical Guidance on the Identification and Evaluation of Possible SARS-CoV Disease among Persons Presenting with Community-Acquired Illness (Version 2).

This page provides guidance for evaluating and diagnosing SARS-CoV infections.

*Centers for Disease Control and Prevention. (2005). Public Health Guidance for Community-Level Preparedness and Response to Severe Acute Respiratory Syndrome (SARS) Version 2, Supplement I: Infection Control in Healthcare, Home, and Community Settings.

This web page contains links to guidance on SARS infection control in various settings.

*Centers for Disease Control and Prevention. (2015). Middle East Respiratory Syndrome (MERS).

This web page contains links to information on MERS for healthcare providers and laboratory professionals. Preparedness checklists for providers and healthcare facilities are included.

Centers for Disease Control and Prevention. (2015). Severe Acute Respiratory Syndrome (SARS).

This web page contains links to information on SARS for healthcare providers and laboratory professionals. Preparedness checklists for providers and healthcare facilities are included.

Centers for Disease Control and Prevention. (2015). Updated Information and Guidelines for Evaluation for MERS. (COCA call.)

This page links to a recording and transcript of a COCA call for clinicians held June 11, 2015 to provide an update on the current outbreak of MERS-CoV and guidance on who should be tested for the disease. Infection control measures are also discussed.

Chen, M.I., Chow, A.L., Earnest, A. et al. (2006). Clinical and Epidemiological Predictors of Transmission in Severe Acute Respiratory Syndrome (SARS). BMC Infectious Diseases. 6:151.

The authors looked at factors contributing to SARS transmission in 98 index cases (22 with transmission; 76 without). They found several factors that seemed to contribute to transmission, including delay to isolation; admission to a non-isolation facility; and higher lactate dehydrogenase levels of greater than 650 IU/L.

*Cheng, V.C., Chan, J.F., To, K.K., and Yuen, K.Y. (2013). Clinical Management and Infection Control of SARS: Lessons Learned. Antiviral Research. 100(2):407-19.

The authors review the 2003 SARS outbreak and discuss lessons learned, particularly with regard to treatment and containment activities. Summaries of studies conducted to identify risk factors and infection control measures, as well as to describe nosocomial outbreaks for affected countries, are included.

Fowler, R.A., Kumar, A., Christian, M., and Martin, C.M. (n.d.) Guidance for the Management of Severe Acute Respiratory Infection in the Intensive Care Unit. Canadian Critical Care Society. (Accessed 9/21/2015.)

This document provides guidance on the identification and treatment of patients with severe acute respiratory infection in the intensive care unit (ICU).

Gardner, L.M., and MacIntyre, C. R. (2014). Unanswered Questions About the Middle East Respiratory Syndrome Coronavirus (MERS-CoV). BMC Research Notes. 7: 358.

The authors summarize the epidemiology of the ongoing MERS-CoV outbreak, noting its sporadic nature and unclear transmission routes. They call for additional research to answer unanswered questions about the disease so that effective interventions to control its spread may be implemented.

Hadjiliadis, D., and Harron, P. (2015). Severe Acute Respiratory Syndrome (SARS). MedlinePlus.

This Medline encyclopedia article on SARS includes information on symptoms, tests, treatments, and prevention methods.

Kao, H.K., Wang, J.H., Sung, C.S. et al. (2005). Pneumothorax and Mortality in the Mechanically Ventilated SARS Patients: A Prospective Clinical Study. Critical Care. 9(4):R440-5.

The authors conducted this study to determine the effects of mechanical ventilation on pneumothorax and if pneumothorax in SARS patients increased mortality. They did not find any increase in mortality from pneumothorax. They found that patients who developed pneumothorax presented with significant respiratory involvement upon admission, and that these individuals required "meticulous" respiratory therapy and monitoring.

Lee, N., Allen Chan, K.C., Hui, D.S., et al. (2004). Effects of Early Corticosteroid Treatment on Plasma SARS-Associated Coronavirus RNA Concentrations in Adult Patients. Journal of Clinical Virology. 31(4):304-9

The authors examined viral load in plasma over time in SARS patients and the effect of corticosteroids on viral load. They found that relatively early corticosteroid treatment was related to a higher subsequent plasma viral load.

Lew, T.W. Kewk, T.K., Tai, D., et al. (2003). Acute Respiratory Distress Syndrome in Critically Ill Patients with Severe Acute Respiratory Syndrome. Journal of the American Medical Association.16;290(3):374-80.

The authors describe clinical and epidemiologic data for 199 patients hospitalized with SARS. Nineteen of 24 ICU deaths occurred a week or later after ICU admission (and were linked to other complications, including acute respiratory distress syndrome (ARDS). The authors hypothesize that differences in the virulence of varied strains and viral load may be related to the likelihood of developing a severe ARDS and suggest aggressive early intervention.

Lu, X., Whitaker, B., Sakthivel, S.K. et al. (2014). Real-time Reverse Transcription-PCR Assay Panel for Middle East Respiratory Syndrome Coronavirus. Journal of Clinical Microbiology. 52(1):67-75.

This article describes an assay kit that was approved by the U.S. Food and Drug Administration in 2013 for the detection of MERS-CoV. The authors discuss the accuracy of the assay, as well as selection of samples for testing, timing of collection after disease onset, and collection methods.

*Milne-Price, S., Miazgowicz, K.L., Munster, V.J. (2014). The Emergence of the Middle East Respiratory Syndrome Coronavirus (MERS-CoV). Pathogens and Disease. Pathogens and Disease.71(2):121-36.

The authors provide a review of the knowledge base pertaining to the current MERS-CoV outbreak, including detection, clinical features, and interventions.

*Peiris, J. Yuen, K., Osterhaus, A., and Stöhr, K. (2003). The Severe Acute Respiratory Syndrome. New England Journal of Medicine. 349(25):2431-41.

The authors share a timeline of the SARS outbreak and include tables that highlight clinical components of the disease, laboratory abnormalities associated with the disease, radiographic results of patients with SARS, and other information that can help healthcare providers understand the 2003 outbreak and prepare for future outbreaks.

*Public Health England. (2015). MERS Co-V Case Algorithm.

This algorithm assists clinicians and public health workers in the management of potential cases of MERS-CoV infection in the United Kingdom.

*Public Health England. (2014). Treatment of MERS-CoV: Information for Clinicians Clinical Decision-making Support for Treatment of MERS-CoV Patients.

This document summarizes a literature review (based on SARS experience) for evidence-based treatment guidelines for MERS-CO-V patients in the United Kingdom.

*Puro, V., Fusco, F.M., Lanini, S., et al. (2008). Risk Management of Febrile Respiratory Illness in Emergency Departments. The New Microbiologica. 31(2):165-73.

The authors use data from prior infectious disease outbreaks, including SARS in 2003, to emphasize how important it is for emergency departments to have effective screening and isolation protocols in place for febrile respiratory illness. Such protocols are critical to avoid possible disease transmission by infected patients in the waiting room to others also waiting to be seen.

Raj, V.S., Osterhaus, A.D., Fouchier, R.A., and Haagmans, B.L. (2014). MERS: Emergence of a Novel Human Coronavirus. Current Opinion in Virology. 5:58-62.

The authors discuss what is known about the current MERS-CoV outbreak. They emphasize the importance of rapid identification and isolation of cases in the absence of effective treatments and clear understanding of how the virus is primarily being transmitted (i.e., human-to-human, or animal-to-human spread).

*Sandrock, C.E. (2008). Severe Febrile Respiratory Illnesses as a Cause of Mass Critical Care. Respiratory Care. 53(1):40-53.

The author reviews the agents that could necessitate the need for mass critical care of patients with severe febrile respiratory illness, as well as associated infection control protocols and personal protective equipment requirements, including those for procedures that could result in a high rate of disease transmission. Planning considerations are included, as are general treatment principles and research supporting lung ventilation protocols.

*Tang, J.W., Nicolle, A., Pantelic, J. et al. (2013). Different Types of Door-Opening Motions as Contributing Factors to Containment Failures in Hospital Isolation Rooms. PLoS One. 8(6):e66663.

The authors conducted experiments with different types of doors to assess which allowed the most air into and out of rooms to determine the type of door(s) that hospitals should use for isolation rooms. The effect of human movement on air flow when operating the doors was also examined. The authors contend that sliding doors are the most effective.

Vyas, J. (2014). Middle East Respiratory Syndrome (MERS).

This Medline encyclopedia article on MERS includes information on geographic extent, transmission, symptoms tests, and prevention methods.

*Wong, S.S. and Yuen, K.Y. (2008). The Management of Coronavirus Infections with Particular Reference to SARS. The Journal of Antimicrobial Chemotherapy. 62(3):437-41.

The authors review treatment options for coronavirus, with an emphasis on that for SARS, based on reports from the 2003 outbreak.

* World Health Organization. (n.d.). Middle East Respiratory Syndrome Coronavirus (MERS-CoV).

This web page contains links to information on MERS for healthcare providers and laboratory professionals. It also provides updates on the various outbreaks occurring around the world.

Zaki, A.M., van Boheemen, S., Bestebroer, T.M., et al. (2012). Isolation of a Novel Coronavirus from a Man with Pneumonia in Saudi Arabia. New England Journal of Medicine. 367(19):1814-20.

The authors describe a previously unknown coronavirus (later known as MERS-CoV) isolated from the sputum of a 60-year-old man who presented with acute pneumonia with a fatal outcome in Saudi Arabia, remarkably similar to that of the severe acute respiratory syndrome (SARS) outbreak in 2003.

Zumla, A., Memish, Z.A., Maeurer, M. et al. (2014). Emerging Novel and Antimicrobial-Resistant Respiratory Tract Infections: New Drug Development and Therapeutic Options. (Abstract only.) The Lancet Infectious Diseases. 14 (11): 1136–1149.

The authors discuss novel and emerging viral agents that cause respiratory illness, and development and use of new antimicrobial agents and immune-based and host-directed therapies to treat them.

Education and Training

*Abrahamson, S.D., Canzian, S., and Brunet, F. (2006). Using Simulation for Training and to Change Protocol During the Outbreak of Severe Acute Respiratory Syndrome. Critical Care. 10(1): R3.

The authors trained 275 health care workers in two weeks on how to don personal protective equipment and perform resuscitation procedures for a patient in cardiac arrest using a high-fidelity simulator. Lessons learned from this initiative have implications for health care worker training, as well as care of patients with infectious respiratory diseases.

Parker, M.J., and Goldman, R.D. (2006). Paediatric Emergency Department Staff Perceptions of Infection Control Measures Against Severe Acute Respiratory Syndrome. Emergency Medicine Journal. 23(5):349-53.

Pediatric emergency department staff completed a questionnaire to assess their perceptions of infection control measures against SARS. The authors found that perception of an agent as a significant public health threat improved compliance with infection control measures. Perception of effectiveness of infection control measures did not improve compliance.

Event-Specific Lessons Learned

*Abrahamson, S.D., Canzian, S., and Brunet, F. (2006). Using Simulation for Training and to Change Protocol During the Outbreak of Severe Acute Respiratory Syndrome. Critical Care. 10(1): R3.

The authors trained 275 health care workers in two weeks on how to don personal protective equipment and perform resuscitation procedures for a patient in cardiac arrest using a high-fidelity simulator. Lessons learned from this initiative have implications for health care worker training, as well as care of patients with infectious respiratory diseases.

Bell, J.A.H., Hyland, S., DePellegrin, T., et al. (2004). SARS and Hospital Priority Setting: A Qualitative Case Study and Evaluation. BMC Health Services Research. 4: 36.

The authors provide an analysis of SARS-related decision making along with recommendations for use of the "accountability for reasonableness" principles and ideas for future situations where information about the pathogen is rapidly evolving and decisions may be open to interpretation.

Campbell, A. (2006). The SARS Commission: Executive Summary. Spring of Fear. Volume 1.

This executive summary of the 3rd part of the Government of Ontario's report on SARS focuses on the workforce issues related to SARS, the psychological impact on the nursing staff in particular, and the issues with the lack of guidance on appropriate infection control. Unfortunate and difficult lessons that echo today with MERS and Ebola.

*Centers for Disease Control and Prevention. (2003). Cluster of Severe Acute Respiratory Syndrome Cases Among Protected Health-Care Workers-Toronto, Canada. Morbidity and Mortality Weekly, 52(19);433-436.

Despite apparent compliance with recommended infection-control precautions, a cluster of healthcare workers became ill with SARS during the 2003 outbreak. One table shows how these workers were exposed, by their occupation and type of exposure.

*Chen, M., Leo, Y.S., Ang B., et al. (2006). The Outbreak of SARS at Tan Tock Seng Hospital--Relating Epidemiology to Control. Annals of the Academy of Medicine, Singapore. 35(5):317-25.

The authors describe the SARS outbreaks in the various wards of a hospital in Singapore, and discuss lessons learned from their experiences. Namely, that early detection and proper infection control procedures are critical to limiting or stopping transmission.

*Chen, W.Q., Ling, W.H., Lu, C.Y., et al. (2009). Which Preventive Measures Might Protect Health Care Workers from SARS? BMC Public Health. Morbidity and Mortality Weekly. 52(19);433-436.

The article describes a retrospective study of health care workers infected with SARS during the 2003 outbreak in China that sought to identify measures that might have protected them from becoming ill. Measures found to be preventive included the use of double gloves; high-air flow ventilation on the wards; and avoidance of face-to-face contact with SARS patients.

*Cheng, VC.., Chan, J.F., To, K.K., and Yuen, K.Y. (2013). Clinical Management and Infection Control of SARS: Lessons Learned. Antiviral Research. 100(2):407-19.

The authors review the 2003 SARS outbreak and discuss lessons learned, particularly with regard to treatment and containment activities. Summaries of studies conducted to identify risk factors and infection control measures, as well as to describe nosocomial outbreaks for affected countries, are included.

Hawryluck, L., Lapinsky, S.E., and Stewart, T.E. (2005). Clinical Review: SARS - Lessons in Disaster Management. Critical Care. 9(4):384-9.

The authors review their experience during the 2003 SARS outbreak and present lessons learned to assist health care facilities plan for future infectious disease outbreak.

Health Canada. (2003). Learning from SARS - Renewal of Public Health in Canada. Ottawa: National Advisory Committee on SARS and Public Health.

This comprehensive analysis of Canada's experience with the 2003 SARS outbreak includes after-action issues and recommendations.

Jefferson, T., Foxlee, R., Del Mar, C. et al. (2008). Physical Interventions to Interrupt or Reduce the Spread of Respiratory Viruses: Systematic Review. BMJ. 336(7635):77-80.

The authors report findings from a literature review on physical interventions to reduce or interrupt the spread of respiratory viruses, such as isolation, quarantine, social distancing, barriers, personal protection, and hygiene. They found that handwashing more than 10 times daily; wearing gowns, gloves, masks, and/or N-95 masks were effective. They also found that hygiene measures directed at children helped contain viral spread in the community.

Koplan, J.P., Butler-Jones, D., Tsang, T., and Yu, W. (2013) Public Health Lessons from Severe Acute Respiratory Syndrome a Decade Later. Emerging Infectious Diseases. 19(6): 861-863.

The authors summarize the eight "national and international policy, operational, and systems needs identified by public health officials and emphasize the value of having a national public health institute in the preparedness and response phases of a public health emergency.

Lee, S.S., and Wong, N.S. (2015). Probable Transmission Chains of Middle East Respiratory Syndrome Coronavirus and the Multiple Generations of Secondary Infection in South Korea. International Journal of Infectious Disease. 38:65-7.

Authors described possible cause of MERS-CoV transmission in South Korea resulting in 185 secondary infections as of July 14, 2015. These secondary infections were attributed to three overlapping generations of cases who have contracted the virus almost exclusively in the healthcare environment. Fomite transmission may explain a significant proportion of the infections occurring in the absence of direct contact with infected cases. The analysis of publicly available data collected from multiple sources, including the media, is useful for describing the epidemic history of an infectious disease outbreak.

Liu, C.C., Chang, R.E., and Chang, W.C. (2004). Limitations of Forehead Infrared Body Temperature Detection for Fever Screening for Severe Acute Respiratory Syndrome. (Abstract only.) Infection Control Hospital Epidemiology. 25(12):1109-11.

The authors investigated alternative measurement methodology for infrared body thermometry to increase accuracy for outdoor fever screening during the 2003 SARS epidemic. They found that temperature by ear was a more accurate measurement than forehead body surface temperature. This has implications for fever screening interventions for emerging infectious diseases.

Mailles, A., Blanckaert, K., Chaud, P. et al. (2013). First Cases of Middle East Respiratory Syndrome Coronavirus (MERS-CoV) Infections in France, Investigations and Implications for the Prevention of Human-to-Human Transmission, France, May 2013. Euro Surveillance. 13;18(24).

The authors discuss the first 2 cases of MERS-CoV in France in 2013, and how they were handled to demonstrate the need for stringent infection control measures when caring for suspected or confirmed cases. They also note the atypical presentation of the index case, who did not originally present with respiratory symptoms.

*Peiris, J. Yuen, K., Osterhaus, A., and Stöhr, K. (2003). The Severe Acute Respiratory Syndrome. New England Journal of Medicine. 349(25):2431-41.

The authors share a timeline of the SARS outbreak and include tables that highlight clinical components of the disease, laboratory abnormalities associated with the disease, radiographic results of patients with SARS, and other information that can help healthcare providers understand the 2003 outbreak and prepare for future outbreaks.

*Puro, V., Fusco, F.M., Lanini, S., et al. (2008). Risk Management of Febrile Respiratory Illness in Emergency Departments. The New Microbiologica. 31(2):165-73.

The authors use data from prior infectious disease outbreaks, including SARS in 2003, to emphasize how important it is for emergency departments to have effective screening and isolation protocols in place for febrile respiratory illness. Such protocols are critical to avoid possible disease transmission by infected patients in the waiting room to others also waiting to be seen.

Reuss, A., Litterst, A., Drosten, C., et al. (2014). Contact Investigation for Imported Case of Middle East Respiratory Syndrome, Germany. Emerging Infectious Disease. 20(4):620-626.

The authors described a contact investigation to identify possible person-to-person transmission and assess infection control measures following an imported, confirmed case of MERS-CoV in Germany. They identified 83 identified contacts and followed up with 81. Ten contacts reported experiencing mild symptoms, but test results for respiratory and serum samples were negative for MERS-CoV. Serologic testing was done for 53 (75%) of 71 nonsymptomatic contacts; all results were negative.

*Reynolds, M.G., Anh, B.H., Thu, V.H. et al. (2006). Factors Associated with Nosocomial SARS-CoV Transmission Among Healthcare Workers in Hanoi, Vietnam, 2003. BMC Public Health. 6: 207.

The authors conducted a small cohort study to determine factors for nosocomial transmission of SARS among health care workers, and which job categories had the highest rates of infection. Nurses working on general wards and who cared for SARS

patients had the highest attack rates. Non-clinical staff experienced a 19% attack rate. These findings have implications for hospital infection control plans.

*Rizo, C.A., Lupea, D., Baybourdy, H. et al. (2005). What Internet Services Would Patients Like from Hospitals During an Epidemic? Lessons from the SARS Outbreak in Toronto. Journal of Medical Internet Research. 3;7(4):e46.

This article describes a study of attitudes towards use of the Internet to provide services during an outbreak of infectious disease. Patients at 3 Toronto hospitals were interviewed during the second SARS outbreak of 2003. The authors recommend that hospitals develop plans to use the Internet to maintain communication and continuity of care with patients during a large-scale infectious disease outbreak.

Schull, M., Stukel, T., Vermeulen, M., et al. (2007). Effect of Widespread Restrictions on the Use of Hospital Services During an Outbreak of Severe Acute Respiratory Syndrome. Canadian Medical Association Journal. 176(13).

The authors examined the effects of restrictions on non-urgent use of hospital services during the SARS outbreak in Toronto and found substantial decreases in elective use and also some decreases in emergency use, suggesting that some patients may have forgone care for urgent conditions.

Singer, P., Benatar, S., Bernstein, M., et al. (2003). Ethics and SARS: Lessons from Toronto. British Medical Journal. 327(7427): 1342-1344.

The authors formed a working group and developed a list of SARS-related ethical issues and values by a consensus process. They also developed a framework for looking at the ethical implications of the SARS outbreak, including 10 key ethical values, and five major ethical issues faced by medical decision makers.

Svoboda, T., Henry, B., Shulman, L., et al. (2004). Public Health Measures to Control the Spread of the Severe Acute Respiratory Syndrome During the Outbreak in Toronto. New England Journal of Medicine. 3;350(23):2352-61

The authors share an overview of patterns of transmission to help health officials prepare for future outbreaks.

Tai, D. (2006). SARS: How to Manage Future Outbreaks? Annals of the Academy of Medicine, Singapore. 35:368-73.

Using lessons learned from the 2003 SARS outbreak, the author provides planning recommendations for future outbreaks, and notes that this planning is valuable for bioterrorism or pandemic influenza response, even if SARS does not reemerge.

Tan, C. (2006). SARS in Singapore--Key Lessons from an Epidemic. Annals of the Academy of Medicine, Singapore. 35(5):345-9.

This article reviews lessons learned from the SARS outbreak in Singapore in 2003, and focuses on the containment and monitoring measures utilized. Large-scale home quarantine and telephone surveillance helped identify probable cases quickly, but required a significant effort to find a small number of cases comparatively. Daily temperature monitoring of health care workers led to early identification of SARS cases, but monitoring of children and travelers at the airports did not.

*Toner, E. and Nuzzo, J. (2011). Acting on the Lessons of SARS: What Remains To Be Done? (First page only.) Biosecurity and Bioterrorism: Biodefense Strategy, Practice, and Science. 9(2).

The authors share the lessons learned from the SARS outbreak, including how hospitals "amplified" the disease by performing specific procedures (e.g., endotracheal intubation and airway suctioning) that can aerosolize respiratory droplets. The authors then highlight successes (e.g., the use of "respiratory etiquette") that have come about as a result of implementing the lessons learned.

Wang, L.M., Chen, Y.C., Tung, S.P., et al. (2006). The Rationale of Fever Surveillance to Identify Patients with Severe Acute Respiratory Syndrome in Taiwan. Emergency Medicine Journal. 23(3):202-5.

The article describes a cohort study conducted in 2003 to develop a predictive score for SARS infection in patients presenting to emergency departments at several hospitals in Taiwan with fever. The score is based on 10 evaluation items that include symptoms; travel history; contact history; blood count data; and chest X-ray findings. The authors contend that the scoring system was more sensitive and specific than the World Health Organization case definition criteria.

Weinstein, R. (2004). Planning for Epidemics--The Lessons of SARS. New England Journal of Medicine. (Abstract only.) 350(23):2332-4.

The author provides comment on the public health measures taken during the 2003 SARS outbreak in Toronto.

*Wong, S.S. and Yuen, K.Y. (2008). The Management of Coronavirus Infections with Particular Reference to SARS. The Journal of Antimicrobial Chemotherapy. 62(3):437-41.

The authors review treatment options for coronavirus, with an emphasis on that for SARS, based on reports from the 2003 outbreak.

Yang, J.S., Park, S., Kim, Y.J., et al. (2015). Middle East Respiratory Syndrome in 3 Persons, South Korea, 2015. Emerging Infectious Diseases. 21(11): AOD

This article described the incident of Middle East Respiratory Syndrome coronavirus infection in South Korea on May 2015. Patients included were a man who had recently visited the Middle East, his wife, and a male patient who shared a hospital room with the index patient. The authors emphasize that rapid laboratory confirmation can facilitate subsequent prevention and control for imported cases.

Health Care Worker Safety

Branch-Elliman, W., Price, C.S., McGeer, A., and Perl, T.M. (2015). Protecting the Frontline: Designing an Infection Prevention Platform for Preventing Emerging Respiratory Viral Illnesses in Healthcare Personnel. (Abstract only.) Infection Control & Hospital Epidemiology. 36(3): 336-345.

The authors review the data behind current theories of respiratory virus transmission, and discuss critical aspects of respiratory illness prevention, taking into account influences such as the relative cost-effectiveness of different protection strategies.

*Brouqui, P. (2009). Facing Highly Infectious Diseases: New Trends and Current Concepts. Clinical Microbiology and Infection. 15(8):700-5.

This article includes guidelines for the care of patients with highly infectious diseases, with an emphasis on droplet precautions, isolation units, and need for healthcare worker training. The author advocates that protective measures for isolation units be modeled after those for biosafety level laboratories. Pediatric considerations are also included.

*Centers for Disease Control and Prevention. (2003). Cluster of Severe Acute Respiratory Syndrome Cases Among Protected Health-Care Workers-Toronto, Canada. Morbidity and Mortality Weekly, 52(19);433-436.

Despite apparent compliance with recommended infection-control precautions, a cluster of healthcare workers became ill with SARS during the 2003 outbreak. One table shows how these workers were exposed, by their occupation and type of exposure.

*Chen, W.Q., Ling, W.H., Lu, C.Y., et al. (2009). Which Preventive Measures Might Protect Health Care Workers from SARS? BMC Public Health. Morbidity and Mortality Weekly. 52(19);433-436.

The article describes a retrospective study of health care workers infected with SARS during the 2003 outbreak in China that sought to identify measures that might have protected them from becoming ill. Measures found to be preventive included the use of double gloves; high-air flow ventilation on the wards; and avoidance of face-to-face contact with SARS patients.

*Cheng, V.C., Chan, J.F., To, K.K., and Yuen, K.Y. (2013). Clinical Management and Infection Control of SARS: Lessons Learned. Antiviral Research. 100(2):407-19.

The authors review the 2003 SARS outbreak and discuss lessons learned, particularly with regard to treatment and containment activities. Summaries of studies conducted to identify risk factors and infection control measures, as well as to describe nosocomial outbreaks for affected countries, are included.

Chung, S.J., Ling, M.L., Seto, W.H. et al. (2014). Debate on MERS-CoV Respiratory Precautions: Surgical Mask or N95 Respirators? Singapore Medical Journal. 55(6):294-7.

The authors summarize a debate among infectious disease practitioners in Singapore regarding whether surgical masks or N-95 respirators should be recommended for health care workers caring for patients with MERS-CoV. They conclude that the evidence supports MERS-CoV being transmitted through droplets, except for aerosol-generating procedures, and so surgical masks are sufficient. They contend that it is more protective for health care workers to consistently wear surgical masks, than inconsistently wear N-95s. N-95 masks have previously been found to be uncomfortable and cause headaches and impaired mental function in health care workers after prolonged use. (Note that the CDC recommends N95s be used for suspect MERS-CoV in the U.S.)

*Fusco, F.M., Schilling, S., Puro, V. et al. (2009). EuroNHID Checklists for the Assessment of High-Level Isolation Units and Referral Centres for Highly Infectious Diseases: Results from the Pilot Phase of a European Survey. Clinical Microbiology and Infection. 15(8):711-19.

This article describes a series of three checklists developed to assess hospital capabilities in infection control and health care worker safety related to the treatment of patients with highly infectious diseases. Checklists focus on hospital resources, hospital procedures, and health care worker safety.

MacIntyre, C.R., and Chughtai, A.A. (2015). Facemasks for the Prevention of Infection in Healthcare and Community Settings. (Abstract only.) BMJ. 350:h694.

The authors summarize the available data on face mask use, noting how there is a lack of uniformity among the studies done to date, and a lack of data on the cost-effectiveness of face mask use. They discuss how the recommendations and language used varies across guidelines, and recommend areas for future research.

Memish, Z.A., Al-Tawfiq, J.A., Makhdoom, H.Q. et al. (2014). Screening for Middle East Respiratory Syndrome Coronavirus Infection in Hospital Patients and Their Healthcare Worker and Family Contacts: A Prospective Descriptive Study. Clinical Microbiology and Infection. 20(5); 469–474.

The article discusses a descriptive study wherein 5,065 individuals were screened for MERS-CoV, including suspected cases, health care worker contacts, and contacts of

laboratory-confirmed cases. The authors cite the data collected as part of this study, as well as data from studies undertaken in several countries, as proof that current infection control recommendations work. They state that the risk of transmission to health care workers is low.

Nickell, L., Crighton, E., Tracy, C., et al. (2004). Psychosocial Effects of SARS on Hospital Staff: Survey of a Large Tertiary Care Institution. Canadian Medical Association Journal. 170(5):793-8.

The authors studied the psychosocial effects associated with working in a hospital environment during the SARS outbreak. They found significant negative effects on employees' families and lifestyles as a result of this experience.

*Nishiyama, A., Wakasugi, N., Kirikae, T. et al. (2008). Risk Factors for SARS Infection Within Hospitals in Hanoi, Vietnam. Japanese Journal of Infectious Diseases. 61(5):388-90.

The authors looked at risk factors for nosocomial SARS infections in Vietnam in 2003. Consistent mask use by health care workers was found to reduce transmission of SARS among those exposed to patients with the disease.

Pei, L.Y., Gao, Z.C., Yang, Z. et al. (2006). Investigation of the Influencing Factors on Severe Acute Respiratory Syndrome Among Health Care Workers. (Abstract only.) Journal of Peking University Health Sciences. 18;38(3):271-5.

This article describes a study to determine factors affecting infections in health care workers from three hospitals. The authors found 19 protective factors (including double exposure suits, gloves, education, and room air ventilation) and three risk factors (including tracheal intubation).

*Reynolds, M.G., Anh, B.H., Thu, V.H., et al. (2006). Factors Associated with Nosocomial SARS-CoV Transmission Among Healthcare Workers in Hanoi, Vietnam, 2003. BMC Public Health. 6: 207.

The authors conducted a small cohort study to determine factors for nosocomial transmission of SARS among health care workers, and which job categories had the highest rates of infection. Nurses working on general wards and who cared for SARS patients had the highest attack rates. Non-clinical staff experienced a 19% attack rate. These findings have implications for hospital infection control plans.

Tran, K., Cimon, K., Severn, M., et al. (2013). Aerosol-Generating Procedures and Risk of Transmission of Acute Respiratory Infections: A Systematic Review. Canadian Agency for Drugs and Technologies in Health (CADTH).

The authors performed a literature review to assess evidence for the risk to health care workers of contracting an infectious disease from aerosol-generating procedures. They found the data to be limited, and describe the findings of each of the 10 included studies

in detail. They note that aerosol-generating procedures do seem to increase the risk of infection for health care workers, but that good infection control and proper training of workers can limit disease spread.

Nosocomial Transmission

*Assiri A., Al-Tawfiq JA, Al-Rabeeah AA, et al. (2013). Epidemiological, Demographic, and Clinical Characteristics of 47 Cases of Middle East Respiratory Syndrome Coronavirus Disease from Saudi Arabia: A Descriptive Study. (Abstract only.) Lancet Infectious Disease. (9):752-61.

The Saudi Arabian Ministry of Health provided an analysis of 47 individuals with laboratory-confirmed MERS-CoV disease. Data suggest that the clinical presentation of MERS-CoV infection ranges from asymptomatic to severe pneumonia with the acute respiratory distress syndrome, septic shock and multi-organ failure resulting in death. At least two cases had a consumptive coagulopathy during the course of their illness.

Breban R., Riou J., and Fontanet A. (2013). Interhuman Transmissibility of Middle East Respiratory Syndrome Coronavirus: Estimation of Pandemic Risk. Lancet. 382(9893):694-9.

The authors calculated the rate of MERS CoV introductions into the population from outbreaks in Jordan and Al Hasa. They modeled two potential scenarios: one where there are many introductions, but only moderate transmissibility, and another with few introductions but higher transmissibility. Their analysis suggested that, at the time of the study, MERS-CoV did not yet have pandemic potential.

Cauchemez, S., Fraser, C., Van Kerkhove, M.D., et al. (2014). Middle East Respiratory Syndrome Coronavirus: Quantification of the Extent of the Epidemic, Surveillance Biases, and Transmissibility. Lancet Infectious Disease. 14(1):50-6.

These authors analyzed epidemiological and genetic data to assess the extent of human infection, the performance of case detection, and the transmission potential of MERS-CoV with and without control measures.

*Centers for Disease Control and Prevention. (2003). Cluster of Severe Acute Respiratory Syndrome Cases Among Protected Health-Care Workers-Toronto, Canada. Morbidity and Mortality Weekly, 52(19);433-436.

Despite apparent compliance with recommended infection-control precautions, a cluster of healthcare workers became ill with SARS during the 2003 outbreak. One table shows how these workers were exposed, by their occupation and type of exposure.

*Chen, M., Leo, Y.S., Ang B., et al. (2006). The Outbreak of SARS at Tan Tock Seng Hospital--Relating Epidemiology to Control. Annals of the Academy of Medicine, Singapore. 35(5):317-25.

The authors describe the SARS outbreaks in the various wards of a hospital in Singapore, and discuss lessons learned from their experiences. Namely, that early detection and proper infection control procedures are critical to limiting or stopping transmission.

Cheng P.K., Wong D.A., Tong L.K., et al. (2004). Viral Shedding Patterns of Coronavirus in Patients with Probable Severe Acute Respiratory Syndrome. Lancet. 363(9422):1699-700.

The authors studied viral shedding of SARS coronavirus to improve diagnosis and infection control. They found that overall, peak viral loads were reached at 12-14 days of illness when patients were probably in hospital care, which would explain why hospital workers were prone to infection. Low rate of viral shedding in the first few days of illness meant that early isolation measures would probably be effective.

Cotten, M., Watson, S., Kellam, P., et al. (2013). Transmission and Evolution of the Middle East Respiratory Syndrome Coronavirus in Saudi Arabia: a Descriptive Genomic Study. Lancet. 382(9909):1993-2002.

Full genome deep sequencing was done on nucleic acid extracted directly from PCR-confirmed clinical samples from patients with confirmed MERS-CoV demonstrated that transmission within Saudi Arabia is consistent with either movement of an animal reservoir, animal products, or movement of infected people.

Fagbo, S. Skakni, L., Chu, D., et al. (2015). Molecular Epidemiology of Hospital Outbreak of Middle East Respiratory Syndrome, Riyadh, Saudi Arabia, 2014. Emerging Infectious Diseases 21(11):unv.

The authors examined an outbreak of MERS in a hospital in Riyadh, Saudi Arabia in 2014, and found this outbreak was part of a larger outbreak that affected multiple health care facilities in Riyadh and possibly arose from a single zoonotic transmission event.

Geller, C., Varbanov, M., and Duval, R.E. (2012). Human Coronaviruses: Insights into Environmental Resistance and its Influence on the Development of New Antiseptic Strategies. Viruses. 12;4(11):3044-68.

The authors summarize the available knowledge base regarding how well coronaviruses persist in the environment, and discuss the effectiveness of commonly used antiseptics-disinfectants to kill them. New antiseptic strategies are also discussed.

Hijawi, B., Abdallat, M., Sayaydeh, A., et al. (2013). Novel Coronavirus Infections in Jordan, April 2012: Epidemiological Findings from a Retrospective Investigation. East Mediterranean Health. 19(Supp1):S12-18.

This paper describes the epidemiological findings of retrospective investigation carried out in November 2012 for the earliest known healthcare associated outbreak of MERS-

CoV that occurred in April 2012. A total of 2 laboratory-confirmed and 11 probable cases were identified from this outbreak: 10 were HCWs and 2 were family members of cases. These findings highlight the likelihood of nosocomial transmission of nCoV infection in a health-care setting.

Lai, M.Y., Cheng, P.K., and Lim, W.W. (2005). Survival of Severe Acute Respiratory Syndrome Coronavirus. Clinical Infectious Diseases. 1;41(7):e67-71.

The authors assessed the survival of SARS-CoV from stool and respiratory specimens on different environmental surfaces and found that fecal and respiratory samples can remain infectious at room temperature for long periods of time (four days and more than seven days, respectively). The effectiveness of cleaning agents was also evaluated and the authors found that common disinfectants inactivated the virus.

*Nishiyama, A., Wakasugi, N., Kirikae, T. et al. (2008). Risk Factors for SARS Infection Within Hospitals in Hanoi, Vietnam. Japanese Journal of Infectious Diseases. 61(5):388-90.

The authors looked at risk factors for nosocomial SARS infections in Vietnam in 2003. Consistent mask use by health care workers was found to reduce transmission of SARS among those exposed to patients with the disease.

Pebody, R.G., Chand, M.A., Thomas, H.L., et al. (2012). The United Kingdom Public Health Response to an Imported Laboratory Confirmed case of a Novel Coronavirus in September 2012. EuroSurveillance. 17(40):20292.

The authors found that rapid institution of infection control measures can prevent acquisition of MERS-CoV in healthcare settings. They share a case study and highlight that strict respiratory isolation was instituted with a severely ill patient. Ten days after last exposure, none of 64 close contacts had developed severe disease (13 of 64 reported mild respiratory symptoms). The novel coronavirus was not detected in 10 of 10 symptomatic contacts tested.

Raboud, J. Shigayeva, A., McGeer, A., et al. (2010). Risk Factors for SARS Transmission from Patients Requiring Intubation: A Multicentre Investigation in Toronto, Canada. PLoS One. 5(5):e10717.

The authors conducted a retrospective cohort study to identify risk factors for transmission of SARS-CoV during intubation from confirmed SARS patients to healthcare workers. They found that close contact with the airway of severely ill patients and failure of infection control practices to prevent exposure to respiratory secretions were associated with transmission of SARS-CoV.

*Tang, J.W., Nicolle, A., Pantelic, J., et al. (2013). Different Types of Door-Opening Motions as Contributing Factors to Containment Failures in Hospital Isolation Rooms. PLoS One. 8(6):e66663.

The authors conducted experiments with different types of doors to assess which allowed the most air into and out of rooms to determine the type of door(s) that hospitals should use for isolation rooms. The effect of human movement on air flow when operating the doors was also examined. The authors contend that sliding doors are the most effective.

*Toner, E. and Nuzzo, J. (2011). Acting on the Lessons of SARS: What Remains To Be Done? (First page only.) Biosecurity and Bioterrorism: Biodefense Strategy, Practice, and Science. 9(2).

The authors share the lessons learned from the SARS outbreak, including how hospitals "amplified" the disease by performing specific procedures (e.g., endotracheal intubation and airway suctioning) that can aerosolize respiratory droplets. The authors then highlight successes (e.g., the use of "respiratory etiquette") that have come about as a result of implementing the lessons learned.

World Health Organization. (2014). Infection Prevention and Control of Epidemic- and Pandemic-Prone Acute Respiratory Infections in Health Care: WHO Guidelines.

This document provides recommendations, best practices and principles for infection prevention and control for acute respiratory infections in health care, particularly those that present as epidemics or pandemics. It includes information on PPE and aerosol-generating procedures. There are also summaries of literature and research reviews on physical interventions for infection control; risk of transmission from aerosol-generating procedures; and effectiveness of vaccination of health care workers to protect patients.

Plans, Tools, and Templates

California Emergency Medical Services Authority. (n.d.). Incident Response Guide: Infectious Disease. (Accessed 9/17/2015.)

This is an Incident Response Guide for hospitals to use in conjunction with their Incident Command System and emergency management plans. It describes actions by response role for identifying, triaging, isolating, treating, and tracking a surge of potentially infectious patients and staff.

Centers for Disease Control and Prevention. (2004). Public Health Guidance for Community-Level Preparedness and Response to Severe Acute Respiratory Syndrome (SARS) Version 2, Supplement C: Preparedness and Response in Healthcare Facilities.

This document provides recommendations on how to prepare for and respond to a case of SARS in a healthcare facility.

*Centers for Disease Control and Prevention. (2005). Public Health Guidance for Community-Level Preparedness and Response to Severe Acute Respiratory Syndrome (SARS) Version 2, Supplement I: Infection Control in Healthcare, Home, and Community Settings.

This web page contains links to guidance on SARS infection control in various settings.

*Centers for Disease Control and Prevention. (2015). Middle East Respiratory Syndrome (MERS).

This web page contains links to information on MERS for healthcare providers and laboratory professionals. Preparedness checklists for providers and health care facilities are included.

Dan, Y.Y., Tambyah, P.A., Sim, J., et al. (2009). Cost-effectiveness Analysis of Hospital Infection Control Response to an Epidemic Respiratory Virus Threat. Emerging Infectious Diseases. 15(12):1909-16.

The authors used cost data from hospitals in Singapore in a model to assess cost-effectiveness of infection control protocols in response to a respiratory virus epidemic. The model was based on transmission from a single case in the hospital setting, and did not assume widespread community transmission. The authors concluded that it was most cost-effective to use a step-up approach to infection control measures, as necessary, based on how an outbreak evolves vs. applying very stringent measures at the start of the outbreak and then scaling them back when it becomes apparent they are too broadly applied.

*Fusco, F.M., Schilling, S., Puro, V., et al. (2009). EuroNHID Checklists for the Assessment of High-Level Isolation Units and Referral Centres for Highly Infectious Diseases: Results from the Pilot Phase of a European Survey. Clinical Microbiology and Infection. 15(8):711-19.

This article describes a series of three checklists developed to assess hospital capabilities in infection control and health care worker safety related to the treatment of patients with highly infectious diseases. Checklists focus on hospital resources, hospital procedures, and health care worker safety.

*Peiris, J., Yuen, K., Osterhaus, A., and Stöhr, K. (2003). The Severe Acute Respiratory Syndrome. New England Journal of Medicine. 349(25):2431-41.

The authors share a timeline of the SARS outbreak and include tables that highlight clinical components of the disease, laboratory abnormalities associated with the disease, radiographic results of patients with SARS, and other information that can help healthcare providers understand the 2003 outbreak and prepare for future outbreaks.

*Public Health England. (2015). MERS Co-V Case Algorithm.

This algorithm assists clinicians and public health workers in the management of potential cases of MERS-CoV infection in the United Kingdom.

Punke, H. (2014). In Light of the Ebola Outbreak: 3 Considerations for Hospitals Dealing with Infectious Disease. Becker's Infection Control and Clinical Quality

This article focuses on three key business aspects of treating patients with highly infectious diseases: communication; human resources and staffing; and HIPAA concerns.

*Puro, V., Fusco, F.M., Lanini, S., et al. (2008). Risk Management of Febrile Respiratory Illness in Emergency Departments. The New Microbiologica. 31(2):165-73.

The authors use data from prior infectious disease outbreaks, including SARS in 2003, to emphasize how important it is for emergency departments to have effective screening and isolation protocols in place for febrile respiratory illness. Such protocols are critical to avoid possible disease transmission by infected patients in the waiting room to others also waiting to be seen.

Puro, V., Fusco, F.M., Schilling, S. et al. (2012). Biosecurity Measures in 48 Isolation Facilities Managing Highly Infectious Diseases. Biosecurity and Bioterrorism: Biodefense Strategy, Practice, and Science. 10(2): 208–214.

The authors discuss a survey of isolation units in Europe and advocate for the application of biosecurity measures to specialized isolation units in health care facilities to limit exposure of health care workers and deter theft of infectious material. Such measures include the use of key card access; surveillance cameras; guards at the doors; and sign-in/sign-out for all personnel entering the isolation area.

Qureshi, K., Gershon, R.R., Sherman, M.F., et al. (2005). Health Care Workers' Ability and Willingness to Report to Duty During Catastrophic Disasters. Journal of Urban Health. 82(3):378-88.

The authors conducted a survey of health care workers at 47 health care facilities in New York City and the surrounding area to determine responsiveness and willingness to work during disasters. They found that 64% of respondents felt they would be able to report to work during a SARS outbreak, while 48% indicated they would be willing to report to work during a SARS outbreak.

Rebmann, T. (2009.) Assessing Hospital Emergency Management Plans: A Guide for Infection Preventionists. (Abstract only.) American Journal of Infection Control. 37(9); 708-714.e4.

The author conducted a literature search to develop a checklist for infection preventionists to use to assess their hospital's emergency management plans. Infectious disease response considerations are addressed.

*Rizo, C.A., Lupea, D., Baybourdy, H. et al. (2005). What Internet Services Would Patients Like from Hospitals During an Epidemic? Lessons from the SARS Outbreak in Toronto. Journal of Medical Internet Research. 3;7(4):e46.

This article describes a study of attitudes towards use of the Internet to provide services during an outbreak of infectious disease. Patients at 3 Toronto hospitals were interviewed during the second SARS outbreak of 2003. The authors recommend that hospitals develop plans to use the Internet to maintain communication and continuity of care with patients during a large-scale infectious disease outbreak.

San Francisco Bay Area Advanced Practice Area. (2011.) Infectious Disease Emergency Response Toolkit. National Association of County and City Health Officials.

This toolkit contains customizable templates and guidance documents to assist public health planners with developing a comprehensive infectious disease response plan that incorporates principles of communicable disease control and emergency management.

San Francisco Department of Public Health. (2011). Infectious Disease Emergency Response Plan.

This plan contains the following sections: command, plans section (by unit), operations section, logistics, and finance. Four annexes that focus on different threats are included, as are sample forms and other appendices.

*Sandrock, C.E. (2008). Severe Febrile Respiratory Illnesses as a Cause of Mass Critical Care. Respiratory Care. 53(1):40-53.

The author reviews the agents that could necessitate the need for mass critical care of patients with severe febrile respiratory illness, as well as associated infection control protocols and personal protective equipment requirements, including those for procedures that could result in a high rate of disease transmission. Planning considerations are included, as are general treatment principles and research supporting lung ventilation protocols.

Sim, S.W., Moey, K.S., and Tan, N.C. (2014). The Use of Facemasks to Prevent Respiratory Infection: a Literature Review in the Context of the Health Belief Model. Singapore Medical Journal. 55(3):160-7.

The authors reviewed studies on facemask use in the community and framed their findings under the five principles of the Health Belief Model. They found that perceived susceptibility and perceived benefits of face mask use positively influenced compliance and recommend that a comprehensive approach to encouraging mask use during outbreaks of infectious disease in the community be utilized.

Teasdale, E., Santer, M., Geraghty, A.W. et al. (2014). Public Perceptions of Non-Pharmaceutical Interventions for Reducing Transmission of Respiratory Infection: Systematic Review and Synthesis of Qualitative Studies. BMC Public Health. 14:589.

The authors reviewed 16 studies from nine countries to synthesize the data on public perception of non-pharmaceutical interventions to reduce transmission of respiratory infections. They found that hand and respiratory hygiene were viewed as socially responsible, and that concerns about stigma influence perceptions around social distancing and isolation. Barriers, including beliefs about infection transmission, are also discussed in this article.

The Kingdom of Saudi Arabia Ministry of Health. MERS Command and Control Center. Health Guideline. (Accessed 9/21/15.)

This website provides recommendations on how to identify and manage a case of MERS in a healthcare facility.

Trust for America's Health. (2015.) Issue Brief: Top Actions the United States Should Take to Prepare for MERS-CoV and Other Emerging Infections.

This document discusses gaps in preparedness for responding to emerging infectious diseases, and provides recommendations for health care facilities to prepare to identify and care for patients with MERS-CoV or other novel respiratory infections.

Wallinga, J., van Boven, M., and Lipsitch, M. (2009). Optimizing Infectious Disease Interventions During an Emerging Epidemic. Proceedings of the National Academy of Sciences of the United States of America. 107(2):923-8.

The authors present a framework for allocating scarce resources and implementing interventions to limit or stop transmission during an epidemic, using limited data. They state that interventions should be targeted at groups with the highest risk of infection per individual to have the greatest impact, and that adjustments may be made as more data becomes available during the course of the epidemic.

*World Health Organization. (n.d.). Middle East Respiratory Syndrome Coronavirus (MERS-CoV). (Accessed 9/21/15.)

This web page contains links to information on MERS for healthcare providers and laboratory professionals. It also provides updates on the various outbreaks occurring around the world.

Agencies and Organizations

Note: The agencies and organizations listed in this section have a page, program, or specific research dedicated to this topic area.

Centers for Disease Control and Prevention. Middle East Respiratory Syndrome.

Centers for Disease Control and Prevention. Severe Acute Respiratory Syndrome.

The Kingdom of Saudi Arabia Ministry of Health. Middle East Respiratory Syndrome.

The Ontario Ministry of Health and Long Term Care. Severe Acute Respiratory Syndrome.

World Health Organization. Middle East Respiratory Syndrome Coronavirus.

World Health Organization. Severe Acute Respiratory Syndrome.

This ASPR TRACIE Topic Collection was comprehensively reviewed in August and September 2015 by the following subject matter experts (listed in alphabetical order): ***Eric Alberts****, BS, FPEM, CHS-V, CDP-1, CHPP, CHEP, SEM, CFRP, FABCHS, Manager, Emergency Preparedness, Orlando Health, Inc. (Hospital System);* ***John Hick,*** *MD, HHS ASPR and Hennepin County Medical Center;* ***Brad Learn,*** *Regional Healthcare Preparedness Coordinator, Kentucky Department for Public Health;* ***Connie Savor Price****, MD, Chief Medical Officer, Denver Health and Hospital and Professor of Medicine, Division of Infectious Diseases, University of Colorado School of Medicine;* ***Mary Russell,*** *EdD MSN, Emergency Services, Boca Raton Regional Hospital; and* ***Xiaoyan Song,*** *PhD, MBBS, MSc, Director, Infection Control/ Epidemiology, Children's National Health System and Associate Professor of Pediatrics, George Washington University School of Medicine and Health Sciences.*