TRACIE

HEALTHCARE EMERGENCY PREPAREDNESS INFORMATION GATEWAY

Ebola / Viral Hemorrhagic Fever Topic Collection

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ASPR

ASSISTANT SECRETARY FOR PREPAREDNESS AND RESPONSE

Topic Collection: Ebola / Viral Hemorrhagic Fever

The world watched as the 2014-2016 Ebola outbreak in West Africa exceeded the scope of previous outbreaks, killed and sickened thousands, overwhelmed health systems, and highlighted international gaps in infectious disease preparedness and response. For the first time, patients with Ebola were treated in American facilities, and we also saw the first secondary cases of Ebola in the U.S. (from a critically ill patient to two healthcare providers). The U.S. public health and healthcare systems mobilized quickly by conducting research, gathering promising practices, and drafting guidance for first responders, healthcare providers, and other stakeholders involved in screening, transporting, treating patients, and handling decontamination and waste management. Many healthcare facilities updated their plans with guidance as it was released, and pharmaceutical firms raced to create and test vaccines and specific therapies. The following resources highlight selected recent case studies, lessons learned, tools, and promising practices for planning for and responding to Ebola and viral hemorrhagic fever outbreaks. ASPR TRACIE updated this Topic Collection in August 2016.

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

Ansumana, R., Jacobsen, K., Idris, M., et al. (2015). Ebola in Freetown Area, Sierra Leone — A Case Study of 581 Patients. The New England Journal of Medicine. 372:587-588.

In this letter to the editor, the authors list treatment protocols used with patients who were admitted to an Ebola treatment center near Freetown, Sierra Leone, on or after September 20, 2014 (the date on which the first patients were admitted to that center). This center saw a 31% case fatality rate, lower than that of other studies.

Beeching, N., Fenech, M., and Houlihan, C. (2104). Ebola Virus Disease. The British Medical Journal. 349.

In this article, the authors explain what causes Ebola, the disease's pathophysiology, how to determine people at risk, infection control and prevention measures, symptoms, management, and recovery.

Centers for Disease Control and Prevention. (n.d.). Ebola Virus Disease (Ebola) Algorithm for Evaluation of the Returned Traveler. (Accessed 8/2/2016.)

Healthcare professionals can follow the steps in this infographic to evaluate travelers returning from countries with widespread Ebola transmission.

Centers for Disease Control and Prevention. (2014). Infection Prevention and Control Recommendations for Hospitalized Patients Under Investigation (PUIs) for Ebola Virus Disease (EVD) in U.S. Hospitals.

This webpage provides guidance for healthcare professionals regarding standard, contact, and droplet precautions when caring for an individual with suspected or confirmed Ebola.

Centers for Disease Control and Prevention. (2015). Interim Guidance for U.S. Hospital Preparedness for Patients Under Investigation (PUIs) or with Confirmed Ebola Virus Disease (EVD): A Framework for a Tiered Approach.

This webpage provides guidance for state and local health department staff and those who work in emergency care settings regarding developing preparedness plans for patients who are under investigation for or with confirmed Ebola.

Emory Healthcare. (2014). Emory Healthcare Ebola Preparedness Protocols. (Requires free registration.).

This website houses protocols developed by Emory Healthcare, which are based on lessons learned from treating patients with Ebola. Materials are grouped in the following categories: triage and risk assessment, inpatient care, support documents, videos, presentations, and appendices. Information on treatment, hospitals and clinics, patients and visitors, and information for physicians are also available.

Fairley, J., Kozarsky, P., Kraft, C., et al. (2016). Ebola or Not? Evaluating the Ill Traveler from Ebola-Affected Countries in West Africa. Open Forum Infectious Diseases. 3(1).

The authors describe the triage and evaluation of 25 travelers meeting the Centers for Disease Control and Prevention's case definition of a person under investigation at an emergency department, outpatient tropical medicine clinic, or Ebola treatment center. None had Ebola virus disease. The authors emphasize the importance of attention to infection control and considering other life-threatening conditions requiring urgent treatment, influenza vaccination, and other preventive measures for travelers.

Smith, P., Anderson, A., Christopher, G., et al. (2006). Designing a Biocontainment Unit to Care for Patients with Serious Communicable Diseases: A Consensus Statement. Biosecurity and Bioterrorism: Biodefense Strategy, Practice, and Science. 4(4):351-65.

The authors synthesize consensus recommendations collected from a conference of civilian and military professionals who are involved in the various aspects of biocontainment patient care units. Appendices include in-depth information on medical care issues (e.g., staffing the units, pathology, housekeeping), infection control issues (e.g., personal protective equipment, dealing with infectious waste), facility issues (e.g., air-handling, communication), and psychosocial and ethical issues.

Smith, C., Hughes, S., Karwowski, M., et al. (2015). Addressing Needs of Contacts of Ebola Patients During an Investigation of an Ebola Cluster in the United States - Dallas, Texas, 2014. MMWR Morbidity and Mortality Weekly Report. 64(5):121-123.

In this report, the authors discuss the importance of anticipating the nonclinical needs of those under public health surveillance (e.g., concerns about housing, transportation, education, employment, food, and other household needs). The report also stresses the importance of ensuring these types of support are addressed so that residents will be more likely to comply with quarantine orders, and the utility of community collaboration (with partners such as businesses, schools, community and faith-based organizations, and social services).

Sterk, E. (2008). Filovirus Hemorrhagic Fever Guideline. Medecins Sans Frontieres.

These guidelines serve as a summary of the *Medecins Sans Frontieres Ebola & Marburg Outbreak Control Guidance Manual*. The author provides an overview of all intervention strategy components deemed necessary during a Medecins Sans Frontieres intervention in both types of outbreaks.

Assessing and Testing

Association of Public Health Laboratories. (2014). Template for Public Health Laboratory Risk Assessment for Ebola Virus Disease (EVD) Testing.

Laboratory staff can download and tailor this template to meet their requirements. It includes comprehensive information on using enhanced precautions and personal protective equipment when handling high-risk Ebola specimens.

Brainard, J., Pond, K., Hopper, L., et al. (2016). Presence and Persistence of Ebola or Marburg Virus in Patients and Survivors: A Rapid Systematic Review. PLoS Neglected Tropical Diseases. 10(2):e0004475.

In this study, the authors review and summarize 33 studies that examined evidence of presence and persistence of infectious virus in various body fluids compared to onset of Ebola or Marburg illness. Research consistently showed high viral loads in blood during illness, but rarely later than 16 days after illness onset. Filovirus was also found in non-blood body fluids of actively ill patients, but rarely found in survivors, with the exception of semen, which tested positive as late as 203 days after onset of illness.

Centers for Disease Control and Prevention. (2014). Guidance for Collection, Transport and Submission of Specimens for Ebola Virus Testing.

This guidance, synthesized by the Centers for Disease Control and Prevention, is intended to help laboratory workers safely collect, transport, and submit specimens for Ebola virus testing.

Centers for Disease Control and Prevention. (2015). Guidance for U.S. Laboratories for Managing and Testing Routine Clinical Specimens When There is a Concern about Ebola Virus Disease.

This guidance is geared toward clinicians who are responsible for managing and testing clinical specimens for Ebola. Guidance covers the use of personal protective equipment, laboratory equipment, patient transport, decontamination, and other related topics.

*Fairley, J., Kozarsky, P., Kraft, C., et al. (2016). Ebola or Not? Evaluating the Ill Traveler from Ebola-Affected Countries in West Africa. Open Forum Infectious Diseases. 3(1).

The authors describe the triage and evaluation of 25 travelers meeting the Centers for Disease Control and Prevention's case definition of a person under investigation at an emergency department, outpatient tropical medicine clinic, or Ebola treatment center. None had Ebola virus disease. The authors emphasize the importance of attention to infection control and considering other life-threatening conditions requiring urgent treatment, influenza vaccination, and other preventive measures for travelers.

*Hill, C., Burd, E., Kraft, C., et al. (2014). Laboratory Test Support for Ebola Patients Within a High-Containment Facility. Laboratory Medicine. 45(3):e109-e111.

The authors (from Emory University) share the story of two U.S. nationals who contracted the Ebola virus while working in Africa. They list the instruments used to provide core assays and how they were used in the isolation facility.

Iwen, P., Garrett, J., Gibbs, S., et al. (2014). An Integrated Approach to Laboratory Testing for Patients with Ebola Virus Disease. Laboratory Medicine. 45(4):e146-151.

This article describes the evolution of the Nebraska Medical Center's approach to laboratory testing in conjunction with its biocontainment unit, including adjustments made following the arrival of its first patient with Ebola virus disease.

Southern, T., Racsa, L., Albarino, C., et al. (2015). Comparison of FilmArray and Quantitative Real-Time Reverse Transcriptase PCR for Detection of Zaire Ebolavirus from Contrived and Clinical Specimens. Journal of Clinical Microbiology. 53(9):2956-2960.

This study finds that emergency use authorization FilmArray panels are effective for detecting Ebola virus disease.

Wadman, M., Schwedhelm, S., Watson, S., et al. (2015). Emergency Department Processes for the Evaluation and Management of Persons Under Investigation for Ebola Virus Disease. Annals of Emergency Medicine. 66(3):306-314.

This article describes testing procedures that can be used by emergency departments and clinics to evaluate persons under investigation for Ebola virus disease.

Clinical Care

Ansumana, R., Jacobsen, K., Idris, M., et al. (2015). Ebola in Freetown Area, Sierra Leone — A Case Study of 581 Patients. The New England Journal of Medicine. 372:587-588.

In this letter to the editor, the authors list treatment protocols used with patients who were admitted to an Ebola treatment center near Freetown, Sierra Leone, on or after September 20, 2014 (the date on which the first patients were admitted to that center). This center saw a 31% case fatality rate, lower than that of other studies.

Centers for Disease Control and Prevention. (2014). Recommendations for Safely Performing Acute Hemodialysis in Patients with Ebola Virus Disease (EVD) in U.S. Hospitals.

The Centers for Disease Control and Prevention provide this guidance for individuals performing renal replacement therapy in patients with Ebola.

Centers for Disease Control and Prevention. (2016). Interim Guidance for Management of Survivors of Ebola Virus Disease in U.S. Healthcare Settings.

This document provides guidance on sequelae and Ebola virus persistence in survivors and infection control recommendations for healthcare workers evaluating them.

*Connor, M., Kraft, C., Mehta, A., et al. (2015). Successful Delivery of RRT in Ebola Virus Disease. Journal of the American Society of Nephrology. 26(1):31-37.

The authors describe the first successful delivery of renal replacement therapy to an Ebola patient and offer safety considerations and clinical practice guidelines based on the experience.

*Eriksson, C., Uyeki, T., Christian, M., et al. (2015). Care of the Child with Ebola Virus Disease. Pediatric Critical Care Medicine. 16(2):97-103.

The authors discuss considerations for the care of children with Ebola virus disease. They emphasize infection control practices to limit disease spread, and supportive care to treat patients.

*Fairley, J., Kozarsky, P., Kraft, C., et al. (2016). Ebola or Not? Evaluating the Ill Traveler from Ebola-Affected Countries in West Africa. Open Forum Infectious Diseases. 3(1):ofw005.

The authors describe the triage and evaluation of 25 travelers meeting the Centers for Disease Control and Prevention's case definition of a person under investigation at an emergency department, outpatient tropical medicine clinic, or Ebola treatment center. None had Ebola virus disease. The authors emphasize the importance of attention to infection control and considering other life-threatening conditions requiring urgent treatment, influenza vaccination, and other preventive measures for travelers.

*Hill, C., Burd, E., Kraft, C., et al. (2014). Laboratory Test Support for Ebola Patients Within a High-Containment Facility. Laboratory Medicine. 45(3):e109-e111.

The authors (from Emory University) share the story of two U.S. citizens who contracted the Ebola virus while working in Africa. The article lists the instruments that were used to provide core assays and describes how they were used in the isolation facility.

Kreuels, B., Wichmann D., Emmerich P., et al. (2014). A Case of Severe Ebola Virus Infection Complicated by Gram-Negative Septicemia. The New England Journal of Medicine. 371:2394-2401.

The authors describe the treatment of a patient who contracted Ebola (and multi-drug resistant, gram-negative sepsis) while working for the World Health Organization in Sierra Leone. The article provides a table that details the patient's clinical variables (e.g., temperature and heart rate), fluid measurements (e.g., intravenous, diarrhea, urine), and laboratory values (e.g., hemoglobin, white cells, sodium) from days 10 through 27 of the patient's illness.

Lyon, G., Mehta A., Varkey J., et al. (2014). Clinical Care of Two Patients with Ebola Virus Disease in the United States. The New England Journal of Medicine. 371:2402-2409.

The authors (from Emory University) present two case reports on two U.S. citizens who contracted the Ebola virus while working in Liberia. Line graphs detail laboratory values in both patients as they received ZMapp, an experimental treatment.

Maganga, G., Kapetshi, J., Berthet, N., et al. (2014). Ebola Virus Disease in the Democratic Republic of Congo. The New England Journal of Medicine. 371:2083-2091.

This article highlights the authors' studies of patients from July to October 2014 as they examined whether the outbreak in the Democratic Republic of Congo was related to the outbreak in West Africa.

Moole, H., Chitta, S., Victor, D., et al. (2015). Association of Clinical Signs and Symptoms of Ebola Viral Disease with Case Fatality: A Systematic Review and Meta-Analysis. Journal of Community Hospital Internal Medicine Perspectives. 5(4).

The authors completed a meta-analysis of articles from 1976 to November 2014 describing the clinical features of Ebola virus disease and identify the following signs and symptoms that may be associated with higher mortality: bleeding, vomiting, diarrhea, abdominal pain, cough, sore throat, and conjunctivitis.

Schieffelin, J., Shaffer, J., Goba, A., et al. (2014). Clinical Illness and Outcomes in Patients with Ebola in Sierra Leone. The New England Journal of Medicine. 371:2092-2100.

The authors provide a summary of clinical features and outcomes of Ebola patient care in the early phase of the response in Sierra Leone.

Smith, P., Boulter, K., Hewlett, A., et al. (2015). Planning and Response to Ebola Virus Disease: An Integrated Approach. (Abstract only.) American Journal of Infection Control. 43(5):441-446.

Like any hazard, the response to Ebola calls for complex tasks to be carried out by people with specific skills. The authors describe a variation of incident command as a framework for providing Ebola virus disease patient care.

*Sterk, E. (2008). Filovirus Hemorrhagic Fever Guideline. Medecins Sans Frontieres.

These guidelines serve as a summary of the *Medecins Sans Frontieres Ebola & Marburg Outbreak Control Guidance Manual*. The author provides an overview of all intervention strategy components deemed necessary during a Medecins Sans Frontieres intervention in both types of outbreaks.

*Sueblinvong, V., Johnson, D., Weinstein, G., et al. (2015). Critical Care for Multiple Organ Failure Secondary to Ebola Virus Disease in the United States. Critical Care Medicine. 43(10):2066-2075.

The authors describe three Ebola patients with severe critical illness and secondary multiple organ failure. Two of the three patients died, showing that mortality rates may be high even with aggressive care among those with multiple organ failure.

Tiffany, A., Vetter, P., Mattia, J., et al. (2016). Ebola Virus Disease Complications as Experienced by Survivors in Sierra Leone. Clinical Infectious Diseases. 62(11):1360-1366.

This research study confirms post-Ebola virus disease complications seen in previous outbreaks and recommends follow-up care begin during hospitalization and immediately following discharge to detect and treat complications before they cause long-term disability.

Uyeki, T., Florescu, D., and Lyon, G. (2014). Approaches to Clinical Management for Patients with Ebola Treated in U.S. Hospitals. Centers for Disease Control and Prevention.

Speakers from the University of Nebraska Medical Center and Emory University share information about the clinical features, complications, and patient management associated with Ebola.

Uyeki, T., Mehta, A., Davey, R., et al. (2016). Clinical Management of Ebola Virus Disease in the United States and Europe. The New England Journal of Medicine. 374:636-646.

The authors review 27 Ebola virus disease patients treated in the United States or Europe, describing patient characteristics, clinical and laboratory findings, supportive clinical care, investigational therapies, results from virologic and immunologic examination, and outcomes.

Vetter, P., Kaiser, L., Schibler, M., et al. (2016). Sequelae of Ebola Virus Disease: The Emergency Within the Emergency. The Lancet Infectious Diseases. 16(6):e82-e91.

The authors discuss current knowledge of Ebola virus disease sequelae, challenges to provision of care to survivors, and areas for future research.

Decontamination and Waste Management

Centers for Disease Control and Prevention. (2015). Ebola-Associated Waste Management.

The information provided in this webpage is intended to help healthcare providers and facility staff safely handle, transport, and dispose of waste associated with the care of patients with suspected or confirmed Ebola virus disease.

Fischer, R., Judson, S. Miazgowicz, K., et al. (2015). Ebola Virus Stability on Surfaces and in Fluids in Simulated Outbreak Environments. Dispatch. 21(7).

The authors simulated environmental conditions and found that the Ebola virus remains active for a longer time on hospital surfaces than it does in African conditions. The virus also lives longer in liquid than it does in dried blood.

Jelden, K., Gibbs, S., Smith, P., et al. (2015). Nebraska Biocontainment Unit Patient Discharge and Environmental Contamination after Ebola Care. American Journal of Infection Control. 43(3).

The authors describe the decontamination protocols to be taken by the staff at the Nebraska Biocontainment Unit in the event of the following: when a patient treated for Ebola is discharged, when a body of a patient with Ebola is removed, and when environmental decontamination of the isolation unit is required.

Krishnan, J., Berry, J., Fey, G., and Wagener, S. (2006). Vaporized Hydrogen Peroxide-based Biodecontamination of a High-Containment Laboratory under Negative Pressure. Applied Biosafety. 11(2):74-80.

The authors examine the efficacy of vaporized hydrogen peroxide (VHP) as a formaldehyde alternative for decontaminating space in a containment level 3 laboratory suite. They found that VHP can be used (under negative pressure) to safely biodecontaminate a laboratory.

Lowe, J., Gibbs, S., Schwedhelm, S., et al. (2014). Nebraska Biocontainment Unit Perspective on Disposal of Ebola Medical Waste. American Journal of Infection Control. 42(12):1256-1257.

The authors describe Ebola medical waste processing requirements and their impact on U.S. hospitals.

Lowe, J., Hewlett, A., Iwen, P., et al. (2015). Surrogate Testing Suggests that Chlorine Dioxide Gas Exposure Would Not Inactivate Ebola Virus Contained in Environmental Blood Contamination. Journal of Occupational and Environmental Hygiene. 12(9):D211-215.

This study finds that decontamination with Chlorine Dioxide must be preceded by manually wiping down surfaces potentially contaminated by blood to inactivate bacteria present in blood.

U.S. Army Medical Department, U.S. Army Public Health Command. (2014). Decontamination of Vehicles Used for Transportation of Potential Ebola Virus Disease (EVD) Patients or Related Equipment.

The authors provide guidance for decontaminating vehicles used to transport equipment or personnel in an Area of Operations impacted by Ebola.

U.S. Army Medical Department, U.S. Army Public Health Command. (2014). Preparing and Measuring High Chlorine Concentration Solutions for Disinfection.

This "Technical Information Paper" shares specific measurements and contact time to achieve disinfection when using chlorine solution to disinfect surfaces contaminated with diseases including Ebola.

U.S. Department of Labor, Occupational Safety and Health Administration. (2014). Cleaning and Decontamination of Ebola on Surfaces: Guidance for Workers and Employers in Non-Healthcare/Non-Laboratory Settings.

This factsheet provides guidance on Ebola cleaning and decontamination procedures for those who work in non-healthcare and non-laboratory settings. Links to information on disinfectants, waste disposal, and personal protective equipment are provided throughout the document.

U.S. Department of Labor, Occupational Safety and Health Administration, Centers for Disease Control and Prevention, National Institute for Occupational Safety and Health, and Environmental Protection Agency. (2016). Safe Handling, Treatment, Transport and Disposal of Ebola-Contaminated Waste.

This fact sheet provides a step-by-step summary of actions workers should take from the point Ebola-contaminated waste is generated through final disposal.

U.S. Department of Transportation, Pipeline and Hazardous Materials Safety Administration. (2014). Procedural Guidance on the Proper Packaging of Ebola Suspected Waste.

This document includes general information on transporting Ebola-contaminated waste and links to related Department of Transportation guidance.

U.S. Environmental Protection Agency. (2014). Disinfectants for Use Against the Ebola Virus.

The Environmental Protection Agency lists products that meet the Centers for Disease Control and Prevention's criteria for use against the Ebola virus on hard, non-porous surfaces. Products are listed by name and indicate whether they are approved for use in hospital/healthcare facilities, institutions such as schools and offices, and residences.

Education and Training

Centers for Disease Control and Prevention. (n.d.). Ebola Virus Disease (Ebola) Algorithm for Evaluation of the Returned Traveler. (Accessed 8/1/2016.)

Healthcare professionals can follow the steps in this infographic to evaluate travelers returning from countries with widespread Ebola transmission.

Centers for Disease Control and Prevention. (n.d.). Preparing Healthcare Workers to Work in Ebola Treatment Units (ETUs) in Africa: Training Toolkit. (Free registration required.) (Accessed 8/3/2016.)

This downloadable or hard copy training toolkit replaces the Centers for Disease Control and Prevention's three-day, in-person training course for healthcare workers planning to work in Ebola Treatment Units in Africa. The course uses lectures, tabletop exercises,

and hands-on interactive exercises to teach effective infection prevention and control before they receive additional follow-up training prior to deployment.

*European Union, European Centre for Disease Prevention and Control. (2014). Safe Use of Personal Protective Equipment in the Treatment of Infectious Diseases of High Consequence: A Tutorial for Trainers in Healthcare Settings.

This training program provides information on the proper use of personal protective equipment at the point of care and shares information on procurement, preparedness, and capacity building.

Evans, D. and del Rio, C. (n.d.). Ebola Virus Disease: An Evolving Epidemic. Emory University. (Accessed 8/3/2016.)

This online course provides an overview of various aspects of the Ebola epidemic, including prevention, treatment, and ethical considerations.

Federal Emergency Management Agency. (2015). Ebola Virus Disease Regional Network Coordination Table Top Exercise.

This exercise can help participants plan for coordinated transport of a person diagnosed with Ebola virus disease, between and within states, to the Regional Ebola Treatment Center in Texas.

Federal Emergency Management Agency. (2015). TALON Ebola Preparedness Tabletop Exercise: Situation Manual.

This situation manual was developed for participants of the Ebola Virus Disease Regional Network Table Top Exercise. It includes scenarios and related questions, and several appendices, including links to helpful resources.

*Gabriel, E., Randolph, J., Levy, D., et al. (2014). Ebola Preparedness for Emergency Medical Services. U.S. Department of Health and Human Services, Office of the Assistant Secretary for Preparedness and Response.

This 55-minute webinar features speakers from the U.S. Department of Health and Human Services, Office of the Assistant Secretary for Preparedness and Response, and Centers for Disease Control and Prevention. The presenters discuss the Detailed Emergency Medical Services Checklist for Ebola Preparedness, which highlights activities that EMS agencies and systems should consider to prepare for managing patients with Ebola and other infectious diseases.

Love, C., Arneson, S., and Phillips, S. (2015). Ebola Outbreak Response: The Role of Information Resources and the National Library of Medicine. (Abstract only.) Disaster Medicine and Public Health Preparedness. 9(1):82-85.

The authors explain the functionality of the National Library of Medicine, and how it works with publishers to provide free access to many full-text articles from over 650 biomedical journals and 4,000 online reference books through the Emergency Access Initiative. They also highlight the recently-created "Ebola Outbreak 2014: Information Resources" webpage.

*MESH Coalition. (2016). An Exercise in the Provision of Care for an Adult Patient under Investigation (PUI) for Ebola: A Patient Care Drill.

This simulation toolkit provides a situation overview, general information, simulation logistics, post-simulation and evaluation activities, and participant information and guidance along with appendices containing templates and forms for hospitals to test their established protocols for the provision of care to a patient with a suspect highly infectious disease. Multiple injects such as vomiting encourage testing a range of different procedures through the exercise.

*Stout, T. and Garza, A. (2015). Emergency Medical Services (EMS) and Ebola. International Society for Disease Surveillance.

This one-hour webinar discusses how emergency medical services (EMS) in the U.S. and Canada responded to the threat of Ebola. It focuses on two main areas affecting EMS providers and their public health partners: EMS agency Ebola information sharing and best practices development, and EMS data surveillance approaches.

Tennessee Department of Health. (2014). Ebola Virus Disease: TDH EVD Tabletop Exercise Situation Manual for Healthcare.

This manual can be used by planners who are interested in carrying out tabletop exercises to bolster healthcare preparedness for infectious disease outbreaks. This particular exercise focuses on Ebola and begins with a scenario of a 23 year-old male reporting to the emergency department with a variety of symptoms.

*The University of Nebraska Medical Center. (n.d.). HEROES Webpage. (Accessed 8/3/2016)

The videos on this webpage feature step-by-step demonstrations of the doffing and donning of personal protective equipment (PPE), testing of powered air purifying respirator-level PPE, and the assembly and use of body sealers and ISOPODs.

The University of Nebraska, College of Public Health. (2014). Nebraska Method-Interviews with Biocontainment Doctors.

In this video, doctors from the University of Nebraska respond to questions about working in the biocontainment unit with patients infected with Ebola.

The University of Nebraska, College of Public Health. (2014). Nebraska Method-Interviews with Biocontainment Nurses.

Two nurses who work in the University of Nebraska's Biocontainment Unit discuss working in this unit, what resources are needed to manage and maintain the unit, and their experience treating patients with highly infectious diseases such as Ebola.

U.S. Department of Health and Human Services, Office of the Assistant Secretary for Preparedness and Response, and the Centers for Disease Control and Prevention. (2014). Ebola Training Webinar for Healthcare Coalitions and Healthcare Workers.

This webinar presents lessons learned, and other best practices for healthcare workers and coalitions as a result of the Ebola epidemic.

University of Nebraska Medical Center. (n.d.). The Nebraska Ebola Method – For General Public. (Available only through iTunes.) (Accessed 8/3/2016.)

This course offers eight lessons geared toward educating the general public about the Ebola virus. The podcast summarizes Ebola issues, and the other lessons cover the medical center's biocontainment unit, and provide information for children/families.

Emergency Medical Services

*Bratt, J., Robinson, A., and Alcorta, R. (n.d.). Strategies and Considerations for the Deployment of EMS Personal Protective Equipment in Response to an Ebola Outbreak. Maryland Institute for Emergency Medical Service Systems. (Accessed 8/1/2016.)

This article describes protection of emergency medical services personnel through personal protective equipment (PPE), including requirements, PPE cost (and how to estimate it), PPE deployment strategies, and personnel requirements.

Centers for Disease Control and Prevention. (2014). EMS (Emergency Medical Services) and Ebola: Field Experience with Transporting Patients.

Speakers from Emory University and the University of Nebraska Medical Center share emergency medical services field experiences with two patients. The session provides information on patient transport, training, equipment, policy, and procedures, and how to identify partners in planning for the transport of patients.

*Centers for Disease Control and Prevention. (2015). Q&A's about the Transport of Pediatric Patients (< 18 years of age) Under Investigation or with Confirmed Ebola.

This webpage is intended to provide first responders with information to help protect themselves, younger patients, and patients' family members by answering the most frequently asked questions.

*Gabriel, E., Randolph, J., Levy, D., et al. (2014). Ebola Preparedness for Emergency Medical Services. U.S. Department of Health and Human Services, Office of the Assistant Secretary for Preparedness and Response.

This 55-minute webinar features speakers from the U.S. Department of Health and Human Services, Office of the Assistant Secretary for Preparedness and Response, and Centers for Disease Control and Prevention. The presenters discuss the Detailed Emergency Medical Services Checklist for Ebola Preparedness, which highlights activities that EMS agencies and systems should consider to prepare for managing patients with Ebola and other infectious diseases.

InterAgency Board for Equipment Standardization and Interoperability. (2014). Recommendations on Selection and Use of Personal Protective Equipment for First Responders against Ebola Exposure Hazards.

The InterAgency Board for Equipment Standardization and Interoperability reviewed current U.S. government guidance related to personal protective equipment (PPE) in order to develop recommendations for first responders on PPE selection and decontamination. The recommendations include descriptions of PPE items for high and low risk exposures and detailed specifications/standards for recommended PPE.

Lowe, J., Jelden, K., Schenarts, P., et al. (2014). Considerations for Safe EMS Transport of Patients Infected with Ebola Virus. Prehospital Emergency Care. 19(2).

The authors discuss the coordination of the Nebraska Biocontainment Unit (through the Nebraska Medical Center in Omaha) and Omaha Fire Department's emergency medical services when transporting patients with confirmed Ebola virus from the airport to the high-level isolation unit. Three critical areas have been identified from their experience and are addressed in this article: ambulance preparation, appropriate selection and use of personal protective equipment, and environmental decontamination.

National Association of State EMS Officials. (2015). NASEMSO After Action Review: Lessons Learned, Best Practices and Recommendations – Ebola Disease Outbreak.

NASEMSO's Domestic Preparedness Committee prepared this document to highlight critical dates during the Ebola outbreak, provide background information on the disease, describe lessons learned from the response, identify best practices, and recommend actions to federal partners.

New Hampshire Division of Public Health Services and New Hampshire Bureau of Emergency Medical Services. (2015). Ebola Preparedness for Emergency Medical Services.

This document provides interim guidance to emergency medical services (EMS) providers to prepare for a suspect Ebola virus disease patient. It includes information on steps that EMS personnel should take immediately as preventative measures, how to

screen suspect cases, how to use personal protective equipment, and steps to take to decontaminate ambulances and medical equipment.

New York State Department of Health and New York State Emergency Medical Services. (n.d.). Ebola Virus Disease (EVD) In-Service EMS Training Online. (Accessed 8/3/2016.)

This document provides information on Ebola (e.g., how it is transmitted, signs and symptoms), and several recommendations to emergency medical services (EMS) personnel such as use of personal protective equipment, cleaning EMS transport vehicles after transporting a patient with suspected or confirmed Ebola, and follow-up and/or reporting measures by EMS personnel after caring for a suspected or confirmed Ebola patient.

*Stout, T. and Garza, A. (2015). Emergency Medical Services (EMS) and Ebola. International Society for Disease Surveillance.

This one-hour webinar discusses how emergency medical services (EMS) in the U.S. and Canada responded to the threat of Ebola. It focuses on two main areas affecting EMS providers and their public health partners: EMS agency Ebola information sharing and best practices development, and EMS data surveillance approaches.

U.S. Department of Health and Human Services, Office of the Assistant Secretary for Preparedness and Response. (n.d.). Ebola Information for EMS Providers, Agencies, and Systems. (Accessed 8/1/2016.)

This webpage provides an overview and links to presentations relevant to emergency medical services providers, agencies, and systems and links to information on patient evaluation and diagnosis, personal protective equipment, patient privacy issues, patient movement, and waste management and disposal.

U.S. Department of Health and Human Services, Office of the Assistant Secretary for Preparedness and Response. (2015). Air to Ground Transport Fact Sheet: Planning Considerations When Developing Standard Operating Procedures for the Transfer of an Ebola (or Other Highly Infectious Disease) Patient from/to an Air Transport Provider to/from a Ground Transport Provider.

This fact sheet can help transport providers and healthcare facilities develop standard operating procedures for air-to-ground transfers of Ebola virus disease patients. It focuses on six elements for consideration: securing and preparing the ground unit(s), communicating with state and local government partners, identifying and resolving airfield issues, securing an appropriate protective force, identifying and resolving travel route issues, and managing public and media communications.

Virginia Department of Health. (n.d.). Ebola Virus Disease (EVD). (Accessed 8/2/2016.)

This webpage highlights guidance and other documents to assist emergency medical services (EMS) providers and agencies in understanding Ebola. It includes links to the plans and guidance of each Regional EMS Council in Virginia.

Wu, H., Fairley, J., Steinberg, J., and Kozarsky, P. (2014). The Potential Ebola Virus–Infected Patient in the Ambulatory Care Setting: Preparing for the Worst Without Compromising Care. Annals of Internal Medicine. 162(1):66-67.

The authors discuss implications of people with undiagnosed Ebola reporting to healthcare facilities. They worked with key stakeholders to develop a list of considerations for patient management, which is displayed in Table 1.

Ethics

*Cohen, J., and Kupferschmidt, K. (2014). Ebola Vaccine Trials Raise Ethical Issues. Science. 346(6207):289-90.

The authors discuss the ethical concerns associated with having a control group when testing Ebola vaccines.

Gutman, A., Wagner, J., Allen, A., et al. (2015). Ethics and Ebola: Public Health Planning and Response. Presidential Commission for the Study of Bioethics.

The authors emphasize that the U.S. must strengthen public health preparedness related to Ebola, including "ethics preparedness." They also share seven recommendations related to policy and research design.

Narasimhulu, D., Edwards, V., Chazotte, C., et al. (2015). Healthcare Workers' Attitudes Toward Patients with Ebola Virus Disease in the United States. Open Forum Infectious Diseases. 3(2):1-7.

This study tested healthcare workers' willingness to care for Ebola virus disease patients and employees' ethical beliefs about refusing to care for Ebola virus disease patients. Results showed that ethical beliefs influenced willingness to care, but were also balanced by concerns about the risks to personal and family safety.

Venkat, A., Wolf, L., Geiderman, J., et al. (2015). Ethical Issues in the Response to Ebola Virus Disease in US Emergency Departments: A Position Paper of the American College of Emergency Physicians, the Emergency Nurses Association and the Society for Academic Emergency Medicine. (Abstract only.) Journal of Emergency Nursing. 41(2):e5-e16.

The American College of Emergency Physicians, the Emergency Nurses Association, and the Society for Academic Emergency Medicine jointly developed a position paper to

share guidance with U.S. emergency physicians, emergency nurses, and other healthcare stakeholders on how to approach the ethical dilemmas posed by the Ebola outbreak.

World Health Organization. (2014). Ethical Issues Related to Study Design for Trials on Therapeutics for Ebola Virus Disease: WHO (World Health Organization). Ethics Working Group Meeting, 20-21 October [2014], Summary of Discussion.

This summary of a meeting of the Ethics Working Group highlights areas in which members reached consensus and key points for companies who are conducting vaccine trials to consider. The authors include a decision matrix that can help potential researchers determine if their proposed studies are ethical in nature.

Fatality Management

Centers for Disease Control and Prevention. (2015). Guidance for Safe Handling of Human Remains of Ebola Patients in U. S. Hospitals and Mortuaries.

The Centers for Disease Control and Prevention provides step-by-step guidance for individuals responsible for performing postmortem care on Ebola patients in U.S. hospitals and mortuaries.

World Health Organization. (2014). Field Situation: How to Conduct Safe and Dignified Burial of a Patient who has Died from Suspected or Confirmed Ebola Virus Disease.

The World Health Organization developed a 12-step burial protocol for Burial Teams, beginning with their arrival to a village and ending with their return to the hospital or team headquarters.

Hospital/Clinic Protocols

*Centers for Disease Control and Prevention. (2014). Infection Prevention and Control Recommendations for Hospitalized Patients Under Investigation (PUIs) for Ebola Virus Disease (EVD) in U.S. Hospitals.

This webpage provides guidance for healthcare professionals regarding standard, contact, and droplet precautions when caring for an individual with suspected or confirmed Ebola.

Centers for Disease Control and Prevention. (2015). Interim Guidance for U.S. Hospital Preparedness for Patients Under Investigation (PUIs) or with Confirmed Ebola Virus Disease (EVD): A Framework for a Tiered Approach.

This webpage provides guidance for state and local health department staff and those who work in emergency care settings regarding developing preparedness plans for patients who are under investigation for or with confirmed Ebola.

Centers for Disease Control and Prevention. (2015). Preparing U.S. Hospitals for Ebola.

This infographic highlights the differences between a frontline healthcare facility, an Ebola assessment hospital, and an Ebola treatment center.

Emory Healthcare. (2014). Emory Healthcare Ebola Preparedness Protocols. (Requires registration.)

This website was designed to house protocols developed by Emory Healthcare, which are based on lessons learned from treating patients with Ebola. Materials are grouped in the following categories: triage and risk assessment, inpatient care, support documents, videos, presentations, and appendices. Information on treatment, hospitals and clinics, patients and visitors, and information for physicians are also available.

Kortepeter, M., Smith, P., Hewlett, A., et al. (2014). Caring for Patients with Ebola: A Challenge in Any Care Facility. Annals of Internal Medicine. 162(1):68-69.

The authors recommend a network of referral centers, linked BSL-4 laboratories or quarantine stations as the preferred clinical option for Ebola patients.

Lurie, N., Merlin, T., Fagen, R., et al. (2014). Hospital Preparedness Call: Preparing Your Healthcare System for Ebola. U.S. Department of Health and Human Services, Office of the Assistant Secretary of Preparedness and Response.

During this call, the speakers discuss preparing the U.S. healthcare system for response to Ebola.

*Redd, S., Smith, P., Hewlett, A., et al. (2014). Preparing for Ebola: What U.S. Hospitals Can Learn From Emory Healthcare and Nebraska Medical Center. (Recording). Centers for Disease Control and Prevention.

Speakers from the Centers for Disease Control and Prevention, the University of Nebraska Medical Center, Nebraska Biocontainment Unit, Emory's Serious Communicable Disease Unit, and Emory Healthcare share their lessons learned on healthcare system preparedness and treating patients with Ebola.

Smith, P., Anderson, A., Christopher, G., et al. (2006). Designing a Biocontainment Unit to Care for Patients with Serious Communicable Diseases: A Consensus Statement. Biosecurity and Bioterrorism: Biodefense Strategy, Practice, and Science. 4(4):351-365.

The authors synthesized consensus recommendations collected from a conference of civilian and military professionals who are involved in the various aspects of biocontainment patient care units. Appendices include in-depth information on medical care issues (e.g., staffing the units, pathology, housekeeping), infection control issues (e.g., personal protective equipment, dealing with infectious waste), facility issues (e.g., air-handling, communication), and psychosocial and ethical issues.

*Sterk, E. (2008). Filovirus Hemorrhagic Fever Guideline. Medecins Sans Frontieres.

These guidelines serve as a summary of the *Medecins Sans Frontieres Ebola & Marburg Outbreak Control Guidance Manual*. The author provides an overview of all intervention strategy components deemed necessary during a Medecins Sans Frontieres intervention in both types of outbreaks.

Infection Control

Bausch, D., Towner, J., Dowell, S., et al. (2007). Assessment of the Risk of Ebola Virus Transmission from Bodily Fluids and Fomites. Journal of Infectious Diseases. 196(Supplement 2):S142-S147.

The authors tested clinical specimens from 26 laboratory-confirmed cases of Ebola and describe how they were able to detect the virus by culture and/or reverse-transcription polymerase chain reaction in 16 of 54 clinical specimens (including saliva, stool, breastmilk, tears, and nasal blood).

*Beam, E., Gibbs, S., Hewlett, A., et al. (2015). Clinical Challenges in Isolation Care. American Journal of Nursing. (Abstract only.).

The authors note variation in personal protective equipment practices among nurses in a patient simulation and the potential impact on facility infection control.

*Centers for Disease Control and Prevention. (2014). Infection Prevention and Control Recommendations for Hospitalized Patients Under Investigation (PUIs) for Ebola Virus Disease (EVD) in U.S. Hospitals.

This webpage provides guidance for healthcare professionals regarding standard, contact, and droplet precautions when caring for an individual with suspected or confirmed Ebola.

Centers for Disease Control and Prevention. (2014). Review of Human-to-Human Transmission of Ebola Virus.

This report is a summary of the published scientific information regarding the human-to-human transmission of Ebola. The Centers for Disease Control and Prevention presents epidemiological data, laboratory data, information on transmission among patients and healthcare personnel, and a summary of recent information on airborne transmission.

Chugtai, A., Barnes, M., and MacIntyre, C. (2016). Persistence of Ebola Virus in Various Body Fluids During Convalescence: Evidence and Implications for Disease Transmission and Control. Epidemiology and Infection. 144(8):1652-1660.

The authors review articles examining persistence of Ebola virus disease in body fluids during the convalescent phase. They note that the virus persists in body fluids following clinical recovery and clearance from the blood and recommend additional study to

quantify virus persistence and infectivity after the acute illness phase to better inform infection control guidelines.

*Edmond, M., Diekema, D., and Perencevich, E. (2014). Ebola Virus Disease and the Need for New Personal Protective Equipment. (First page only). Journal of the American Medical Association. 312(23):2495-2496.

The authors discuss issues associated with personal protective equipment and highly contagious, multiple drug resistant organisms, including the Ebola virus.

*Sterk, E. (2008). Filovirus Hemorrhagic Fever Guideline. Medecins Sans Frontieres.

These guidelines serve as a summary of the *Medecins Sans Frontieres Ebola & Marburg Outbreak Control Guidance Manual*. The author provides an overview of all intervention strategy components deemed necessary during a Medecins Sans Frontieres intervention in both types of outbreaks.

Tang, J., 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.

Legal/Regulatory Issues

Centers for Medicare and Medicaid Services. (2014). Emergency Medical Treatment and Labor Act (EMTALA) Requirements and Implications Related to Ebola Virus Disease (Ebola).

This memorandum shares information about the role of emergency department staff in complying with EMTALA with regards to screening and isolating patients suspected of having Ebola.

*Kraemer, J., Siedner, M., and Stoto, M. (2015). Analyzing Variability in Ebola-Related Controls Applied to Returned Travelers in the United States. Health Security. 13(5):295-306.

This study examined the various policies regarding entry screening and quarantine procedures in effect during the recent Ebola epidemic.

Sunshine, G., and Ransom, M. (2015). Ebola and the Law: Legal Preparedness for Physicians and Hospitals. Centers for Disease Control and Prevention, Office for State, Tribal, Local and Territorial Support.

The authors synthesize the information they shared during the presentation "Ebola and Public Health Law" on the following topics: the duty to plan and comply with the plan, public health powers, disease investigation, isolation and quarantine, and medical guidance for Ebola patients.

*U.S. Department of Health and Human Services. (2014). Ebola Virus Disease Vaccines. Federal Register.

In 2014, ASPR released this declaration under the Public Readiness and Emergency Preparedness Act. This document includes information on when a public health emergency is declared, liability immunity, and covered countermeasures.

Lessons Learned

Bell, B., Damon, I., Jernigan, D., et al. (2016). Overview, Control Strategies, and Lessons Learned in the CDC Response to the 2014-2016 Ebola Epidemic. MMWR Supplement. 65(3):4-11.

The authors provide a history of Ebola virus disease, discuss the response to the recent epidemic, and describe how to apply lessons learned to future outbreaks.

*Bower, H., Grass, J., Veltus, E., et al. (2015). Delivery of an Ebola Virus-Positive Stillborn Infant in a Rural Community Health Center, Sierra Leone, January 2015. The American Journal of Tropical Medicine and Hygiene. 15-0619. (Abstract only.)

The authors provide a case study of an Ebola virus (EBOV) RNA–negative pregnant woman who delivered an EBOV RNA–positive stillborn infant at a community health center in rural Sierra Leone. They also discuss the need for personal protective equipment in similar situations.

*Connor, M., Kraft, C., Mehta, A., et al. (2015). Successful Delivery of RRT in Ebola Virus Disease. Journal of the American Society of Nephrology. 26(1):31-37.

The authors describe the first successful delivery of renal replacement therapy to an Ebola patient and offer safety considerations and clinical practice guidelines based on the experience.

Decker, B., Sevransky, J., Barrett, K., et al. (2014). Preparing for Critical Care Services to Patients with Ebola. Annals of Internal Medicine. 161(11):831-832.

The authors summarize the risks and protective measures associated with providing care for a critically ill patient with Ebola based on National Institutes of Health guidance and lessons learned during the clinical care of patients at Emory University Hospital.

Fielding, J., Allen, T., Chu, B., et al. (2016). Report of the Independent Panel on the U.S. Department of Health and Human Services (HHS) Ebola Response. Independent Panel on the U.S. Department of Health and Human Services (HHS) Ebola Response.

This report discusses the findings and recommendations of the independent panel established to examine the U.S. Department of Health and Human Services response to the 2014-2016 Ebola epidemic.

Herstein, J., Biddinger, P., Kraft, C., et al. (2016). Initial Costs of Ebola Treatment Centers in the United States. Emerging Infectious Diseases. 22(2):350-352.

The authors describe the results of a survey of the 55 designated Ebola treatment centers regarding their organization and costs incurred to establish the facilities.

Independent Panel on the U.S. Department of Health and Human Services (HHS) Ebola Response. (2016). Report of the Independent Panel on the U.S. Department of Health and Human Services (HHS) Ebola Response.

This report discusses the findings and recommendations of the independent panel established to examine the U.S. Department of Health and Human Services response to the 2014-2016 Ebola epidemic.

Jacobsen, K., Aguirre, A., Bailey, C., et al. (2016). Lessons from the Ebola Outbreak: Action Items for Emerging Infectious Disease Preparedness and Response. EcoHealth. 13(1):200-212.

The authors identify lessons learned from the Ebola outbreak and list research and policy priorities to prepare for future emerging infectious disease outbreaks. They focus on environmental conditions related to early warning systems, host characteristics related to public health, and agent issues to be addressed through laboratory science.

Johnson. D., Sullivan J., Piquette C., et al. (2015). Lessons Learned: Critical Care Management of Patients with Ebola in the United States. Critical Care Medicine. 43(6):1157–1164. (Abstract only.)

The authors reviewed patient medical records to gather lessons learned from the preparations for and the provision of care of two patients with Ebola virus disease in the biocontainment unit at the University of Nebraska Medical Center.

*Kamali, A., Jamieson, D., Kpaduwa, J., et al. (2016). Pregnancy, Labor, and Delivery after Ebola Virus Disease and Implications for Infection Control in Obstetric Services, United States. Emerging Infectious Diseases. 22(7):1156-1161.

The authors describe lessons learned through the treatment and delivery of a healthy infant to an Ebola survivor.

Morgan, D., Brauna, B., Milstone, A., et al. (2015). Lessons Learned from Hospital Ebola Preparation. (Abstract only.) Infection Control and Hospital Epidemiology. 36(6):627-361.

A survey was sent to over 250 healthcare institutions who are members of the Society for Healthcare Epidemiology of America to examine costs and challenges associated with hospital Ebola preparation.

***** National Association of State EMS Officials. (2015). NASEMSO After Action Review: Lessons Learned, Best Practices and Recommendations - Ebola Disease Outbreak.

NASEMSO's Domestic Preparedness Committee prepared this document to highlight critical dates during the Ebola outbreak, provide background information on the disease, describe lessons learned from the response, identify best practices, and recommend actions to federal partners.

Schwedhelm, M., Beam, E., Morris, R., et al. (2015). Reflections on Interprofessional Team-Based Clinical Care in the Ebola Epidemic: The Nebraska Medicine Experience. Nursing Outlook. 63(1):27-29.

This article identifies five key characteristics of an effective, interprofessional team in a high-risk, high-pressure situation: training persistence, a wide range of clinical expertise, joint problem solving and creativity, a commitment to learning, and courage.

*Sueblinvong, V., Johnson, D., Weinstein, G., et al. (2015). Critical Care for Multiple Organ Failure Secondary to Ebola Virus Disease in the United States. Critical Care Medicine. 43(10):2066-75.

The authors describe three Ebola patients with severe critical illness and secondary multiple organ failure. Two of the three patients died, showing that mortality rates may be high even with aggressive care among those with multiple organ failure.

Texas Health Resources. (2015). Sharing Lessons, Improving Performance: Ebola Event Report.

This webpage features links to two resources. The first, The Expert Panel Report to Texas Health Resources Leadership on the 2014 Ebola Events, presents the recommendations of an independent expert panel charged with reviewing the circumstances surrounding the first patient diagnosed with Ebola virus disease in the United States and two nurses who contracted the disease while treating him. The second, 2014 Ebola Events: Texas Health Resources Shares Lessons Learned, Action Plans and Improvements, summarizes corrective actions implemented based on lessons learned and the expert panel's recommendations.

Monitoring/Quarantine

Barbisch, D., Koenig, K., and Shih, F. (2015). Is There a Case for Quarantine? Perspectives from SARS to Ebola. (Abstract Only). Disaster Medicine and Public Health Preparedness. 9(5):547-553.

The authors emphasize the need for the public and medical professionals to better understand the meaning of quarantine and explain related terminology. They also provide a case study from Taiwan during the 2002-2003 severe acute respiratory syndrome outbreak. The authors include a quarantine and isolation decision tree that can help policy makers and public health officials in the event of an outbreak.

Haas, C. (2014.) On the Quarantine Period for Ebola Virus. PLoS Currents. 14(6).

The author examines the reasoning behind the 21-day Ebola quarantine period and compares older research to data collected during the first nine months of the 2014 outbreak.

*Kraemer, J., Siedner, M., and Stoto, M. (2015). Analyzing Variability in Ebola-Related Controls Applied to Returned Travelers in the United States. Health Security. 13(5):295-306.

This study examined the various policies regarding entry screening and quarantine procedures in effect during the recent Ebola epidemic.

Smith, C., Hughes, S., and Karwowski, M. (2015). Addressing Needs of Contacts of Ebola Patients During an Investigation of an Ebola Cluster in the United States - Dallas, Texas, 2014. MMWR Morbidity and Mortality Weekly Report. 64(5):121-123.

In this report, the authors discuss the importance of anticipating the nonclinical needs of those under public health surveillance (e.g., concerns about housing, transportation, education, employment, food, and other household needs). The report also stresses the importance of ensuring these types of support are addressed so that residents will be more likely to comply with quarantine orders, and the utility of community collaboration (with partners such as businesses, schools, community and faith-based organizations, and social services).

Sunshine, G., Pepin, D., Cetron, M., et al. (2015). State and Territorial Ebola Screening, Monitoring, and Movement Policy Statements — United States, August 31, 2015. Morbidity and Mortality Weekly Report. 64(40):1145-1146.

This article provides a brief overview of the various policies and procedures regarding Ebola screening and monitoring policies for asymptomatic individuals.

Pediatric Issues

American Academy of Pediatrics. (2014). Ebola FAQs.

This information is geared towards healthcare professionals who work with children. It explains how the Ebola virus presents in children, how it progresses, how it is transmitted and treated, and how parents can talk to children about Ebola.

American Academy of Pediatrics. (2015). 2015 Report of the Committee on Infectious Diseases: Hemorrhagic Fevers Caused by Filoviruses: Ebola and Marburg.

This report provides a general clinical overview of Ebola and Marburg including transmission, diagnostic testing, and treatment options.

Centers for Disease Control and Prevention (CDC). (2015). Care of a Neonate Born to a Mother who is Confirmed to have Ebola, is a Person under Investigation, or has been Exposed to Ebola.

These guidelines pertain to U.S. hospitals and how to care for a neonate born to a mother who is confirmed to have Ebola, is a Person under Investigation, or has been exposed to the Ebola virus.

*Centers for Disease Control and Prevention. (2015). Q&A's about the Transport of Pediatric Patients (< 18 years of age) Under Investigation or with Confirmed Ebola.

This webpage provides first responders with information to help protect themselves, younger patients, and patients' family members by answering the most frequently asked questions about transporting pediatric patients with Ebola.

*Centers for Disease Control and Prevention. (2015). Recommendations for Breastfeeding/Infant Feeding in the Context of Ebola.

These recommendations are for mothers interested in breastfeeding but who are under investigation for Ebola, have confirmed Ebola, or have survived Ebola.

Centers for Disease Control and Prevention (CDC). (2015). Resources for Parents, Schools, and Pediatric Healthcare Professionals.

This website provides current information for parents, schools and pediatric professionals regarding the Ebola virus.

*Eriksson, C., Uyeki, T., Christian, M., et al. (2015). Care of the Child with Ebola Virus Disease. Pediatric Critical Care Medicine. 16(2):97-103.

The authors discuss considerations for the care of children with Ebola virus disease. They emphasize infection control practices to limit disease spread, and supportive care to treat patients.

Goodman, A., Meites, A., Anstey, E., et al. (2015). Clinical Inquiries Received by CDC Regarding Suspected Ebola Virus Disease in Children – United States, July 9, 2014-January 4, 2015. Morbidity and Mortality Weekly Report. 64(36):1006-1010.

This article provides an overview of inquiries to the Centers for Disease Control and Prevention's Emergency Operations Center, which was activated to respond to the Ebola outbreak in West Africa to assist state and local health departments and healthcare providers evaluate persons possibly at risk for Ebola. A total of 89 inquiries were received and a discussion of the outcomes is provided.

Kourtis, A., Appelgren, K., Chevalier, M., et al. (2015). Ebola Virus Disease: Focus on Children. Pediatric Infectious Disease Journal. 34(8):893–897. (Abstract only.)

The authors provide an overview of the Ebola virus, its epidemiology and transmission, clinical and laboratory manifestations, and treatment and infection control procedures. The authors also discuss what is known about the Ebola virus disease in the pediatric population since research in this area is underdeveloped.

Olupot-Olupot, P. (2015). Ebola in Children: Epidemiology, Clinical Features, Diagnosis and Outcomes. Pediatric Infectious Disease Journal. 34(3):314-316.

The author looks at the current and past Ebola outbreaks and focuses on infection and how it presents, is diagnosed, and treated in children.

Shah, T., Greig, J., van der Plas, L., et al. (2016). Inpatient Signs and Symptoms and Factors Associated with Death in Children Aged 5 Years and Younger Admitted to Two Ebola Management Centres in Sierra Leone, 2014: A Retrospective Cohort Study. The Lancet Global Health. 4(7):e495-501.

The authors describe outcomes and symptoms relative to symptoms during admission in children five and younger. The study confirmed higher rates of death in children younger than two and those who presented with a high viral load.

U.S. Department of Health and Human Services, Administration for Children and Families, Office of Human Services Emergency Preparedness and Response. (n.d.). Ebola: Planning Considerations for Human Services Programs. (Accessed 8/2/2016.)

In an effort to provide current and updated information regarding Ebola and children, the Administration for Children and Families created fact sheets to be used in early childhood settings, and help parents and caregivers deal with the possibilities of exposure.

Personal Protective Equipment and Responder Safety

Balci, F. (2016). Isolation Gowns in Health Care Settings: Laboratory Studies, Regulations and Standards, and Potential Barriers of Gown Selection and Use. American Journal of Infection Control. 44(1):104-11.

The author discusses the lack of an isolation gown standard that considers end user desired attributes in addition to barrier resistance.

*Beam, E., Gibbs, S., Hewlett, A., et al. (2015). Clinical Challenges in Isolation Care. American Journal of Nursing. (Abstract only.).

The authors note variation in personal protective equipment practices among nurses in a patient simulation and the potential impact on facility infection control.

*Bratt, J., Robinson, A., and Alcorta, R. (n.d.). Strategies and Considerations for the Deployment of EMS Personal Protective Equipment in Response to an Ebola Outbreak. Maryland Institute for Emergency Medical Service Systems. (Accessed 8/3/2016.)

This article describes protection of emergency medical services personnel through personal protective equipment (PPE), including requirements, PPE cost (and how to estimate it), PPE deployment strategies, and personnel requirements.

Centers for Disease Control and Prevention. (2014). Considerations for U.S Healthcare Facilities to Ensure Adequate Supplies of Personal Protective Equipment (PPE) for Ebola Preparedness.

The Centers for Disease Control and Prevention shares information on the current personal protective equipment (PPE) supply situation, guidance regarding the duration of care certain types of facilities should be prepared to provide to Ebola patients, and how facilities can plan to share PPE supplies if necessary.

Centers for Disease Control and Prevention. (2014). Guidance on Personal Protective Equipment to Be Used by Healthcare Workers During Management of Patients with Confirmed Ebola or Persons Under Investigation (PUIs) for Ebola Who are Clinically Unstable or Have Bleeding, Vomiting, or Diarrhea in U.S. Hospitals, Including Procedures for (Donning and Doffing PPE.

This Centers for Disease Control and Prevention webpage includes guidance on the types of personal protective equipment (PPE) that should be used by those caring for patients with Ebola. It also includes steps for donning and doffing PPE as well as what trained observers should do to ensure these steps are followed.

Centers for Disease Control and Prevention. (2015). For U.S. Healthcare Settings: Donning and Doffing Personal Protective Equipment (PPE) for Evaluating Persons Under Investigation (PUIs) for Ebola Who Are Clinically Stable and Do Not Have Bleeding, Vomiting, or Diarrhea.

This document provides guidance to healthcare workers on donning and doffing PPE while evaluating a clinically stable PUI who does not have bleeding, vomiting, or diarrhea.

*Edmond, M., Diekema, D., and Perencevich, E. (2014). Ebola Virus Disease and the Need for New Personal Protective Equipment. (First page only). Journal of the American Medical Association. 312(23):2495-2496.

The authors discuss issues associated with personal protective equipment and highly contagious, multiple drug resistant organisms, including the Ebola virus.

*European Union, European Centre for Disease Prevention and Control. (2014). Safe Use of Personal Protective Equipment in the Treatment of Infectious Diseases of High Consequence: A Tutorial for Trainers in Healthcare Settings.

This training program provides information on the proper use of personal protective equipment at the point of care and shares information on procurement, preparedness, and capacity building.

Kilmarx, P., Clarke, K., Dietz, P., et al. (2014). Ebola Virus Disease in Health Care Workers — Sierra Leone, 2014. Morbidity and Mortality Weekly Report. 63(49):1168-1171.

The authors studied infection in healthcare workers and found that the incidence of infection peaked in August 2014. The authors also found that infected healthcare workers were less likely to have attended a funeral and more likely to have had contact with an Ebola positive patient in the month prior to symptom onset. They then stress the importance of infection control and protecting the health workforce.

McLaws, M., Chughtai, A., Salmon, S., and MacIntyre, R. (2016). A Highly Precautionary Doffing Sequence for Health Care Workers after Caring for Wet Ebola Patients to Further Reduce Occupational Acquisition of Ebola. American Journal of Infection Control. 44(7):740-744.

The authors reviewed video guidelines to identify exemplary doffing, which they defined as no used personal protective equipment surface coming into contact with mucous membranes, face, or hair.

*Redd, S., Smith, P., Hewlett, A., et al. (2014). Preparing for Ebola: What U.S. Hospitals Can Learn From Emory Healthcare and Nebraska Medical Center. Centers for Disease Control and Prevention.

Speakers from the Centers for Disease Control and Prevention, the University of Nebraska Medical Center, Nebraska Biocontainment Unit, Emory's Serious Communicable Disease Unit, and Emory Healthcare share their lessons learned on healthcare system preparedness and treating patients with Ebola.

*Sterk, E. (2008). Filovirus Hemorrhagic Fever Guideline. Medecins Sans Frontieres.

These guidelines serve as a summary of the *Medecins Sans Frontieres Ebola & Marburg Outbreak Control Guidance Manual*. The author provides an overview of all intervention strategy components deemed necessary during a Medecins Sans Frontieres intervention in both types of outbreaks.

Tennessee Department of Health. (2014). Could it be Ebola? A Guide for Law Enforcement.

Law enforcement representatives can use the information in this infographic to better determine when to contact emergency medical services and how to isolate a person possibly infected with Ebola. The document also includes definitions and state-specific information on who has the authority to enforce quarantine.

*The University of Nebraska Medical Center. (n.d.). HEROES Webpage. (Accessed 8/3/2016.)

The videos on this webpage feature step-by-step demonstrations of the doffing and donning of personal protective equipment (PPE), testing of powered air purifying respirator-level PPE, and the assembly and use of body sealers and ISOPODs.

United States Department of Labor, Occupational Safety and Health Administration. (2014). PPE Selection Matrix for Occupational Exposure to Ebola Virus.

The U.S. Department of Labor shares information on the type of personal protective equipment to be worn in various situations (e.g., normal work activities, casual interaction, providing medical and supportive care, cleaning and disinfecting environments, and dealing with waste).

University of Nebraska Medical Center. (2014). PPE Donning and Doffing: Ebola Patients.

These standard procedures were developed to protect staff from Category A agents and differ slightly from CDC recommendations. Guidance and photos are provided to help readers understand the types of personal protective equipment to use and how to don and doff them appropriately.

Plans, Tools, and Templates

Bellevue Hospital Center. (n.d.). Ebola Virus Disease Incident Response Guide. (Accessed 8/2/2016.)

This guide includes protocols developed by Bellevue (NY) Hospital Center for managing a suspected or confirmed Ebola virus disease patient.

Bellevue Hospital Center. (n.d.). Ebola Virus Disease Incident Response Guide Exhibits. (Accessed 8/2/2016.)

This document contains exhibits associated with Bellevue's Incident Response Guide, including an overview, personal protective equipment Guidance Matrix, Health Alert Network alert, algorithms, checklists, forms, and educational materials.

Centers for Disease Control and Prevention. (2016). Guidance for Developing a Plan for Interfacility Transport of Persons Under Investigation or Confirmed Patients with Ebola Virus Disease in the United States.

This document provides guidance on developing plans for interfacility air or ground transport of PUIs and Ebola patients.

Chamberlin, M., Okunogbe, A., Moore, M., and Abir, M. (2015). Intra-Action Report — A Dynamic Tool for Emergency Managers and Policymakers. RAND Corporation.

The authors coined the term "Intra-Action Report" and tracked and shared the challenges, successes, and lessons being learned and applied during the 2014 response to Ebola.

Kansas Department of Health and Environment. (2015). Ebola Virus Preparedness and Response Plan.

The department shares timely Ebola-specific information on preparedness and response planning, patient management, laboratory testing, infection control, and handling human remains. Links to these sections and nine appendices are also provided.

*MESH Coalition. (2016). An Exercise in the Provision of Care for an Adult Patient under Investigation (PUI) for Ebola: A Patient Care Drill.

This simulation toolkit provides a situation overview, general information, simulation logistics, post-simulation and evaluation activities, and participant information and guidance along with appendices containing templates and forms for hospitals to test their established protocols for the provision of care to a patient with a suspect highly infectious disease. Multiple injects such as vomiting encourage testing a range of different procedures through the exercise.

National Ebola Training and Education Center. (n.d.). Exercise Materials. (Accessed 8/2/2016.)

This webpage includes links to various Homeland Security Exercise and Evaluation Program-compliant templates to assist healthcare coalitions, assessment hospitals, state-designated Ebola treatment centers, regional Ebola treatment centers, and their respective response partners in the planning and conduct of exercises. The site includes templates for drills and tabletop and full-scale exercises.

State of Louisiana Governor's Office of Homeland Security and Emergency Preparedness. (2014). Louisiana Ebola Virus Disease Response Plan.

This plan is an annex to the state's emergency operations plan and focuses on six specific goals: protect life and property, minimize exposure in a variety of settings, conduct medical and public health vigilance, identify steps for confirmed cases and their contacts, support effective and rapid response, and collect and share accurate information.

U.S. Department of Health and Human Services, Office of the Assistant Secretary for Preparedness and Response. (2016). U.S. Department of Health and Human Services Ebola Response Improvement Plan Based on Lessons Learned from the 2014-2016 Ebola Epidemic.

This improvement plan addresses the key findings and recommendations of the Report of the Independent Panel on the U.S. Department of Health and Human Services (HHS) Ebola Response.

Risk Communications

Covello, V., and Hyer, R. (2014). Top Questions On Ebola: Simple Answers Developed by the Association of State and Territorial Health Officials. Association of State and Territorial Health Officials.

The authors worked with risk communication consultants and state health officials to develop messaging written at a sixth to eighth grade reading level. Questions are divided into the following categories: basic, preparedness, medicines and vaccines, healthcare response, quarantine and isolation, monitoring and contact tracing, mental health, travel and transport, and media.

International Federation of Red Cross and Red Crescent Societies. (2014). Psychosocial Support During an Outbreak of Ebola Virus Disease.

Readers can use this document to learn about psychosocial aspects related to Ebola and supportive activities that can be implemented to address these challenges.

World Health Organization, Pan American Health Organization. (2014). Risk Communication Plan for the First Case of Ebola.

This guidance is intended to help health officials communicate with their communities in the event that a resident is diagnosed with Ebola. The authors list communication goals, key assumptions to include in messaging, and a list of specific questions to prepare for. Risk communication principles are included along with sample communication outlets and audiences.

Vaccine/Targeted Treatment

Choi, W., Hong, K, Hong, J., and Lee, W. (2015). Progress of Vaccine and Drug Development for Ebola Preparedness. Clinical and Experimental Vaccine Research. 4(1):11-16.

The authors examine the treatments being used and created to control the 2014 Ebola outbreak.

*Cohen, J., and Kupferschmidt, K. (2014). Ebola Vaccine Trials Raise Ethical Issues. Science. 346(6207):289-290.

The authors discuss the ethical concerns associated with having a control group when testing Ebola vaccines.

Kreil, T. (2015). Treatment of Ebola Virus Infection with Antibodies from Reconvalescent Donors. Emerging Infectious Diseases. 21(3).

The author provides an overview of the Ebola treatment which involves administering plasma from a patient who survived Ebola to a newly-infected patient.

Regules, J., Beigel, J., Paolino, K., et al. (2015). A Recombinant Vesicular Stomatitis Virus Ebola Vaccine — Preliminary Report. The New England Journal of Medicine.

The authors share results from two phase 1 trials of an attenuated, replication-competent, recombinant vesicular stomatitis virus (rVSV)–based Ebola prevention vaccine candidate.

*U.S. Department of Health and Human Services. (2014). Ebola Virus Disease Vaccines. Federal Register.

In 2014, ASPR released this declaration under the Public Readiness and Emergency Preparedness Act. This document includes information on when a public health emergency is declared, liability immunity, and covered countermeasures.

Women's Health

Baggi, F., Taybi, A., Kurth, A., et al. (2014). Management of Pregnant Women Infected with Ebola Virus in a Treatment Centre in Guinea, June 2014. Eurosurveillance. 19(49).

The authors describe two cases where pregnant women presented with symptoms of Ebola at a clinic in Africa and the resulting complications to both the patient and the fetus.

Black, B., Caluwaerts, S., and Achar, J. (2015). Ebola Virus Disease and Pregnancy. Obstetric Medicine. 8(3):108-113.

The authors provide an overview of the interaction between Ebola and pregnancy, current practices in the field, gaps in knowledge, and potential management strategies.

*Bower, H. Grass, J., Veltus, E., et al. (2015). Delivery of an Ebola Virus-Positive Stillborn Infant in a Rural Community Health Center, Sierra Leone, January 2015. The American Journal of Tropical Medicine and Hygiene. 15-0619. (Abstract only.)

The authors provide a case study of an Ebola virus (EBOV) RNA–negative pregnant woman who delivered an EBOV RNA–positive stillborn infant at a community health center in rural Sierra Leone. They also discuss the need for personal protective equipment in similar situations.

Centers for Disease Control and Prevention. (2014). Guidance for Screening and Caring for Pregnant Women with Ebola Virus Disease for Healthcare Providers in U.S. Hospitals.

This webpage provides guidance for healthcare workers on screening and treating suspected or confirmed cases of Ebola in pregnant women.

*Centers for Disease Control and Prevention. (2015). Recommendations for Breastfeeding/Infant Feeding in the Context of Ebola.

These recommendations are for mothers interested in breastfeeding but who are under investigation for Ebola, have confirmed Ebola, or have survived Ebola.

Jamieson, D., Uyeki, T., Callaghan, W., et al. (2014). What Obstetricians-Gynecologists Should Know About Ebola: A Perspective From the Centers for Disease Control and Prevention. Obstetrics and Gynecology. 124(5):1005-1010.

This article provides general background information on Ebola and highlights what is known about Ebola virus disease in pregnancy and the implications for practicing obstetricians-gynecologists in the United States.

*Kamali, A., Jamieson, D., Kpaduwa, J., et al. (2016). Pregnancy, Labor, and Delivery after Ebola Virus Disease and Implications for Infection Control in Obstetric Services, United States. Emerging Infectious Diseases. 22(7):1156-1161.

The authors describe lessons learned through the treatment and delivery of a healthy infant to an Ebola survivor.

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. Ebola: U.S. Healthcare Workers and Settings.

Emory Healthcare Ebola Preparedness Protocols.

National Ebola Training and Education Center.

University of Nebraska Medical Center.

U.S. Department of Health and Human Services, Office of the Assistant Secretary for Preparedness and Response. Ebola Information for Healthcare Professionals and Healthcare Settings.

World Health Organization. Ebola Virus Disease Outbreak.

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