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
Assessing and Testing
Clinical Care
Decontamination and Waste Management
Education and Training
Emergency Medical Services
Ethics
Fatality Management
Hospital/Clinic Policies
Infection Control
Legal/Regulatory Issues
Lessons Learned
Monitoring/Quarantine
Pediatric Issues
Personal Protective Equipment and Responder Safety
Plans, Tools, and Templates
Risk Communications
Vaccine/Targeted Treatment
Women’s Health
Agencies and Organizations
Must Reads


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.


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.


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


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


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.


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.

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.


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.


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).


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**

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.


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.


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.


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.


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.


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.

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.


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


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


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.


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


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

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.


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.


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.


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.


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.


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.

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.


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.


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


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.


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.


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.
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.


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


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.


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**


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.


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.

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.


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.


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


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.


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


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.

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.


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.


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


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**


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


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.


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.


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


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.


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.


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.

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.


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.


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.


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.


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


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.

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.


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.


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.


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.


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.


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.


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.


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.


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.

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.


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


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


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.


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.


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.


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


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


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


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.

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


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.


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


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


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.


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.

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**


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).


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.


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.


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.


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


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.


*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


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.


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

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.


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**


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.


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.


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.


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.

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.


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.


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.


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.


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.


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

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.


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.


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.


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.


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


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.


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.


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


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).


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


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.


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.


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


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

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.


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.


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.


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


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.


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


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


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


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.


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.

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.


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


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.


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.


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.

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.


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.


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


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


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.


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


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.


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.

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.


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.


Risk Communications


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.


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

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**


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


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


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


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


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


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.


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


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.


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


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


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.

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.


National Ebola Training and Education Center.

University of Nebraska Medical Center.


World Health Organization. Ebola Virus Disease Outbreak.

This ASPR TRACIE Topic Collection was comprehensively reviewed in April 2015 by John Hick, MD, HHS ASPR and Hennepin County Medical Center.

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