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Major article

Planning and response to Ebola virus disease: An integrated approach

Philip W. Smith MD [a,b,*], Kathleen C. Boulter RN [c], Angela L. Hewlett MD [a,b], Christopher J. Kratochvil MD [d], Elizabeth J. Beam RN [e], Shawn G. Gibbs PhD [f], John-Martin J. Lowe PhD [f], Michelle M. Schwedhelm RN [c]

[a] Division of Infectious Diseases, College of Medicine, University of Nebraska Medical Center, Omaha, NE
[b] Department of Epidemiology, College of Public Health, University of Nebraska Medical Center, Omaha, NE
[c] Nebraska Medicine, Omaha, NE
[d] Vice Chancellor for Clinical Research, University of Nebraska Medical Center, Omaha, NE
[e] College of Nursing, University of Nebraska Medical Center, Omaha, NE
[f] Department of Environmental, Agricultural and Occupational Health, College of Public Health, University of Nebraska Medical center, Omaha, NE

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The care of patients with Ebola virus disease (EVD) requires the application of critical care medicine principles under conditions of stringent infection control precautions. The care of patients with EVD requires a number of elements in terms of physical layout, personal protective apparel, and other equipment. Provision of care is demanding in terms of depth of staff and training. The key to safely providing such care is a system that brings many valuable skills to the table, and allows communication between these individuals. We present our approach to leadership structure and function—a variation of incident command—in providing care to 3 patients with EVD.

We are in the midst of an unprecedented African outbreak of Ebola virus disease (EVD), a contagious disease with high mortality[1] that has caused more than 21,000 cases and 8,000 deaths as of January 15, 2015.[2] Approximately 10 patients have been cared for in the United States due to repatriation of ill humanitarian workers from Africa, presentation of an infected patient at a Dallas hospital, and 2 nosocomial cases acquired in health care workers (HCWs) following that hospitalization. Following these events the Centers for Disease Control and Prevention (CDC) released much more stringent guidelines for personal protective equipment (PPE) for HCWs caring for patients with EVD in US hospitals.[3]

The University of Nebraska Medical Center (UNMC) has cared for 3 repatriated patients with EVD since September 5, 2014. The Nebraska preparations and response to EVD consisted of 3 primary facets: a biocontainment unit with special design features and a dedicated, highly trained staff; a partnership with public health; and a leadership team responsible for all aspects of unit operation. We will herein describe these 3 facets.

BIOCONTAINMENT UNIT

The Nebraska biocontainment unit (NBU), located on the campus of UNMC in Omaha, Nebraska, is designed to provide care to patients with highly infectious diseases. The NBU opened in 2005, and was used for local and regional training of HCWs, for community outreach, and for research (eg, decontamination studies, mathematical modeling of airflow, transportation decontamination, and donning and doffing studies). Due to the outbreak of EVD in Africa, the NBU was activated to care for US citizens with EVD who were medically evacuated from Africa during 2014. This activation resulted in the use of our existing protocols as well as modifications specifically for EVD.

NBU physical structure and basic policies

The unit is part of a tertiary care 680-bed university hospital. The Nebraska Public Health Laboratory (a National Institutes of Health Biosafety Level 3 certified laboratory) is located on campus. Both civilian and military airports are located near Omaha, Nebraska. Basic policies were similar to those outlined in a 2006 consensus paper.[4]

* Address correspondence to Philip W. Smith, MD, 985400 Nebraska Medical Center, Omaha, NE 68198-5400.
E-mail address: pwsmith@unmc.edu (P.W. Smith).
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Fig 1. University of Nebraska Medical Center biocontainment unit schematic.

A schematic of the structure of the NBU is shown in Figure 1. Although the unit was designed with 5 patient rooms, each with a capacity of up to 2 patients per room, the unique clinical demands of EVD prompted the leadership to reconfigure the use of the 5 patient rooms (see Fig 1). Ultimately the team decided to allocate the space to 2 patient care rooms, an onsite laboratory, a dirty utility room, and a clean utility room. Basic features of the unit included negative airflow with 15-20 air exchanges per hour, single-pass ventilation with high-efficiency particulate arrestance-filtered exit air, a pass-through autoclave, secured unit access, and 2-way video and audio connections between patient rooms and the nurses' station.[5] A red line on the floor demarcates the transition from the clean to the potentially contaminated dirty area.

PUBLIC HEALTH COLLABORATION

Public health is an integral partner in the unit. The NBU is 1 element in the spectrum of public health response to EVD in particular and infectious diseases in general. The unit was built under the joint auspices of the UNMC/hospital and Nebraska Health and Human Services. It is activated only with the joint approval of the NBU medical director and the chief medical officer of the Nebraska Department of Health and Human Services.

Public health experts provided guidance and assistance with regard to NBU HCW exposure and monitoring protocols.[6] The Department of Health and Human Services also assisted by providing community education during the activation process, which is essential in mitigating community fears regarding EVD. This included institution of a telephone hotline staffed by the county health department and educational Web sites to address community concerns as well as assisting with media communications. Other issues that require public health interaction include patient transport to the unit, patient release and travel home after discharge from the unit, legal issues (eg, transportation of an EVD patient across state lines), and handling of the remains of patients who die.

NBU LEADERSHIP TEAM

Although the NBU had a defined structure in place before activation for EVD, it became clear during the care of the initial patients with EVD that multiple additional key roles with defined responsibilities were necessary (see Fig 2).

Administrative structure and roles

Preplanning for patients with EVD involves quite a number of diverse roles. The key roles in the NBU leadership team are listed in Figure 2, and the major responsibilities are listed in Table 1. The unit director had extensive administrative experience, and this role was distinct from the clinical focus of the lead clinical nurse. Both the environmental/occupational specialist and the transportation specialist had significant experience in microbiology and infection control. The clinical research specialist served as the associate vice chancellor for clinical research. All members of the leadership team were crosstrained and/or had at least 1 qualified backup person identified in the event of their absence. Leadership personnel were drawn from hospital administration, as well as the Colleges of Medicine, Public Health, and Nursing.

A robust modified incident command structure[7] is a critical element of response to a patient with EVD that facilitated communication between members of the leadership team. Incident command should be activated as soon as a patient with EVD is anticipated, and include key state and local organizations and leaders as well as national entities such as the CDC. Daily briefings were essential to inform all parties, identify goals and priorities, address any issues that arose, and integrate any and all work group efforts. It was very helpful to have a large incident command center in close proximity to the NBU.

Leadership team key responsibilities

The unit director served as liaison to hospital administration, which facilitated rapid procurement of equipment, supplies, and financial support. The incident commander performed a number of