

Educating Health Care Providers in Treatment of Patients With **Ebola Virus Disease**

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Nurses manage patients with common infectious diseases by following institutional guidelines based on expert advice, evidence in the literature, and a wealth of experience. Today nurses are challenged to provide care to patients with multidrug-resistant organisms and virulent infectious diseases such as Ebola virus disease. Management of some patients with virulent infectious diseases occurs in the context of minimal experience with the pathogen, course of infection, diagnostics, nursing care, and treatment. Limited evidence exists in the US or international literature about direct nursing care of patients with virulent infectious diseases in the community, clinic, or hospital. Workplaces may have insufficient supplies, equipment, and knowledge of the management of patients with these diseases. At the National Institutes of Health Clinical Center in Bethesda, Maryland, nursing education strategies for enhanced experiential learning are used to prepare staff to care for patients with virulent infectious diseases, especially Ebola virus disease. (*Critical Care Nurse*. 2016;36[5]:e8-e13)

Over the years, the number of organisms associated with diseases that require isolation or heightened isolation of infected patients because of the virulence of the causative agent has increased. This change is due to a noted increase in organisms resistant to current medical therapies. Penicillin was discovered in 1923 by Alexander Fleming but was not widely used until the 1940s, and by 1943, antibiotic resistance had been identified.¹ In 2013, the Centers for Disease Control and Prevention (CDC) reported that since the inception of penicillin and development of additional antibiotics, resistance to the drugs had been detected in 18 organisms.¹ Because of the increase in resistance of organisms and the risks that more virulent pathogens may become resistant, the need for increased isolation precautions has proliferated. Consequently, a heightened awareness has developed about how

Table 1 Ebola virus subtypes^a

Feature	Subtype				
	Zaire	Sudan	Tai Forest	Bundibugyo	Reston
Abbreviation	ZEBOV	SUDV	TAFV	BDBV	RESTV
Outbreaks	1976	1976	1994	2007	1989
Fatalities	Highest mean, 83% (in 27 years)	~65%	No human	34%	No human

^a Based on information from Centers for Disease Control and Prevention.³

to properly care for patients in isolation and protect caregivers, staff, visitors, compromised patients, and other patients within a health care facility.² On a daily basis, nurses follow institutional guidelines, policies, and procedures based on expert opinion, best practice, and experience to care for and manage patients who have common infectious diseases and infections caused by drug-resistant organisms. Today nurses are challenged to provide care to patients with virulent infectious diseases (VIDs) such as Ebola virus disease (EVD). Of paramount importance to caregivers is the protection of themselves and others. Information on the organisms that cause VIDs that references disease, diagnosis, and treatment is abundant, but

actual patient care experience with these pathogens before the later part of 2014 was almost nonexistent in the United States or other areas outside Africa. Sensationalism and misinformation in films and/or material provided by the media on patients with EVD present challenges for the education of staff nurses. The National Institutes of Health (NIH) has been successful in treating patients with a diagnosis of EVD. In this article, we describe the staff education process provided at our hospital, the Clinical Center, to ensure appropriate care for patients who have EVD.

Ebola Virus Disease

First discovered in 1976 in the regions of the Sudan and Congo in Africa, Ebola virus is a single-stranded RNA virus from the filoviridae family of hemorrhagic fever viruses. Initially 4 main subtypes were identified; a fifth subtype was discovered later. The lethality of EVD varies according to the subtype³ (Table 1). Transmission of the virus occurs through direct contact with blood, secretions, or other body fluids of a symptomatic individual who is infected; contact with the body of a recently deceased person with EVD; via objects contaminated with infected fluids or secretions; and through inhalation of droplets during a procedure or other high-risk invasive treatments that could create an aerosol. Incubation is 8 to 21 days. Characteristic signs and symptoms include fever, malaise, headache, vomiting, and diarrhea.⁴⁻⁶ Although Ebola virus is a member of the hemorrhagic fever family of viruses, major bleeding in EVD is rare and usually occurs in the late stage of the disease.

Background

The essential foundation of staff education on EVD is the standard of safety of health care workers and the impact of the VID being treated.^{7,8} In determining what

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knowledge health care workers require to care for a patient with EVD, multiple aspects of the disease were considered. Topics presented to staff members included discussions related to disease epidemiology, transmission, diagnosis, treatment, and safe putting on (donning) and taking off (doffing) of personal protective equipment (PPE). An increased understanding of the virus leads to increased comfort of staff members with the pathophysiological aspects of EVD and results in decreased anxiety during patient care.

The special clinical studies unit (SCSU) at NIH was opened in 2010 to support occupational exposure of a laboratory worker from one of the biosafety level (BSL) 3 or 4 laboratories in northern Maryland dedicated to

research on highly virulent, contagious organisms. The SCSU is 1 of 4

The SCSU checklists were used to ensure that additional staff members were proficient at caring for EVD patients and that consistency of education was maintained through these checklists.

high-containment units located within the United States.⁷⁻⁹ The entire SCSU, with the exception of the nursing station, operates at negative pressure with a high rate of air exchange, allowing maximum isolation, if needed, to care for patients with an occupational exposure. The containment unit has 7 beds; all are telemetry equipped with central monitoring. One room is constructed with an anteroom and is designed to accommodate care of higher acuity patients according to the lethality of the organism or the status of the patient.^{8,9} Strict clinical practices (isolation techniques and knowledge of disease, signs and symptoms, and transmission) are used to maintain continuity of care and safety of health care workers within the SCSU.

Ten core nurses were hired for this unit. Because the SCSU was developed to provide care for patients with occupational exposures that might occur in BSL 3 or BSL 4 laboratories, these core nurses quarterly attend didactic lessons and simulation drills on VID organisms, such as Ebola virus.^{7,9} Having a core team of nurses with updated knowledge of the disease characteristics, transmission, and prevention of infections caused by virulent pathogens and the competence in caring for patients with VIDs is vital to support additional staff members who are being trained to provide care or are caring for patients with EVD. Knowledgeable staff members with

decreased anxiety are better able to demonstrate competency in and maintain unit protocols.

Preparation With a Recent Outbreak in Mind

All core nursing staff assigned to the SCSU are consistently trained on organisms handled in the BSL 3 and BSL 4 laboratories. Included in this training, which is done quarterly, are discussions of the organisms, incubation times and signs and symptoms of diseases caused by the organisms, patient care procedures for patients infected with the organisms, and actual use of PPE. Joint exercises with BSL laboratory personnel with drills or tabletop exercises (exercises designed to test the theoretical ability of a group to respond to a situation) are also used. At the time of the recent outbreak of EVD, staff members received a targeted review of EVD by subject matter experts in the National Institute of Allergies and Infectious Diseases.⁹ This reeducation consisted of discussions of the particular organism, mode of transmission, diagnostics, and treatment and included return demonstration of procedures for donning and doffing PPE, obtaining and transport of specimens to the laboratory, waste removal (both patient and nonpatient), and cleaning (both daily and managing spills). The core SCSU nurses developed videos for proper donning and doffing techniques for PPE and designed posters illustrating each of the steps. These nurses became the trainers for educating additional volunteer staff (those willing to assist in caring for a patient with EVD from other patient care areas within the clinical center). The SCSU procedural checklists were used to ensure that additional staff members were proficient at caring for EVD patients and that consistency of education was maintained through these step-by-step checklists.

Staffing Model

Caring for a patient in a high-containment area requires a large number of staff personnel. Therefore, in addition to the core SCSU nurses, inclusion of other interdisciplinary staff volunteers from the clinical center and the institutes and centers within the NIH was important to provide adequate numbers of staff personnel.^{7,10} Identification of staff required to care for an EVD patient was delineated in detail by the management team. Staffing plans included a core SCSU nurse scheduled for each shift with additional non-SCSU staff. The staffing model

used by the SCSU for EVD patients was grounded in the “buddy system.” Two health care workers or nurses were in the patient’s room at all times (1 performing direct patient care and 1 acting as the observer or monitor), 1 health care worker was a monitor observing compliance in both donning and doffing of PPE (just outside the patient’s room), and 1 was a circulating nurse who was able to obtain supplies, answer telephones, and so on, thereby assisting as needed.^{8,9} These staffing patterns could be adjusted on the basis of the patient’s acuity.

Education Process Development

Education of staff was based on adult learning principles. For adult learners, the learning experience is more relevant if it creates a change in skills, behavior, knowledge level, or attitudes. Aspects that enhance an adult learner’s readiness to learn include motivation, previous experience, level of engagement in learning, the environment, application of what is learned, and positive and immediate feedback.¹¹⁻¹⁴ Adult learners have various learning styles for gaining knowledge: visual, auditory, kinesthetic, and intellectual. Most adult learners generally use a combination of styles to learn.^{11,12,14-16} Clinical simulation builds on the theoretical underpinnings assimilated through the various adult learning styles and allows implementation of knowledge and acquired skills within a controlled, authentic, and safe environment.^{15,17} The ability to experience practical application of acquired knowledge and the ability to discuss and debrief strongly enhance an adult’s learning experience.^{13,14,16} The SCSU developers of the educational program considered these principles of adult learning to help ensure positive outcomes and enhanced knowledge acquisition.

Before admission of the first patient, a simulation was conducted with the core SCSU nurses and observers from the hospital’s epidemiology department, nursing leaders, nurse consultants from the safety management department, and personnel from the infectious diseases department to detect any lapses in techniques during provision of patient care (ie, donning and doffing PPE, cleaning, obtaining and transport of laboratory specimens). The scenario “patient” exhibited gastrointestinal signs and symptoms, and simulated vomitus and body fluids were impregnated with material that glows under ultraviolet light (Glo Germ) to enhance visualization. The SCSU nurses in full PPE performed routine patient

Table 2 Zones of possible transmission of Ebola virus within the special clinical studies unit

Zone	Description
Hot	Immediate area within infected patient’s room where most contagion could exist
Warm	The area within an anteroom or a hallway between the patient and a clean area
Cold	Area considered clean with no direct contact with patient

care, and the observers watched for any breaks in technique and/or potential lapses in procedures.^{7,13,17} After the simulation, a “hot wash” (an after-action debriefing) was done, bringing participants and observers together for discussion. The main purposes of the debriefing were to evaluate and critique staff performance, provide opportunities for discussion on improvement in procedures of care and PPE, and institute any corrective actions to those procedures. The hot wash validated the current procedures in place for the SCSU.

Volunteer staff members benefited from this simulation scenario in caring for a patient with EVD to direct their education.^{13,17} In addition to the core staff of SCSU, staff volunteers came from all areas of the clinical center and institutes to be trained and scheduled to care for a patient with EVD.

Basic Training Process

Basic training for the volunteer staff to care for a patient with EVD incorporated multiple training methods to reinforce knowledge and acquisition of competency. The training included a slide presentation, demonstration videos of using PPE, return demonstration of using the protective equipment and other care-related procedures with completion of checklists, a knowledge review assessment, and participation in simulation scenarios. The use of many different learning styles for adult learners helped the volunteers assimilate knowledge.^{14,16} The slide presentation was a summary of EVD, an overview of the rationale for the SCSU, and the roles and responsibilities of the caregiver team interacting with a patient. Detailed information on the various levels of PPE for different zones within the SCSU (hot, warm, and cold; Table 2) was provided via the presentation, especially as related to the donning and doffing of the PPE. After the slide presentation, learning was reinforced by viewing 2 demonstration videos developed in house: 1 for donning

and 1 for doffing. The next phase was to have staff members do return demonstrations of the donning and doffing processes and understand the critical need for compliance with these procedures to maintain safety for all.

Each aspect of donning and doffing was initiated 1 step at a time to ensure that staff members understood the process and rationale for such a meticulous procedure. Breaks in procedure were identified and followed up with immediate feedback and retraining. Once the return demonstration was satisfactorily completed, a written assessment of procedural aspects of patient care and process was reviewed with the staff member. Knowledge validation of education presented was accomplished via return demonstration and written assessment. This process of education was used for all medical, nursing, respiratory therapy, and ancillary staff. Documentation of training was collected and incorporated into a master list; copies of the paperwork were sent to staff supervisors for inclusion in the staff member's personnel file.

Simulation Training

Use of PPE is challenging whether it occurs during an exercise or the actual provision of patient care. Repetitive training, practice, and feedback are critical components for ensuring the safety of staff while providing care to a patient with EVD. This is the point where the use of scenarios was valuable and the next step of training for

A WatSan is a health care worker who ensures that meticulous donning and doffing techniques are used by all staff entering and leaving a patient's room.

the interdisciplinary staff. Simulation has been used in medical and

nursing education as an effective way of creating positive learning experiences. Experiential training environments provide critical evaluation of a staff member's competency in using appropriate PPE.^{13,17} While wearing PPE, staff members from medicine, nursing, and respiratory therapy were challenged when performing simple and complex procedures. Team simulation captured the nuances of an in-the-life aspect of a critically ill patient requiring critical care. Through simulation, staff members were able to better visualize the requirements for the daily care of a patient with EVD. Members of the nursing staff demonstrated competency in waste removal, obtaining specimens and transporting them to the laboratory, and cleaning during team simulation. Physicians

and respiratory therapy personnel in full PPE simulated procedures, including aseptic intubation and insertion of central catheters.

Monitors

One vital aspect of caring for patients with EVD discussed with health care professionals returning from the West African front was the use of a monitor or "WatSan."^{7,9} The term WatSan was coined in West Africa and stands for water and sanitation. For our purposes, a WatSan is a health care worker who ensures that meticulous donning and doffing techniques are used by all staff entering and leaving a patient's room.^{5,9} The WatSans received the same basic training described earlier. Included in the knowledge assessment were what's-wrong-with-this-picture photographs to ensure recognition of breaches in procedure. When engaged as a WatSan, the health care worker used specific scripts (based on the procedure checklists) to step by step ensure that staff members were following appropriate processes in donning PPE before they entered a patient's room and in doffing PPE when leaving the room, to avert contamination of staff or the unit.

Training With a Patient Present

Education of staff originally occurred within the actual confines of the SCSU to allow staff members to familiarize themselves with care of a patient with EVD in the actual SCSU surroundings. Once a patient was admitted, the education plan was altered slightly. Classes were held in a nearby conference room instead of in the SCSU. The education still consisted of a slide presentation, review of the videos, return demonstration, and a knowledge assessment. Team simulation training could not be used for the steps of cleaning, waste removal, and transporting specimens to the laboratory; however, completion of these checklists was accomplished by requiring an orientation shift with a core SCSU staff member through involvement in the care of the actual patient. Once the patient was discharged, the basic and simulation training was again conducted within the SCSU. With or without a patient in residence, retaining a solid base of trained volunteer staff to care for an EVD patient was important.

Maintaining Training

The immediate process for educating staff to safely care for a patient with EVD incorporated a variety of

aspects of adult learning and reinforcement of experiential learning through simulation as described. To continue to maintain the skills for procedures in the care of a patient with EVD acquired through initial trainings, staff members attended additional retraining sessions. With the current reeducational plan, staff members (core and volunteer) review a computer-based training module of the slide presentation, simulation, and a knowledge assessment on a biannual to annual basis. Demonstrations of donning and doffing PPE are done quarterly (with a current outbreak) to biannually to annually in preparation for any further outbreaks. If admission of a patient with EVD is expected, retraining on donning and doffing PPE will be done for staff immediately before the arrival of the patient. The premise of the training plan is to ensure maintenance of staff skills and ability to care for a patient with VIDs.

Summary

The safety of health care workers is paramount when care is provided for a patient with EVD. In the SCSU, safety was achieved via a comprehensive educational approach that included repeated content about the causative organism involved and classes on the meticulous use of PPE. The multiple teaching methods (slide presentation, video, return demonstration, knowledge assessment, and simulation) used to meet the various learning styles of adult learners were all designed to increase learning acquisition and retention. Use of periodic refresher training continues to keep staff members ever vigilant and prepared to care for a patient with EVD or other VIDs. [CCN](#)

Financial Disclosures
None reported.



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