

## Ebola: Are We Ready?

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### The Case

A 28-year-old man, well-appearing but pale, walked into the emergency department (ED) on a Wednesday afternoon at 3 PM complaining of nausea, vomiting, and fever since morning. The patient stated that he was at a potluck the night before and thought he ate something that made him sick because he had a foul tasting potato salad. He was unsure if anyone else got sick. The patient glanced at the sign prominently posted at the triage desk. "Tell us if you have traveled outside the United States in the past month." He did not volunteer any information, but when the triage nurse asked him directly, he reported that he returned the previous week from Sierra Leone, where he was volunteering with Doctors Without Borders handling patient intake. Because of this history, the nurse initiated an isolation protocol for patients with symptoms and travel history consistent with possible exposure to Ebola. The triage nurse donned a mask and handed one to the patient, asking him to don it as well. She did not touch him but asked him to go with her to a decontamination room and to wait there until staff could don personal protective equipment (PPE). The patient was also instructed to don a blue plastic gown over his street clothes. He waited in the decontamination room for 20 minutes.

An ED physician and nurse, both wearing full PPE, introduced themselves to the patient and explained why they were dressed in coveralls, powered air purifying respirators, double gloves, and protective leg and shoe covers. They took a history and assisted the patient to a gurney. Outside the room, two security officers cleared the corridor. The physician and nurse pushed the gurney down the secured hallway toward the elevators where they would go up to an isolation room. There seemed to be confusion as to which elevators should be used. At that moment three different elevators arrived on the ground floor, more than 30 staff members (at their shift change) exited the elevators to go home and were surprised to see the two human silhouettes covered head-to-toe in yellow and white spacesuits pushing a gurney occupied by a pale young man, now garbed in an isolation gown, bonnet, and mask, and in considerable distress with vomiting. As the patient arrived in the isolation room, the ED nurse was asked to start an IV, draw blood, and insert a Foley catheter. As the nurse gathered supplies and cannulated the peripheral vein, she asked, "Where is the transfer set?" referring to an equipment tray used in the ED to draw blood from a peripheral IV. As the clinicians soon discovered, this set was not available on the patient unit. The blood was

successfully collected using available equipment, yet the procedure to send it to the laboratory was not clear. The specimen was placed in a double biohazard bag and left in the room pending additional instructions about how to transport it to the laboratory.

The critical care team, two intensivists and two nurses, arrived in the isolation room. A trained observer assisted the critical care team as they donned their PPE, a process that took more than 20 minutes. A warm handoff was provided by the ED team as they exited. A warm handoff includes an in-person summary of the patient's history, symptoms, and ED care and decision-making, with an opportunity for the critical care team to ask questions. As the critical care team turned to the patient, he vomited again, became tachycardic and hypotensive, and his oxygen saturation dropped and did not respond to supplemental oxygen. The intensive care unit (ICU) physicians decided the patient needed central venous access and requested supplies and ultrasound. While they often supervise resident and fellow insertions of central lines, attending physicians in the ICU seldom perform insertion themselves. Unfamiliar with the central line kit, they struggled but successfully put a triple-lumen catheter in the internal jugular vein using ultrasound guidance. Sterile technique was breached multiple times as they navigated the central line insertion process in their bulky PPE. At several points in the process as they reached for supplies, their backs were to the patient. An airway was never secured.

Fortunately, this case was only a simulation. Multiple experts observed and provided feedback on the process.

Although the patient was not harmed, he was placed at risk for development of a central line–associated bloodstream infection. Hospital faculty and staff were placed at risk of contamination with Ebola. Yet, this simulation took place in a hospital that was "ready" for a patient with Ebola. The hospital had developed and disseminated guidelines for caregivers and had trained them especially on safe PPE donning and doffing.

## The Commentary

As of November 4, 2014, Ebola is estimated to have affected 13,241 individuals with 4950 deaths.<sup>(1)</sup>

With easy international mobility between West Africa and the United States, American health care providers need to be ready for Ebola. As of November, there have been four confirmed cases identified in the US. Two of these were "imported" cases, patients who acquired the disease abroad (one a Liberian and one an American health care worker, neither were diagnosed until after they arrived in the US). The Liberian man's disease went unrecognized on his first emergency department (ED) visit in Dallas, Texas, and he ultimately died after he was later hospitalized. The only two cases of Ebola acquired in the US arose in health care workers who cared for this patient. The Dallas case vividly illustrated that even high-quality hospitals in major cities had not been properly prepared to receive or manage patients.<sup>(2,3)</sup> However, other health care workers have been returned to the US for treatment after becoming ill with Ebola abroad, and they have successfully recovered without transmitting the disease to health care workers or personal contacts.<sup>(4)</sup>

The Centers for Disease Control and Prevention (CDC) have offered guidance to hospitals and clinicians preparing for patients with possible or definite Ebola.<sup>(5)</sup> Many hospitals, especially those in the five major metropolitan areas that receive 70% or more of the travelers from West Africa, have scrambled to set up intake, triage, laboratory, and patient care facilities and to train personnel in accordance with CDC guidelines. After the initial experience in Dallas, these guidelines were revised, requiring hospitals to retrain personnel based on emerging understanding of best practices. The complexity of the protocols makes it seem almost inevitable that there will be error and potential exposure of health care providers to harm.

In light of the complexity of caring for patients with Ebola, the high stakes, and the evolving guidelines, our team at Northwestern Medicine, from which the above case was drawn, has used the technique of simulation to test and improve clinicians' response to plausible clinical scenarios. Each simulation teaches myriad lessons regarding our state of preparedness. The team in the case had failed to plan the route in sufficient detail from the ED to the designated isolation unit. In the confusion, they headed to the closest elevator, but this was a bay designated for staff—who were just leaving at the end of a shift and, of course, were not wearing personal protective equipment (PPE). This breach could have exposed dozens of individuals to the patient's illness. Depending on the extent of the exposure, collaboration with public health officials could have determined the need for 21-day monitoring or even (if there were body fluid exposure) home quarantine.<sup>(6)</sup>

The Joint Commission lists communication as the number one cause of sentinel events.<sup>(7)</sup> Clear lines of communication to establish secured elevator access and transportation pathways were needed. This requires advance planning, education, practice, and coordination among physicians, ED staff, security, and isolation unit personnel, and the simulation made clear that there was work to be done in this area.

A second group of errors was identified once on the isolation unit: a lack of standardized equipment familiar to staff. Although the nurse was able to draw blood, in doing so she ran the risk of becoming contaminated. The physician, who breached sterile technique during the central venous catheter (CVC) insertion, put the simulated patient at risk for developing a central line–associated bloodstream infection and put himself at risk for contamination. Our experience is that hospitals in the US do not use the same medical supplies and techniques across all departments. Therefore, staff are variably trained. However, standardization of process, training, supplies, and kits has been shown to improve patient care <sup>(8,9)</sup> and will be particularly vital in a situation like this one, when the ED and critical care services teams must collaborate to care for patients with Ebola but have typically not participated in shared training.

A related error in this simulation was that the team did not observe standard infection control procedures, perhaps related to their unfamiliarity with the equipment and environment. For example, they repeatedly turned their backs to the sterile field in a crowded patient room, while wearing bulky PPE <sup>(10)</sup>, which carries the risk of contaminating the field. Other health care personnel in the room should be trained to guide the clinicians with verbal redirection if they have their backs to the patient.

Third, there was lack of clear direction on how to handle blood specimens safely. The CDC recommends that health care providers "establish policies and procedures for containing, transporting, and handling patient-care equipment and instruments/devices that may be contaminated with blood or body fluids."<sup>(11)</sup> For Ebola, the CDC advises testing be performed proximate to the patient if possible—for example, in an

adjacent room. Otherwise, the specimen can be transported in a biohazard bag within a durable, leak-proof secondary container.(6) Our own facility guideline calls for a biohazard bag, wiped with an approved hospital disinfectant, then double-bagged and placed in a rigid container for transport. Despite the existence of the protocol, the team performing the simulation had difficulty recalling the specifics when they were performing a simple blood test. Here too, clear communication and standardized training among leadership, staff, and the laboratory must be established. The team's solution was to post written protocols inside the isolation unit so staff could easily view appropriate steps for proper specimen handling and other procedures.

Fourth, the number of years practicing a specialty is not a proxy for competence. It should not be surprising that attending physicians committed errors during CVC insertion because they often rely on residents or fellows to perform these tasks. The Accreditation Council for Graduate Medical Education has issued guidance urging that residents and fellows be directly supervised by trained attending physicians when they care for patients with Ebola.(12) In light of CDC guidance to keep the number of health care workers in these settings to a minimum to reduce the potential for exposure, our institution and others have concluded that direct Ebola patient care by residents and fellows is not in the best interest of the health care team at this time. Additionally, residents and fellows also demonstrate poor skills on simulated CVC insertion skills exams.(13-15)

However, attending physicians have shown variable skill in even the procedures they perform in practice every day. We have shown that critical care, emergency medicine, and surgery attending physicians who perform hundreds of CVC insertions in practice also perform poorly on a simulated skills examination, with only 25% passing the test (unpublished data). When Birkmeyer and colleagues evaluated the skills of 20 attending surgeons in Michigan performing laparoscopic gastric bypass procedures (16), based on video voluntarily submitted by the surgeons, his team found that surgical skill varied widely, with poorer surgical technique associated with higher complication rates.

Therefore, simulation training and assessment is vital to ensure that attending physicians are competent to perform procedures on patients with Ebola, particularly procedures that are typically delegated to trainees. The need for high levels of competence is even higher when the procedures are to be performed by individuals wearing bulky PPE and when the risks associated with exposure are heightened.

Competency assessment using simulated patient scenarios is the best means to ensure that skills are adequate and operations run smoothly, and to help to discover areas that need improvement. The use of simulation for training in bioterrorism exercises has resulted in improved trainee skills.(17,18) However, there are no specific data about how simulation affects Ebola care. Simulation has been shown to improve skills in complex scenarios such as trauma care, where multidisciplinary teams need to work together to effectively treat a patient.(19,20) Simulation has also been shown to improve leadership skills and patient care in advanced cardiac life support (21), decrease surgical complications (22), and reduce complications from procedural tasks such as lumbar puncture (23), paracentesis (24), and CVC insertion.(15,25) This overwhelming body of evidence from comparable clinical situations suggests that care for patients with Ebola can benefit from simulation as well. Due to the complex nature of coordination needed for Ebola simulation, we recommend using hybrid simulation with a combination of standardized patient actors (simulating communication, isolation, and transportation protocols), high fidelity simulators ("crashing"

patients), and task trainers (CVC insertions).

While a cliché, we know that only "perfect practice makes perfect." Canadian astronaut Chris Hadfield summarized this best in a TED talk entitled, "What I learned from going blind in space."<sup>(26)</sup> During a routine space walk, tears built up in his eyes and he was temporarily blinded, with no means of wiping them away and no gravity to pull them into his nasolacrimal duct. Instead of panicking, Hadfield reflected, "We knew everything there is to know about the spacesuit and we trained underwater thousands of times. And we don't just practice things going right, we practice things going wrong all the time.... We actually practiced incapacitated crew rescue."

In order to get it right in this highly complex process of caring for patients with Ebola, we need to repeatedly simulate scenarios to ensure our patients get the best care and our clinical staff are protected. At Northwestern Memorial Hospital, we have learned that preparing detailed guidance is not enough—we must conduct realistic drills and offer clinicians and administrators both practice and honest feedback on their performance. Checklists and reminders can help inform clinicians about best practices, but only through simulation can we develop effective skills and teamwork to assure safe, high-quality care for the patient and a safe work environment for the care team.

#### Take-Home Points

- Error is nearly inevitable in a process that is rare, complex, and involves teams and individuals who do not work together routinely. Care of a confirmed or suspected patient with Ebola meets all these definitions and is inherently high-risk for error and, due to the nature of the organism, high-risk for harm to staff and patients.
- Checklists and procedures create the foundation or infrastructure for safe processes, but are completely inadequate to assure real-life reliable practice.
- Unusual circumstances like Ebola may be very helpful to reveal unrecognized or underappreciated gaps in patient care safety and preparedness, such as variability in supplies and equipment among specialties or lack of proficiency in procedures by attending physicians.
- Simulation, preferably in the actual place that care will be provided (in situ), is by far the best method to allow clinicians to learn systems, identify their skill development needs, and develop familiarity with procedures, teamwork, and resources for problem solving.

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