2014-2016 ebola crisis: us preparedness

The 2014-2016 Ebola Crisis and the Effects onU. S. Emergency Preparedness

The 2014-2016 Ebola crisis in West Africa proved to be a difficult lesson for the African countries affected as well as for the state of U. S. emergency preparedness when dealing with a relatively unknown infectious disease. Erupting from within a Guinean prefecture in December of 2013, the disease would spread through Guinea, Sierra Leone, and Liberia unchecked due to lack of awareness and emergency preparation due to theunfamiliarityof the disease (Baize et al., 2014). The World Health Organization, Doctors without Borders, and the Centers for Disease Control and Prevention, among others, would collaborate with regional government and public health officials to contain the disease, but the efforts would require extensive time, funding, education, and preparation, and would ultimately result in the loss of over 11, 000 lives (Centers for Disease Control and Prevention, 2014, 2016). It would be the largestEbolaoutbreak known to date. While U. S. public health agencies and military based support would play a crucial role in the end to the outbreak in 2016, the U. S. would have to come to terms with its own lack of planning and emergency preparedness when dealing with an imported infectious disease, and the fear and reservations that plagued its people and healthcare systems in its aftermath.

Emergencypreparedness has been shaped by a myriad of natural disasters, epidemics, andpandemics that have sieged not only countries, but entire continents. It is thejourney in discovering how to approach, contain, treat, and prevent these masshealth crises from re-occurring in the future, that has given rise to thecomplex and unique strategies that keep the general population safe. These advances in prevention and containment, uncovered

particularly inthe wake of epidemics and pandemics such as the plague, Spanish Influenza, SARS, and as highlighted in this report, Ebola Virus Disease, prove that theprotective measures that responders on the front line must implement to keepdisaster at bay, must remain adaptable and ever fluid.

TheWest African Ebola outbreak of 2014-2016 encroached upon the fears and concernsof continental Americans as never before in history. An elusive disease onlyknown by most to be a worry of inhabitants of the sub-Saharan regions of theAfrican continent, Ebola was now knocking on America’s doorstep.

To understand and properly weigh thegravity of the Ebola outbreak, a general understanding of the virus and mostrecent outbreak is warranted. Ebola virus disease is one of two members of the *Filoviridae* virus family and is comprised of five differing variationswithin itself (Centers for Disease Control and Prevention, 2014). Firstdiscovered within Africa in 1976 when two variations of the virus led tooutbreaks, the Sudan viral strain, or SUDV within South Sudan, and the Ebolavirus strain, or EBOV, in the Democratic Republic of Congo, were introduced(Cenciarelli et al., 2015). The spread of the virus among humans is via contactwith infected bodily fluids such as blood, vomit, feces, sweat, and urine, orcontaminated fomites (Centers for Disease Control and Prevention, 2014). However, the originating vectors are believed to be fruit bats, which arecommonly hunted and eaten as wild game in some areas of Africa, and otherwiseknown as bushmeat (Saéz et al., 2014).

Uponexposure to the virus, the incubation period prior to onset of symptoms rangesanywhere from 2 to 21 days, with symptoms tending to manifest by day 8 throughday 10 post-exposure (Signs and Symptoms | Ebola Hemorrhagic Fever | CDC, 2014). It has been identified that infected individuals are not contagiouswhile asymptomatic (Cenciarelli et al., 2015). The tell-talesymptoms of Ebola virus primarily begin with fever, which progresses to onsetof profuse diarrhea and vomiting usually after 3 to 5 days of fever (Chertow etal., 2014). Accompanied with pain, lethargy, and secondary complications(including hemorrhaging) that occur if the patient is not given supportivetreatment, the rapid deterioration in health that transpires due tohypovolemia, shock, or multi-organ failure, will ultimately lead to death(Chertow et al., 2014). Survivors of the virus tend to improve near day10 of active viral symptoms and are generally expected to live once they havemade it to day 13 (Chertow et al., 2014). Those that do not improve and succumbto the virus tend to pass away between days 7 and 12 of viral infection(Chertow et al., 2014). The case fatality rates for the Ebola virus rangeanywhere from 50% to 90%, and to date there is still no definitive cureavailable (World Health Organization, 2018).

Theunfolding of the 2014-2016 crisis was fast, and the virus rampant by the timethe nature of the culprit had been properly unmasked. A sudden rashof illness exhibiting the characteristics of a filovirus, was first reported byhealth agencies within the Guéckédou and Macenta prefectures in Guinea in Marchof 2014, raising the initial red flag of outbreak (Baize et al., 2014). Ateam of professionals was sent to the area in mid-March by Medecins sansFrontieres, also known as “ Doctors without Borders”, and research

began thatsame month to uncover the cause of the illnesses (Baize et al., 2014). Coinciding with the beginning ofsurveillance and research of the outbreak of illness by Doctors without Bordersin March of 2014, the Centers for Disease Control and Prevention, or CDC, alsoarrived on deck with a small team, lending an additional hand with research andguidance to the Guinean government. The CDC had already maintained a supportivepresence in Guinea, Sierra Leone, and Liberia, due to the assistance that itoffered in vaccination of the population, and other public health relatedprograms including combating diseases such as malaria and polio (Bell et al, 2016). Alongside the World Health Organization, UNICEF and InternationalFederation of Red Cross partners, a structured, five-pronged investigationemerged, with the Guinean government primarily orchestrating the responseefforts (Dahl et al., 2016).

Extensiveinvestigation and contact tracing led the researchers to surmise that theillness was in fact the EBOV, or Ebola virus, and that the suspected “ patientzero” was a 2-year old from Meliandou in the Guéckédou prefecture (Baize et al., 2014). The toddler had succumbed to the virus in December of 2013, with thesecond through fourth victims passing afterwards the following January, allwithin the same prefecture of Guéckédou (Baize et al., 2014). The agencies worked side by side with theGuinean Ministries of Health to get ahead of the outbreak, as surveillancemethods in the region demanded strengthening to debilitate the spread of adisease known to have high case fatality rates, exhibiting at that time aninitial 71% case fatality rate (Baize et al., 2014).

TheCDC, alongside the other agencies worked to support the various villages, towns, and districts through continued tracing of contacts, providing educationregarding contact precautions, safety when isolating those that were ill orpotentially ill, as well as options for handling the deceased with care (Bellet al, 2016). Researchers were able to discover that it was a healthcareworker, or the 14 th victim, that initiated the spread of EBOVoutside of the Guéckédou boundaries, with further incidences popping up insurrounding areas such as Kissidougou and Macenta (Baize et al., 2014). Research indicated that at the close of March, there were well over 100potential EBOV cases in Guinea, with almost 80 dead (Baize et al., 2014).

Thevoracity at which the disease spread would be fueled by unchecked traveling ofcontacts between Guinea and its surrounding countries, as well as individualsand healthcare workers in contact with the homes, surroundings, and families ofthose sick or becoming sick, unaware that the illness was in fact Ebola, andextremely infectious (Ebola in Sierra Leone: A slow start to an outbreak thateventually outpaced all others, 2015). By April of 2014, the presence ofEbola had been officially confirmed in Sierra Leone and Liberia (Bell et al, 2016). The first case of Ebola in SierraLeone is believed to have been a woman that attended the burial of the “ patientzero” in Meliandou in December of 2013 (Ebola in Sierra Leone: A slow start toan outbreak that eventually outpaced all others, 2015). The woman wasapparently still in the home of the family of the first case when they too fellill, and later returned to her home in Sierra Leone, where she subsequently becamesick and passed away (Ebola in Sierra Leone: A slow start to an outbreak thateventually outpaced all others, 2015). The Lofa

County in Liberia, whichskirts the Guinean border, was able to confirm its first cases of Ebola at theend of March 2014 (A timeline of the Ebola outbreak, 2014).

Bythe end of April 2014, there were well over 200 cases across the region, however it appeared that the amount of cases was stabilizing, and on thedecline in areas such as Liberia (Briand et al., 2014, Centers for Disease Control and Prevention, 2016). However, afterthe next two months of apparent stability, reporting indicated a renewed upwardtrend in Ebola cases, and the fresh report of confirmed Ebola cases in the cityof Monrovia, the heavily populated capital of Liberia, unveiled an explodingtime bomb of infection (Liberia: A country-and its capital-are overwhelmed withEbola cases, 2015).

Evenwith the best efforts of all participating agencies, it had become elusive tokeep up with the massive chains of potential contacts, and with the disease nowappearing in Monrovia, Liberia, the city was found to be ill-prepared to dealwith such a contagion, allowing it to spread like wildfire (World HealthOrganization, 2015). It is notable to mention that West Africa had notexperienced an Ebola outbreak of any measurable magnitude, and the experienceand lessons in containing the disease were bestowed upon those countries suchas the Democratic Republic of Congo, and Uganda (World Health Organization, 2015). Monrovia’s major health center was in desperate need of repairs and hadlimited resources, in turn opening the door for widespread infection ofhealthcare personnel on top of the patient care load (Liberia: A country-andits capital-are overwhelmed with Ebola cases, 2015). With the onset ofJuly, cases of Ebola doubled in Liberia, and a rising

trend of infectionpersisted in Guinea and Sierra Leone (Centersfor Disease Control and Prevention, 2016). This rash of new cases that nowplagued the region prompted the CDC to employ an Emergency Operations Center, or EOC, on July 9 th , 2014 (Dahl et al., 2016). The engagement ofthis operation led the CDC to forward task an increased presence of personnelto directly assist the regional governments, supplying epidemiologists, laboratoryscientists and a plethora of supportive staff (Dahl et al., 2016). WHO, UNICEF, and Doctors without Borders remained prominently active during theamplification of support, and with the increased presence of American aid, allagencies worked tirelessly with the local government leaders and Ministries ofHealth to establish a much-needed emergency management plan capable ofsupporting and withstanding the outbreak (Dahl et al., 2016).

As the supportive efforts amongst first respondersand the new cases of Ebola both drew to a fervor in the early summer of 2014, American citizens and other countries became aware of the uniqueness of thisEbola outbreak. Word spread globally ofthe first case of Ebola transported into Nigeria in July of 2014 (Fasina et al., 2014). Flying from Liberia to Nigeria after exposure to the disease, the individualwas symptomatic in flight, and succumbed to the illness just 5 days after theflight into Nigeria (Fasina et al., 2014). The individual was Patrick Sawyer, anAmerican citizen fromMinnesota (Man Who Died of Ebolain Nigeria Was American Citizen: Wife, 2014). A native of Liberia, but anAmerican citizen, Mr. Sawyer had been working and living in Liberia, while hiswife and children continued to reside in the United States (Minnesota Man WhoDied of Ebola in Nigeria Was American Citizen: Wife,

2014). On July 31 st , 2014, a few daysafter the death of Patrick Sawyer, the Centers for Disease Control andPrevention issued a class 3 travel warning, advising against travel to theaffected region, and highlighting measures being taken to screen travelersleaving the region to ensure that they are not infected(Centersfor Disease Control and Prevention, 2014). Along with this advisory, theCDC also reported an additional advisory issued to U. S. healthcare workers, toaddress protocols to be followed when addressing the possibility ofencountering potentially infected patients (Centers for Disease Control andPrevention, 2014). As confirmed cases throughout the affected region peaked toover 1300, with over 700 dead, the CDC announced in the July 2014 advisory thatthe United States would continue to work with international partners over thenext several years to help strengthen and enhance emergency response efforts inthe region, with the president of the United States aiming to dedicate $45million dollars towards the cause (Centers for Disease Control and Prevention, 2014, 2016).

The steps that the United States would need to taketo ensure its own readiness to handle Ebola would soon be put to the test, whenaround the same time that the CDC issued its health alert and travel advisory, it was announced that two American healthcare workers had contracted Ebolawhile stationed in Monrovia, Liberia (CBS/AP, 2014). In late July of 2014, Dr. Kent Brantly, a doctor employed in a post-residency position with the aid groupSamaritan’s Purse, became infected with Ebola while serving as a medicaldirector in relief efforts in the area (CBS/AP, 2014). Nancy Writebol, an aid worker with the groupcalled Serving in Mission, had also contracted Ebola in the same timeframewhile working as a hygienist in the Samaritan’s

Purse Ebola care center(CBS/AP, 2014). Plans immediately commenced to arrange for the workers to betransported back to the United States to continue supportive care (Achenbach, Dennis, & Hogan, 2014).

As part of the CDC's recent health alert, healthcareagencies within the United States were advised to inquire of patients if theyhave recently traveled to or from the West African region within the prior21-day timeframe (Centers for Disease Control and Prevention, 2014). The CDCstressed the importance of healthcare provider awareness of the signs andsymptoms of Ebola, as well as activation of isolation and contact procedures immediatelyupon any suspicion of the disease (2014).

Just as West Africa had never experienced an Ebolaoutbreak, the CDC was also aware that U. S. healthcare facilities had neverdealt with the Ebola disease head on, and problems could arise if facilitieswere not properly equipped to handle infected patients (Morbidity and MortalityWeekly Report (MMWR), 2017). Thus, inplanning for the transport of Dr. Brantly and Mrs. Writebol, plans werecemented to arrange for their arrival at Emory University Hospital in Atlanta(Achenbach, Dennis, & Hogan, 2014). Emory University Hospital is one offour facilities across the United States that can treat patients diagnosed withhighly infectious diseases(Courage, 2014). Thetwo-room isolation unit housed within Emory Hospital, and constructed in handwith the Centers for Disease Control and Prevention, provides an optimalenvironment for healthcare personnel and patients when managing infectiousdiseases (Courage, 2014). Touting state of the art digital pressure monitoring, negative air pressure and HEPA filtration, a safe zone workspace and prep area, contained bathroom facilities, and specialized laboratory

space, workers canessentially care for a patient without risk of any contact with the remainderof the facility(Courage, 2014). Regarding medicalwaste, which is a key concern when dealing with highly infectious cases, thehospital dilutes all bodily waste in toilets with bleach for a set period priorto flushing, and all other items to include personal protective equipment fromstaff, and other solid items are sanitized and then incinerated (Courage, 2014).

The remainingthree facilities across the United States with comparable biocontainmentfacilities include the National Institutes of Health's Special Clinical StudiesUnit located in Bethesda, MD, the University of Nebraska Medical Center'sBiocontainment Patient Care Unit, and Saint Patrick Hospital in Missoula, MT(Courage, 2014). As Dr. Brantly arrivedat Emory University Hospital at the end of July 2014, followed by Mrs. Writebolin the first week of August, President Obama addressed the United Statesregarding the outbreak, assuring the American public that screening precautionsin airports were in effect in West Africa and in the United States to reducethe risk of infected individuals entering the country (Achenbach, Dennis, & Hogan, 2014).

Bythe 8 th of August in 2014, the West African Ebola Virus epidemic hadbecome extreme enough for the World Health Organization to make aninternational announcement, that the situation had now become an emergencydetrimental to public health (Cenciarelli et al., 2015.) By this time, the total cases over the region equated to just over 1700, with deaths risingto near 1000 (Centers for DiseaseControl and Prevention, 2016). The numbers of cases and deaths associated with the current outbreakexceeded the worst Ebola outbreak previously documented in Uganda in the year2000,

where there were 425 cases and 244 deaths (Bell et al., 2016). Theimplementation of this Public Health Emergency of International Concern, orPHEIC, by the World Health Organization, is a deliberate tool meant to be usedwhen disaster calls (Briand et al., 2014). Meant to put emergency plansinto action with the assistance of international partners, the beginning ofcollaborative efforts would begin to aid in mitigating the toll that the virushas taken on the affected countries.

Inresponse to the emergency declaration by the World Health Organization, the CDCwould in turn increase the amount of personnel that it had deployed to the area(Dahl et al., 2016). The WhiteHouse followed suit with an official press release detailing the U. S. responseto the crisis. On September 16, 2014, the White House relayed the expansion offunding and support to the evolving outbreak (The White House Office of thePress Secretary, 2014). Along with supplying additional U. S. funding to bring atotal of almost $175 million invested collectively towards various supportiveefforts, the White House also activated a cell of U. S. Africa Command personnelto provide on ground support in Liberia to arrange operational oversight of theU. S. based activities aligned with response efforts (The White House Office ofthe Press Secretary, 2014). The press release also entailed the deployment ofadditional personnel through the U. S Disaster Assistance Response Team, orDART, as well as the supply of care kits, training, and the institution ofadditional Ebola Treatment Units, as well as laboratory support (The WhiteHouse Office of the Press Secretary, 2014).

Thelatter only briefly touches on some of the response efforts engaged by the U. S. in support of the affected region, however the need for effective

emergencymanagement measures would hit home, when just days after the White House pressrelease, a man whom had recently traveled from Liberia to Texas to attend hisson's graduation, would arrive at the emergency room of Texas HealthPresbyterian Hospital in Dallas, TX (Chevalier et al., 2014, VOA News, 2014).

TexasHealth Presbyterian's ER would send Thomas Duncan home after treating him forwhat was believed to be sinusitis (Chevalier et al., 2014). Presenting to theER with a fever, headache and stomach pain, Mr. Duncan had informed the staffthat he had recently arrived from Africa, and while this information wasdocumented in his record, the ER physician at that time somehow overlooked it, and did not conclude that Ebola virus disease should be suspected (Dallas News, 2014). The hospital would later acknowledge this oversight, as three dayslater, Mr. Duncan would be transported to the Texas Presbyterian Hospital's ER, this time via ambulance, with an exacerbation of symptoms to include vomitingand diarrhea (Dallas News, 2014, VOA News, 2014). This time, Mr. Duncan'srecent arrival from Liberia would be accounted for in his medical assessment, and subsequent testing would conclude that he was in fact infected with Ebola(Dallas News, 2014).

Furtherexposing the fissures within the handling of this case, the hospital's holdingcompany later acknowledged that the clinician training regarding the Ebolavirus had been available but was not required of staff at the time when Mr. Duncan presented to the facility(Dallas News, 2014). The facility was also awareof the CDC health alert from July of 2014 that stressed the possibility of aninfected traveler arriving in America due to the magnitude of the outbreak, andthe need for American healthcare facilities to be on the lookout

for the verysymptoms Mr. Duncan presented with on September 25 th , 2014 (Dallas News, 2014). As a result, numerous peoplewould need to be traced and evaluated relating to their contact with Mr. Duncanduring his travel and after his arrival to Dallas, TX. As Texas responders and the CDC personnelworked to trace the 48 potential contacts for Mr. Duncan, the man wouldeventually succumb to the disease on October 8 th , 2014, becomingAmerica's first death from Ebola Virus Disease(VOANews, 2014.)

Some experts say that the initial misdiagnosisof Mr. Duncan is due to human error, since travel should have been an essentialquestion asked of the patient upon assessment by the physician (Dallas news, 2014). However other experts acknowledge the difficulty of identifying adisease that has never been diagnosed on American soil (Dallas news, 2014). Itwas more than likely a combination of these factors that led to the results ofMr. Duncan's case, and while Texas health officials dealt with the missteps ofthe event, just 3 days after Mr. Duncan's death, one of the nurses thatparticipated in his care would be diagnosed with Ebola, with a second nursetesting positive 4 days after the first (McCarty et al., 2014). The secondnurse diagnosed with Ebola after taking care of Mr. Duncan, reported that shehad traveled to Ohio from Texas prior to her diagnosis (McCarty et al., 2014).

Enlisting the CDC to support in guidance andtraining, Ohio public health officials began the process of tracing contacts(McCarty et al., 2014). Learning throughfirst-hand experience how to identify and monitor individuals that may haveinteracted with the infected nurse, as well as how to prepare local healthfacilities regarding ability to properly triage, isolate, and safely transportinfected patients, Ohio officials hoped to avert a crisis

while assuring theprotection of healthcare staff and the general population(McCarty et al., 2014). The total effort in Ohio wasextensive and required cooperation from a considerable portion of the state’scounties, with 164 contacts to follow (McCarty et al., 2014). While most of thefacilities were determined to be ready to act in the event of an active case ofEbola, the transportation plans and other points of coordination such astransfers between various agencies needed to be established, and theinformation gleaned from this real-world scenario exemplified the necessity forhealthcare facilities to have these forms of emergency preparedness already inplace (McCarty et al., 2014).

Asthe number of Ebola cases continued to escalate in the West African region, with confirmed diagnoses reaching over 8, 000 into the first couple weeks ofOctober 2014, and deaths numbering over 4, 000, the American public attempted toprocess that two of its own had contracted Ebola on U. S. soil (Centers for Disease Control and Prevention, 2016). Fear pervaded the comfortzones of many Americans. Some protested allowing anyone from the Africancontinent to travel to the United States, while others feared encounteringindividuals that had been anywhere near Africa (Sanburn, 2014). During thevarious stages of emergency preparedness in Ohio after the turn of eventssurrounding Mr. Duncan, one business closed when it was learned that anemployee was a contact of the Ebola-positive nurse from Texas (Sanburn, 2014). The fear of infection also hit healthcare workers particularly hard. As theinvestigation ensued into how the two nurses in Texas acquired the Ebola virus, despite employing protective measures, the uncertainty regarding thereliability and proper use of personal protective

equipment (PPE) againstEbola, was compounded with the question of whether training among healthcarepersonnel was effectively being implemented (Fernandez, 2014). Both nurses recovered from the disease, andthe biocontainment ready facilities in Nebraska and Atlanta would carry on tosuccessfully treat up to 11 total Ebola-positive patients transferred from theWest African region by April of 2015 (Hewett, Varkey, Smith, & Ribner, 2015). The successful treatment andability to prevent cross-infection of other healthcare workers proved that theU. S. could properly manage an uncommon infectious disease abroad and at home. Howeverthe initial problems that led to the fear and uncertainty of the aftermath ofEbola virus disease within the United States, point to unfamiliarity with thedisease in general, as well as lack of preparedness at a level that allowed forproper management of a highly infectious patient from the moment they presentto a healthcare facility to diagnosis and commensurate care(Hewett, Varkey, Smith, & Ribner, 2015). Management of Ebola virus demands an intricately woven web of planning andpreparation that not only carries the foresight of how to identify potentialcases, but how to prepare healthcare staff to properly protect themselves anduse PPE, how and when to arrange the transport of a patient while preserving achain of clean and safe hand-off with all involved agencies, and how toconserve the safety of all personnel throughout (Hewett, Varkey, Smith, &Ribner, 2015). This lesson hearkens to the explosion of the outbreak in WestAfrica as well. Unfamiliar with Ebola virus, many care centers in the affectedregion attributed initial cases of Ebola to more familiar diseases endemic tothe area, such as malaria and yellow fever (World Health Organization, 2015). Acombination of initial misinterpretation of disease, lack of effective protocolsthat would have

prevented the continuous spread of cases in both the healthcarefacilities and in the civilian sector, populations were simply unaware of thegravity of the situation until it was too late (World Health Organization, 2015).

The2014-2016 Ebola outbreak highlighted the need within the United States tofilter more time, attention, and funding into research and planning to dealwith unique public health emergencies such as Ebola virus (Gostin, Hodge, &Burris, 2015). U. S. assistance via the CDC, U. S. public health affiliates andaid organizations, in hand with military support, was crucial to the eventualcontainment of the Ebola crisis in West Africa. Clinical trials would lead tothe implementation of a promising vaccination against Ebola known as ZMapp, however a cure remains out of reach to date (U. S. Department of Health and Human Services, 2016). As the outbreak finally died out in 2016, with over 28, 000 cases and over11, 000 deaths collectively, a haunting reminder of mistakes and lessons learnedwould follow all agencies and countries involved (Centers for Disease Control and Prevention, 2016). The phoenix that would arise from this eventis the understanding that the United States would be required to fortify itspublic health awareness and planning, along with tightening emergencypreparedness protocols to remain ahead of the inevitability that one day, another infectious disease may find its way to America’s doorstep.

References

Achenbach, J., Dennis, B., & Hogan, C. (2014, August 02). Special ‘ air ambulance’ to carry American Ebola victims to Atlantafor treatment. Retrieved fromhttps://www. washingtonpost. com/national/health-science/us-confirms-2-americans-with-ebola-coming-home-for-treatment/2014/08/01/

c20a27cc-1995-11e4-9e3b-7f2f110c6265_story. html? utm_term=. da406c3c7030

A timeline of the Ebolaoutbreak. (2014, November 29). Retrieved fromhttp://www. abc. net. au/news/2014-10-22/ebola-timeline-worst-outbreak-in-history/5831876

Bell BP, Damon IK, Jernigan DB, et al. Overview, Control Strategies, and Lessons Learned in the CDC Response to the 2014–2016Ebola Epidemic. MMWR Suppl 2016; 65(Suppl-3): 4–11. DOI: http://dx. doi. org/10. 15585/mmwr. su6503a2

Briand, S., Bertherat, E., Cox, P., Formenty, P., Kieny, M. P., Myhre, J. K., ... & Dye, C. (2014). The international Ebolaemergency. *New England Journal of Medicine* , *371* (13), 1180-1183.

CBS/AP. (2014, July 27). Two Americans infected withdeadly Ebola virus in West Africa. Retrieved fromhttps://www. cbsnews. com/news/american-doctor-in-west-africa-contracts-deadly-ebola-virus/

Cenciarelli, O., Pietropaoli, S., Malizia, A., Carestia, M., D'Amico, F., Sassolini, A., ... & Palombi, L. (2015). Ebolavirus disease 2013-2014 outbreak in west Africa: an analysis of the epidemicspread and response. *International journal of microbiology* , *2015* .

Centers for Disease Control and Prevention. (2014, April 07). Viral Hemorrhagic Fevers (VHFs). Retrieved fromhttps://www. cdc. gov/vhf/virus-families/filoviridae. html

Centers for Disease Control and Prevention. (2014, July 28). CDC Newsroom. Retrieved fromhttps://www. cdc. gov/media/releases/2014/t0728-ebola. html

Centers for Disease Control and Prevention. (2014, July 31). CDC Newsroom. Retrieved fromhttps://www. cdc. gov/media/releases/2014/p0731-ebola. html

Centers for Disease Controland Prevention. (2016, April 14). Ebola (Ebola Virus Disease). Retrieved fromhttps://www. cdc. gov/vhf/ebola/outbreaks/2014-west-africa/previous-case-counts. htmlhttps://www. cdc. gov/mmWR/preview/mmwrhtml/mm6346a9. htm

Chertow, D. S., Kleine, C., Edwards, J. K., Scaini, R., Giuliani, R., & Sprecher, A. (2014). Ebola virus disease in WestAfrica—clinical manifestations and management. *New England Journal ofMedicine* , *371* (22), 2054-2057.

Chevalier, M. S., Chung, W., Smith, J., Weil, L. M., Hughes, S. M., Joyner, S. N., ... & Threadgill, H. (2014). Ebola virusdisease cluster in the United States–Dallas County, Texas, 2014. *MMWR. Morbidity and mortality weekly report* , *63* (46), 1087-1088.

Courage, K. H. (2014, October 24). Inside the 4 U. S. Biocontainment Hospitals That Are Stopping Ebola [Video]. Retrieved fromhttps://www. scientificamerican. com/article/inside-the-4-u-s-biocontainment-hospitals-that-are-stopping-ebola-video/

Dahl BA, Kinzer MH, Raghunathan PL, et al. CDC’sResponse to the 2014–2016 Ebola Epidemic — Guinea, Liberia, and Sierra Leone. MMWR Suppl 2016; 65(Suppl-3): 12–20. DOI: http://dx. doi. org/10. 15585/mmwr. su6503a3

Dallas News. (2014, December 07). ER doctor discussesrole in Ebola patient’s initial misdiagnosis. Retrieved fromhttps://www. dallasnews. com/news/news/2014/12/06/er-doctor-discusses-role-in-ebola-patients-initial-misdiagnosis

Ebola in Sierra Leone: Aslow start to an outbreak that eventually outpaced all others. (2015, November10). Retrieved fromhttp://www. who. int/csr/disease/ebola/one-year-report/sierra-leone/en/

Fasina, F. O., Shittu, A., Lazarus, D., Tomori, O., Simonsen, L., Viboud, C., & Chowell, G. (2014). Transmission dynamics andcontrol of Ebola virus disease outbreak in Nigeria, July to September2014. *Eurosurveillance* , *19* (40), 20920.

Fernandez, M. (2014, October 12). 2nd Ebola Case inU. S. Stokes Fears of Health Care Workers. Retrieved fromhttps://www. nytimes. com/2014/10/13/us/texas-health-worker-tests-positive-for-ebola. html

Freedman, A. (2014, October 16). America’s 4 EbolaHospitals Can Only Hold 9 Patients. Retrieved fromhttps://mashable. com/2014/10/16/ebola-us-hospital-capacity/#jlTEhWW9igq9

Frieden, T. R., & Damon, I. K. (2015). Ebola inWest Africa—CDC’s Role in Epidemic Detection, Control, and Prevention. *EmergingInfectious Diseases* , *21* (11), 1897–1905. http://doi. org/10. 3201/eid2111. 150949

Gostin, L. O., Hodge, J. G., & Burris, S. (2014). Is the United States Prepared for Ebola?. *Jama* , *312* (23), 2497-2498.

Hewlett, A. L., Varkey, J. B., Smith, P. W., &Ribner, B. S. (2015). Ebola virus disease: preparedness and infection controllessons learned from two biocontainment units. *Current opinion ininfectious diseases* , *28* (4), 343.

Liberia: A country-and itscapital-are overwhelmed with Ebola cases. (2015, October 01). Retrieved fromhttp://www. who. int/csr/disease/ebola/one-year-report/liberia/en/

Man Who Died of Ebola in Nigeria Was American Citizen: Wife. (2014, July 29). Retrieved fromhttps://www. nbcnews. com/storyline/ebola-virus-outbreak/man-who-died-ebola-nigeria-was-american-citizen-wife-n167546

McCarty, C. L., Basler, C., Karwowski, M., Erme, M., Nixon, G., Kippes, C., ... & Stone, N. D. (2014). Response to importationof a case of Ebola virus disease —Ohio, October 2014. *Morbidity andMortality Weekly Report* , *63* (46), 1089-1091.

Morbidity and Mortality Weekly Report (MMWR). (2017, July 17). Retrieved fromhttps://www. cdc. gov/mmwr/volumes/65/su/su6503a8. htm

Response to Importation of a Case of Ebola VirusDisease – Ohio, October 2014. (2014, November 14). Retrieved fromhttps://www. cdc. gov/mmwr/preview/mmwrhtml/mm63e1114a6. htm

Saéz, A. M., Weiss, S., Nowak, K., Lapeyre, V., Zimmermann, F., Düx, A., ... & Sachse, A. (2014). Investigating thezoonotic origin of the West African Ebola epidemic. *EMBO molecular medicine* , e201404792.

Sanburn, J. (2014, October 20). Ebola: Psychology ofFear During Disease Outbreak. Retrieved fromhttp://time. com/3525666/ebola-psychology-fear-symptoms/

Signs and Symptoms | Ebola Hemorrhagic Fever | CDC.(2014, November 2). Retrieved fromhttps://www. cdc. gov/vhf/ebola/symptoms/index. html

The White House Office of the Press Secretary. (2014, September 16). FACT SHEET: U. S. Response to the Ebola Epidemic in West Africa. Retrieved fromhttps://obamawhitehouse. archives. gov/the-press-office/2014/09/16/fact-sheet-us-response-ebola-epidemic-west-africa

U. S. Department of Health and Human Services. (2016, October 13). Study finds Ebola treatment ZMapp holds promise, although resultsnot definitive. Retrieved fromhttps://www. nih. gov/news-events/news-releases/study-finds-ebola-treatment-zmapp-holds-promise-although-results-not-definitive

VOA News. (2014, October 08). Liberian Man Infectedwith Ebola Dies at Texas Hospital. Retrieved fromhttps://www. voanews. com/a/second-un-staffer-infected-iwth-ebola-in-liberia/2476380. html

World Health Organization. (2015, September 22). Factors that contributed to undetected spread of the Ebola virus and impededrapid containment. Retrieved fromhttp://www. who. int/csr/disease/ebola/one-year-report/factors/en/

World Health Organization. (2018, January). Ebola virusdisease. Retrieved March 1, 2018, fromhttp://www. who. int/mediacentre/factsheets/fs103/en/