Challenges to Control Ebola in West Africa: A Review

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Abstract: Ebola Virus disease (EVD) is a severe, often-fatal, zoonotic viral disease in humans and nonhuman primates (monkeys, gorillas and chimpanzees) that has appeared sporadically since its initial recognition in 1976. The virus is one of two members of a family of RNA viruses called the Filoviridae. There are five identified subtypes of Ebola virus. Four of the five have caused disease in humans: Ebola-Zaire, Ebola-Sudan, Ebola-Ivory Coast and Ebola-Bundibugyo. The fifth, Ebola-Reston, has caused disease in non-human primates, but not in humans. Filovirus epidemics have originated from West Africa and now spreading to other continents. This outbreak has been so challenging to control in West Africa. The main objectives of this paper are to highlight the general characteristics of Ebola virus disease and to review the possible challenges of controlling the disease outbreak in West Africa. The affected countries in West Africa do not have the basic infrastructure to contain the Ebola epidemic. Most primary health workers did not have any prior experience dealing with this virus. Ebola is transmitted through body fluids and immediately attacks the immune system, then progressively attacks the major organs and the lining of blood vessels. Treatment to date has been supportive, not curative and outbreak control strategies have been met with distrust due to fear, stigmatization and misinformation. Traditional burial practices also pose a major risk to close relatives, since they typically involve the cleaning and rubbing of dead bodies. Interagency policies for outbreak detection and rapid response increased understanding of cultural and traditional risk factors within and between nations, delivery of culturally embedded public health education and regional coordination and collaboration, particularly with governments and health ministry throughout Africa were required to control these challenges.

Key words: Body fluids · Ebola · Challenges · Ebola zaire · Filoviridae

INTRODUCTION

Ebola hemorrhagic fever is an emerging zoonotic viral disease that historically has occurred in rural areas of Central Africa, with isolated cases identified elsewhere. The Ebola virus (EBOV) was first identified in humans in southern Sudan in 1976. The Ebola virus belongs to the family Filoviridae and there are also five identified subtypes of Ebola virus; Ebola-Zaïre, Ebola-Sudan, Ebola-Ivory Coast, Reston ebolavirus and Ebola-Bundibugyo. The virus causes severe morbidity and high mortality in humans and wildlife [1]. Humans typically are infected with Ebola virus either through contact with bodily fluids of infected animals or humans, or through consumption of bush meat, caring for patients, or preparing the deceased for burial [2]. EBOV can be found in a number of human secretions during the acute phase of infection, such as saliva, feces, semen, breast milk, tears, nasal blood and skin [3].

The current outbreak is caused by a new variant of EBOV, (Ebola Zaïre), the species most virulent in humans [4], the natural reservoir of EBOV is unknown, but is thought to be fruit bats. EBOV is known to cause disease in humans, non-human primates and other mammals [5]. EBOV is thought to enter the human population through exposure to the bodily fluids of an infected fruit bat or mammal, especially non-human primates. Human infection with EBOV has been associated with hunting and processing bush meat [6]. Those most at risk of infection during outbreaks are family members and caregivers of
infected individuals, individuals in contact with dead bodies during funeral preparations and rituals and health care personnel through safety protocol breaches [7].

Following an incubation period of 2 to 21 days, Ebola initially presents with non-specific symptoms (e.g. headaches, fever and muscle pain). This progresses to a rash, diarrhea and vomiting typically followed by multi-organ failure, hemorrhaging and death. Antigen-capture enzyme-linked immune-sorbent assay (ELISA) testing, immunoglobulinM (IgM) ELISA, polymerase chain reaction (PCR) and virus isolation can be used to diagnose a case of Ebola virus diseases within a few days of the onset of symptoms [8]. Presently, there is no vaccine or other therapeutic interventions beyond supportive care, although promising pharmaceutical options are on the horizon, including vaccines [9]. Although treatment options to date have been limited, outbreak control measures are effective in arresting transmission when they can be executed properly. These measures include barrier and quarantine methods to limit exposure, early identification and isolation of cases, contact tracing, communication strategies to decrease risky behaviors and epidemiologic surveillance [7].

The Ebola virus disease is the most deadly African virus especially in 2013-2014 occurrence of the outbreak in West African countries. Sierra Leone, Guinea and Liberia are small countries that have limited resources to respond to prolonged outbreaks, especially in rural areas. This is the first time that West Africa has had to deal with an EBOV outbreak, most primary health workers did not have any prior experience dealing with this virus. Limited surveillance and reporting systems may have delayed outbreak identification and the subsequent global response. The World health organization has identified these issues as gaps in the outbreak response [10]. The affected countries in West Africa do not have the basic infrastructure to contain the Ebola epidemic. Even with international help, it will take months (or longer) to bring the crisis under infections, lack of public education and deep-seated distrust among the population. EVD is spreading unchecked because of fragile health systems; emergence in densely populated urban areas, cultural practices that lead to new storm has fueled an unprecedented health and humanitarian crisis [11].

Traditional burial practices also pose a major risk to close relatives, since they typically involve the cleaning and rubbing of dead bodies that may have a high load of Ebola virus. The recommendation that these burial practices be performed by outbreak response team members has been perceived to conflict with beliefs and cultural practices [12].

Therefore, the Main Objectives of this Review Were:

- To highlight the general characteristics of Ebola virus disease and
- To review the possible challenges of controlling the disease outbreak in West Africa.

Etiology: The family Filoviridae consists of two genera, the Ebola virus and Marburg viruses, which are among the most virulent pathogens in humans and nonhuman primates [5]. The Zaire species of Ebola virus is the causative agent of the 2014-2015 epidemics in West Africa, in which the case fatality rate has been reported to be as high as 70 percent [10]; rates in earlier outbreaks have reached 80 to 90 percent [13].

Classification: Ebola virus is a non-segmented, negative-sense, single-stranded RNA virus that resembles Rhabdoviruses and paramyxoviruses in its genome organization and replication mechanisms. It is a member of the family Filoviridae, taken from the Latin "filum," meaning thread-like, based upon their filamentous structure. The genus Ebola virus is divided into five species (Zaire, Sudan, Ivory Coast, Bundibugyo and Reston) [14]. The Zaire virus, since it was first recognized in 1976, has caused multiple large outbreaks in Central Africa, with mortality rates ranging from 55 to 88 percent. It is the causative agent of the West African epidemic. The Sudan virus has been associated with a case-fatality rate of approximately 50 percent. The Ivory Coast virus has only been identified as the cause of illness in one person and that individual survived [15]. The exposure occurred when an ethologist performed a necropsy on a chimpanzee found dead in the Tai Forest, where marked reductions in the great ape population had been observed. The Bundibugyo virus emerged in Uganda in 2007, causing an outbreak of Ebola virus disease with a lower case-fatality rate (approximately 30 percent) than is typical for the Zaire and Sudan viruses. Sequencing has shown that the agent is most closely related to the Ivory Coast species [16].

The fifth Ebola species, the Reston virus, differs markedly from the others, because it is apparently maintained in an animal reservoir in the Philippines and has not been found in Africa [17]. Nothing further was heard of the Reston virus until 2008, when the
investigation of an outbreak of disease in pigs in the Philippines unexpectedly revealed that some of the sick animals were infected both by an arterivirus (porcine reproductive and respiratory disease virus) and by Ebola Reston virus. Serologic studies have shown that a small percentage of Philippines pig farmers have immunoglobin G (IgG) antibodies against the agent without ever developing severe symptoms, providing additional evidence that Ebola Reston virus is able to cause mild or asymptomatic infection in human [10].

**Epidemiology:** Ebola virus, was first recognized when two outbreaks occurred in Zaire and Sudan in 1976 [5]. Outbreaks of Ebola virus disease have been confined to Sub-Saharan Africa. An epidemic caused by the Zaire species resulted in several hundred cases in 1995 in Kikwit, Democratic Republic of the Congo and the Sudan virus infected more than 400 people in Gulu, Uganda in 2000 [18]. The 2014-2015 Ebola epidemics, caused by the Zaire species of virus, are not only the first to occur in West Africa, but it is far larger than all previous outbreaks combined. In addition to causing human infections, Ebola virus has also spread to wild nonhuman primates, apparently as a result of their contact with an unidentified reservoir host (possibly bats).

Ebola virus disease has contributed to a marked reduction in chimpanzee and gorilla populations in Central Africa and has also triggered some human epidemics due to handling of and/or consumption of sick or dead animals by local villagers as a source of food [19].

Viruses were not found during very limited sampling of live cattle, sheep, goats and pigs during outbreaks. Some animal species (e.g., sheep and goats) were described as “completely insensitive” to the effects of the virus when inoculated with large amounts of live Ebola viruses for the production of hyper-immune serum in Russian studies, but whether this indicates asymptomatic infection or complete absence of virus replication seems to be uncertain. Pigs have been infected experimentally with Zaire Ebola virus and developed respiratory signs [4].

Although all previous Ebola outbreaks have occurred in Central Africa, in 2014-2015 an epidemic began in the West African nation of Guinea in late 2013 and was confirmed by the World Health Organization (WHO) in March 2014. The outbreak subsequently spread to Liberia, Sierra Leone, Nigeria, Senegal and Mali of African countries and some cases of the Ebola virus disease also were observed in United States, Spain, France, Norway and others [4].

![Fig. 1: Distribution of Ebola outbreak in West Africa.](source: World Health Organization: Ebola Response Roadmap (2014).)
Viral Reservoirs: Perhaps the greatest mysteries regarding the filoviruses are the identity of their natural reservoir and the mode of transmission to wild apes and humans [14]. While Marburg virus has been isolated directly from bats captured in Uganda, only Ebola virus sequences, not infectious virus, have been detected in samples collected from bats in Central Africa. However, data suggest that bats are at least one of the reservoir hosts of Ebola viruses in Africa [20]. The transmission pathway from bats to humans and the possible role of bats in the initiation of the 2014-2015 West African outbreaks have not been defined.

Transmission: Epidemics of Ebola virus disease are generally thought to begin when an individual becomes infected through contact with the meat or body fluids of an infected animal. Once the patient becomes ill or dies, the virus then spreads to others who come into direct contact with the infected individual’s blood, skin, or other body fluids. Studies in laboratory have found that animals (primates) can be infected with Ebola virus through droplet inoculation of virus into the mouth or eyes, suggesting that human infection can result from the inadvertent transfer of virus to these sites from contaminated hands [21].

The 2014-2015 West African epidemic has shown that Ebola virus disease can spread rapidly and widely as a result of the extensive movement of infected individuals (including undetected travel across national borders), the spread of the disease to densely populated urban areas and the avoidance and/or lack of adequate personal protective equipment and medical isolation centers. Person-to-person transmission occurs through direct contact with blood, body fluids, or skin of patients with Ebola virus disease, including those who have died from the infection [10].

Transmission from animals can occur by direct contact with infected animals, human infection with Ebola virus can occur through contact with wild animals (example: hunting, butchering and preparing meat from infected animals) [22]. In Mayibou, Gabon in 1996, for example, a dead chimpanzee found in the forest was butchered and eaten by 19 people, all of whom became severely ill over a short interval [23]. Since that time, several similar episodes have resulted from human contact with infected gorillas or chimpanzees through hunting [22]. Direct transmission of Ebola virus infection from bats to wild primates or humans has not been proven. However, Ebola RNA sequences and antibodies to Ebola virus have been detected in bats captured in Central Africa [24, 25].

Pathogen spillover to humans is typically associated with the use of bush meat and direct contact with tissues and/or body fluids through handling and eating of infected animals (A) e.g., duiker, primates, or fruit bats [26]. Predation and consumption of a red colobus monkey by chimpanzees has also been linked to an outbreak of Ebola among chimpanzees and one researcher in Côte d’Ivoire [15]. Ingestion of fruit contaminated with Ebola infected bat saliva or feces may be another mechanism by which bats might infect other involved wildlife species (e.g., duiker, non-human primates) or even humans. Human-to-human transmission has been associated with traditional burial practices, caregiving, or some other form of direct physical contact with infected individuals or bodily fluids [27]. Transmission dynamics in high-density urban centers (C) will differ importantly from rural villages (B) influencing outbreak progression and control efforts. Transmission in the hospital setting is largely associated with failures in infection control procedures and standard barrier precautions (D) [28].

Pathogenesis: Because of the difficulty of performing clinical studies under outbreak conditions, almost all data on the pathogenesis of Ebola virus disease have been obtained from laboratory experiments employing mice, guinea pigs and nonhuman primates. However, case reports and large-scale observational studies of patients in the 2014-2015 West African outbreaks are providing urgently needed data on the pathogenesis of the disease in humans [22].

Cell Entry and Tissue Damage: After entering the body through mucous membranes, breaks in the skin, or parenterally, Ebola virus infects many different cell types. Macrophages and dendritic cells are probably the first to be infected; filoviruses replicate readily within these ubiquitous "sentinel" cells, causing their necrosis and releasing large numbers of new viral particles into extracellular fluid [13]. Patients with Ebola virus disease commonly suffer from vomiting and diarrhea, which can result in acute volume depletion, hypotension and shock. It is not clear if such dysfunction in Ebola virus disease is the result of viral infection of the gastrointestinal tract, or if it is induced by circulating cytokines, or both [29].
**Systemic Inflammatory Response:** In addition to causing extensive tissue damage, *Ebola virus* also induces a systemic inflammatory syndrome by inducing the release of cytokines, chemokine’s and other pro-inflammatory mediators from macrophages and other cells. Infected macrophages produce tumor necrosis factor (TNF)-alpha, interleukin (IL)-1beta, IL-6, macrophage chemotactic protein (MCP)-1 and nitric oxide (NO) [30]. These and other substances have also been identified in blood samples from Ebola-infected macaques and from acutely ill patients in Africa [20]. Breakdown products of necrotic cells also stimulate the release of the same mediators. *Ebola virus* acts both directly and indirectly to disable antigen-specific immune responses. This systemic inflammatory response may play a role in inducing gastrointestinal dysfunction, as well as diffuse vascular leak and multi-organ failure that is seen later in the disease course [13].

**Coagulation Defects:** The coagulation defects seen in Ebola virus disease appear to be induced indirectly, through the host inflammatory response. Virus-infected macrophages synthesize cell-surface tissue factor (TF), triggering the extrinsic coagulation pathway; pro-inflammatory cytokines also induce macrophages to produce TF. The simultaneous occurrence of these two stimuli helps to explain the rapid development and severity of the coagulopathy in Ebola virus infection [30].

**Clinical Manifestations:** Common signs and symptoms include fever, fatigue, headache, vomiting, diarrhea and loss of appetite [31]. Reports have also described weakness, myalgia, as well as a high fever accompanied by relative bradycardia as seen in typhoid fever [29]. Gastrointestinal signs and symptoms are common and usually develop within the first few days of illness. These include watery diarrhea, nausea, vomiting and abdominal pain. During the 2014-2015 West African outbreaks, vomiting and diarrhea have resulted in severe fluid loss, potentially leading to dehydration, hypotension and shock [31]. Nonhuman primates are severely affected by filoviruses, Wild chimpanzees and gorillas are often found dead. Clinical signs observed in dying wild animals (of various species) during Ebola virus outbreaks have included: vomiting, diarrhea, hair loss and emaciation, as well as bleeding from the nostrils [29].

**Diagnosis:** The ability of diagnosing diseases both old and emerging, in humans and in animals often is overlooked. Patients with *Ebola virus* disease typically develop leukopenia, thrombocytopenia and serum transaminase elevations, as well as renal and coagulation abnormalities. Other laboratory findings include a marked decrease in serum albumin and elevated amylase levels [32].

Basic anatomic pathology involves analyzing tissues from dead specimens, making observations, interpreting those findings and following up with histopathology studies of samples under a microscope. In recent years, the advent of molecular pathology has heightened the power of diagnostic pathology. Using such tools as immunohistochemistry and polymerase chain reaction (PCR) assays, pathologists now can identify the etiology, or cause of death, faster than ever before and, in many cases, where it would otherwise have been impossible. However, current disease surveillance systems, for human diseases and zoonosis alike, fail to make adequate use of diagnostic pathology [33].

Diagnosing EVD in an individual who has been infected only a few days is difficult because early symptoms, such as red eyes and a skin rash, are nonspecific to the virus and are seen in other patients with diseases that occur much more frequently. Antigen-capture enzyme-linked immune sorbent assay (ELISA) testing, IgM ELISA, polymerase chain reaction (PCR) and virus isolation can be used to diagnose a case of EVD within a few days of the onset of symptoms. Persons tested later in the course of the disease or after recovery can be tested for IgM and IgG antibodies; the disease can also be diagnosed retrospectively in deceased patients by using immunohistochemistry testing, virus isolation, or PCR [8].

**Treatment and Prevention:** No specific treatment has been demonstrated yet to be safe and effective in humans; however, experimental drugs, vaccines and monoclonal antibodies to filoviruses have been tested in animals, with varying degrees of success in nonhuman primates. These experimental treatments are diverse and may be aimed at inhibiting virus replication and/or entry into cells, treating clotting abnormalities or sepsis, or boosting immune response [8].

Prevention measures should be directed above all toward avoiding inter-human transmission. It is necessary to isolate the patient and take immediate steps to institute strict containment nursing practices. In addition, all samples taken for diagnostic purposes, excreta and any other materials that may have been in contact with the patient should be regarded as infectious and handled and decontaminated using the appropriate procedures. The number of health workers assigned to the patients care
should be restricted and all such individuals should be
dually trained. Avoid contact with suspected reservoir
hosts and nonhuman primates [34].

Human epidemics have been successfully
stopped in the past by tracing infected individuals and
isolating patients in facilities with barrier nursing
procedures and strict infection control measures.
Health care workers should use the personal protective
equipment currently recommended by experts
(example: gloves, gowns, masks, eye protection and other
equipment) to prevent exposure to blood and body
fluids. Burial practices should avoid all contact with the
body or fomites. During convalescence, the possibility of
exposure during breastfeeding or sexual intercourse
should be considered [10].

**Challenges to Control Ebola in West Africa:** The 2014
Ebola epidemic is the largest in history, affecting multiple
countries in West Africa. There were a small number of
cases reported in Nigeria and Mali and a single case
reported in Senegal; however, these cases were
contained, with no further spread in these countries. Case
counts updated in conjunction with the World Health
Organization updates and are based on information
reported by the Ministries of Health (Updated June 3,
2015) Total Cases (Suspected, Probable and Confirmed):
27,225, Laboratory-Confirmed Cases: 15,037, Total Deaths:
11,164. There has been a rapid spread of Ebola Virus
disease in Guinea, Liberia and Sierra Leone since March
2014. There are many challenges that make very difficult
to control this disease in West African countries [10].

**Fear and Obstruction of Health System:** Immense fear
and anxiety exists toward modern health care providers in
Ebola outbreak countries. This fear has stopped many
individuals from seeking health care, instead hiding from
authorities and reverting to traditional healers or family
members for care. Sick individuals already admitted to
health care facilities have also fled, fearing they will only
die in the hospital environment. For example, in the
Ugandan outbreak, people feared that once they went to
hospital they would never see their families again [35].

In a rural setting, these influences will be important,
but in high-density communities, they can be catastrophic
in their effect on outbreak dynamics and control efforts.
While health care and aid workers have the very best of
intentions, the nature and severity of the virus means that
quick action must be taken, resulting in the breakdown of
communication between patients, relatives and workers
and the inability of traditional practices to take place,
propagating more fear and distrust between the parties.

This outcome stems in large part from a lack of
understanding and familiarity with Western medicine and
practices, where community values often prioritize
traditional practices and consultation and see both as a
critical step in any community process engendering trust.
For example, with the immediate need to disinfect and
dispose of infected corpses, healthcare workers carried
out burials before notifying families [36].

In 1995, during the Kikwit epidemic, all deceased
individuals were buried in individual or common graves
by the Red Cross staff. The body of one individual,
however, was forcibly taken from the hospital to the
family’s home to have a traditional burial [6]. Fear is not
limited to community members, but is also common among
healthcare workers. These concerns are not unwarranted
as hospital staffs are at an increased risk of exposure.
Health care worker infection can be catastrophic,
particularly where large populations are served by an
inadequate public health sector. In September 2014, 10
percent of the deceased were believed to be healthcare
workers [10].

Due to the high chance of infection while caring for
patients, many health workers left their jobs out of fear, as
in the Kikwit outbreak in 1995 [18]. Understaffing of
hospitals involved in Ebola outbreaks has led to staff
working longer and harder, resulting in exhaustion and an
increased potential for deadly mistakes. The nurses that
remained in the hospital were also harshly stigmatized,
rejected by their communities and even stoned by
community members, as they were believed to act as a
reservoir for the virus. Ebola survivors are also heavily
stigmatized, many survivors are rejected by their
communities, have their belongings burned and are not
allowed to share common amenities [37].

**Human Mobility:** A complex suite of sociological and
economic factors influence human movement across the
landscape and can have critical impacts on outbreak
dynamics and the spatial spread of infectious disease.
Infected individuals moved rapidly from the originally
infected village into other locations, eventually leading to
human introduction of EBOV into major urban centers

Historically, Ebola virus disease has been
responsible for smaller outbreaks in the remote forests of
Sub-Saharan Africa that have typically involved animal-
to-human transmission and sporadic human-to-human
transmission. This outbreak marks the first time EBOV has
appeared in a capital city and has been imported by an
infected person into Africa's most populous country,
Nigeria. The unprecedented size and location of the
outbreak, combined with the fact that the virus is now circulating in densely populated urban centers, sets up the conditions for sustaining human-to-human transmission making the outbreak even more challenging to control [10].

The Ebola Virus Attack Mechanisms: The Ebola virus enters the host through small skin lesions and mucosal surfaces facilitated by its surface glycoprotein (GP). Upon cell entry the virus replicates and, as progeny virus buds from the host cell membrane, the infected cell is destroyed. Analysis of tissues from infected human and non-human primates have demonstrated that viral replication occurs initially in leukocytes, epithelial cells, hepatocytes, splenic, adrenal cortical and endothelial cells. Infected leukocytes are thought to spread the virus systemically through the lymphatic system and blood. The virus then preferentially attacks epithelial, hepatic, splenic and adrenal cells. Infected epithelial cells lining the gut cause gastrointestinal symptoms during the early stages of infection (e.g. vomiting and diarrhea). Infected hepatocytes lead to increased liver enzyme levels and impaired liver function. This may decrease the synthesis of coagulation factors, contributing to coagulation abnormalities [38]. Infected splenic cells can lead to necrosis and hemorrhage into the abdominal cavity. Necrosis of adrenal cortical cells affects the regulation of blood pressure and appears to contribute to septic shock during the later stages of infection. The virus eventually reaches all vital organs, leading to progressive organ failure and shock [39].

Treatment Is Supportive, Not Curative: There are currently no approved therapeutic treatments for Ebola. Until recently, treatment focused on rehydration, electrolyte management, antibiotics and antiviral to treat secondary infections and medications to control pain, fever and gastrointestinal distress [10].

Behavioral and Cultural Practices: Consideration of behavior and culture in disease transmission is critical to understanding transmission dynamics and control [40]. Cultural diversity shapes African nations between and within countries and can have a profound influence on social cohesion and communication, particularly during times of disturbance. EBOV, due to its nature of transmission, is particularly influenced by cultural and behavioral practices that occur at the household and community levels and within a hospital setting (patient care, family involvement and role, health-seeking behaviors and responses [41].

Burial Practices: Traditional burial practices, involving washing and touching of the deceased, have been linked to 60 percent of Ebola cases in Guinea [35] Traditional burial of the body of a person who has died from Ebola could involve contact with body fluids, posing a risk for infection. For example, in northern Uganda, the body is prepared for burial by the paternal aunt (or if no paternal aunt exists, by an older woman on the paternal side of the family). After removing clothes from the body, the woman washes and dresses it. Funeral rituals include all family members washing their hands in a common bowl and touching the face of the deceased person in the open casket, referred to as a love touch, a white cloth is used to wrap the body and the body is buried [37].

Traditional Medicine and Cures: Traditional medicine is defined as a total knowledge base, skills and associated practices that arise from theories, beliefs and experiences identified by different cultures and used in the maintenance of health. Traditional medicine constitutes the world’s oldest health care and has involved the development of culturally and geographically specific techniques for preventing illnesses and diagnosing and treating individuals and communities for centuries. While modern health care based on Western medicine is now considered the norm in many countries, much of Western Africa still relies heavily on traditional practices. Indeed, in countries surrounding the outbreak zone such as Cote d’Ivoire and Ghana, 70 percent of the population depend solely on traditional medicine, while in Burkina Faso and the DRC, this figure increases to 80 percent of the population [42, 43]. While traditional medicine can have a positive role in health care, ethno medical beliefs can also have important impacts on health seeking behavior, health outcomes and pathogen transmission pathways. Traditional healers may have positions of influence within the community and, therefore, command a level of trust and can also have a significant influence on health seeking behavior and uptake of health messages, factors that can directly affect outbreak dynamics [36, 43, 44].

Bush Meat Consumption: Bush meat utilization has been identified as the primary mechanism of EBOV spillover from wildlife reservoirs to humans. Rapid human migration to urban centers has placed increased pressure on the region for food production [43-45], including access to bush meat, a preferred protein source. Cultural practices can also differ importantly as to what wildlife species are used, obtained, processed and consumed, potentially influencing Ebola transmission risk as a result Ebola remains challenging to control in West Africa [40, 46-50].
CONCLUSION AND RECOMMENDATIONS

Ebola Virus disease (EVD) is a severe, often-fatal, zoonotic viral disease in humans and nonhuman primates with sporadic appearance, mainly in West Africa since 1976. Once the patient becomes ill or dies, the virus then spreads to others who come into direct contact with the infected individual’s blood, skin, or other body fluids. Standard treatments currently available are supportive therapy and maintenance of electrolyte balance and blood volume. Isolating infected individuals, no carcass washing and touching, proper burial techniques and creating awareness among society is the best prevention methods.

There are a number of factors that make the Ebola virus outbreak in West Africa a challenge to control. The EBOV has efficient ways to paralyze host defense mechanisms and attack vital organs. It resides in a poorly understood wildlife reservoir and has emerged in countries that have challenges in both health care capacity and risk communication. High human mobility, burial practices highly facilitate the distribution and transmission of EVD. Fear due to stigmatization, limited health infrastructures in the affected areas and the dissemination of the virus to urban areas and lack of education about the transmission of the virus creates a great difficulty to control the diseases.

Based on the above conclusion the following recommendations are forwarded:

- Coordinated development of communication strategies and surveillance partnerships across the region and global community is needed and illegal immigrant should be managed.
- Critical information about disease surveillance needs to be shared across geographic and institutional boundaries, ensuring cooperative efforts between all involved and the prevention of redundant activities.
- Public health education regarding Ebola dynamics and transmission is urgently needed in West Africa and other parts of the world.
- Hunters, laboratory workers and those having contact with primates or secretions should also be protected when handling animals and specimens.
- Dead bodies of animals and human beings should be buried appropriately to avoid potential source of infection.
- As the disease is the current issue worldwide, further research on the disease like on vaccine development should be done.

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