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Patterns in Ebola Virus Disease Outbreaks: A Systematic Review of Epidemiological Trends and Contributing Factors

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Abstract

Ebola Virus Disease (EVD) is a life-threatening condition caused by Ebola virus. It has case fatality rates ranging from about 25% to 90%. Since its first discovery in 1976, EVD has become a persistent public health challenge, especially in sub-Saharan Africa. In this review, we consolidated data from 1976 to 2024 to examine epidemiological trends, transmission patterns, and factors contributing to EVD outbreaks. We searched PubMed, Springer, PubMed Central, Wiley Online Library, and official reports from the WHO and CDC, and these identified 19 studies meeting the inclusion criteria. Findings showed a progressive increase in outbreak frequency, scale, and geographical spread, with the 2014-2016 West African outbreak marking a turning point in EVD epidemiology. The main transmission pathways that were identified included zoonotic spillover events, human-to-human transmission, healthcare-associated infections, and cultural burial practices. Risk factors such as environmental alterations, socioeconomic inequalities, cultural practices, and weaknesses in the healthcare system exacerbated outbreak severity and persistence. Despite advances in diagnostics and vaccines, challenges persist in predicting, preventing, and containing Ebola outbreaks. This review highlights the need for sustained investment in disease surveillance, medical facilities, public participation, and global partnerships to reduce the impact of future EVD epidemics. Dealing with these challenges through a multidisciplinary approach will help reduce the global burden of EVD.

Keywords: *Ebola Virus, Epidemiology, Outbreaks, Public health, Transmission, Zoonotic.*

I. INTRODUCTION

Ebola Virus Disease is caused by viruses belonging to the genus Ebolavirus which are part of the Filoviridae family. The fatal disease was first identified in 1976 during concurrent outbreaks in Sudan and Zaire (currently known as the Democratic Republic of Congo, DRC). Since then, EVD has reemerged as a persistent public health concern, especially in sub-Saharan Africa (Martínez et al., 2015; WHO, 2023). Symptoms of the disease include fever, severe hemorrhagic signs, and multi-organ failure, with case fatality rates (CFR) that vary from 25% to 90%, depending on the outbreak and available healthcare interventions (Organization, 2020; WHO, 2023). The virus is mainly spread through direct contact with infected bodily fluids, and secondary transmission can occur in households, medical facilities, and through traditional burial customs (Billioux et al., 2016).

Over the past five decades, EVD outbreaks have shown changing epidemiological patterns. There has been an increase in frequency and distribution of Ebola cases. The 2014-2016 West African outbreak was the largest recorded outbreak to date, resulting in 28,646 cases and 11,323 deaths. This marked an important shift in the disease's changes and prompted an extensive global response to the outbreak (Nanclares et al., 2016). The subsequent outbreaks, including those in DRC (2018-2020) and Uganda (2022), have reinforced the requirement for continued surveillance, early detection, and rapid containment measures (Sospeter et al., 2023). The persistence of EVD outbreaks is prompted by factors such

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as, healthcare system weaknesses, and socio-cultural practices like traditional burial rites (Alexander et al., 2015). Furthermore, environmental alterations, such as deforestation and human encroachment into wildlife habitats, have increased human exposure to potential viral reservoirs, such as bats and non-human primates (Esposito et al., 2023).

Despite advancements in diagnostic tools, vaccines such as rVSV-ZEBOV, and treatment methods, the ability to predict, prevent, and contain EVD outbreaks is still a challenge (Crozier et al., 2022). Understanding the epidemiological trends and risk factors associated with previous outbreaks is important for formulating effective public health programs. This systematic review sought to analyze trends in EVD outbreaks, examine epidemiological patterns and identify risk factors for transmission and persistence. By synthesizing data from past outbreaks, this review may provide insight into potential intervention strategies. It may also identify crucial areas for future research to reduce the impact of future Ebola virus epidemics.

II. METHODS

- *Study Design*

This systematic review was conducted following the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines. We synthesized published literature on the epidemiological trends and risk factors of EVD outbreaks. We focused on the frequency of the outbreaks, geographical distribution, transmission dynamics, and associated risk factors.

- *Search Strategy*

We conducted a search across four electronic databases: PubMed, Springer, PubMed Central, and Wiley Online Library to identify relevant literature on the epidemiological patterns and risk factors of Ebola Virus Disease outbreaks. The search focused on studies published between 1976 and 2024, covering key themes such as outbreak trends, transmission dynamics, and factors linked to it. To ensure a broad yet precise search, a combination of Medical Subject Headings (MeSH) terms and free-text keywords was employed. Boolean operators (AND, OR) were used to refine search queries. The search string for PubMed included: ("Ebola Virus Disease" OR "Ebola hemorrhagic fever" OR "EVD") AND ("epidemiology" OR "outbreak trends" OR "transmission patterns") AND ("risk factors" OR "zoonotic transmission" OR "healthcare-associated infections") AND ("surveillance" OR "vaccine" OR "prevention strategies"). Similar search strategies were adapted regarding Springer, PubMed Central, and Wiley Online Library. Additionally, official reports from the World Health Organization (WHO) and Centers for Disease Control and Prevention (CDC) were reviewed for supplementary data.

To enhance relevance and data quality, we applied specific search filters. Only studies published in English were included. Eligible sources comprised peer-reviewed original research articles and official public health reports. The search focused on epidemiologic studies analyzing outbreak trends and risk factors. Our screening and selection process involved importing search results into EndNote for reference management, then removing duplicate records. Two independent reviewers screened titles and abstracts for relevance, and full-text articles were assessed based on predefined inclusion and exclusion criteria. Any disagreements were resolved through discussion or consultation with a third reviewer to ensure methodological strictness and minimize selection bias.

- *Inclusion and Exclusion Criteria*

In our inclusion criteria for this review, we encompassed peer-reviewed epidemiological studies and outbreak reports on Ebola Virus Disease. We focused on outbreak frequency, geographic trends, transmission dynamics, and risk factors. Only studies published in English were considered. In contrast, the exclusion criteria excluded non-peer-reviewed articles, editorials, and commentaries, as well as laboratory-based studies without an epidemiological focus. Additionally, we excluded case studies that lacked wider implications of outbreaks. This helped to maintain the significance and applicability of findings to public health and outbreak management.

- *Data Extraction and Analysis*

We came up with a structured data extraction form to collect relevant information from selected studies, covering aspects such as outbreak characteristics (year, location, number of cases, and case fatality rate), transmission patterns (zoonotic vs. human-to-human transmission), and risk factors (environmental, healthcare, socio-cultural, and economic determinants). Additionally, data on control measures, including the effectiveness of interventions such as vaccination, contact tracing, and public health responses, were extracted. A narrative synthesis approach was applied to analyze trends over time, enabling comparison across outbreaks and identification of main epidemiological changes.

- *Quality Assessment*

We assessed the methodological quality of the selected studies using the Joanna Briggs Institute (JBI) critical appraisal tools for epidemiological studies. Studies with low methodological quality or inadequate data reporting were excluded from the final analysis.

III. RESULTS

- *Study Selection Process*

A total of 3,274 articles were retrieved from PubMed (58), Springer (359), Wiley Online Library (229), PubMed Central (2,623), and 5 from WHO, CDC, and ECDC. After removing duplicates 1,013 and 2,261 studies remained for title and abstract screening. Based on inclusion and exclusion criteria, 43 full-text articles were assessed, and 19 met the eligibility criteria for final review. Figure 1 shows the detailed selection process.

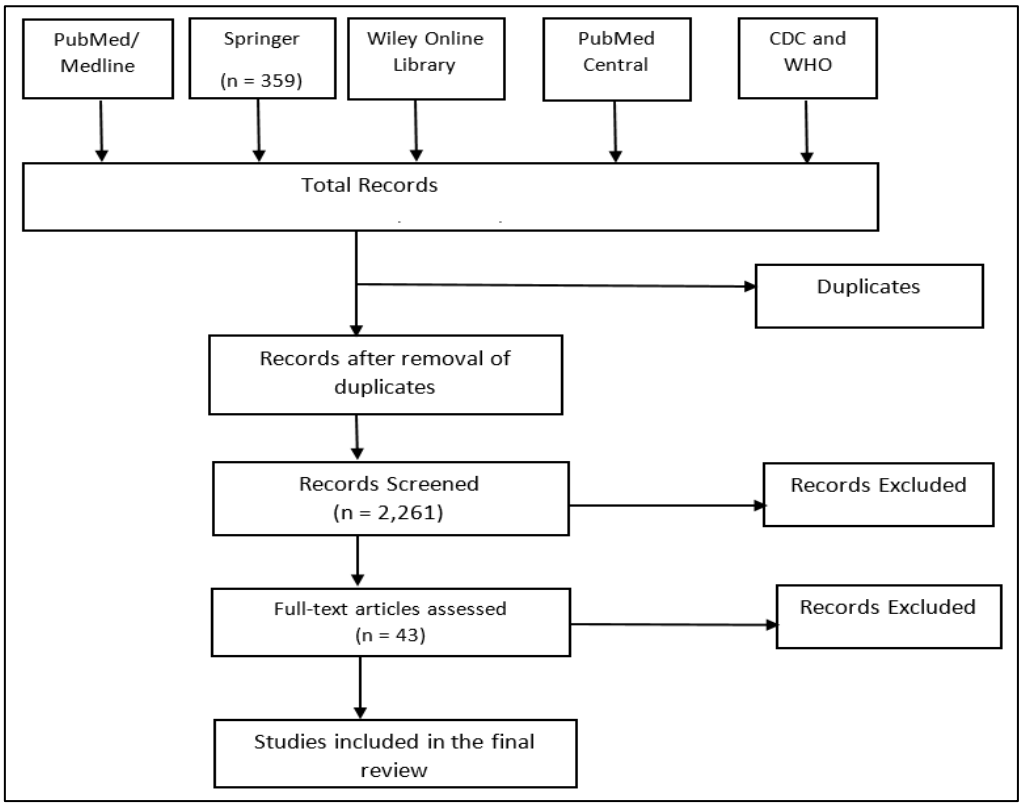

Fig 1 The PRISMA Flow Diagram Illustrating the Study Selection Process.

Ebola outbreaks were mainly caused by the Zaire ebolavirus, which was the most prevalent and lethal species, followed by the Sudan ebolavirus. The Democratic Republic of the Congo was the most affected country recording multiple outbreaks. Uganda, Guinea, and other several West African nations have also experienced significant number of outbreaks. Transmission often began with contact with wildlife, such as through hunting wild animals, and spread via close personal contact or in medical facilities. Notably, several outbreaks in 2021 and 2022 were linked to persistent infections in survivors, suggesting that the virus might pose long-term risks even after initial containment.

➢ *Temporal Trends in Ebola Virus Disease Outbreaks*

When we analyzed the EVD outbreaks from 1976 to 2024, we observed a progressive incidence, geographic spread, and severity. Initially, the EVD outbreaks seemed to be sporadic and geographically confined, but in the recent decades, the disease showed a trend toward persistent transmission, larger outbreaks and cross-border spread.

➢ *Early Outbreaks (1976–2000)*

The first documented EVD outbreaks occurred simultaneously in DRC and Sudan in 1976, with case fatality rates of 88% and 53%, respectively (CDC, 2024). Over the next two decades, the sporadic outbreaks occurred in DRC, Sudan, Gabon, and Uganda. These outbreaks had relatively low case numbers, typically fewer than 500 per outbreak (CDC, 2024).

➢ *Increasing Outbreak Frequency (2000–2013)*

From the early 2000s onward, EVD outbreaks became more frequent and widespread. The 2000 Uganda outbreak in Gulu was one of the largest outbreaks before 2014. This outbreak reported 425 cases and 224 deaths (Okware et al., 2003). Additionally, the early 2000s witnessed several outbreaks in Central Africa, especially in DRC, Sudan, and Gabon, indicating the virus's endemic presence in these regions. Factors such as deforestation increased the interaction between humans and wildlife and this resulted to high chances of exposure to the virus. There was also an increase in the mobility of the population increasing person to person interaction hence contributing to this trend (Olivero et al., 2017). By this time, it became evident that EVD was no longer occurring in isolation but becoming a recurrent public health threat.

➢ *Large-Scale Epidemics (2014–2024)*

The West African outbreak was a turning point in EVD epidemiology, marking the first instance of widespread, sustained human-to-human transmission across several countries. This outbreak impacted countries like Guinea, Liberia, and Sierra Leone, leading to a total of 28,610 cases and 11,308 deaths, making it the largest and deadliest EVD epidemic to date (CDC, 2024). For the first time, the cases were being exported beyond Africa to the United States, the United Kingdom, and Spain, and this raised global concerns about the EVD preparedness (CDC, 2024).

Following the West African epidemic, the outbreaks from 2018 to 2020 in DRC outbreaks shifted toward persistent, overlapping events. The regions that were affected by the conflicts, where insecurity hindered

containment activities against the Ebola virus, remained hotspots for the disease (Shears & Garavan, 2020). This trend continued with the 2022 Uganda outbreak, where the Sudan ebolavirus was identified as the cause. The Sudan ebolavirus strain lacked approved vaccines or treatments, making containment of the outbreak hard (WHO, 2022). With the increasing frequency and scale of these outbreaks, it is suggested that EVD is no longer an unpredictable event but an ongoing public health challenge.

➢ *Geographical Distribution of EVD Outbreaks*

DRC has stood out as the country most affected by the EVD outbreaks. DRC has been hit by more than 14 separate Ebola outbreaks since 1976, making it an epicenter of this disease. In the recent years, Ebola spread beyond its usual zones, making it sporadic. The expansion of outbreaks into West Africa (2014-2016) and East Africa (2022) shows that the disease has widened the geographic risk map. This means Ebola is no longer confined in Central Africa; it has spread beyond borders into new areas and regions. Its power to cause epidemics now extends to a wider area, raising concerns about transmission in new environments and the need for broader surveillance.

Table 1 Regional Distribution of the Ebola Virus Disease Outbreaks

Region	Countries Affected	Notable Outbreaks
Central Africa	DRC, Sudan, Gabon, Republic of Congo	1976, 1995, 2007, 2018–2020 (DRC)
West Africa	Guinea, Liberia, Sierra Leone, Nigeria	2014–2016 (largest outbreak)
East Africa	Uganda, South Sudan	2000, 2007, 2022 (Uganda)
Global Spread	USA, UK, Spain, Italy (imported cases)	2014–2016 (travel-related cases)

➢ *Transmission Patterns of Ebola Virus Disease (EVD)*

The studies examined identified four main transmission pathways that contribute to EVD outbreaks: zoonotic spillover events, human-to-human transmission, healthcare-associated infections, and cultural burial practices. Each of these factors is essential in the propagation of the disease, with certain elements having a more pronounced effect on the scale of outbreaks than others.

Most of the initial EVD outbreaks have been linked to human contact with infected wildlife. The outbreaks have been associated with fruit bats (Pteropodidae), duikers, and non-human primates like chimpanzees, gorillas and various species of monkeys (Leroy, 2005). Fruit bats are the ones widely considered the natural reservoir of the Ebola virus. The spillover events occur when the humans consume or come into contact with infected animal tissues (Leroy, 2005). Deforestation and the hunting of bushmeat have also increased human exposure to Ebola reservoirs. These activities bring people into closer contact with wildlife populations that may be harboring the virus (Olivero et al., 2017). These spillover events are often the index cases of EVD outbreaks before human-to-human transmission drives further spread of the disease.

Once introduced into the human populations, EVD will essentially spread through direct contact with infected bodily fluids like, blood, saliva, vomit, urine, feces, and semen (Olivero et al., 2017; WHO, 2023). Studies have noted that transmission in household settings is common, especially among caregivers and family members who provide direct care to infected individuals without adequate protection (Olivero et al., 2017; WHO, 2023). Unlike airborne viruses, Ebola requires close physical contact for transmission. This is why outbreaks are often localized but they can escalate rapidly if containment measures fail. The semen of male survivors is able to harbor the virus for months after recovery and this has contributed to sexual transmission in some cases (ECDC, 2023).

Healthcare facilities have been a considerable source of EVD amplification. In the settings with poor infection control measures, inadequate personal protective equipment (PPE), and delayed diagnosis the disease may easily be transmitted (Shears & O'Dempsey, 2015). Nosocomial transmission has been a major concern during most of these outbreaks, including the 1995 Kikwit outbreak in the Democratic Republic of Congo and the 2014 to 2016 West African epidemic (Shears & O'Dempsey, 2015; Team*, 2018). In both cases, health workers unknowingly treated patients without personal protective equipment, leading to widespread infections among the medical personnel. Needlestick injuries and contaminated medical instruments have also contributed to this transmission in the hospital settings.

Studies have identified traditional funeral rites as one of the drivers of EVD outbreaks. Burial practices that involve washing the body, dressing, and touching of deceased bodies have been directly linked to major transmission events (Victory, 2015). The 2014 to 2016 West African epidemic was particularly affected by this factor. Improper burials accounted for up to 80% of new cases in some areas of West Africa during the outbreak (WHO, 2015). In many affected communities, funerals have been deeply rooted in cultural and religious customs and this made it difficult to implement safe burial practices. Resistance to the health interventions provided, mistrust of authorities, and lack of awareness about EVD transmission complicated efforts to control the disease. However, community engagement strategies, such as safe and dignified burial teams, ended up being effective in reducing transmission while respecting cultural traditions of the locals (Claude, 2019).

➢ *Risk Factors for Ebola Virus Disease Outbreaks*

Ebola outbreaks are driven by environmental factors, healthcare-related factors, socio-economic, and cultural

factors. These items have contributed to the emergence, spread, and severity of the outbreaks.

Deforestation and land use changes increased human interactions with fruit bats (Pteropodidae) which are the suspected natural reservoirs of the virus, thereby increasing the risk of getting the disease (Olivero et al., 2017). As forests are cleared for agriculture and housing, human settlements tend to encroach on bat habitats increasing the risk of zoonotic transmission (Leroy, 2005; Olivero et al., 2017). Climate change and rainfall variability have also been shown to influence bat migration routes. These changes in migration and viral shedding affect the frequency of spillover events during the transmission of the infection (Andersen-Ranberg et al., 2024).

Weak medical infrastructure and poverty worsen EVD outbreak severity and the capacity to respond to the problem. Many affected regions, especially in Sub-Saharan Africa, usually face delays in outbreak diagnosis due to inadequate surveillance systems (Ryan et al., 2022). The absence of well-equipped healthcare facilities leads to poor or substandard containment plans, allowing the virus to spread undetected in the community (Kyomba et al., 2024; Ryan et al., 2022). Furthermore, reduced medical care access often leads infected individuals to seek alternative treatments. The alternatives include traditional healers and spiritualists that inadvertently facilitate the transmission of the disease (Caleo et al., 2018). These socioeconomic issues contribute to extended outbreaks and increased mortality rates.

Community behaviors and conventional practices influenced EVD transmission dynamics during the outbreaks. Traditional burial customs that included washing, dressing, and touching of deceased bodies were directly linked to transmission of the disease (Claude, 2019; WHO, 2015). The mistrust of health authorities and widespread misinformation fueled resistance to containment measures such as quarantine, contact tracing, and safe burial protocols (Claude, 2019). The resistance sometimes led to violent attacks on healthcare workers and treatment centers and this hindered good response efforts to the outbreak.

Weak medical systems played a central role in the nosocomial transmission of EVD. Many outbreaks were amplified by poor infection prevention and control measures. There was inadequate personal protective equipment (PPE) and insufficient training of healthcare workers. (WHO, 2023). The rVSV-ZEBOV vaccine had demonstrated high efficacy; however, its availability was limited. In remote areas and conflict-affected regions, the preventive vaccination campaigns were difficult to implement due to the insufficient vaccine supplies (Bausch et al., 2024).

IV. DISCUSSION

This study analyzed the patterns from over four decades of Ebola Virus Disease outbreaks. We examined the major temporal trends in outbreak frequency and scale, the expanding geographical distribution of the virus, the primary pathways of its transmission, and the complex mix of risk factors that fuel its spread. By amalgamating these elements, we identified the major challenges and lessons necessary to advance future preparedness and response efforts.

- *Temporal Trends in EVD Outbreaks*

The sequential progression of Ebola Virus Disease outbreaks showed a disturbing trajectory, evolving from sporadic, localized tragedies to a persistent and complex global health challenge. The 1976 outbreaks in Zaire and Sudan, while astonishingly lethal (CFRs of 88% and 53%, respectively), established an initial pattern of spontaneity and geographical isolation (CDC, 2024). For the subsequent two decades, EVD largely conformed to this pattern: a zoonotic spark would ignite a devastating but relatively contained fire in a rural community, burning out after claiming a few hundred lives. This pattern reinforced a perception of Ebola as a tragic but infrequent event confined to specific regions of Central Africa.

This paradigm, however, proved to be fragile. The dawn of the 21st century marked a perceptible shift. The 2000 outbreak in Uganda (425 cases, 224 deaths) was a critical epidemiological signal, demonstrating the virus's potential for sustained human-to-human transmission beyond its previously recognized heartland (Okware et al., 2003). It was a prologue to a new era. This trend found its catastrophic apex in the 2014-2016 West African epidemic. With 28,610 cases and 11,308 deaths, this outbreak was not merely larger; it was qualitatively different (CDC, 2024). Its swift urbanization and international spread, with exported cases to Europe and North America, exposed a sobering reality: in an interconnected world, a local epidemic can become a global crisis overnight. This event irrevocably shattered the myth of Ebola as a distant threat and forced a monumental reassessment of global health security infrastructure.

The post 2016 landscape has further complicated the response calculus. Rather than returning to sporadic quiet, we have entered a phase of persistent, smoldering transmission, particularly in the conflict-ridden regions of the eastern DRC where security constraints severely cripple containment efforts (Shears & Garavan, 2020). Moreover, the Sudan ebolavirus strain outbreak in Uganda delivered a clear reminder of the virus's cunning diversity, successfully neutralizing our most advanced medical countermeasures as no licensed vaccines or therapeutics existed for this species (WHO, 2022).

Collectively, these temporal trends compellingly argue that EVD cannot be conceptualized as a series of discrete, unpredictable events. Instead, it has become an ongoing and evolving public health emergency that requires more attention. This new reality demands a paradigm shift from reactive outbreak response to proactive, sustained investment in robust surveillance systems, agile rapid-response mechanisms, and the

development and equitable distribution of a broader arsenal of vaccines and treatments.

- *Geographical Distribution of EVD Outbreaks*

The historical map of EVD outbreaks shows a disease whose geographical footprint is evolving, challenging its long-standing characterization as a threat confined to the rainforests of Central Africa. While the Congo River basin, especially the Democratic Republic of the Congo, remains the undeniable epicenter, with over 14 outbreaks since 1976 signaling a persistent, endemic circulation of the virus, the past decade has shown the virus's alarming ability to expand beyond borders (CDC, 2024). The 2014-2016 West African epidemic was a watershed moment in this geographical narrative. This was not simply a spillover but a massive, sustained intrusion into a new region, indicating that the necessary ecological and societal conditions for explosive transmission exist far beyond the virus's previously known range (Shears & O'Dempsey, 2015).

This shifting pattern is probably driven by an intersection of anthropogenic factors rather than random chance. Deforestation and land-use change disrupt wildlife habitats, altering the distribution of reservoir species of the virus and forcing novel interactions at the human-animal interface (Olivero et al., 2017). Also, a high rate of population mobility, both within and between nations, facilitates the swift transport of the virus from remote spillover sites to densely populated urban centers, as was catastrophically demonstrated when Ebola reached the capitals of Guinea, Liberia, and Sierra Leone (Shears & Garavan, 2020). The exportation of cases to the United States and Europe during that epidemic was a logical consequence of this mobility, serving as a clear reminder that in a globalized world, geographical distance is no longer a reliable barrier against pathogen spread.

Therefore, the geographical distribution of EVD must now be understood in two contexts: First, a persistent endemic zone (for example, DRC) where a complex interaction between viral ecology and societal vulnerability creates a constant high risk of recurrence. Secondly, a possible emergence zone encompasses much of sub-Saharan Africa, where environmental change and connectivity have created landscapes increasingly susceptible to ignition. This expanded risk map underscores the critical need for a shift from a reactive approach, focused on known hotspots, to a proactive, capabilities-based preparedness strategy that prioritizes strengthening integrated surveillance and response systems across the African continent and beyond.

- *Transmission Patterns of EVD*

Understanding the transmission dynamics of EVD is critical to disrupting its devastating cycle. Our analysis confirms that outbreaks are driven by a predictable yet complex interplay of four distinct pathways, each presenting unique challenges for containment. The inciting event for any outbreak is invariably a zoonotic spillover from a wildlife reservoir, most likely through the hunting, handling, or consumption of infected animals, such as fruit bats or non-human primates (Leroy, 2005). This initial jump from the animal to the human represents the fundamental spark; however, the magnitude of the subsequent conflagration is determined by the efficiency of human-to-human transmission.

Once the virus establishes itself in a community, it usually exploits the intimate community frameworks and flaws within the health care system. Human-to-human transmission through direct contact with infected bodily fluids remains the most common mode of spread, with households acting as primary amplifiers of infection due to the high-risk caregiving practices for the ill (Crozier et al., 2022; ECDC, 2023). Healthcare-associated transmission has repeatedly served as a powerful catalyst for these epidemics. The outbreaks in Kikwit (1995) and during the West African epidemic tragically show how hospitals, meant to be places of healing, can become epicenters of transmission when infection prevention and control protocols are inadequate (Crozier et al., 2022; Shears & O'Dempsey, 2015). This iatrogenic amplification accelerates the spread of the viral infection and devastates public trust, and yet it is a critical asset for outbreak response.

Traditional rites, which involve washing and touching the highly contagious deceased are identified as potent superspreading events. In some outbreaks these rituals have accounted for a disproportionate number of cases, up to 80% (Team*, 2018; Victory, 2015). This emphasizes a critical lesson that technical medical interventions are insufficient without cultural competence. Consequently, the proven success of safe and dignified burial (SDB) teams, that integrate epidemiological safety with respect for cultural traditions demonstrates that successful public health strategy must bridge the gap between biomedical science and socio-cultural reality (Claude, 2019).

The transmission of EVD is not a linear process but a synergistic one, in which spillover events are amplified by social networks, fragile health care systems, and deep-seated cultural practices. Successful containment, therefore needs a multifaceted strategy that simultaneously strengthens surveillance for spillover, reinforces IPC in healthcare settings, and engages communities as respected partners in developing culturally acceptable interventions.

- *Risk Factors for EVD Outbreaks*

The recurrence and severity of EVD outbreaks cannot be ascribed to a single cause but are instead the product of a dangerous convergence of ecological, societal, and institutional vulnerabilities. Our study suggests that these risk factors are not simply additive; they are synergistic, creating a rich soil for spillover and allowing sparks of infection to ignite into devastating epidemics.

At the most fundamental level, environmental and ecological drivers create the initial conditions for emergence. Deforestation, land-use change, and climate variability alter the distribution and behavior of wildlife

reservoirs, such as fruit bats, forcing them into closer and more frequent contact with human populations and thereby increasing the probability of a zoonotic spillover event (Andersen-Ranberg et al., 2024; Olivero et al., 2017). This ecological pressure often intersects with profound socioeconomic factors. Poverty drives communities to rely on bushmeat for protein, a high-risk activity, while simultaneously limiting access to education and healthcare. Weak health infrastructure a function of both poverty and underinvestment directly exacerbates outbreak severity by causing critical delays in detection, diagnosis, and initial containment, allowing nascent chains of transmission to remain undetected until they are well established (Caleo et al., 2018; Hasan et al., 2019; Kyomba et al., 2024).

Once an outbreak begins, a second layer of socio-cultural and political factors determines its trajectory. Deeply held cultural practices, including traditional burial rites, can become powerful vectors for transmission. Perhaps more damaging than any single practice is a pervasive mistrust of government and health authorities, often born from a legacy of conflict, neglect, or misinformation. This distrust can render top-down public health measures ineffective, as communities may hide cases, avoid treatment centers, and resist response teams, thereby perpetuating transmission. This is compounded by inherent healthcare system fragilities. Inadequate infection prevention and control measures within clinics and hospitals transform these institutions from places of refuge into amplifiers of disease, as tragically documented in multiple outbreaks (Ekakoro et al., 2025; Kyomba et al., 2024).

The organizational and international context can present the ultimate barrier to control. The promising advent of the rVSV-ZEBOV vaccine is often neutralized in remote, insecure, or conflict-affected regions where cold chains cannot be maintained, supply routes are blocked, and healthcare workers are targeted (Bausch et al., 2024). In these settings, the mere existence of a countermeasure is insufficient; its delivery depends on resolving complex challenges of access and security.

EVD thrives at the convergence of environmental change, poverty, fragile governance, and social discord. Dealing with these deeply entrenched risk factors requires moving beyond a purely biomedical response towards a holistic strategy that integrates ecological surveillance, strengthens health systems, builds community trust from the ground up, and ensures that advanced medical tools are accessible to the most vulnerable populations.

V. CONCLUSION

Our analysis showed that the era of sporadic, containable outbreaks has given way to a new normal of persistent and expanding risk. Therefore, the fundamental goal must shift from simply responding to outbreaks to proactively building resilience. This will require strategic investment that prioritizes community-centric surveillance. It also means that we have to pre-emptively deploy vaccines to at-risk regions to help control outbreaks. Ecological monitoring should be integrated into public health planning. Defeating Ebola requires attacking the very vulnerabilities it exploits. We should strengthen health infrastructure, earn community trust, and foster equitable global collaboration to combat the Ebola outbreaks.

VI. LIMITATIONS

The review included only English-language studies, which potentially excludes relevant research published in other languages. The Francophone African countries were heavily affected by EVD and some of the Ebola outbreak literature was not written in English. The scope of this review prioritized acute outbreak dynamics instead of the long-term public health implications of viral persistence in survivors.

CONFLICT OF INTEREST

None to declare

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